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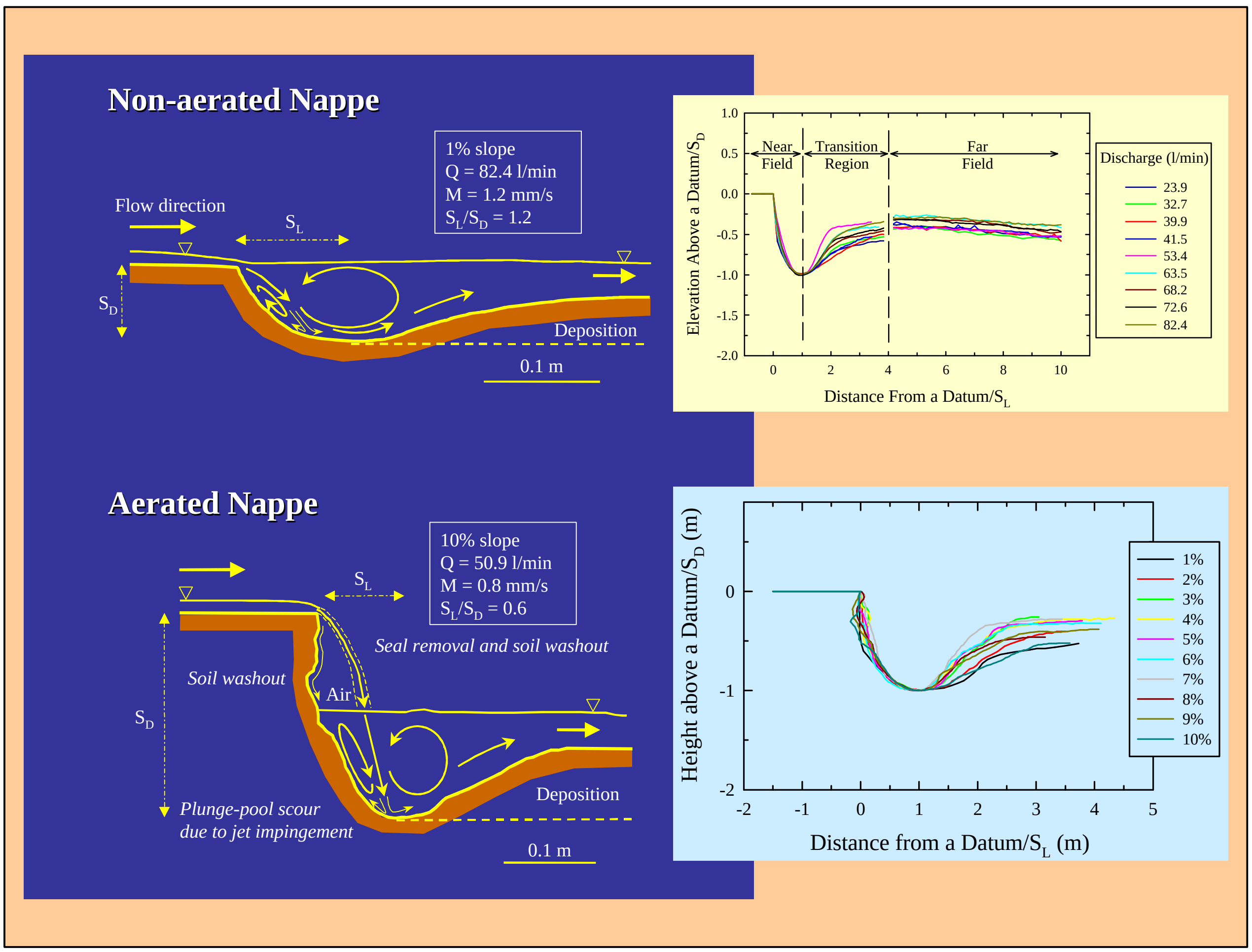
An Experimental Study of Headcut Growth and Development in Upland Concentrated Flows



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1 Introduction

This report summarizes an experimental program designed to investigate the growth and development of headcuts in soils typical of those occurring in upland areas and on agricultural plots. The experiments were conducted at the National Sedimentation Laboratory in Oxford, MS from July 1996 through June 1997.

Chapter 2 summarizes experiments designed to examine the effect of flow discharge on headcut growth and development given a bed slope of 1% and initial headcut height of 25 mm. As of July 1999, this chapter has been reviewed, revised, and resubmitted to *Water Resources Research* with the title "An experimental study of headcut growth and migration in upland concentrated flows," and authored by S.J. Bennett, C.V. Alonso, S.N. Prasad, and M.J.M. Römkens.

Chapter 3 summarizes experiments designed to examine the effect of bed slope on headcut growth and development given a overland flow discharge of about 52 l min^{-1} and initial headcut height of 25 mm. As of July 1999, this chapter has been reviewed, revised, and accepted for publication in *Geomorphology* with the title "Effect of slope on the growth and migration of headcuts in rills," and authored by S.J. Bennett.

The Appendices provide tabulations all data collected and reported for Chapter 2 (Experiment 1) and Chapter 3 (Experiment 2).

2 An experimental study of headcut growth and migration in upland concentrated flows

Abstract. Experiments were conducted to examine soil erosion by headcut development and migration in concentrated flows typical of upland areas. In a laboratory channel, packed sandy loam to sandy clay loam soil beds with pre-formed headcuts were subjected to simulated rain followed by overland flow. The rainfall produced a well-developed surface seal that minimized surface soil detachment. During overland flow, soil erosion occurred exclusively at the headcut, and after a short period of time a steady-state condition was reached where the headcut migrated at a constant rate, the scour hole morphology remained unchanged, and sediment yield remained constant. A four-fold increase in flow discharge resulted in larger scour holes, yet aspect ratio was conserved. A sediment bed was deposited downstream of the migrating headcut, and its slope generally increased with flow discharge.

2.1 Introduction

Headcuts and knickpoints are step-changes in bed surface elevation where intense, localized erosion takes place [*Brush and Wolman*, 1960; *Gardner*, 1983]. Step-changes that occur at the head of channel networks are referred to as headcuts, and those that occur within the confines of channel banks, whether in rills or streams, are referred to as knickpoints. Formation of headcuts and knickpoints and their upstream migration have been linked to concentration of overland flow [*Mosley*, 1974; *Merritt*, 1984], rill and gully erosion and development [*Seginer*, 1966; *Piest et al*., 1975; *Bryan and Poesen*, 1989; *Bryan*, 1990; *Slattery and Bryan*, 1992], erosion of bedrock channels [*Miller*, 1991; *Seidl et al*., 1994], and initiation of drainage systems and landscape evolution [*Seginer*, 1966*; Piest et al*., 1975; *Parker*, 1977; *Gardner*, 1983; *Schumm et al.*, 1984, 1987; *Dietrich and Dunne*, 1993].

In upland concentrated flows such as rills, the occurrence and migration of headcuts is commonly associated with significant increases in sediment yield [*Mosley*, 1974; *Meyer et al*., 1975; *Bryan*, 1990; *Römkens et al*., 1996, 1997]. For example, *Römkens et al*. [1996, 1997] observed the failure of surface seals on soils immediately proceeded by headcut formation, bed incision, and rill development. Prior to bed incision, sediment yield from the soil surface was essentially zero. Moreover, migrating headcuts can account for up to 60% of the total rill erosion on some soils [*Elliot and Laflen*, 1993].

Investigating erosion due to headcut migration has both practical and environmental importance. The USDA-Agricultural Research Service has a long history of developing soil erosion prediction tools such as the Revised Universal Soil Loss Equation [*Renard et al.*, 1997] and Water Erosion Prediction Project [*Nearing et al.*, 1989; *Elliot and Laflen*, 1993]. However, prediction tools are extremely difficult to apply in areas impacted by headcuts because they can have both variable morphology (e.g. steps, chutes, and zones) and variable rates of migration [*Holland and Pickup*, 1976; *Gardner*, 1983; *Bryan*, 1990]. Moreover, failure of reservoir embankment dams and vegetated earth emergency spillways commonly occurs by headcut formation and gully development [*Powledge et al*., 1989; *Temple*, 1992; *Temple et al*., 1993; *Temple and Hanson*, 1994; *Moore et al*., 1994]. Tens of thousands of such structures exist in the U.S. alone, threatening life and property [*Powledge et al*., 1989; *Temple et al*., 1993].

Geomorphologists have examined migrating headcuts and knickpoints in relation to rill incision, drainage network development, and alluvial response to base-level lowering. *Lewis* [1944] investigated the upstream migration of a pre-formed knickpoint in muddy-sand material and noted that knickpoint height decreased with migration distance. *Brush and Wolman* [1960] examined the evolution of pre-formed knickpoints in non-cohesive sand and noted a reduction in bed slope downstream of a migrating headcut. *Holland and Pickup* [1976] investigated knickpoint development in stratified sediment composed of cohesive and non-cohesive layers. They described the physical characteristics of three different knickpoint types (stepped, rotating, and minor erosion headcuts), and the requisite stratification for the maintenance of a stepped knickpoint during migration. *Parker* [1977; *Parker and Schumm*, 1982] examined drainage network development on a sandy loam soil, and observed the formation and upstream migration of knickpoints in response to base-level lowering. As the knickpoints moved upstream, their rate of migration slowed because of the reduction in basin area and the resulting decrease in discharge. *Begin et al.* [1980a, b] and *Gardner* [1983] conducted experiments similar to *Parker* [1977]. By lowering the water level at the flume outlet, *Begin et al.* [1980a, b] initiated degradation and observed knickpoint development. As these knickpoints migrated, they decreased in both size and rate of migration. *Gardner* [1983] described in detail bed adjustment to knickpoint migration in homogenous cohesive sediment, and presented schematic models of knickpoint evolution. *Bryan* [1990] demonstrated the link between headcut formation, flow concentration, and rill incision in cohesive materials. *Bryan* suggested that supercritical flow was a necessary precursor for headcut development and that once formed headcuts displayed a complex evolutionary history during migration. *Bryan and Rockwell* [1998] observed headcut formation in soils as a result of water table development.

Engineers have examined headcut erosion processes in relation to soil loss on agricultural fields and gully headcut development on earthen spillway channels. *Stein* and his co-workers [*Stein and Julien*, 1993, 1994; *Stein et al*., 1993] investigated scour processes using pre-formed steps in cohesive and non-cohesive materials. *Stein et al*. [1993] successfully formulated a jet impingement model to predict scour hole development and mode of headcut migration. More recently, *Latray and Stein* [1997] observed constant rates of headcut migration in a laboratory channel filled with stratified soil materials. Using a large outdoor facility, *Robinson and Hanson* [1995; 1996a, b] investigated the migration characteristics and failure mechanics of pre-formed headcuts in cohesive materials, and examined the roles of stratigraphy, overfall height, flow discharge, and backwater level in headcut migration. *Robinson and Hanson* highlighted the significant impact that material characteristics and especially soil water content have on sediment erodibility and rates of headcut migration.

In spite of these studies, little information exists on the processes of headcut migration and soil erosion, variation of scour hole morphology, mechanics of headcut erosion, and effect of flow discharge. This deficiency is primarily due to the logistical difficulties in examining actively migrating headcuts. The objectives of the present study are (1) to develop an experimental methodology to generate steady-state soil erosion due to headcut migration in concentrated flows typical of upland areas (i.e. rills on relatively shallow slopes), and (2) to obtain data on the physical characteristics of migrating headcuts and their impact on soil erosion, sediment yield, and bed adjustment. Complementary experiments on the effect of bed slope [*Bennett*, 1999] and initial headcut height [*Casalí and Bennett*, unpub. ms.] are discussed elsewhere. The present experiments focussed on the effect of flow discharge on headcut morphology and erosion processes for a given rainfall intensity and duration, soil material, bed slope, and initial headcut height. The goal of this research is to use these data to enhance erosion prediction technology in agricultural areas impacted by headcuts.

2.2 Experimental Equipment and Procedure

2.2.1 Flume and Rainfall Simulator

All experiments were conducted in a non-recirculating, 5.5-m long tilting flume (Figure 1). Flow discharge was controlled by two adjustable intake valves and monitored with a manometer and a pressure transducer connected to an inline Venturi meter. Measurements of flow discharge were also made manually during each experimental run. The average standard deviation of flow discharge measurement was 4%. The pump was connected to a reservoir tank that received a constant supply of clear water close to 20ºC.

Water was fed initially into an inlet tank 0.8 m long, 0.4 m wide, and 0.3 m deep (Figure 1). The tank acted as a reservoir for damping pump-related turbulence and for controlling flow discharge into the test section. Once the tank was filled, water spilled onto a raised floor, 1 m long and 0.165 m wide, located immediately upstream of a soil cavity 2 m long, 0.165 m wide, and 0.25 m deep (Figure 1). A subsurface drainage system was installed along the base of the soil cavity and consisted of three pipes 12.7-mm in diameter that were interconnected and perforated. These pipes had five free-air outlets equally spaced along the flume, and provided escape routes for both air and water during rainfall application. Trace amounts of subsurface drainage were commonly observed at the conclusion of rainfall

Figure 1. Line Diagram of Flume

application and overland flow. All water and sediment that passed through the flume was concentrated into an outlet pipe where sampling took place.

Suspended approximately 4 m above the flume was a multiple-intensity rainfall simulator consisting of two oscillating nozzles spaced 1.64 m apart [*Meyer and Harmon*, 1979; Figure 1]. Water was pumped to these nozzles, attaining a pressure of 41 N m^{-2} (6 psi) and a flow discharge of 22.1 l min^{-1} (±1%) at each nozzle. At this height and water pressure, most simulated water drops attain terminal velocity by the time they reach the soil surface. Rainfall intensity (mm h^{-1}) was governed by the oscillation frequency of the nozzles, operated by an electronic controller to within ±1.3% and calibrated for the bed area under investigation.

2.2.2 Soil Material

The material used in this study is a sandy loam to sandy clay loam texture (Ruston Series; fine-loamy, siliceous, thermic, Typic Paleudult; *Römkens et al*., 1997), commonly found in the southeastern U.S, and it is derived from a marine deposit of Eocene age [*Nash et al*., 1988]. The present material was obtained from a site in Neshoba County, MS, at a depth of about 3 m. It consists of 20.0% clay, 2.9% silt, and 77.1% sand. Based on sieve analyses, the median grain size (D_{50}) of the sand component was 0.26 mm ($D_{16} = 0.16$ mm and $D_{84} = 0.55$ mm). Much of the soil used during this study was recycled from previous experimental runs.

The soil contains an appreciable amount of iron oxide as hematite (2.9% CDB-extractable, see *Römkens et al*., 1997; but can be as high as 18.9% for this soil series, see *Nash et al*., 1988), which greatly enhances its stability. The presence of iron oxides, and in particular the amorphous variety, has a favorable effect on the soil’s physical properties [*Rhoton et al.*, 1998]. Specifically, iron oxides can increase aggregate stability, permeability, friability, porosity, and hydraulic conductivity while reducing clay swelling and dispersion, bulk density, and modulus of rupture [*Goldberg*, 1989]. Aggregation is understood as the association of soil matrix particles into small aggregates by minute particles of iron oxide [*Schwertmann and Taylor*, 1989]. These aggregates form by chemical and physical bonding between particles of similar and dissimilar materials. Moreover, iron oxide precipitation (i.e. cementation) can occur within the pores of matrix particles, also increasing aggregate stability [*Schwertmann and Taylor*, 1989].

2.2.3 Soil Bed Preparation

Before the soil cavity was filled, the subsurface drainage system was installed at its base. These pipes were covered with a porous fabric and 0.1 mm-diameter sand to a depth of 0.03 m to minimize clogging. All interior seams were sealed with molding clay; the only openings to the free air were the five outlets of the subsurface drainage system.

The soil material was air dried in a greenhouse, mechanically crushed, and passed through a 2 mm sieve. One would expect that the size of the aggregates within the soil would vary both at the field site as well as from run to run. This process of drying, crushing, and sieving ensured that variation in the distribution of aggregate size was minimized in the experiments. The soil was then packed incrementally in layers of about 0.02 m. Each increment was spread evenly across the flume and tamped in a uniform and systematic manner using a 9 kg block of aluminum mounted to an aluminum frame 0.6 m long and 0.165 m wide. This block was raised 0.3 m above the soil and allowed to free-fall onto the frame approximately ten times. By repeatedly moving the frame along the soil bed, a uniformly packed soil profile was constructed with a bulk density close to 1370 kg m^{-3} (Table 1).

After packing the soil to a depth of 0.225 m, an aluminum frame was placed 1.52 m downstream of the soil cavity's entrance for the purpose of forming a headcut. This frame had a vertical face, 0.025 m high and 0.165 m wide, and once in place it had little impact on the applied rainfall. After installation, soil was packed upstream of the frame producing a pre-formed vertical step in the bed profile. The experimental procedure by design focussed on the two-dimensional characteristics of migrating headcuts.

The soil material within the uppermost 0.02 m, which was non-recycled soil, was treated with 0.75 cmol of $Ca(OH)_2$ per 100 g of soil (about 0.74 g per 1 kg of soil) to promote a physio-chemically

Table 1. Summary of Experimental Parameters

Parameter	Units	Experimental Run								
		1	2	3	4	5	6	7	8	9
		Initial experimental parameters								
Initial headcut height	m	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Soil bulk density	kg m^{-3}	1468	1369	1379	1369	1369	1386	1369	1369	1370
Rainfall rate	mm h^{-1}	20.8	21.5	9.9	21.5†	21.2	21.6	21.0	21.2	21.2
Rainfall duration	h	5	4	7	4	4	4	4	4	4
Total rainfall	mm	104.0	86.0	69.3	86.0†	84.8	86.4	84.0	84.8	84.8
Bed slope during rainfall	%	5	5	5	5	5	5	5	5	5
Time of runoff initiation	h	2.00†	1.73	n.a.	1.69	1.75	1.77	1.72	1.69	1.07
Runoff rate at conclusion of rainfall	mm h^{-1}	13.0	12.5	n.a.	14.3	14.3	15.5	14.0	13.7	15.6
Bed slope during overland flow	%	1	1	1	1	1	1	1	1	1
Overland flow run time	s	630	540	600	510	690	570	600	540	810
Flow discharge (Q)	l min^{-1}	23.9	32.7	39.9	41.5	53.4	63.5	68.2	72.6	82.4
Mean flow depth upstream of headcut (d)	m	0.008	0.009	0.008	0.008	0.012	0.013	0.012	0.015	0.017
Mean flow velocity upstream of headcut (U)	m s^{-1}	0.346	0.367	0.504	0.500	0.450	0.495	0.561	0.490	0.492
Upstream Froude number (Fr)		1.24	1.24	1.80	1.78	1.31	1.39	1.64	1.28	1.20
Mean flow depth downstream of headcut	m	0.006	0.008	0.007	0.008	0.011	0.012	0.012	0.015	0.015
Mean flow velocity downstream of headcut	m s^{-1}	0.461	0.413	0.571	0.500	0.491	0.536	0.561	0.490	0.558
Downstream Froude number		1.90	1.47	2.18	1.78	1.49	1.56	1.64	1.28	1.45
		Average steady-state parameters								
Overfall entry angle (q)	degrees	41.6	45.5	46.8	43.0	41.3	44.3	41.8	39.8	37.0
Headcut migration rate (M)	mm s^{-1}	1.6	1.8	1.7	2.0	1.4	1.6	1.9	1.9	1.2
Maximum scour depth (S_D)	m	0.025	0.037	0.038	0.040	0.054	0.070	0.059	0.065	0.079
Length to S_D (S_L)	m	0.030	0.047	0.043	0.068	0.083	0.073	0.079	0.087	0.093
S_L/S_D		1.20	1.27	1.13	1.73	1.54	1.04	1.36	1.34	1.18
Deposit thickness (d_T)	m	0.016	0.023	0.020	0.025	0.040	0.052	0.040	0.046	0.060
S_D/d_T		1.56	1.61	1.90	1.60	1.35	1.35	1.48	1.41	1.32
Sediment yield ($q_{s(Y)}$)	kg s^{-1}	0.0069	0.0083	0.0109	0.0109	0.0089	0.0131	0.0143	0.0149	0.0114
Final bed slope	%	1.61	1.10	1.17	1.30	0.71	0.98	1.11	0.86	0.46
Slope of self-made bed (S_f)	%	2.05	1.60	1.91	1.96	1.32	2.81	2.23	2.30	1.98

† estimated value

$Fr = U/\sqrt{gd}$ where g is gravitational acceleration favorable condition for seal development [*Römkens et al*., 1998]. Following the application of simulated rain, a well-developed and reproducible surface seal formed. Surface seal development is a commonly occurring phenomenon on exposed soils [e.g. *Römkens et al*., 1990b], and it served two purposes in the present study. First, upon the introduction of overland flow the seal negated surface soil detachment both upstream and downstream of the headcut. Thus all sediment erosion was the result of headcut growth and migration. Second, it produced the requisite two-layer stratigraphy common to many stepped headcuts and knickpoints observed in field and flume studies [e.g. *Holland and Pickup*, 1976; *Bryan and Poesen*, 1989]. This stratigraphy allowed the headcut to maintain a nearly vertical headwall during migration.

2.2.4 Data Acquisition

The Plexiglas sidewall of the flume had a superimposed grid system allowing for visual observation of many morphologic and hydraulic parameters. A video camera mounted on a tripod during rainfall application and to a movable carriage during the overland flow recorded each experimental run. From these images, the following information could be determined with sufficient accuracy (length scales to within 3%): progression of the wetting front within the soil profile, position and morphology of the headcut, overland flow depth, and angle of the overfall nappe. During rainfall application, inception of surface runoff was noted, and rate of runoff was obtained by measuring water discharge from the outlet pipe for 5 min at 30-min intervals. Flow depth upstream of the headcut was also measured using a point gauge suspended above the flume, and these values were in agreement with measurements obtained from video recordings. During overland flow, water and sediment samples were obtained from the outlet pipe as fast as possible until the headcut stabilized in form and migration rate, and then the sampling rate was reduced to 30-s intervals. Approximately 0.5 l of water and sediment were obtained for each sample, 1 ml of 0.09 M solution of $Al_2(SO_4)_3$ was added to settle the soil, and the clear water was decanted. The sample remains were decanted, oven dried, and weighed to determine total sediment mass. At the conclusion of the run, a bed profile was taken along the flume’s centerline using a point gauge on a carriage suspended above the flume. The depth of the scour trace relative to the bed surface was also measured along the flume sidewall.

2.3 Results

2.3.1 Rainfall Application, Wetting Front Progression, Surface Runoff, and Seal Development

With the bed prepared and headcut-forming plate installed, a splash curtain hanging from the rainfall simulator was lowered and gutters were placed along the flume sidewalls. A rainfall of known intensity and duration was applied to the soil material. In most runs, about 21 mm h^{-1} of rain was applied for 4 h to a bed slope of 5% (Table 1). This bed slope was chosen to promote removal of any dispersed soil material during rainfall application so all soil surface areas would be exposed to raindrop impact. Negligible soil erosion occurred during rainfall application.

Through the flume's sidewall, advance of the wetting front was observed (Figure 2). Due to differences in infiltration rates along the soil-Plexiglas interface, this observation might not be necessarily representative of the actual wetting front position. However, the characteristics of this progression were consistent for all runs. The wetting front migrated relatively fast during the initial stages of rainfall application (*ca.* 0.09 m h^{-1} during the first two hours), then slowed as both the upper soil profile became saturated and runoff processes commenced (*ca.* 0.02 to 0.04 m h^{-1} during the time interval from 2 to 3 h), and then increased slightly when the front intercepted the more porous sand layer (*ca.* 0.02 to 0.07 m h^{-1} during the time interval from 3 to 4 h; Figure 2). Variations in the front position between runs were due to differences in packing, stratification, and soil bulk density especially near the flume sidewalls. At the conclusion of the rainstorm, minor amounts of subsurface drainage were commonly observed at the most downstream outlet pipe. There was no evidence for perched water tables due to soil stratification.

Surface runoff normally occurred after about 1.6 h of rainfall (Figure 3). Runoff rates increased dramatically during the interval from 1.6 to 3 h. After about 3 h, the rate of increase in runoff lessened asymptotically. The value of this asymptote, after 4 h of continued rainfall, was about 14 mm h^{-1} or about

Figure 2. Progression of the wetting front through the soil profile as observed from the flume sidewall for Run 9. Positions shown are 1, 2, 3, and 4 hours after rainfall initiation.

Figure 3. Time variation in surface runoff rate measured at 30-min intervals for all experiments (data for Run 3 not available).

67% of the applied rate. Runs 1 and 9 have different time variations in runoff rate as compared to the other runs, and these trends are probably due to minor differences in soil bulk density.

At the conclusion of rainfall application, visual inspection of the soil surface revealed the formation of a thin, pliable layer, a few millimeters thick, which constituted the surface seal. Washed sand grains were present on the bed surface, presumably dispersed from the soil bed during rainfall and seal development. A higher concentration of sand was observed in the downstream portions of the flume, the result of transportation during surface runoff. Soil material was also present on the flume sidewalls due to raindrop splash. In general, formation of a surface seal reduces infiltration and increases soil surface strength. Different types of surface soil seals have been reported: (1) physico-chemical seals due to dispersion of soil (i.e. breakdown of soil aggregates) during adsorption and its associated chemical response; (2) physical seals due to the dispersive and compactive action of raindrop impact; and (3) mechanical seals due to deposition of interstitial sediment [*Römkens et al*., 1990b]. The duration and intensity of rainfall can affect seal formation [*Römkens et al*., 1990a]. Therefore, rate of infiltration, time to inception of runoff, and variation of runoff rate can all be used as surrogate indicators of seal formation. Measurements of these indicators suggest that the hydraulic and physical characteristics of the seal were consistent between experimental runs. No significant variations in surface seal characteristics due to packing, rainfall application, and soil recycling were observed.

2.3.2 Growth, Development, and Morphology of Migrating Headcuts

Headcut growth and development were the same for all runs. After an initial period of bed adjustment, a steady-state condition ensued: a headcut of similar geometry migrated upstream at a constant velocity, producing both a constant rate of sediment yield and a constant rate of deposition in the downstream portion of the flume. Some key morphologic parameters are defined in Figure 4. In most runs, headcut migration continued for a distance of up to 1 m, or for about 8 to 14 minutes, at which time overland flow was terminated as the headcut approached the upstream end of the soil bed (Figure 1).

2.3.2.1 Initial scour and headcut development

With the rainfall application completed, the curtain, gutters, and headcut-forming plate were removed from the flume. The bed slope was adjusted to 1%, and an overland flow of known discharge was released onto the soil material. The overland flows ranged in discharge (Q) from 23.9 to 82.5 l min^{-1}, where mean depth (d) of the approach flow ranged from 8 to 17 mm, and mean velocity (U) ranged from 0.346 to 0.561 m s^{-1} ($U = Q/dW$, where W is flow width; Table 1). These values were chosen as being representative of flows along crop furrows on agricultural plots [e.g. *Meyer et al.,* 1975; *Line and Meyer,* 1988].

The overland flow passed over the pre-formed step, and the flow impinged the surface seal just downstream of the step. This impinging overfall caused surface seal failure and soil erosion, and a scour hole developed and enlarged. The location of initial scour and seal failure depended upon the flow rate. At high discharges, the overfall entry angle was initially low (ca. 25º to 40º), and failure occurred several centimeters downstream of the headcut. At low discharges, this angle was initially larger (ca. 40º to 50º), and surface failure occurred closer to the headcut. Entry angle as described herein is the angle of the overfall centerline as is enters the backwater pool (Figure 4). In general, the scour hole rapidly increased its length S_L relative to its depth S_D (Figure 5; initially high S_L/S_D values, Figure 6; Table 1). As scour lengthening proceeded, the location of maximum scour moved towards the step, and the scour hole deepened. Concomitantly, erosion initiated at the brinkpoint, the position where the nearly vertical headcut face intersects the horizontal soil bed on the upstream side, and headcut migration ensued. During this initial period of bed adjustment, normally from one to three minutes, both the scour depth and sediment production increased (Figures 5 and 7, Table 1). Because the resultant scour hole was larger at higher flow discharges, this produced initially large sediment yields. Once the scour hole attained an ‘equilibrium’ or maximum depth, downstream deposition began, scour hole length was maintained, and sediment yield decreased.

Figure 4. Definition sketch of water and bed surface profile of a steady-state headcut digitized directly from a video image (Run 9). Primary and secondary flow patterns are shown, and key morphologic parameters of the headcut are defined.

Figure 5. Time variation in the maximum scour depth S_D and the length to maximum scour depth S_L for all experiments. Measurements were obtained at approximately 30-s intervals.

Figure 6. Time variation in the ratio of the length to the maximum scour depth-to-maximum scour depth (*S_l/S_D*) for all experiments. Measurements were obtained at approximately 30-s intervals.

Figure 7. Time variation in sediment yield for all experiments. Samples were obtained as fast as possible until the headcut form and its migration rate stabilized, and thereafter at 30-s intervals.

2.3.2.2 Steady-state erosion

After this initial period of growth, the headcut brinkpoint migrated upstream in a gradual and linear fashion through time (Figure 8). Headcut migration rate was constant during each run, ranging from 1.2 to 2.0 mm s^{-1}, and the average rate for all runs was 1.7 mm s^{-1} (Table 1). The timing of initial headcut movement varied: headcuts in Runs 8 and 9 took longer to initiate migration, presumably due to differences in soil packing in the headcut region, but these runs eventually attained a rate of migration similar to the other experiments (Figure 8).

The peak in sediment yield at about 50 s (Figure 7) coincided with initiation of both headcut movement and downstream deposition. Because downstream bed height was fixed in place by the soil retaining wall, sediment erosion was moderated by downstream deposition. After this initial pulse, steady-state sediment yield was attained when the rate of sediment production due to headcut migration and the rate of sediment deposition downstream of the headcut did not change with time. Steady-state sediment yield occurred after 300 to 400 s, ranging from 0.007 to 0.014 kg s^{-1} (Figure 7; Table 1). *Parker* [1977] also observed constant rates of headcut migration and sediment yield in his experiments on drainage network development. These constant rates and yields, however, were short-lived because as the headcut migrated upstream, drainage area and discharge decreased.

Within individual experiments, the morphology of the headcut did not vary significantly during migration once steady-state conditions were achieved (Figure 9). Deviations from the mean headcut profile at any given time were due to random spatial and temporal variations in boundary conditions such as bulk density, packing efficiency, soil water content, subsurface pore pressure, soil adhering to the sidewall, and physical, hydraulic, and chemical characteristics of the surface seal. The headcut self-corrected these random boundary conditions to maintain a similar morphology. The ratio S_L/S_D remained relatively unchanged for each run, ranging from 1.04 to 1.73 (Figure 6, Table 1). This within-run shape invariance allows the complicated morphology of the scour hole to be removed analytically in the integral conservation of mass calculation [*Alonso*, pers. comm., 1997].

Figure 8. Time variation in headcut brinkpoint position for all experiments. Measurements were obtained at approximately 30-s intervals.

Figure 9. Time averaged bed profiles of the steady-state headcut for all experiments.

2.3.2.3 Scour hole trace and downstream bed adjustment

Along-flume profiles of the scour hole trace (erosional surface) show that during an experiment depth of scour did not vary significantly (Figures 5 and 10, Table 1). Entrance effects at the transition from the fixed false floor to the soil bed caused erosion of the surface seal upstream of the headcut in Runs 3 and 6 (Figure 10). The added sediment did not appreciably impact deposition rates downstream and sediment yield at the flume's outlet. Only minor amounts of deposition were observed on the original bed surface downstream of the initial headcut position.

Between the scour depth trace and the final bed surface was a region of deposition that represents a self-made bed (Figure 10; see also Figure 4). *Bryan and Oostwoud Wijdenes* [1992] observed similar deposition downstream of migrating headcuts. The bed slope from near the final scour hole position to the flume's exit, encompassing the self-made bed and remnants of the original bed surface, ranged from 0.46 to 1.30% with a mean value of 1.03%, very close to the original slope (1%; Table 1). However, the bed upstream of the original headcut position, thus representing the 'equilibrium' slope of the self-made bed, ranged from 1.32 to 2.81% (Table 1). The slope of the self-made bed was greater than the original slope, and tended to increase with flow discharge. In previous studies, *Bryan* [1990] reported lower bed slopes (0.1 to 1.4%) downstream of headcuts migrating on 6.5 to 7.3% slopes. However, *Bryan and Oostwoud Wijdenes* [1992] reported higher bed slopes (3.1 to 4.0%) downstream of headcuts (microsteps) migrating on 2.6% slopes. Clearly, the combined effects of flow discharge, bed slope, and soil erodibility will determine the equilibrium bed slope downstream of the migrating headcut.

In general, flow over this self-made bed was faster and shallower as compared to flow upstream of the headcut (Table 1). This difference was because the surface seal was visibly rougher than the surface of the self-made bed and the self-made bed had a greater bed slope. Effects of the soil retaining wall and possible backwater on headcut migration and sediment yield are yet to be determined [see *Robinson and Hanson,* 1996b].

Figure 10. Along-flume profiles of the initial and final bed surface and the trace of the scour depth for all experiments. Flow is from left to right.

Rill or crop furrow length will also affect downstream bed adjustment. Experiments described herein were limited to a relatively short flume length. For an infinitely long flume and steady-state migrating headcut, the scour hole trace will remain parallel to the self-made bed profile only if the original bed slope (S) is equal to the slope of the self-made bed (S_f; Figure 11a). If during migration $S > S_f$, the scour hole trace may exhibit instantaneous or gradual shifts vertically upward to maintain a constant S_D (Figure 11b), and possibly cause renewed aggradation downstream. Conversely if $S < S_f$, the scour hole trace may exhibit instantaneous or gradual shifts vertically downward (Figure 11c), and possibly cause renewed degradation downstream. In the experiments described herein, $S > S_f$ and such adjustments in the scour hole trace are observed in all runs (Figure 10).

2.3.2.4 Replication of experiments

Four experiments were conducted to assess the intrinsic variability of headcut characteristics for a given set of nearly identical conditions. Using an initial headcut height of 50 mm, a rainfall rate of 26.8 mm h^{-1}, and a flow discharge of 71 l min^{-1}, the results from these experiments are presented in Table 2. The conditions were chosen to replicate a recent set of experiments examining the effect of initial step height of headcut development [*Casalí and Bennett*, unpubl. ms.]. The average percent variation of the derived headcut characteristics amongst these runs ranged from 3 to 10%, but nearly identical results were obtained for some parameters in some experiments. Time to runoff inception and final runoff rate are different to those presented in Table 1 because rainfall rates were higher and a chemically-different water source was used. The challenge in replicating soil erosion experiments is ensuring that the texture, composition, chemistry, soil water content, and bulk density of the soil material are identical for each run.

Figure 11. Schematic diagram of headcut migration and scour hole trace when the upstream bed slope (*S*) is (a) equal to, (b) greater than, and (c) less than the slope of the self-made bed (S_f) at different times (t_0, t_1, t_2, t_3, and t_4).

Table 2: Summary of experimental parameters from repeated runs.

Parameter	Units	Experimental Run				Summary	
		A	B	C	D	mean	% variation
		Initial experimental parameters					
Initial headcut height	mm	50	50	50	50	---	---
Bulk soil density	kg m^{-3}	1558	1564	1583	1622	1582	1.6
Rainfall rate	mm h^{-1}	26.8	26.8	26.8	26.8	---	---
Rainfall duration	h	4.6	4.6	4.6	4.6	---	---
Bed slope during rainfall	%	5	5	5	5	---	---
Time of runoff initiation	h	0.95	0.95	0.88	0.83	0.90	5.5
Runoff rate after 4.5 h	mm h^{-1}	22.4	24.4	25.4	25.2	24.4	4.9
Bed slope during overland flow	%	1	1	1	1	---	---
Flow discharge (Q)	l min^{-1}	69.9	71.3	71.4	71.2	71.0	0.9
Mean flow depth upstream of headcut	m	0.015	0.015	0.016	0.014	0.015	4.7
Mean flow velocity upstream of headcut	m s^{-1}	0.471	0.480	0.451	0.514	0.479	4.8
Upstream Froude number (Fr)		1.23	1.25	1.14	1.39	1.25	7.1
		Average steady-state parameters					
Headcut migration rate (M)	mm s^{-1}	1.52	1.32	1.44	1.75	1.51	10.4
Maximum scour depth (S_D)	m	0.119	0.114	0.112	0.109	0.114	3.2
Length to S_D (S_L)	m	0.090	0.101	0.081	0.091	0.091	7.8
S_L/S_D		0.76	0.89	0.72	0.83	0.80	8.0
Deposit thickness (d_T)	m	0.070	0.056	0.062	0.058	0.062	8.7
S_D/d_T		1.70	2.04	1.81	1.88	1.86	6.6
Sediment yield ($q_{s(Y)}$)	kg s^{-1}	0.0277	0.0274	0.0277	0.0326	0.0276	7.5
Slope of self-made bed (S_f)	%	1.61	1.92	1.69	1.57	1.70	8.0

$\% \text{ variation} = \left[\left(\frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^2 \right)^{0.5} \Big/ \bar{x} \right] \cdot 100$, n is the number of samples, x_i is the individual measurement, and $\bar{x}$ is the mean

2.3.2.5 Generalized flow structure in scour hole

Figure 4 shows the time-mean flow pattern within a headcut scour hole obtained from video recording. Uniform, supercritical flow accelerated and converged at the overfall brinkpoint. Overfall entry angle was near 44º at low flow rates and 40º at high flow rates (Figure 4, Table 1). At this bed slope, the overfall nappe (two-dimensional jet) remained non-aerated at all flow rates, and the diffuse jet impinged the bed just upstream of the maximum scour depth (Figure 4). Within the sour hole, the submerged, two-dimensional jet split into two wall jets. These jets formed two counter-rotating eddies or 'rollers' upstream and downstream of the jet that eroded and shaped the scour hole. The upstream roller was captive: it remained fixed in place relative to the headcut during migration. The downstream roller also remained fixed relative to the impinging jet, but the roller became three-dimensional downstream of the scour hole and caused complex flow patterns (Figure 4). The circulation within the downstream roller also caused a region of significant upwelling, and sediment deposition occurred as the flow was directed toward the water surface. Thus the self-made bed exhibited upstream-dipping trough cross-stratification. This general flow pattern did not vary either during headcut migration nor with increasing flow discharge.

2.3.2.6 Processes of headcut erosion, and their relation to bed morphology

Two processes of headcut erosion were observed: surface seal failure and jet impingement scour. During overland flow, the intermittent removal of the surface seal as pieces was visually observed at the headcut brinkpoint position. These pieces were hexagonal to rectangular in shape, approximately 1 to 10 mm in diameter, and millimeters thick. Once the seal was removed, the underlying soil was quickly washed away. At the conclusion of overland flow, numerous cracks were observed on the exposed soil surface, parallel to the headcut and transverse to the flow direction (Figure 12). These cracks were (1) arcuate in shape, discontinuous across the exposed soil bed, and normally 10s of millimeters long, (2) widest and deepest near the brinkpoint, becoming faint and shallow further upstream, and (3) restricted to a distance of approximately 20 mm from the headcut brinkpoint. From these observations, it was

Figure 12. Photograph of bed surface at the conclusion of overland flow showing the occurrence and placement of cracks near the headcut brinkpoint. Width of channel is 0.165 m, and flow is toward bottom of photograph.

concluded that formation of these cracks caused the failure and removal of the surface seal, resulting in rapid erosion of the underlying material. Crack formation in surface seals may be related to turbulent shear forces imparted by the overland flow, subsurface pressure effects, and cantilever mass failure [e.g. *Römkens et al.*, 1997]. Changes in subsurface pressures, namely a decrease in negative pore pressure (tension), may have significantly affected surface seal adherence to the soil substrate [*Römkens et al.*, 1995, 1996]. Undercutting of the headcut due to erosive circulation in the captive roller within the scour hole was also observed, and cantilever mass failure of the soil bed may have triggered or facilitated crack formation and surface seal failure at the brinkpoint.

As noted above, the submerged jet formed at the brinkpoint caused soil erosion within the scour hole. The dynamics of sediment erosion by submerged jets is well documented [e.g. *Rajaratnam*, 1981], and impinging jet scour has been successfully applied to headcut erosion [*Stein and Julien,* 1993, 1994; *Stein et al.* 1993]. During the present runs as flow discharge increased, the erosive potential of the impinging jet and its two wall jets increased, thus causing deeper and larger scour holes.

Soil erosion at the head of channels can also occur by seepage or sapping processes provided the exit gradient produces forces sufficient to overcome the grain's resisting forces [*Hagerty*, 1991]. *Dunne* [1990; see also *Montgomery*, 1999] provided the following expression to calculate the vertical head gradient (i_c) necessary for seepage erosion,

$$i_c = \frac{\frac{c}{\Delta z} + (r_s - r)g(1 - p)}{rg}$$

where c is soil cohesion, Δz is headcut height, r_s is the saturated bulk density of the soil, r is fluid density, p is soil porosity, and g is gravitational acceleration. Using very conservative estimates ($c = 2500$ to 5000 Pa, $\Delta z = 0.08$ m, $r_s = 2100$ kg m^{-3}, $r = 1000$ kg m^{-3}, $g = 9.81$ m s^{-2}, and $p = 0.3$), seepage erosion would occur when the vertical head gradient is 4 to 7 m m^{-1}. Yet near the submerged headcut, maximum vertical head gradients (a 0.013-m change in water surface elevation over a distance of 0.1 m) were about 0.13 m m^{-1} (e.g. Figure 4). A perched water table and the presence of cracks would greatly enhance seepage erosion processes [e.g. *Bryan and Rockwell*, 1998]. First, there was no visual evidence of water table development. Moreover, the subsurface drainage system ensured escape routes for both air and water. Second, the cracks in the surface seal were restricted in distance from the headcut (10 to 20 mm) and depth (1 to 2 mm), suggesting that any enhanced infiltration would only impact the brinkpoint region.

2.3.3 The Effect of Discharge and the Conservation of Form and Process

With a four-fold increase in flow discharge, dimensions of the steady-state scour hole and its associated sediment yield increased accordingly: both S_D and S_L increased by about 200%, d_T increased by almost 300%, and sediment yield increased by as much as 100% (Figure 13, Table 1). The increase in flow discharge was accommodated by a significant increase in the approach flow depth (an increase of 100%) and a moderate increase in flow velocity (an increase of about 45%; Table 1).

Of interest here, however, are those steady-state parameters that did not vary greatly with discharge. The very weak dependence of migration rate on flow discharge (Figure 13) suggests that material characteristics may be an important control on headcut advance. As noted earlier, the surface seal provides the two-layer stratigraphy necessary for the migration of stepped headcuts. Moreover, headcut advance was accomplished by surface seal failure triggered by crack formation, immediately proceeded by soil washout. The physical characteristics of the surface seal were consistent between runs, thereby minimizing the potential variation in migration rate.

Relative length scales of the headcut and deposit were also similar with increasing discharge. The ratio S_L/S_D was close to 1.31 (Figure 6, Table 1), and the ratio of maximum scour depth-to-deposit thickness (S_D/d_T) was close to 1.5 (Table 1) for all runs.

The conservation of scale over a range of flow can be further demonstrated by scaling the headcut profiles. Because the rollers extended over the entire scour hole region (see Figure 4), the scour hole length scales S_L and S_D can be used to normalize all time averaged headcut profiles, and three different

Figure 13. Variation of steady-state headcut and sediment parameters with discharge.

Figure 14. Time-averaged bed profiles of the steady-state headcut normalized by S_D and S_L for each experiment. Also shown are schematic profiles of the water surface and the generalized flow field (see Fig. 4).

morphological fields are recognized (Figure 14). Such normalization has been used in examining dimensional similarity of scour holes formed by plane turbulent wall and impinging jets [*Rajaratnam*, 1981] or in association with bridge abutments [*Totapally et al*., 1998]. In the near field, headcut shape was wholly dependent on the erosive recirculation within the upstream roller (Figure 4), and virtual collapse of all bed profiles is observed, indicating the existence of morphologic similarity in this region. In the far field, sediment generated during headcut migration was partitioned, either deposited or transported, depending upon the transport capacity of the flow. The soil bed downstream of the headcut was constructional, and bed height generally increased with flow discharge. Within the transitional region, the downstream roller became three-dimensional causing complex transport patterns, with greater discharges tending to form higher beds. Dimensional similarity was not observed in the transitional region nor the far field because bed profiles were dependent upon rates of sediment production and deposition, size-density distribution of the sediment, and flow transport capacity. With identical soil materials and soil properties, the increase in flow discharge was accommodated by a systematic and predictable increase in scour hole dimensions.

As discussed above, erosive potential of the impinging jet and its dimensions increased as flow discharge increased [see also *Rajaratnam*, 1981]. Moreover, the mode of seal failure at the brinkpoint position was consistently observed in all experiments. Thus mechanisms of headcut erosion did not change with increased flow rate.

2.4 Conclusions

Headcut development and migration plays a critical role in the initiation of drainage systems, rill and gully formation, erosion of bedrock channels, failure of earthen dams, and landscape evolution. An experimental methodology was developed to examine growth and migration of headcuts in a laboratory channel using a sandy loam to sandy clay loam soil and a pre-formed headcut. Simulated rain produced a well-developed surface seal that increased the soil's resistance to surface soil detachment. During overland flow, an overfall nappe or two-dimensional jet initiated soil erosion, and a headcut developed and migrated upstream. During migration, a steady-state condition was reached where headcut geometry, rate of migration, and sediment yield remained unchanged. Erosion and migration at the headcut brinkpoint were related to the removal of the surface seal, and erosion of the scour hole was related to impinging jet scour and its associated turbulent flow structure. With increased flow discharge, the scour hole became progressively larger but its aspect ratio was conserved. Deposition downstream of the headcut produced a self-made bed whose slope was a function of flow discharge. These data will be used to assess soil erosion in agricultural areas impacted by headcuts and its numerical simulation.

3 Effect of slope on the growth and migration of headcuts in rills

Abstract. Experiments were conducted to examine soil erosion by headcut development and upstream migration in rills typical of upland areas. Soil material, simulated rain, overland flow discharge, and initial headcut height were held constant in each experiment, but initial slope of the bed varied from 1 to 10%. Air-dried, crushed, and sieved sandy loam to sandy clay loam soil was incrementally packed into a laboratory channel 2 m long and 0.165 m wide to a depth of 0.25 m. Soil bulk density was 1425 kg m^{-3} in each experiment. A pre-formed headcut 25-mm high was constructed 1.5 m downstream of the entrance of the flume. Simulated rain, applied at 21 mm h^{-1} for 4 h, produced a well-developed surface seal that minimized the detachment of the surface soil. Following the rainfall, overland flow at a rate of 52 l min^{-1} was released onto the bed, soil erosion occurred at the pre-formed headcut overfall, and a scour hole developed, enlarged, and migrated upstream. The rate of headcut migration was constant within each experiment, but higher slopes of the bed generally resulted in lower rates of migration. At slopes on the bed of 2% and smaller, the overfall nappe at the headcut brinkpoint remained submerged, and a steady-state condition was achieved: sediment yield and geometry of the scour hole remained constant as the headcut migrated upstream. For slopes on the bed of 3% and greater, the overfall nappe became aerated, and as the headcut migrated upstream, the depth of scour increased. Higher slopes on the bed resulted in deeper scour holes. Mechanisms of soil erosion included the formation of tension cracks and seal removal at the headcut brinkpoint, soil washout along the aerated headcut face, and plunge-pool scour. The slope of the sediment deposit downstream of the migrating headcut was 2.2% for all experiments, and suggests that flow discharge and not the initial slope of the bed controlled transport capacity and downstream adjustment of the bed.

3.1 Introduction

Intense, localized erosion of soil, sediment, and bedrock often occurs at discrete step-changes in the elevation of the bed surface on hillslopes and within streams and rivers. These steps are commonly referred to as headcuts when they are located at the head of a rill, gully, or stream, and knickpoints when they are located within the banks of a channel [*Brush and Wolman*, 1960; *Gardner*, 1983]. Formation of headcuts and knickpoints and the upstream migration have been linked to rill and gully erosion [*Seginer*, 1966; *Piest et al*., 1975; *Bryan and Poesen*, 1989; *Bryan*, 1990; *Slattery and Bryan*, 1992], concentration of overland flow [*Mosley*, 1974; *Merritt*, 1984], erosion of bedrock channels [*Miller*, 1991; *Seidl et al*., 1994], and initiation of drainage systems and landscape evolution [*Seginer*, 1966; *Piest et al*., 1975; *Gardner*, 1983; *Schumm et al*., 1984, 1987; *Dietrich and Dunne*, 1993]. Moreover, the occurrence of headcuts in agricultural regions can dramatically increase soil losses [*Meyer et al*., 1975; *Bryan*, 1990; *Römkens et al*., 1996, 1997], and failure of reservoir embankments and spillways commonly occurs by headcut formation and gully development [*Powledge et al*., 1989; *Temple*, 1992; *Temple et al*., 1993; *Temple and Hanson*, 1994; *Moore et al*., 1994]. Hence, examining the erosion processes of headcuts and knickpoints has both environmental and practical importance.

Experimental investigations have already described some basic characteristics of headcut erosion [*Brush and Wolman*, 1960; *Holland and Pickup*, 1976; *Begin et al*. 1980a, b; *Gardner*, 1983, *Bryan*, 1990; *Robinson and Hanson*, 1995, 1996a, 1996b; *Stein and Julien*, 1993, 1994; *Stein et al*., 1993; see review in *Bennett et al*., 1999]. Because of logistical difficulties in examining actively migrating headcuts, little information exists on the dynamics of headcut migration, the variation in the morphology of scour holes, and the mechanics of headcut erosion.

Thus, *Bennett et al*. [1999] developed an experimental methodology to examine in detail actively migrating headcuts in soil material. In their study, *Bennett et al*. [1999] incrementally packed a sandy loam to sandy clay loam soil into a laboratory flume and applied simulated rain to produce a surface seal. Using constant 1% slope of the bed and initial headcut height (25 mm), *Bennett et al*. [1999] released onto this sealed soil overland flows ranging from about 20 to 80 l min^{-1}, and soil erosion occurred at the pre-formed headcut. After an initial period of bed adjustment, *Bennett et al*. [1999] observed the following: (1) a steady-state condition was reached where headcut geometry, rate of migration, and sediment yield remained unchanged, and (2) whereas the scour hole became progressively larger at higher flow discharges, headcut geometry was conserved. The present study extends this experimental methodology to examine, for a given initial headcut height and overland flow discharge, the effect of bed slope on headcut development, migration, and sediment yield. The objective of this research is to enhance the understanding of the processes of soil erosion and to use these data to improve the technology to predict soil erosion [e.g. *Nearing et al*., 1989; *Elliot and Laflen*, 1993].

3.2 Experimental Equipment and Procedure

3.2.1 Flume and Rainfall Simulator

All experiments were conducted in a non-recirculating, 5.5-m long, tilting flume (Fig. 1). Flow discharge was controlled by two adjustable in-take valves and monitored with a pressure transducer connected to an in-line Venturi meter. Measurements of flow discharge were also made manually during each experimental run. The standard deviation of the measurement of flow discharge was generally 3%. The pump was connected to a reservoir tank that received a constant supply of clear water close to 20ºC.

Water was fed initially into an inlet tank 0.8 m long, 0.4 m wide, and 0.3 m deep, then onto a raised floor, 1 m long and 0.165 m wide, located immediately upstream of a soil cavity 2 m long, 0.165 m wide, and 0.25 m deep (Fig. 1). A subsurface drainage system was installed along the base of the soil cavity and consisted of three ½”-pipes that were interconnected and perforated. All water and sediment passing through the flume was concentrated into an outlet pipe where sampling took place.

Suspended approximately 4 m above the flume was a multiple-intensity rainfall simulator consisting of two oscillating nozzles spaced 1.64 m apart [*Meyer and Harmon*, 1979; Fig. 1]. Water was pumped to these nozzles, attaining a pressure of 41 N m^{-2} (6 psi) and a flow discharge of 22.1 l min^{-1}

(±1%) at each nozzle. At this height and water pressure, most simulated water drops reach terminal velocity by the time they impact the soil surface. The intensity of rainfall (mm h^{-1}) was governed by the oscillation frequency of the nozzles, operated to within ±1.3%, and calibrated for the bed area under investigation.

3.2.2 Soil Material

The soil used in this study, a sandy loam to sandy clay loam (fine-loamy, siliceous, thermic, Typic Paleudult; *Römkens et al*., 1997, 1998) that is derived from a marine deposit of Eocene age [*Nash et al*., 1988], is quite common to the southeastern U.S. The present material was obtained from an excavated borrow pit in Neshoba County, MS, at a depth of about 3 m. It consists of 20.0% clay, 2.9% silt, and 77.1% sand. Based on sieve analyses, the median grain size (D_{50}) of the sand component was 0.26 mm ($D_{16} = 0.16$ mm, $D_{84} = 0.55$ mm). Much of the soil used in this study was recycled from previous experimental runs.

3.2.3 Preparation of the Soil Bed

Before the soil cavity was filled, the subsurface drainage system was installed at its base (Fig. 1). These pipes were covered with a porous fabric and 0.1 mm-diameter sand to a depth of 0.03 m. All interior seams were sealed with molding clay; the only openings to the free air were the five outlets of the subsurface drainage system.

The soil material was air dried in a greenhouse, mechanically crushed, and passed through a 2 mm sieve. Soil was packed incrementally in layers of about 0.02 m. Each increment was spread evenly across the flume and tamped in a uniform and systematic manner using a 9 kg aluminum block mounted to an aluminum frame 0.6 m long and 0.165 m wide. This block was raised 0.3 m above the soil and allowed to free-fall onto the frame approximately ten times. By repeatedly moving the frame along the soil bed, a uniformly-packed soil profile was constructed with a bulk density close to 1425 kg m^{-3}.

After preparing the soil to a depth of 0.225 m, an aluminum frame was placed 1.5 m downstream of the entrance to the soil cavity for the purpose of forming a headcut. This frame had a vertical face, 0.025 m high and 0.165 m wide, and it had little impact on the applied rainfall. Once installed, soil was packed upstream of the frame, producing a pre-formed vertical step in the bed profile.

The soil material within the upper-most 0.02 m was treated with 0.75 cmol of $Ca(OH)_2$ per 100 g of soil to promote a physio-chemically favorable condition for the development of a seal [*Römkens et al*., 1998]. Following the application of simulated rain, a well-developed and reproducible surface seal formed. This seal negated surface soil detachment upstream and downstream of the headcut, and it produced the requisite two-layer stratigraphy common to many stepped headcuts and knickpoints observed in field and flume studies [e.g. *Holland and Pickup*, 1976].

3.2.4 Data Acquisition

The Plexiglas sidewall of the flume had a superimposed grid system for visual observation of many morphologic and hydraulic parameters. A video camera, mounted to a tripod during rainfall application and to a movable carriage during the overland flow, recorded each experimental run. During overland flow, the camera was mounted normal to the downstream flow direction, and was moved orthogonally upstream as the headcut migrated. From these images, the following information could be determined with sufficient accuracy (length scales to within ±3%): progression of the wetting front within the soil profile, position and morphology of the headcut, overland flow depth, and entry angle of the overland flow nappe. Flow depth upstream of the headcut was also measured using a point gauge suspended above the flow, and was in agreement with the measurements obtained from the video. During the application of rainfall, inception of surface runoff was noted, and rate of runoff was obtained by measuring water discharge from the outlet pipe for 5 min at 30-min intervals. During overland flow, water and sediment samples were obtained from the outlet pipe as fast as possible until the headcut stabilized in form and migration rate; afterward the rate of sampling was reduced to 30-s intervals. Approximately 0.5 l of water and sediment were obtained for each sample. To each sample, 1 ml of 0.09

M solution of $Al_2(SO_4)_3$ was added to settle the soil, and the clear water was later decanted. The sample remains were oven dried and weighed to determine total mass of the sediment. At the conclusion of the run, a bed profile was taken along the centerline of the flume at 0.01-m increments using a point gauge on a carriage suspended above the flume. Depth of scour relative to the bed surface was measured along the flume sidewall.

3.3 Results and Discussion

3.3.1 Rainfall Application, Wetting Front Procession, Surface Runoff, and Seal Development

With the bed prepared and headcut-forming plate installed, a rainfall of known intensity and duration was applied to the soil material. In most runs, about 21.3 mm h^{-1} of rain was applied for 4 to 7 h to a bed slope of 5% (Table 3). This bed slope was chosen to promote removal of dispersed soil material during the application of rainfall so all soil surface areas would be exposed to raindrop impact. During the course of the experiments, the pump supplying local well water to the laboratory failed. For Runs 8, 9, and 10, water provided by Oxford, MS was used instead. The impact of this change is discussed below.

Through the flume's sidewall, advance of the wetting front was observed. Due to differences in infiltration rates along the soil-Plexiglas interface and the packed soil bed, this observation might not be necessarily representative of the actual wetting front position, but rather an apparent one. The characteristics of this procession were consistent for all runs, and are very similar to results presented elsewhere [*Bennett et al*., 1999]. At the conclusion of the rainstorms, minor amounts of subsurface drainage were commonly observed at the most downstream outlet pipe.

Surface runoff normally occurred after about 1.3 h of rainfall (Table 3; Fig. 15). Rates of runoff rates increased dramatically from about 2 to 14 mm h^{-1} during the interval from 1.3 to 3 h, the rate of increase in runoff decreased asymptotically thereafter. The value of this asymptote, after 4 h of continued rainfall, was about 14 mm h^{-1} or about 66% of the applied rate. Because of the different water source,

Table 3. Summary of Experimental Parameters

Parameter	Units	Experimental Run									
		1	2	3	4	5	6	7	8	9	10
Rainfall rate	mm h^{-1}	21.5	22.2	20.7	21.1	21.1	21.4	21.3	21.2	21.3	21.3
Rainfall duration	h	4	4	4	4	4	4	4	4	6	7
Total rainfall	mm	85.9	88.6	82.9	84.5	84.2	85.7	85.0	85.0	127.5	148.8
Bed slope during rainfall	%	5	5	5	5	5	5	5	5	5	5
Time of runoff initiation	h	1.60	1.38	1.17	1.18	1.58	1.33	1.37	0.92	1.13	0.97
Runoff rate at conclusion	mm h^{-1}	13.3	12.2	14.3	14.1	14.3	15.4	14.7	18.4	15.3	20.5
Bed slope during overland flow	%	1	2	3	4	5	6	7	8	9	10
Initial headcut height	m	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Soil bulk density	kg m^{-3}	1464	1382	1382[a]	1382[a]	1485	1387	1410	1410	1433	1518
Flow discharge	l min^{-1}	52.5	52.7	52.8	58.4	51.4	51.8	51.1	52.3	51.4	50.9
Flow discharge standard deviation	l min^{-1}	1.5	1.8	1.9	7.0	1.1	1.0	1.9	2.1	1.7	1.3
Flow depth upstream of headcut	m	0.010	0.009	0.008	0.009	0.011	0.009	0.009	0.010	0.010	0.008
Flow velocity upstream of headcut	m s^{-1}	0.558	0.598	0.685	0.641	0.464	0.588	0.580	0.545	0.524	0.660
Froude number upstream of headcut		1.8	2.0	2.5	2.1	1.4	2.0	2.0	1.8	1.7	2.4
Stream power upstream of headcut (ω)	J m^{-2} s^{-1}	0.52	1.04	1.57	2.31	2.55	3.08	3.54	4.15	4.58	5.05
Mean headcut migration rate	mm s^{-1}	1.0	1.6	1.0	1.3	0.7	1.2	1.2	0.7	0.6	0.8
Time of overfall aeration [b]	s	n.a.	n.a.	298	120	30	53	38	68	76	28
Mean S_L/S_D [c]		0.95	1.25	0.76	0.79	0.79	0.71	0.80	0.79	0.65	0.60
Slope of sediment deposit (S_F)	%	2.4	2.5	2.2	2.5	1.8	2.3	2.0	1.8	2.0	2.2
Stream power on sediment deposit (ω)	J m^{-2} s^{-1}	1.23	1.31	1.13	1.45	0.92	1.17	1.03	0.95	1.02	1.11

[a] estimated
[b] n.a.: overfall never became aerated
[c] mean of last 10 values observed

Figure 15. Time variation in the rate of surface runoff measured at 30-min intervals. A different water source was used in Runs 8, 9, and 10, and caused deviation in the rate of runoff with time as compared to the other runs.

runs 8, 9, and 10 have different time variations in rates of runoff as compared to the other runs: runoff initiation started earlier in time and the rate of runoff was greater. These effects required a longer period of rainfall to ensure nearly saturated soil conditions.

At the conclusion of the rainfall application, visual inspection of the soil surface revealed the formation of a thin, pliable layer, millimeters thick, which constituted the surface seal. Washed sand grains were present on the bed surface, dispersed from the soil bed during rainfall and seal development. A higher concentration of sand was observed in the downstream portions of the flume, presumably the result of transportation during surface runoff. Soil material was also present on the flume sidewalls because of raindrop splash. Different types of surface seals have been reported: (1) physico-chemical seals from dispersion of soil (breakdown of soil aggregates) during adsorption and its associated chemical response; (2) physical seals from the dispersive and compactive action of raindrop impact; and (3) mechanical seals from the deposition of interstitial sediment [*Römkens et al*., 1990b]. Many parameters can affect the development of the seal and the dispersion of clay particles including the duration and intensity of rainfall, presence of exchangeable cations, pH, organic anions, severity of drying, and clay macrostructure [*Rengasamy et al*., 1984; *Römkens et al*., 1990a; *Roth and Pavan*, 1991]. Formation of a surface seal reduces infiltration and increases the strength of the soil surface. Therefore, rate of infiltration, time to inception of runoff, and variation of rate of runoff can all be used as surrogate indicators of seal development and maturity. Measurements of these indicators suggest that the hydraulic and physical characteristics of the seal were consistent between experimental runs. No significant variations in surface seal characteristics from packing, rainfall application, water source, and soil recycling were observed. For Runs 8, 9, and 10, the seal formed at a faster rate, aided by the enhanced dispersive properties of the more alkaline city water and its associated variation in chemistry.

3.3.2 Morphology and Characteristics of Migrating Headcuts

Growth and development of headcuts were the same for all runs. After an initial period of bed adjustment, a quasi-steady state condition ensued where the headcut migrated upstream at a constant rate.

As discussed below, however, headcut geometry, sediment production, and sediment yield were time dependent. Some key morphologic parameters are defined in Figure 16. In most runs, headcut migration continued for a distance of up to 1 m, or about 14 to 23 minutes, at which time overland flow was terminated. *Bennett et al*. [1999] discuss in detail the characteristics of migrating headcuts for nearly-identical experiments.

3.3.2.1 Initial scour and headcut development

With the rainfall application completed, the headcut-forming plate was removed from the soil bed exposing the pre-formed headcut 25 mm high. The bed slope was adjusted to its target value (between 1 and 10%), and an overland flow of known discharge was released onto the soil material. The overland flow discharge (*Q*) was close to 52 l min^{-1}, mean depth of flow (*d*) was about 10 mm, and mean velocity of flow (*u*) ranged from 0.46 to 0.66 m s^{-1} ($u = Q/dw$, where *w* is the width of flow; Table 3). All flows upstream of the headcut were supercritical ($Fr > 1$, $Fr = u/\sqrt{gd}$ where *Fr* is Froude number, and *g* is gravitational acceleration) and turbulent ($Re > 2000$, $Re = rud/m$ where *Re* is boundary Reynolds number, *r* is fluid density, and *m* is fluid molecular viscosity). These values were chosen as being representative of overland flows along crop furrows [e.g. *Meyer et al*., 1975; *Meyer and Harmon*, 1985; *Line and Meyer*, 1988]. Unintentionally, Run 4 had a slightly higher flow discharge (58 l min^{-1}, about 12% higher than the other experiments). Mean depth of flow and velocity upstream of the headcut did not vary significantly as bed slope increased (Table 3). In addition to the effects of surface roughness, resistance to flow in shallow, supercritical flow is complicated by wave drag effects [see *Abrahams and Parsons*, 1994], and such effects would impact observed variations in depth, velocity, and slope.

The overland flow caused failure of the surface seal and soil erosion downstream of the vertical step, and a scour hole developed and enlarged. The location of initial scour and failure of the seal depended upon the initial bed slope. At high slopes, the point of overfall bed impingement occurred farther downstream; thus, surface failure (initial scour) also occurred farther downstream as compared to experiments with lower slope. In general, the scour hole rapidly increased its length S_L and depth S_D during this initial period (Fig. 17). As scour lengthening proceeded, the location of maximum scour moved towards the step, and the scour hole deepened. Concomitantly, erosion initiated at the brinkpoint (defined as the position where the nearly vertical headcut face intersects the horizontal soil bed; Fig. 16), and headcut migration ensued. During this period of bed adjustment, normally lasting for 200 to 400 s, both the depth and length of the scour (Fig. 17) and production of sediment (Fig. 18) increased. The scour holes were larger at higher bed slopes and resulted in initially larger sediment yields as compared to the other experiments. Once the scour hole migrated upstream a short distance as the rate of scour enlargement declined, downstream deposition began and sediment yield decreased accordingly.

Figure 16. Definition sketch of water and bed surface profile of a steady-state headcut with an aerated overfall.

3.3.2.2 Rate of migration, geometry of the scour hole, and sediment yield

After this initial period of growth, the headcut brinkpoint migrated upstream at a constant rate, ranging from 0.6 to 1.6 mm s^{-1} (Fig. 19). The timing of initial movement of the headcut varied: headcuts on greater bed slopes tended to take longer to initiate migration.

During migration, the response of the headcut geometry depended on initial bed slope. For bed slopes 2% and smaller, geometry of the scour hole remained unchanged (Fig. 17). Both the maximum depth of scour, S_D, and length to maximum scour, S_L, attained constant values after about 300 s; the ratio S_L/S_D also remained constant (Fig. 20). For bed slopes 3% and greater, S_L remained constant whereas S_D increased systematically during the experiment (Fig. 17) and caused S_L/S_D to decline with time (Fig. 20). Soil stratification and soil adhesion to the Plexiglas sidewall would also cause minor deviations in the measurement of the length and depth of the scour hole.

For an infinitely long flume, scour depth S_D is hypothesized to asymptotically approach a maximum value in all cases [see *Bennett et al*., 1999]. The erosivity of the impinging jet cannot exceed indefinitely the resistance of the soil to erosion. Similarly, S_L/S_D will also asymptotically approach a

Figure 17. Time variation of the maximum depth of scour, S_D, and length to maximum depth of scour, S_L, measured at 15-s intervals.

Figure 18. Time variation in sediment yield $Q_{S(y)}$. Also shown is the variation in production of sediment at the headcut determined from equation (2).

Figure 19. Time variation in brinkpoint position of the headcut measured at 15-s intervals.

Figure 20. Time variation in the ratio of the length of scour to the maximum depth of scour, S_L/S_D, measured at 15-s intervals.

maximum value. Time variation in S_D for Runs 3 to 5 (Fig. 17) shows such asymptotic tendencies, but asymptotic values were not achieved for Runs 6 to 10 because of the short length of the flume.

The geometry of the scour hole also controlled the temporal variation in sediment yield. For bed slopes 2% and smaller, sediment yield remained fairly constant with time after 300 s (Fig. 18). For bed slopes 3% and greater, sediment yield increased steadily with time in concert with an enlarging depth of scour, S_D.

3.3.2.3 Overfall aeration and nappe entry angle

Overfall at the headcut brinkpoint produced an inclined, impinging, two-dimensional jet or nappe. At bed slopes 2% and smaller, the overfall nappe remained submerged during the entire experiment (Table 3). At bed slopes 3% and greater, the overfall nappe became aerated at some stage during the experiment. An aerated nappe is herein defined as the presence of an air pocket between the overfall, the headcut face, and the water within the scour hole (Fig. 16). For bed slopes of 3 and 4%, nappe aeration occurred after 298 and 120 s, respectively (Table 3). For bed slopes of 5% and greater, nappe aeration occurred very shortly after the initial migration of the headcut. The occurrence of aeration impacts the erosive potential of the jet and the mechanisms of headcut erosion as discussed below.

The entry angle of the overfall nappe relative to the soil surface generally increased with time as scour ensued, reaching an asymptote after about 300 s (Fig. 21). Nappe entry angle depended upon aeration: non-aerated nappes had angles close to 52º, whereas aerated nappes had angles close to 63º.

3.3.2.4 Trace of the scour hole and downstream adjustment of the bed

Along-flume profiles of the trace of the scour hole (erosional surface) show that, during an experiment at bed slopes 2% and smaller, depth of scour did not vary significantly (Fig. 22). At bed slopes 3% and greater, depth of scour increased with distance upstream.

Figure 21. Time variation of nappe entry angle measured at 15-s intervals. Overfall angle is reported relative to the upstream soil bed (see Fig. 2).

Figure 22. Along flume profiles of the initial and final bed surface and the trace of the depth of scour for each experiment. Flow is from left to right.

In all runs, the surface seal upstream of the migrating headcut remained completely intact (Fig. 22). Except for runs 9 and 10, the seal downstream of the initial position of the headcut also remained intact. In these two latter experiments once scour was initiated, erosion proceeded in two directions: upstream from headcut migration and downstream through seal removal (analogous to downstream migration of a positive step). Additional scour also occurred at the exit of the flume because of the constriction of the flow. These additional sediment sources impacted sediment yield as discussed below.

Between the trace of the scour depth and the final bed surface was a region of deposition that represents a self-made bed (Fig. 22). The bed slope from near the final position of the scour hole to a position just upstream of the initial position of the headcut, representing the 'equilibrium' slope, ranged from 1.8 to 2.5% (Table 3). The slope of the self-made bed represents a dynamic equilibrium between rate of sediment production through the migration of the headcut, rate of deposition because of the local flow field and its transport capacity, and imposed flow discharge. Effects of the soil retainer wall, backwater [see *Robinson and Hanson*, 1996b], and roughness of the bed surface on headcut dynamics and sediment yield are yet to be determined.

3.3.2.5 Generalized flow structure in scour hole with an aerated overfall

Based on video recordings, Figure 16 shows a schematic representation of the mean flow field within a scour hole with an aerated overfall nappe, i.e. bed slopes of 3% and greater. Uniform, supercritical, turbulent flow accelerated and converged at the overfall brinkpoint. Overfall angle was near 63º relative to upstream soil surface. The aerated overfall nappe impacted the water surface of the scour hole and plunged downward, impinging the bed just upstream of the maximum depth of scour. This plunging jet split into two wall jets, upstream and downstream, and each wall jet formed a counter-rotating eddy or 'roller'. The distribution of shear stress away from the impingement location and the rotation within these rollers eroded soil material and shaped the scour hole [e.g. *Rajaratnam*, 1981]. The upstream roller was captive; its position between the impinging jet and the headcut face remained constant during the migration of the headcut, and it was primarily two-dimensional in form. The downstream roller became three-dimensional, distorted, and diffuse with distance from the headcut. This general flow pattern did not vary during migration of the headcut, with increasing bed slope, or with increasing depth of scour. *Bennett et al*. [1999] describe a similar flow pattern within a scour hole with a submerged nappe, applicable to the runs herein with bed slopes 2% and smaller.

3.3.2.6 Mechanisms of headcut erosion

Three processes of headcut erosion with an aerated overfall were observed: surface seal failure at the headcut brinkpoint, soil washout along the aerated headcut face, and plunge-pool scour (Fig. 16). During overland flow, the intermittent removal of pieces of surface seal was observed at the headcut brinkpoint. These pieces were hexagonal to rectangular in shape, approximately 1 to 10 mm in length, several millimeters wide, and about a millimeter thick. Once a piece of seal was removed, the underlying soil was quickly washed away. At the conclusion of overland flow, numerous cracks were observed on the exposed soil surface, parallel to the headcut and transverse to the flow direction. These cracks were (1) arcuate in shape, discontinuous across the exposed bed of the soil, and normally centimeters long, (2) widest and deepest near the brinkpoint, becoming faint and shallow further upstream, and (3) restricted to a distance of approximately 20 to 30 mm from the headcut brinkpoint. A photograph of these cracks is presented in *Bennett et al*. [1999]. Crack formation in surface seals could be related to turbulent shear forces, subsurface pressure effects particularly tension [*Römkens et al*., 1995, 1996, 1997], and cantilever mass failure of the soil. For submerged jets, *Bennett et al*. [1999] observed undercutting of the headcut because of erosive recirculation of the captive roller within the scour hole, and cantilever mass failure of the soil bed caused crack formation and soil erosion at the headcut brinkpoint. A similar process is suggested here.

Along the aerated headcut face, soil material was continuously being removed because of fluidized mass wasting. The periodic removal of the seal at the brinkpoint caused an instantaneous ‘flapping’ of the overfall. A small but significant portion of water adhered to and moved down along the headcut face, eroding soil as it did so. This washout process was further augmented by the nearly saturated condition of the underlying soil. Recessed areas in the lower parts of the aerated headcut face were observed at the conclusion of the run, facilitating formation of tension cracks and cantilever failure at the headcut brinkpoint.

Within the scour hole, a submerged jet formed at the entry point and caused soil erosion. The dynamics of sediment erosion by submerged jets are well documented [e.g. *Rajaratnam*, 1981], and impinging jet scour has been successfully applied to headcut erosion [*Stein and Julien*, 1993, 1994; *Stein et al*. 1993]. For the case of non-aerated overfalls, i.e. bed slopes of 2% and smaller, the dominant mechanisms of erosion were (1) the removal of seals at the headcut brinkpoint because of crack formation, undercutting and cantilever failure, and (2) plunge-pool scour.

3.3.2.7 Conservation of mass during headcut migration

Using a control volume, the principle of fluid and sediment mass conservation was applied to a migrating headcut that maintained its rate of migration M and its geometry [*C.V. Alonso*, pers. comm., 1998]. Regardless of the shape of the headcut and depositional front, the mass of sediment per unit time produced by headcut migration ($Q_{S(h)}$) under steady-state conditions must equal the mass of sediment per unit time deposited ($Q_{S(d)}$) plus the sediment yield ($Q_{S(y)}$), that is

$$Q_{S(h)} = Q_{S(d)} + Q_{S(y)} \tag{1}$$

$$Q_{S(h)} = M \cdot r_e \cdot S_D \cdot w \tag{2}$$

$$Q_{S(d)} = M \cdot r_d \cdot d_T \cdot w \tag{3}$$

where r_e and r_d are the bulk densities of the soil and deposit, respectively, and d_T is the average thickness of the equilibrium deposit [see also *Begin et al*. (1980a]). This analysis is applicable to bed slopes 3% and greater only after S_D reaches its asymptotic limit. Equation (2), however, can be used to determine the rate of sediment production at the headcut and this is compared to sediment yield (Fig. 18). At bed slopes 5% and smaller, the production of sediment at the headcut parallels sediment yield, and the difference between these two mass fluxes is the rate of sediment deposition, which is fairly constant. At bed slopes 6% and greater, time variation of sediment production at the headcut and sediment yield appear to converge, even crossing for Run 10. In these latter experiments, the rate of sediment deposition decreased with time and the deposit became a secondary source of sediment.

3.3.3 Effect of Slope on Headcut Growth and Migration

3.3.3.1 Conservation of headcut shape

With a 10-fold increase in bed slope for a given flow discharge, depth of scour at the headcut and length to maximum scour increased by as much as 200% (Fig. 23a; Table 3). *Bennett et al*. [1999] used the depth of scour, S_D, and the length to maximum scour, S_L, to normalize headcut profiles, and reasonable dimensional similarity of the scour holes is observed (Fig. 23b). This collapse of headcut profiles over the 10-fold range in slope demonstrates morphologic similarity: with identical soil materials and soil properties, the increase in bed slope was accommodated by a systematic and predictable increase in the dimensions of the scour hole. Complete dimensional similarity is not attained herein because within the scour hole, the aerated headcut face has a highly variable profile because of processes of soil wasting and the position of the water level within the scour hole.

3.3.3.2 Form and process

Morphologic parameters related to the characteristics of the material, processes of erosion and deposition, and the flow field display systematic variation and invariance with increased slope of the bed. The rate of headcut migration tended to be greater at lower bed slopes (Fig. 24a; not statistically significant, Table 4). Whereas upstream of the headcut unit stream power ($w = rgqS$ where w is stream power per unit bed area per unit time, $q = Q/w$ ($m^2\ s^{-1}$), and S is bed slope) increased from 0.52 J $m^{-2}\ s^{-1}$ at 1% bed slope to 5.05 J $m^{-2}\ s^{-1}$ at 10% bed slope (Table 3), undercutting processes at the brinkpoint were apparently more effective at lower bed slopes, especially in the presence of submerged jets. As noted above for bed slopes 3% and greater, the depth of scour increased asymptotically during the migration of the headcut. The rate of increase in the depth of scour with time $\mathrm{d}(S_D)/\mathrm{d}t$ is observed to increase with bed slope (Fig. 24b; statistically significant, Table 4). S_L did not vary significantly, however, during migration of the headcut (Fig. 18), nor was any discernable trend in $\mathrm{d}(S_L)/\mathrm{d}t$ observed (Fig. 24c; Table 4). Despite the time-dependency of the geometry of the scour, mean aspect ratios S_L/S_D for aerated overfalls were close to 0.7 (Fig. 24d), and decreased slightly with bed slope (Table 4). Negative correlation also occurred between $\mathrm{d}(S_D)/\mathrm{d}t$ and S_L/S_D (statistically significant, Table 4). Conversely, for submerged jets, $S_L/S_D \approx 1.1$ for data presented herein and $S_L/S_D \approx 1.3$ for data presented by *Bennett et al*. [1999].

Figure 23. Profiles of the headcut scour hole for each experiment shown (a) in true scale and (b) normalized by S_L and S_D. Each profile was obtained from digitized images of the headcut taken near the conclusion of the run.

Figure 24. Variation of headcut and sediment parameters with bed slope.

Table 4. Summary of statistical tests performed on data as a function of initial bed slope. All statistically significant levels at the 95% confidence interval are shown in bold.

Variable		M (mm s^{-1})	S_L/S_D*	$d(S_D)/dt$ (mm s^{-1})	$d(S_L)/dt$ (mm s^{-1})	S_f	ω (Pa)	$Q_{S(y)}$* (kg s^{-1})
Results		**Descriptive Statistics of Data Population[a]**						
Mean		1.006	0.809	0.0445	0.0024	2.170	1.131	0.0168
Median		1.005	0.790	0.0465	0.0078	2.190	1.121	0.0167
Standard deviation		0.313	0.182	0.0026	0.0283	0.252	0.165	0.0053
Standard error		0.099	0.057	0.0081	0.0090	0.080	0.052	0.0017
P		0.776	**0.005**	0.141	0.263	0.820	0.784	0.463
Results		**Linear Regression using Initial Bed Slope as the Independent Variable[b]**						
R		–0.580	**-0.733**	**+0.864**	+0.341	–0.534	–0.553	+0.516
F		4.063	**9.273**	**23.580**	1.053	3.183	3.522	2.896
P		0.079	**0.016**	**0.001**	0.335	0.112	0.097	0.127
PW		0.418	0.696	**0.934**	0.154	0.350	0.377	0.326
Variable		**Spearman Rank Order Correlation[c]**						
M	R	•	0.448	–0.177	–0.394	**0.794**	**0.818**	0.067
	P	•	0.185	0.607	0.243	**0.004**	**0.002**	0.838
S_L/S_D*	R		•	**-0.623**	–0.202	0.276	0.313	–0.337
	P		•	**0.048**	0.559	0.425	0.365	0.327
$d(S_D)/dt$	R			•	0.012	–0.256	–0.335	**0.774**
	P			•	0.946	0.446	0.327	**0.007**
$d(S_L)/dt$	R				•	–0.285	–0.345	–0.030
	P				•	0.404	0.309	0.919
S_f	R					•	**0.988**	–0.139
	P					•	<**0.001**	0.681
ω	R						•	–0.164
	P						•	0.631

S_L/S_D*: the average of the last ten measurements observed in each run.
$Q_{S(y)}$*: the average of the last five measurements observed in each run.
[a] Descriptive statistics performed on entire population including mean, median, standard deviation, and standard error of estimate. P is the probability of concluding correctly that the data are normally distributed at the 95% confidence level.
[b] Results of linear regressions performed using bed slope as the independent parameter. R is the correlation coefficient, varying from –1 to +1, and indicates either positive or negative correlation and its magnitude. F gauges the contribution of bed slope in predicting the dependent parameter. If F is large, then bed slope contributes to the prediction of the dependent variable. P is the probability of incorrectly concluding that an association occurred between bed slope and the dependent variable, and P should be less that 0.05. PW is the probability that the linear regression correctly describes the relationship between bed slope and the dependent variable, and PW should be greater than 0.8. PW depends on number of observations, the chance of erroneously reporting a difference (5%), and the correlation coefficient.
[c] Spearman Rank Order Correlation measures the strength of association between pairs of variables that are not normally distributed without specifying which variable is dependent or independent. R is the correlation coefficient, and P is the probability of incorrectly concluding that a true association exists between the variables. P should be less than 0.05.

Despite the large range of the initial slope of the bed and the geometry of the scour hole, the slope of the sediment deposit, S_F, was always close to 2.2% (Fig. 24e; data normally distributed about the mean with a standard error of estimate of ±0.1%, Table 4). Factors such as transport capacity, sediment flux, and the caliber of the sediment will determine slopes of constructed beds. Variation in stream power over this self-made bed parallels S_F (Fig. 24f, Table 4), and was close to 1.13 J m^{-2} s^{-1} (spanning a fairly narrow range from 0.92 to 1.45 J m^{-2} s^{-1}). The larger initial slopes of the bed resulted in larger headcuts and greater sediment fluxes (Table 3; Figs. 18 and 24g); also a positive correlation occurred between $\mathrm{d}(S_D)/\mathrm{d}t$ and $Q_{S(y)}$ (statistically significant, Table 4). Yet sediment flux towards the end of each experiment did not vary significantly for bed slopes 4% and greater (Table 3; Fig. 24g).

For transport of eroded soil material along rills, *Nearing et al*. [1997] suggest that unit stream power is the best predictor of unit sediment load ($q_{S(y)}$; g cm^{-1} s^{-1}). Based on an extensive database, *Nearing et al*. [1997] empirically derived the following relation for predicting sediment load per unit width from unit stream power (ω; erg cm^{-2} s^{-1})

$$\log q_{S(y)} = a + \frac{b e^{g + l \log w}}{1 + e^{g + l \log w}} \qquad (4)$$

where $a = -34.47$, $b = 38.61$, $g = 0.845$, and $l = 0.412$. By assuming that an equilibrium condition existed between sediment yield and the slope of the bed downstream from the migrating headcut, we can use $S = S_f$ and compare (4) with the present data with reasonable success (Fig. 25). Observed sediment yields, however, were not well correlated with stream power (Table 4). Criticisms of applying Equation (4) include (1) empirical expressions are inapplicable to data-sets not used in its derivation, (2) values of $q_{S(y)}$ used for comparison are not in equilibrium or steady state, and (3) the length of the flume is too short for the flow field to reach equilibrium transport capacity. The emphasis here, however, is that soil erosion is governed by headcut migration whereas sediment yield is governed by the transport capacity of the flow.

Figure 25. Variation in unit sediment load ($q_{S(Y)}$) with increasing unit stream power (w) for all experiments. Also shown for comparison is the empirical equation derived by Nearing et al. (equation (4); 1997).

3.4 Summary

The development and migration of headcuts play a critical role in the initiation of drainage systems, rill incision and gully formation, erosion of bedrock channels, failure of earthen dams, and landscape evolution. A methodology previously developed was used to examine the effect of the slope of the bed on growth and migration of headcuts in an experimental channel using a sandy loam to sandy clay loam soil and a pre-formed headcut. Simulated rain produced a well-developed surface seal which increased the resistance of the soil to surface erosion. Overland flow caused erosion by the overfall, and a headcut developed and migrated upstream. The rate of migration of the headcut was constant during each experiment, but the characteristics of the scour hole depended upon the initial slope of the bed. For bed slopes 2% and smaller, the overfall nappe remained submerged, and sediment yield and geometry of the scour hole reached steady-state values where $S_L/S_D \approx 1.1$. For bed slopes 3% and greater, the overfall nappe was aerated, and sediment yield and geometry of the scour hole were not constant with time. In these latter experiments, the downstream deposit became a secondary source of sediment, maximum depth of scour, S_D, increased as the headcut migrated upstream, and $S_L/S_D \approx 0.7$. Erosion for aerated headcuts proceeded by seal removal at the headcut brinkpoint because of the formation of tension cracks, soil washout along the aerated headcut face, and plunge-pool scour because of jet impingement. Increased bed slope resulted in progressively deeper scour holes that migrated upstream at slower rates. The bed slope of the constructed sediment deposit downstream of the headcut was consistently about 2.2% that suggests flow discharge controlled downstream adjustment of the bed.

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Appendix A

Time variation in runoff rate (mm h^{-1}) measured at the outflow during rainfall application for each experimental run.

Runoff Rates: Experiment 1					
Run Number	Discharge ($l\ min^{-1}$)	Rainfall ($mm\ h^{-1}$)	Date	Time (hr)	Runoff Rate ($mm\ h^{-1}$)
1	23.9	20.8	26-Aug-96	3.00	6.90
				3.50	10.11
				4.38	12.02
				4.82	12.82
				5.00	13.03
2	32.7	21.5	16-Sep-96	1.73	4.11
				2.32	8.70
				2.90	10.98
				3.48	11.64
				3.92	12.46
4	41.5	21.5*	25-Sep-96	1.68	3.48
				2.27	10.27
				2.87	12.65
				3.45	13.65
				3.90	14.25
5	53.4	21.2	12-Sep-96	1.75	1.13
				2.33	6.67
				2.92	11.05
				3.50	12.89
				3.92	14.32
6	63.5	21.6	30-Aug-96	1.76	2.97
				2.35	9.12
				2.93	12.08
				3.52	13.98
				3.98	15.52
7	68.2	21.0	1-Oct-96	1.72	2.72
				2.30	9.46
				2.88	11.86
				3.47	13.15
				3.92	13.96
8	72.6	21.2	9-Sep-96	1.68	0.67
				2.27	7.76
				2.85	11.49
				3.43	13.04
				3.92	13.68

9	82.4	21.2	4-Sep-96	1.07	1.56
				1.65	10.08
				2.25	12.30
				2.83	14.30
				3.42	15.18
				4.00	15.63
* estimated value					

Runoff Rates: Experiment 2

Run Number	Slope (%)	Rainfall ($mm\ h^{-1}$)	Date	Time (hr)	Runoff Rate ($mm\ h^{-1}$)
1	1	21.5	28-Feb-97	1.60	3.96
				1.92	6.78
				2.42	9.93
				2.92	11.74
				3.42	12.88
				3.92	13.25
2	2	22.2	17-Jan-97	1.38	4.41
				1.97	9.57
				2.55	11.65
				3.13	10.46
				3.72	12.21
3	3	20.7	24-Jan-97	1.17	1.52
				1.75	6.36
				2.33	10.46
				2.92	11.74
				3.55	14.17
				3.92	14.33
4	4	21.1	31-Jan-97	1.18	1.18
				1.77	10.41
				2.35	12.49
				2.93	10.79
				3.52	13.91
				3.92	14.12
5	5	21.1	12-Feb-97	1.58	3.79
				1.92	4.32
				2.42	9.71
				2.92	11.00
				3.42	13.59
				3.92	14.34
6	6	21.4	10-Mar-97	1.33	3.13
				1.83	10.72

				2.33	13.11
				2.83	14.14
				3.33	15.13
				3.83	15.35
7	7	21.3	17-Mar-97	1.37	5.66
				1.87	10.84
				2.37	12.78
				2.87	13.62
				3.37	14.59
				3.87	14.73
8	8	21.2	24-Mar-97	0.92	3.01
				1.42	10.93
				1.92	16.35
				2.42	17.03
				2.92	17.57
				3.42	18.34
				3.92	18.38
9	9	21.3	3-Apr-97	1.13	1.71
				1.42	6.97
				1.92	11.46
				2.42	13.42
				2.92	14.40
				3.42	14.85
				3.92	15.27
				4.42	15.98
				4.92	16.39
				5.92	17.57
10	10	21.3	3-Jun-97	0.97	4.71
				1.47	14.91
				1.97	17.51
				2.47	18.64
				2.97	19.24
				3.47	19.89
				3.97	19.84
				4.47	20.29
				4.97	20.34
				5.47	20.15
				5.97	20.32
				6.47	20.12
				6.97	20.50

Appendix B

Time variation in brinkpoint position, maximum scour depth (S_D), length-to-maximum scour depth (S_L), S_L/S_D, and entry angle of overfall jet for each experimental run.

Scour Hole Dimensions: Experiment 1

Run	Discharge (l min^{-1})	Date	Time (s)	Brinkpoint (m)	S_D (m)	S_L (m)	S_L/S_D	Time (s)	Jet Angle (degrees)
1	23.9	26-Aug-96	0	0.000	0.025	0.000	0.000	15	67.6
			30	0.023	0.030	0.021	0.700	30	42.0
			60	0.068	0.032	0.037	1.156	45	41.7
			90	0.122	0.034	0.033	0.971	60	45.0
			120	0.188	0.033	0.037	1.121	75	43.2
			147	0.234	0.032	0.034	1.063	90	44.7
			180	0.291	0.029	0.029	1.000	105	48.2
			210	0.339	0.031	0.034	1.097	120	45.0
			240	0.386	0.029	0.034	1.172	135	43.8
			270	0.433	0.025	0.035	1.400	148	42.6
			300	0.480	0.024	0.039	1.625	165	42.9
			330	0.525	0.022	0.032	1.455	180	36.9
			360	0.574	0.027	0.051	1.889	195	49.5
			390	0.621	0.024	0.025	1.042	210	42.0
			420	0.660	0.021	0.024	1.143	221	41.7
			453	0.732	0.023	0.019	0.826	240	49.7
			472	0.761	0.029	0.028	0.966	255	50.4
			510	0.806	0.017	0.024	1.412	270	45.0
			540	0.870	0.020	0.019	0.950	285	44.7
			570	0.910	0.020	0.027	1.350	300	50.7
			597	0.961	0.025	0.029	1.160	315	44.7
			630	1.001	0.029	0.026	0.897	328	41.3
								345	42.0
								360	50.4
								375	40.4
								390	45.6
								405	46.4
								420	43.5
								435	41.0
								454	32.6
								465	35.4
								498	36.1
								510	33.8
								525	40.7
								540	30.5
								555	35.0
								570	26.6
								585	42.6
								597	42.9
								622	42.0
								639	42.6
2	32.7	16-Sep-96	0	0.000	0.025	0.000	0.000	15	41.3
			30	0.025	0.030	0.048	1.600	30	45.0
			60	0.072	0.040	0.064	1.600	45	45.0
			90	0.106	0.043	0.058	1.349	60	52.4

			120	0.157	0.041	0.053	1.293	75	44.1
			150	0.209	0.041	0.055	1.341	90	47.2
			180	0.287	0.035	0.041	1.171	105	46.4
			210	0.349	0.038	0.052	1.368	120	47.7
			240	0.404	0.038	0.043	1.132	135	40.0
			270	0.448	0.038	0.045	1.184	150	44.7
			303	0.497	0.038	0.046	1.211	165	31.0
			330	0.539	0.037	0.047	1.270	180	45.0
			369	0.611	0.037	0.053	1.432	195	43.2
			390	0.656	0.039	0.051	1.308	210	42.0
			420	0.705	0.039	0.046	1.179	220	50.0
			450	0.759	0.036	0.043	1.194	240	50.0
			482	0.818	0.032	0.040	1.250	255	52.4
			510	0.877	0.037	0.048	1.297	270	47.5
			545	0.923	0.034	0.048	1.412	285	50.4
								303	38.7
								315	42.6
								330	42.9
								345	39.7
								355	43.2
								375	35.8
								390	44.4
								405	42.9
								420	48.2
								435	41.7
								450	44.1
								465	47.5
								482	50.0
								495	47.7
								510	48.2
								525	41.7
								536	50.7
								552	49.0
3	39.9	7-Aug-96	0	0.000	0.025	0.000	0.000	15	44.1
			30	0.038	0.044	0.043	0.977	30	47.2
			60	0.090	0.040	0.041	1.025	45	50.7
			90	0.146	0.041	0.042	1.024	60	49.0
			120	0.198	0.039	0.044	1.128	75	41.0
			150	0.253	0.034	0.039	1.147	90	52.9
			210	0.373	0.039	0.036	0.923	105	42.0
			240	0.424	0.036	0.040	1.111	120	47.7
			270	0.478	0.035	0.044	1.257	135	44.7
			298	0.528	0.040	0.045	1.125	150	45.0
			330	0.566	0.040	0.047	1.175	165	42.0
			360	0.613	0.041	0.043	1.049	210	47.7
			420	0.717	0.042	0.042	1.000	230	45.3
			450	0.770	0.036	0.044	1.222	240	45.6
			480	0.816	0.037	0.041	1.108	265	42.6
			512	0.885	0.038	0.042	1.105	270	61.3
			540	0.926	0.038	0.041	1.079	285	48.7
			570	0.966	0.038	0.053	1.395	299	49.0
			603	1.008	0.032	0.038	1.188	320	41.3
								330	48.5
								345	52.4

								360	42.6
								375	52.2
								389	45.0
								405	54.3
								420	52.4
								435	42.9
								450	36.9
								465	42.9
								480	54.7
								525	44.4
								540	47.7
								555	51.3
								570	45.8
								585	42.9
								604	40.4
								615	43.5
4	41.5	25-Sep-96	0	0.000	0.025	0.000	0.000	15	41.7
			30	0.049	0.039	0.049	1.256	30	41.3
			61	0.088	0.045	0.071	1.578	45	38.3
			90	0.131	0.045	0.065	1.444	60	47.2
			120	0.195	0.044	0.066	1.500	75	45.0
			150	0.257	0.042	0.064	1.524	90	40.4
			188	0.327	0.047	0.072	1.532	105	51.1
			210	0.368	0.043	0.076	1.767	120	55.8
			240	0.435	0.041	0.073	1.780	135	43.5
			280	0.492	0.043	0.067	1.558	150	50.7
			315	0.584	0.043	0.070	1.628	165	50.9
			330	0.620	0.039	0.068	1.744	180	54.8
			360	0.689	0.038	0.056	1.474	195	52.6
			409	0.784	0.039	0.070	1.795	210	46.9
			420	0.805	0.040	0.066	1.650	225	44.1
			450	0.858	0.037	0.074	2.000	240	39.0
			480	0.921	0.037	0.079	2.135	257	38.0
			510	0.979	0.038	0.059	1.553	270	35.4
								285	42.0
								300	44.7
								315	44.4
								330	38.7
								348	58.0
								360	39.4
								375	47.2
								390	39.7
								405	39.4
								420	43.2
								450	37.6
								465	45.3
								480	41.3
								495	47.7
								511	48.5
5	53.4	12-Sep-96	0	0.000	0.025	0.000	0.000	15	32.2
			30	0.033	0.032	0.059	1.844	30	35.8
			60	0.048	0.040	0.077	1.925	45	27.9
			90	0.081	0.039	0.099	2.538	60	31.0

			123	0.121	0.035	0.073	2.086	75	27.5
			150	0.165	0.040	0.086	2.150	90	29.2
			180	0.212	0.047	0.086	1.830	105	34.6
			221	0.262	0.054	0.082	1.519	115	39.7
			240	0.287	0.056	0.087	1.554	135	38.3
			270	0.318	0.057	0.078	1.368	150	35.0
			300	0.378	0.051	0.085	1.667	165	42.9
			330	0.413	0.055	0.083	1.509	180	36.1
			360	0.450	0.056	0.083	1.482	195	35.4
			390	0.480	0.054	0.084	1.556	210	35.4
			420	0.528	0.054	0.079	1.463	225	41.7
			450	0.558	0.057	0.080	1.404	240	46.9
			480	0.601	0.057	0.080	1.404	255	37.6
			508	0.639	0.055	0.071	1.291	270	47.2
			540	0.684	0.055	0.081	1.473	285	43.8
			570	0.739	0.053	0.084	1.585	300	39.0
			600	0.781	0.053	0.083	1.566	315	40.4
			642	0.844	0.052	0.091	1.750	330	39.4
			660	0.882	0.052	0.091	1.750	345	39.0
			690	0.932	0.055	0.097	1.764	360	37.6
								375	41.7
								390	41.7
								405	41.3
								420	40.7
								435	38.7
								450	43.8
								465	45.3
								480	39.7
								495	42.6
								510	48.5
								528	35.4
								540	44.7
								555	45.6
								570	40.0
								585	40.0
								600	38.3
								615	42.0
								630	35.8
								645	48.0
								660	43.5
								675	33.8
								690	44.4
6	63.5	30-Aug-96	0	0.000	0.025	0.000	0.000	15	34.2
			30	0.010	0.040	0.063	1.575	30	38.3
			60	0.062	0.044	0.065	1.477	45	38.7
			90	0.120	0.061	0.073	1.197	60	40.7
			117	0.164	0.067	0.076	1.134	75	38.3
			150	0.212	0.069	0.065	0.942	90	40.7
			180	0.277	0.073	0.082	1.123	105	35.8
			210	0.329	0.073	0.069	0.945	117	45.0
			218	0.345	0.075	0.076	1.013	135	46.1
			283	0.465	0.068	0.070	1.029	150	46.4
			301	0.497	0.070	0.072	1.029	165	47.7
			330	0.531	0.070	0.075	1.071	180	52.4

			359	0.582	0.073	0.073	1.000	195	48.0
			390	0.626	0.075	0.077	1.027	210	46.9
			420	0.659	0.072	0.083	1.153	218	42.6
			450	0.701	0.071	0.070	0.986	283	50.2
			480	0.749	0.070	0.074	1.057	301	41.7
			510	0.798	0.065	0.065	1.000	315	38.0
			540	0.851	0.065	0.065	1.000	330	52.0
			570	0.893	0.063	0.067	1.063	345	42.0
			594	0.942	0.067	0.078	1.164	358	54.5
								375	42.3
								390	42.3
								405	40.4
								420	38.7
								435	46.4
								450	54.5
								465	33.0
								480	45.6
								495	42.3
								510	44.1
								525	41.7
								540	44.4
								555	36.1
								570	41.3
								585	39.7
7	68.2	1-Oct-96	0	0.000	0.025	0.000	0.000	15	46.4
			30	0.009	0.036	0.058	1.611	30	26.6
			60	0.055	0.055	0.076	1.382	45	40.0
			90	0.096	0.061	0.080	1.311	60	41.3
			120	0.152	0.058	0.083	1.431	75	36.1
			150	0.228	0.058	0.069	1.190	90	41.3
			180	0.293	0.058	0.070	1.207	105	50.2
			210	0.362	0.057	0.078	1.368	120	49.0
			240	0.428	0.064	0.083	1.297	135	45.0
			270	0.466	0.062	0.082	1.323	150	46.9
			300	0.509	0.068	0.086	1.265	165	39.4
			330	0.553	0.065	0.080	1.231	180	52.9
			348	0.584	0.065	0.087	1.338	195	46.4
			390	0.659	0.052	0.067	1.288	210	41.7
			420	0.731	0.058	0.079	1.362	225	43.8
			450	0.803	0.057	0.081	1.421	240	50.2
			480	0.855	0.056	0.074	1.321	255	40.0
			510	0.920	0.055	0.077	1.400	270	39.7
			540	0.963	0.057	0.077	1.351	282	47.2
			581	1.027	0.052	0.085	1.635	300	39.0
			594	1.057	0.051	0.071	1.392	315	32.2
								330	41.0
								345	41.3
								390	36.9
								405	39.7
								420	36.1
								433	46.4
								450	45.6
								465	54.7
								480	44.4

								495	41.7
								510	31.0
								527	42.6
								540	45.0
								555	40.7
								570	45.0
								585	42.3
								600	36.1
8	72.6	9-Sep-96	0	0.000	0.025	0.000	0.000	15	25.2
			30	0.007	0.031	0.058	1.871	30	20.3
			60	0.048	0.037	0.077	2.081	45	32.2
			90	0.099	0.053	0.078	1.472	60	36.1
			120	0.140	0.060	0.083	1.383	75	35.4
			150	0.203	0.062	0.089	1.435	90	38.3
			180	0.261	0.061	0.084	1.377	105	35.4
			216	0.329	0.064	0.068	1.063	120	41.0
			240	0.374	0.069	0.081	1.174	135	40.0
			270	0.422	0.068	0.086	1.265	150	36.9
			300	0.477	0.064	0.084	1.313	162	41.7
			330	0.525	0.064	0.089	1.391	180	42.0
			360	0.585	0.069	0.090	1.304	215	45.8
			385	0.648	0.069	0.102	1.478	225	37.2
			420	0.714	0.062	0.080	1.290	240	44.1
			450	0.777	0.069	0.087	1.261	255	43.8
			488	0.854	0.059	0.090	1.525	270	35.0
			511	0.903	0.059	0.093	1.576	285	41.3
			533	0.955	0.063	0.090	1.429	300	40.4
			555	1.003	0.069	0.093	1.348	315	44.1
								330	29.2
								345	51.8
								360	40.0
								375	41.0
								390	38.0
								405	39.0
								420	35.4
								435	42.3
								450	42.0
								465	43.5
								485	36.1
								495	35.0
								510	35.4
								525	33.0
								543	40.4
								555	41.7
9	82.4	4-Sep-96	0	0.000	0.025	0.000	0.000	15	29.7
			30	0.008	0.028	0.049	1.750	30	31.0
			60	0.023	0.042	0.075	1.786	45	41.3
			90	0.051	0.054	0.098	1.815	60	35.0
			120	0.080	0.066	0.098	1.485	75	35.8
			150	0.109	0.070	0.093	1.329	90	38.0
			180	0.148	0.072	0.113	1.569	105	39.0
			210	0.172	0.071	0.092	1.296	120	35.0
			240	0.216	0.069	0.076	1.101	135	42.3

			270	0.255	0.070	0.082	1.171	150	45.0
			300	0.299	0.067	0.080	1.194	165	38.7
			330	0.337	0.067	0.080	1.194	180	41.3
			360	0.374	0.072	0.091	1.264	195	44.1
			390	0.423	0.075	0.098	1.307	210	37.6
			420	0.465	0.074	0.098	1.324	225	33.8
			450	0.497	0.075	0.100	1.333	240	31.0
			476	0.524	0.080	0.090	1.125	255	30.5
			510	0.567	0.086	0.093	1.081	271	32.2
			540	0.605	0.084	0.094	1.119	285	45.0
			570	0.636	0.087	0.091	1.046	300	39.0
			600	0.666	0.082	0.092	1.122	315	35.4
			660	0.708	0.086	0.101	1.174	330	35.0
			690	0.750	0.085	0.100	1.176	345	38.3
			720	0.788	0.089	0.093	1.045	360	39.4
			750	0.823	0.088	0.099	1.125	375	21.8
			780	0.857	0.082	0.090	1.098	390	36.5
			810	0.897	0.086	0.107	1.244	405	39.0
			840	0.938	0.084	0.101	1.202	420	35.8
								435	35.8
								450	41.3
								465	35.0
								480	45.3
								495	46.1
								510	45.8
								525	34.6
								540	39.4
								555	31.0
								570	31.0
								585	44.7
								600	44.4
								615	34.2
								630	36.5
								645	38.0
								660	34.2
								675	32.6
								691	42.6
								705	36.1
								720	35.0
								735	35.0
								750	41.3
								765	39.7
								780	42.0
								795	35.8
								810	31.0

Scour Hole Dimensions: Experiment 2

Run	Slope (%)	Date	Time (s)	Brinkpoint (m)	S_D (m)	S_L (m)	S_L/S_D	Jet Angle (degrees)	Flow Depth (m)
1	1	28-Feb-97	15	0.008	0.027	0.015	0.556	46.1	0.011

			30	0.014	0.026	0.023	0.885	40.6	0.012
			45	0.018	0.030	0.025	0.833	45.5	0.012
			60	0.025	0.037	0.052	1.405	40.0	0.013
			75	0.031	0.047	0.066	1.404	44.1	0.013
			90	0.049	0.053	0.076	1.434	47.2	0.012
			105	0.063	0.058	0.094	1.621	45.5	0.012
			120	0.092	0.051	0.100	1.961	48.4	0.012
			135	0.112	0.054	0.087	1.611	41.9	0.012
			150	0.126	0.058	0.071	1.224	39.3	0.014
			165	0.145	0.065	0.080	1.231	43.8	0.013
			180	0.162	0.066	0.078	1.182	48.4	0.013
			195	0.179	0.067	0.070	1.045	47.4	0.012
			210	0.195	0.070	0.076	1.086	46.1	0.012
			225	0.213	0.073	0.073	1.000	55.0	0.012
			240	0.226	0.075	0.074	0.987	57.8	0.013
			255	0.247	0.080	0.075	0.938	43.8	0.013
			270	0.263	0.081	0.076	0.938	47.7	0.012
			285	0.276	0.081	0.071	0.877	50.1	0.012
			300	0.289	0.080	0.075	0.938	54.2	0.012
			315	0.306	0.078	0.074	0.949	51.1	0.011
			330	0.330	0.082	0.067	0.817	52.8	0.010
			345	0.351	0.082	0.083	1.012	55.5	0.012
			360	0.365	0.082	0.080	0.976	52.2	0.012
			375	0.372	0.080	0.084	1.050	50.6	0.013
			390	0.394	0.082	0.084	1.024	63.9	0.014
			405	0.409	0.084	0.088	1.048	64.6	0.015
			420	0.426	0.084	0.083	0.988	58.6	0.015
			435	0.435	0.084	0.093	1.107	50.4	0.013
			450	0.442	0.082	0.085	1.037	56.4	0.011
			465	0.456	0.084	0.081	0.964	53.0	0.012
			480	0.467	0.081	0.089	1.099	52.0	0.012
			495	0.481	0.080	0.088	1.100	54.4	0.010
			510	0.491	0.081	0.091	1.123	52.0	0.010
			525	0.508	0.079	0.093	1.177	57.5	0.010
			540	0.523	0.080	0.090	1.125	59.9	0.011
			555	0.541	0.076	0.091	1.197	57.3	0.009
			570	0.553	0.077	0.088	1.143	56.4	0.012
			585	0.569	0.077	0.086	1.117	53.6	0.011
			600	0.577	0.076	0.080	1.053	57.8	0.011
			615	0.598	0.077	0.089	1.156	55.2	0.011
			630	0.616	0.077	0.094	1.221	54.8	0.011
			645	0.626	0.076	0.086	1.132	58.3	0.011
			660	0.641	0.076	0.088	1.158	57.3	0.011
			675	0.659	0.076	0.084	1.105	59.6	0.012
			690	0.673	0.079	0.080	1.013	53.2	0.011
			705	0.692	0.081	0.086	1.062	52.8	0.011
			720	0.706	0.080	0.077	0.963	46.3	0.011
			735	0.723	0.082	0.082	1.000	48.4	0.013
			750	0.734	0.080	0.079	0.988	53.4	0.012
			765	0.741	0.079	0.079	1.000	56.1	0.010
			780	0.757	0.079	0.076	0.962	58.4	0.011
			795	0.775	0.081	0.079	0.975	58.1	0.011
			810	0.792	0.082	0.082	1.000	50.6	0.010
			825	0.804	0.081	0.080	0.988	60.3	0.010
			840	0.817	0.086	0.076	0.884	53.0	0.011

			855	0.829	0.083	0.084	1.012	53.2	0.012
			870	0.842	0.084	0.069	0.821	52.2	0.011
			885	0.856	0.083	0.076	0.916	57.3	0.010
			900	0.871	0.085	0.077	0.906	64.6	0.010
2	2	17-Jan-97	15	0.011	0.028	0.036	1.286	34.9	0.010
			30	0.030	0.043	0.061	1.419	30.5	0.009
			45	0.046	0.050	0.076	1.520	27.9	0.009
			60	0.062	0.055	0.078	1.418	29.2	0.012
			75	0.082	0.058	0.058	1.000	23.7	0.012
			90	0.108	0.056	0.087	1.554	28.4	0.012
			105	0.141	0.062	0.088	1.419	36.8	0.102
			120	0.163	0.064	0.087	1.359	44.1	0.010
			135	0.208	0.067	0.097	1.448	31.7	0.011
			150	0.216	0.061	0.102	1.672	30.9	0.010
			165	0.251	0.063	0.099	1.571	40.7	0.013
			180	0.271	0.065	0.076	1.169	37.2	0.010
			192	0.295	0.068	0.086	1.265	43.5	0.010
			210	0.331	0.072	0.102	1.417	44.1	0.010
			225	0.354	0.073	0.101	1.384	46.7	0.010
			240	0.377	0.071	0.092	1.296	53.7	0.010
			255	0.392	0.072	0.087	1.208	43.2	0.009
			270	0.426	0.072	0.087	1.208	43.2	0.009
			285	0.437	0.072	0.091	1.264	41.3	0.009
			300	0.451	0.069	0.088	1.275	49.2	0.010
			315	0.484	0.074	0.092	1.243	48.5	0.010
			330	0.503	0.071	0.088	1.239	45.8	0.009
			345	0.510	0.072	0.097	1.347	50.2	0.010
			360	0.594	0.071	0.086	1.211	46.1	0.009
			375	0.605	0.072	0.096	1.333	42.6	0.009
			390	0.667	0.071	0.103	1.451	36.0	0.009
			405	0.698	0.071	0.080	1.127	43.2	0.008
			420	0.705	0.073	0.097	1.329	47.9	0.008
			435	0.723	0.073	0.100	1.370	47.7	0.008
			450	0.738	0.073	0.089	1.219	45.1	0.010
			465	0.757	0.069	0.072	1.043	47.2	0.009
			480	0.776	0.072	0.088	1.222	37.9	0.009
			495	0.794	0.073	0.075	1.027	51.8	0.009
			510	0.811	0.072	0.076	1.056	31.4	0.009
			525	0.827	0.072	0.090	1.250	51.1	0.009
			535	0.856	0.074	0.091	1.230	49.9	0.011
			555	0.886	0.076	0.087	1.145	49.2	0.010
			570	0.903	0.072	0.079	1.097	37.9	0.010
			585	0.927	0.072	0.073	1.014	41.3	0.010
			600	0.949	0.076	0.087	1.145	48.9	0.011
			615	0.973	0.073	0.106	1.452	46.6	0.008
			630	0.990	0.076	0.094	1.237	54.6	0.011
			645	1.013	0.076	0.091	1.197	54.2	0.009
			660	1.035	0.074	0.096	1.297	53.8	0.009
			675	1.053	0.071	0.103	1.451	50.8	0.010
			690	1.064	0.075	0.095	1.267	56.6	0.010
			705	1.086	0.073	0.094	1.288	49.2	0.012
			720	1.102	0.075	0.089	1.187	48.7	0.011
3	3	24-Jan-97	15	0.017	0.029	0.009	0.310	32.6	0.009

			30	0.026	0.034	0.038	1.118	39.4	0.010
			45	0.049	0.054	0.062	1.148	39.3	0.010
			60	0.054	0.056	0.088	1.571	26.1	0.009
			75	0.057	0.062	0.087	1.403	42.3	0.009
			90	0.063	0.068	0.093	1.368	39.0	0.009
			105	0.066	0.073	0.086	1.178	32.6	0.009
			120	0.080	0.076	0.099	1.303	40.0	0.009
			135	0.101	0.078	0.107	1.372	27.0	0.010
			150	0.118	0.073	0.099	1.356	41.9	0.009
			165	0.137	0.076	0.099	1.303	33.8	0.009
			180	0.141	0.076	0.103	1.355	40.7	0.009
			195	0.178	0.087	0.115	1.322	36.8	0.010
			210	0.211	0.085	0.096	1.129	39.4	0.010
			225	0.215	0.078	0.085	1.090	43.2	0.009
			240	0.241	0.097	0.090	0.928	46.9	0.009
			255	0.278	0.088	0.104	1.182	45.8	0.009
			270	0.298	0.083	0.096	1.157	38.6	0.009
			285	0.312	0.093	0.104	1.118	39.7	0.008
			300	0.318	0.094	0.115	1.223	44.4	0.009
			315	0.344	0.087	0.103	1.184	44.4	0.009
			330	0.360	0.088	0.104	1.182	54.5	0.008
			345	0.372	0.090	0.095	1.056	46.4	0.009
			361	0.403	0.094	0.107	1.138	45.0	0.008
			375	0.408	0.092	0.108	1.174	49.7	0.009
			390	0.424	0.086	0.101	1.174	44.3	0.009
			405	0.436	0.087	0.095	1.092	58.0	0.009
			420	0.468	0.087	0.118	1.356	51.6	0.009
			435	0.494	0.089	0.104	1.169	48.5	0.011
			450	0.508	0.092	0.108	1.174	46.1	0.010
			505	0.527	0.097	0.093	0.959	52.4	0.010
			518	0.546	0.094	0.085	0.904	59.1	0.009
			535	0.555	0.091	0.104	1.143	50.9	0.009
			550	0.585	0.094	0.088	0.936	65.8	0.010
			565	0.615	0.097	0.091	0.938	52.0	0.009
			580	0.627	0.098	0.097	0.990	51.8	0.011
			595	0.646	0.100	0.091	0.910	59.8	0.011
			610	0.662	0.101	0.099	0.980	61.5	0.009
			625	0.672	0.104	0.082	0.788	59.5	0.008
			640	0.685	0.103	0.082	0.796	60.0	0.009
			655	0.701	0.088	0.081	0.920	54.8	0.008
			670	0.715	0.087	0.082	0.943	51.8	0.008
			685	0.726	0.107	0.082	0.766	60.9	0.008
			700	0.741	0.108	0.088	0.815	61.6	0.008
			715	0.764	0.116	0.085	0.733	57.2	0.008
			730	0.776	0.112	0.089	0.795	62.0	0.009
			745	0.794	0.093	0.097	1.043	53.5	0.008
			760	0.806	0.092	0.088	0.957	46.9	0.008
			775	0.825	0.113	0.095	0.841	65.4	0.008
			790	0.830	0.109	0.091	0.835	49.0	0.008
			805	0.847	0.109	0.096	0.881	54.5	0.008
			820	0.864	0.111	0.090	0.811	54.1	0.008
			835	0.874	0.110	0.092	0.836	47.5	0.009
			850	0.890	0.113	0.083	0.735	50.2	0.008
			865	0.903	0.113	0.094	0.832	49.0	0.008
			880	0.914	0.113	0.079	0.699	52.4	0.008

			895	0.933	0.107	0.092	0.860	50.2	0.008
			910	0.952	0.108	0.068	0.630	59.5	0.010
			925	0.962	0.113	0.083	0.735	53.5	0.010
			940	0.981	0.113	0.083	0.735	53.5	0.010
			955	1.005	0.109	0.095	0.872	50.2	0.009
			970	1.019	0.112	0.080	0.714	54.5	0.010
4	4	31-Jan-97	15	0.007	0.034	0.045	1.324	23.7	0.005
			30	0.021	0.045	0.054	1.200	43.8	0.006
			45	0.039	0.060	0.061	1.017	43.5	0.006
			60	0.060	0.063	0.071	1.127	47.2	0.007
			75	0.079	0.067	0.057	0.851	51.3	0.006
			90	0.100	0.071	0.072	1.014	39.4	0.007
			105	0.117	0.078	0.071	0.910	38.3	0.007
			120	0.137	0.080	0.072	0.900	60.7	0.007
			135	0.166	0.085	0.072	0.847	51.3	0.007
			150	0.198	0.093	0.080	0.860	60.9	0.008
			165	0.206	0.082	0.068	0.829	58.5	0.007
			180	0.226	0.088	0.085	0.966	63.4	0.008
			190	0.238	0.090	0.088	0.978	51.6	0.008
			210	0.255	0.094	0.084	0.894	62.6	0.008
			225	0.276	0.088	0.083	0.943	64.2	0.008
			240	0.300	0.091	0.078	0.857	66.9	0.008
			255	0.318	0.091	0.083	0.912	71.8	0.008
			270	0.329	0.094	0.077	0.819	58.8	0.007
			285	0.363	0.092	0.090	0.978	72.6	0.007
			300	0.376	0.086	0.080	0.930	74.9	0.007
			315	0.396	0.092	0.074	0.804	64.0	0.009
			330	0.423	0.091	0.079	0.868	79.5	0.008
			345	0.443	0.092	0.079	0.859	72.6	0.008
			360	0.426	0.095	0.080	0.842	57.2	0.008
			375	0.484	0.099	0.081	0.818	67.8	0.007
			390	0.526	0.109	0.096	0.881	54.5	0.008
			405	0.551	0.108	0.098	0.907	62.2	0.008
			420	0.567	0.101	0.086	0.851	74.8	0.009
			435	0.571	0.100	0.083	0.830	76.0	0.008
			450	0.588	0.104	0.078	0.750	77.5	0.008
			465	0.613	0.103	0.076	0.738	64.3	0.010
			480	0.638	0.108	0.076	0.704	58.0	0.008
			495	0.659	0.112	0.083	0.741	64.0	0.010
			510	0.674	0.114	0.086	0.754	60.3	0.010
			525	0.682	0.113	0.097	0.858	70.0	0.008
			540	0.703	0.113	0.084	0.743	64.3	0.007
			555	0.723	0.111	0.092	0.829	66.9	0.007
			570	0.746	0.117	0.095	0.812	54.1	0.008
			585	0.759	0.116	0.086	0.741	64.5	0.007
			600	0.787	0.120	0.100	0.833	62.2	0.008
			615	0.793	0.110	0.088	0.800	62.9	0.007
			630	0.807	0.120	0.096	0.800	69.7	0.007
			645	0.827	0.115	0.101	0.878	64.0	0.007
			660	0.853	0.114	0.086	0.754	72.0	0.007
			675	0.872	0.116	0.084	0.724	65.1	0.008
			690	0.896	0.116	0.085	0.733	53.5	0.008
			705	0.911	0.117	0.089	0.761	56.3	0.007
			720	0.938	0.120	0.105	0.875	60.9	0.007

			735	0.961	0.123	0.097	0.789	68.8	0.007
			750	0.971	0.117	0.102	0.872	63.4	0.008
			765	0.984	0.119	0.099	0.832	60.0	0.007
			780	1.009	0.117	0.085	0.726	60.3	0.007
5	5	12-Feb-97	15	0.007	0.050	0.038	0.760	37.5	0.008
			30	0.014	0.048	0.057	1.188	54.1	0.008
			45	0.016	0.068	0.056	0.824	55.0	0.011
			60	0.032	0.070	0.053	0.757	74.9	0.008
			75	0.060	0.078	0.062	0.795	63.4	0.007
			90	0.085	0.101	0.075	0.743	67.5	0.009
			105	0.100	0.099	0.070	0.707	56.0	0.010
			120	0.121	0.100	0.078	0.780	68.2	0.009
			135	0.142	0.105	0.073	0.695	52.4	0.009
			150	0.166	0.113	0.074	0.655	53.5	0.010
			165	0.174	0.114	0.083	0.728	50.2	0.009
			180	0.183	0.114	0.071	0.623	52.4	0.010
			195	0.189	0.108	0.068	0.630	67.4	0.008
			210	0.205	0.104	0.081	0.779	71.0	0.009
			225	0.217	0.106	0.075	0.708	67.8	0.009
			240	0.228	0.106	0.076	0.717	66.5	0.008
			255	0.242	0.111	0.073	0.658	56.3	0.009
			270	0.265	0.112	0.082	0.732	75.8	0.008
			285	0.280	0.117	0.089	0.761	55.8	0.008
			300	0.294	0.115	0.092	0.800	55.4	0.008
			315	0.313	0.121	0.095	0.785	62.0	0.008
			330	0.317	0.127	0.092	0.724	61.9	0.008
			345	0.323	0.123	0.095	0.772	70.7	0.009
			360	0.334	0.117	0.090	0.769	63.0	0.008
			375	0.350	0.124	0.089	0.718	64.3	0.008
			390	0.359	0.121	0.091	0.752	55.6	0.008
			405	0.364	0.117	0.089	0.761	64.0	0.008
			420	0.376	0.119	0.090	0.756	55.4	0.008
			435	0.386	0.122	0.090	0.738	58.9	0.008
			450	0.408	0.127	0.093	0.732	61.9	0.007
			465	0.411	0.126	0.093	0.738	57.7	0.009
			480	0.420	0.122	0.103	0.844	64.0	0.008
			495	0.434	0.124	0.102	0.823	69.7	0.008
			510	0.445	0.125	0.102	0.816	68.2	0.009
			525	0.457	0.122	0.100	0.820	54.8	0.008
			540	0.466	0.130	0.100	0.769	56.3	0.009
			555	0.478	0.129	0.098	0.760	49.0	0.007
			570	0.490	0.128	0.095	0.742	68.7	0.008
			585	0.502	0.127	0.098	0.772	76.0	0.009
			600	0.508	0.125	0.095	0.760	71.3	0.009
			615	0.510	0.129	0.086	0.667	75.3	0.010
			630	0.518	0.121	0.093	0.769	62.9	0.010
			645	0.535	0.126	0.105	0.833	74.9	0.010
			660	0.541	0.129	0.100	0.775	62.6	0.011
			675	0.554	0.131	0.098	0.748	52.4	0.009
			690	0.557	0.130	0.099	0.762	62.7	0.010
			705	0.581	0.129	0.115	0.891	52.4	0.010
			720	0.597	0.134	0.108	0.806	53.7	0.009
			735	0.619	0.139	0.107	0.770	64.5	0.010
			750	0.627	0.135	0.110	0.815	73.1	0.010

			780	0.633	0.133	0.102	0.767	63.4	0.012
			795	0.644	0.136	0.110	0.809	76.6	0.011
			810	0.660	0.143	0.109	0.762	49.0	0.011
			825	0.665	0.138	0.114	0.826	58.8	0.010
			840	0.682	0.140	0.116	0.829	71.4	0.010
			855	0.685	0.141	0.109	0.773	65.1	0.011
			870	0.702	0.144	0.108	0.750	64.5	0.010
			885	0.712	0.146	0.117	0.801	58.0	0.010
			900	0.717	0.149	0.111	0.745	58.0	0.010
			915	0.723	0.143	0.112	0.783	50.2	0.009
			930	0.733	0.144	0.111	0.771	65.0	0.009
			945	0.742	0.145	0.120	0.828	64.0	0.009
			960	0.747	0.146	0.106	0.726	53.5	0.009
			975	0.759	0.142	0.103	0.725	70.5	0.011
			990	0.769	0.146	0.106	0.726	57.2	0.011
			1005	0.778	0.146	0.112	0.767	73.6	0.010
			1020	0.795	0.148	0.113	0.764	61.6	0.010
			1035	0.805	0.143	0.116	0.811	59.5	0.009
			1050	0.821	0.144	0.115	0.799	50.2	0.009
			1065	0.831	0.144	0.126	0.875	60.5	0.008
			1080	0.845	0.145	0.113	0.779	52.4	0.009
			1095	0.855	0.149	0.122	0.819	72.2	0.010
			1110	0.873	0.142	0.110	0.775	67.8	0.008
			1125	0.883	0.147	0.115	0.782	59.1	0.009
			1140	0.899	0.145	0.117	0.807	65.6	0.010
6	6	10-Mar-97	15	0.008	0.025	0.010	0.400	48.2	0.005
			30	0.010	0.024	0.019	0.792	52.4	0.005
			45	0.019	0.048	0.059	1.229	38.6	0.006
			60	0.040	0.074	0.076	1.027	42.9	0.006
			75	0.054	0.086	0.080	0.930	60.9	0.006
			90	0.069	0.098	0.084	0.857	49.0	0.007
			105	0.091	0.098	0.096	0.980	60.3	0.007
			120	0.102	0.101	0.092	0.911	60.3	0.007
			135	0.120	0.109	0.093	0.853	50.2	0.008
			150	0.132	0.109	0.090	0.826	55.6	0.006
			165	0.155	0.115	0.098	0.852	54.5	0.007
			180	0.167	0.117	0.092	0.786	49.5	0.007
			195	0.178	0.116	0.094	0.810	53.6	0.007
			210	0.205	0.125	0.086	0.688	60.0	0.009
			225	0.231	0.116	0.098	0.845	56.7	0.009
			240	0.245	0.121	0.099	0.818	50.2	0.009
			255	0.257	0.121	0.099	0.818	58.5	0.008
			270	0.271	0.125	0.098	0.784	66.5	0.008
			285	0.291	0.127	0.106	0.835	63.1	0.009
			300	0.306	0.122	0.093	0.762	68.2	0.010
			315	0.330	0.125	0.103	0.824	57.2	0.010
			330	0.355	0.127	0.101	0.795	63.4	0.009
			345	0.368	0.125	0.121	0.968	56.7	0.008
			360	0.394	0.127	0.098	0.772	64.5	0.010
			375	0.418	0.122	0.090	0.738	55.8	0.008
			390	0.433	0.127	0.103	0.811	58.8	0.008
			405	0.443	0.126	0.102	0.810	49.5	0.009
			420	0.463	0.125	0.101	0.808	68.2	0.008
			435	0.485	0.129	0.105	0.814	56.3	0.007

			450	0.499	0.130	0.097	0.746	62.9	0.007
			465	0.523	0.125	0.095	0.760	66.6	0.007
			480	0.544	0.126	0.101	0.802	66.5	0.008
			495	0.563	0.130	0.110	0.846	64.0	0.007
			510	0.579	0.130	0.110	0.846	65.1	0.009
			525	0.600	0.125	0.104	0.832	70.7	0.008
			540	0.628	0.135	0.103	0.763	61.6	0.009
			555	0.635	0.141	0.095	0.674	71.1	0.010
			570	0.650	0.137	0.102	0.745	73.1	0.010
			585	0.675	0.140	0.099	0.707	76.6	0.010
			600	0.699	0.140	0.086	0.614	66.8	0.010
			615	0.719	0.143	0.086	0.601	68.2	0.009
			645	0.749	0.145	0.091	0.628	74.7	0.008
			660	0.755	0.145	0.091	0.628	61.6	0.008
			675	0.786	0.143	0.101	0.706	66.3	0.009
			690	0.808	0.142	0.100	0.704	64.0	0.009
			705	0.825	0.141	0.106	0.752	60.3	0.009
			720	0.833	0.144	0.107	0.743	66.9	0.008
			735	0.849	0.140	0.089	0.636	72.6	0.009
			750	0.868	0.143	0.091	0.636	74.5	0.010
			765	0.875	0.136	0.094	0.691	62.9	0.008
			780	0.888	0.135	0.100	0.741	59.5	0.010
			795	0.909	0.148	0.106	0.716	69.3	0.010
			810	0.928	0.149	0.101	0.678	75.3	0.011
			825	0.955	0.150	0.110	0.733	66.9	0.009
			840	0.971	0.151	0.116	0.768	52.4	0.010
7	7	17-Mar-97	15	0.004	0.025	0.008	0.320	24.2	0.007
			30	0.012	0.038	0.067	1.763	44.1	0.007
			45	0.017	0.065	0.080	1.231	43.5	0.007
			60	0.029	0.076	0.095	1.250	47.2	0.007
			75	0.045	0.076	0.112	1.474	46.4	0.007
			90	0.066	0.093	0.124	1.333	42.0	0.008
			105	0.092	0.097	0.135	1.392	41.3	0.007
			120	0.112	0.107	0.115	1.075	51.8	0.010
			135	0.124	0.118	0.100	0.847	47.7	0.008
			150	0.137	0.120	0.112	0.933	51.3	0.007
			165	0.156	0.122	0.109	0.893	53.9	0.009
			180	0.179	0.122	0.121	0.992	50.7	0.010
			195	0.190	0.121	0.119	0.983	45.8	0.008
			210	0.204	0.125	0.134	1.072	51.3	0.008
			225	0.223	0.126	0.126	1.000	49.0	0.007
			240	0.240	0.158	0.131	0.829	55.4	0.010
			255	0.254	0.124	0.123	0.992	45.8	0.010
			270	0.278	0.121	0.144	1.190	52.4	0.008
			285	0.294	0.125	0.143	1.144	41.3	0.008
			300	0.320	0.120	0.141	1.175	51.8	0.008
			315	0.345	0.123	0.138	1.122	55.8	0.008
			330	0.372	0.127	0.140	1.102	56.3	0.009
			345	0.398	0.134	0.148	1.104	53.1	0.008
			360	0.419	0.136	0.141	1.037	62.0	0.008
			375	0.432	0.137	0.141	1.029	52.4	0.009
			390	0.458	0.141	0.148	1.050	62.9	0.008
			405	0.469	0.135	0.134	0.993	58.0	0.008
			420	0.481	0.135	0.138	1.022	61.6	0.008

			435	0.486	0.142	0.123	0.866	59.8	0.009
			450	0.499	0.145	0.136	0.938	63.1	0.008
			465	0.519	0.140	0.134	0.957	53.9	0.008
			477	0.534	0.138	0.130	0.942	69.0	0.008
			495	0.553	0.140	0.125	0.893	62.2	0.008
			510	0.573	0.142	0.122	0.859	70.0	0.009
			525	0.595	0.143	0.132	0.923	62.0	0.009
			540	0.612	0.148	0.121	0.818	61.2	0.008
			555	0.625	0.148	0.122	0.824	76.0	0.008
			570	0.647	0.153	0.121	0.791	62.2	0.009
			585	0.663	0.154	0.121	0.786	70.5	0.008
			600	0.679	0.156	0.129	0.827	63.4	0.009
			618	0.697	0.154	0.119	0.773	66.0	0.009
			630	0.714	0.154	0.129	0.838	58.8	0.009
			645	0.728	0.156	0.124	0.795	64.2	0.008
			660	0.743	0.154	0.120	0.779	59.2	0.008
			675	0.760	0.157	0.116	0.739	64.2	0.009
			690	0.775	0.160	0.112	0.700	59.5	0.010
			705	0.794	0.159	0.124	0.780	60.3	0.009
			725	0.813	0.154	0.121	0.786	50.7	0.011
			735	0.834	0.154	0.134	0.870	59.5	0.008
			750	0.842	0.158	0.127	0.804	56.3	0.011
			762	0.858	0.154	0.133	0.864	50.7	0.009
			780	0.882	0.156	0.122	0.782	57.7	0.010
			810	0.922	0.132	0.120	0.909	62.2	0.011
8	8	24-Mar-97	15	0.000	0.023	0.018	0.783	24.2	0.008
			30	0.010	0.030	0.045	1.500	19.2	0.010
			45	0.012	0.054	0.072	1.333	43.2	0.010
			60	0.020	0.060	0.089	1.483	44.1	0.010
			75	0.029	0.070	0.109	1.557	49.7	0.009
			90	0.046	0.080	0.125	1.563	37.6	0.010
			105	0.057	0.091	0.115	1.264	51.8	0.010
			120	0.067	0.098	0.106	1.082	49.7	0.010
			135	0.079	0.106	0.114	1.075	59.5	0.010
			150	0.097	0.117	0.124	1.060	42.9	0.011
			165	0.109	0.117	0.115	0.983	41.3	0.011
			180	0.117	0.121	0.120	0.992	53.5	0.011
			195	0.127	0.123	0.117	0.951	50.2	0.010
			210	0.140	0.127	0.114	0.898	52.0	0.010
			225	0.149	0.124	0.108	0.871	45.8	0.012
			240	0.160	0.130	0.125	0.962	56.7	0.010
			255	0.171	0.130	0.130	1.000	48.2	0.010
			270	0.185	0.132	0.121	0.917	52.8	0.010
			285	0.191	0.134	0.120	0.896	57.2	0.010
			300	0.203	0.134	0.116	0.866	50.7	0.010
			315	0.214	0.135	0.116	0.859	71.3	0.010
			330	0.227	0.135	0.124	0.919	60.5	0.010
			345	0.239	0.136	0.110	0.809	55.8	0.011
			360	0.250	0.137	0.111	0.810	52.0	0.010
			375	0.264	0.139	0.119	0.856	53.9	0.010
			390	0.275	0.141	0.122	0.865	52.4	0.010
			405	0.284	0.140	0.118	0.843	60.5	0.010
			420	0.293	0.142	0.121	0.852	54.5	0.010
			435	0.302	0.142	0.117	0.824	59.5	0.010

			450	0.315	0.146	0.125	0.856	58.5	0.011
			465	0.325	0.150	0.123	0.820	55.4	0.010
			480	0.340	0.151	0.132	0.874	52.4	0.010
			495	0.350	0.151	0.121	0.801	54.5	0.011
			510	0.365	0.150	0.132	0.880	59.5	0.010
			525	0.375	0.151	0.138	0.914	46.4	0.010
			540	0.385	0.155	0.140	0.903	54.5	0.011
			555	0.390	0.153	0.125	0.817	53.5	0.009
			570	0.410	0.150	0.147	0.980	54.8	0.010
			585	0.425	0.151	0.150	0.993	58.0	0.010
			600	0.432	0.155	0.141	0.910	55.4	0.010
			615	0.438	0.160	0.136	0.850	48.2	0.009
			630	0.459	0.160	0.147	0.919	49.0	0.010
			645	0.471	0.158	0.150	0.949	56.8	0.010
			660	0.483	0.164	0.142	0.866	51.8	0.010
			675	0.497	0.158	0.149	0.943	53.5	0.010
			690	0.505	0.152	0.148	0.974	51.8	0.009
			705	0.509	0.151	0.138	0.914	59.2	0.010
			720	0.525	0.151	0.145	0.960	55.4	0.010
			735	0.535	0.149	0.134	0.899	52.9	0.009
			750	0.552	0.155	0.124	0.800	49.7	0.009
			765	0.561	0.161	0.130	0.807	61.6	0.010
			780	0.580	0.171	0.136	0.795	55.2	0.010
			795	0.591	0.175	0.122	0.697	66.0	0.010
			810	0.602	0.170	0.125	0.735	60.5	0.010
			825	0.614	0.171	0.140	0.819	54.5	0.009
			840	0.617	0.176	0.106	0.602	70.3	0.010
			855	0.622	0.177	0.139	0.785	53.9	0.010
			870	0.636	0.177	0.139	0.785	53.9	0.010
			885	0.646	0.195	0.144	0.738	54.5	0.010
			900	0.648	0.175	0.136	0.777	49.7	0.009
			915	0.650	0.130	0.100	0.769	58.8	0.008
			930	0.652	0.171	0.134	0.784	49.7	0.008
			945	0.664	0.170	0.135	0.794	52.4	0.009
			960	0.666	0.169	0.132	0.781	53.9	0.008
			975	0.672	0.167	0.138	0.826	54.1	0.007
			990	0.678	0.174	0.136	0.782	60.9	0.009
			1005	0.690	0.166	0.139	0.837	52.4	0.009
			1020	0.695	0.174	0.138	0.793	50.7	0.009
			1035	0.706	0.175	0.145	0.829	48.2	0.009
			1050	0.721	0.176	0.145	0.824	48.7	0.009
			1065	0.735	0.171	0.152	0.889	51.8	0.008
			1080	0.737	0.172	0.149	0.866	55.4	0.009
			1095	0.740	0.172	0.151	0.878	57.2	0.009
			1110	0.742	0.175	0.136	0.777	53.5	0.010
			1125	0.745	0.172	0.142	0.826	54.5	0.010
			1140	0.756	0.179	0.142	0.793	53.3	0.010
			1155	0.766	0.176	0.144	0.818	60.3	0.010
			1170	0.784	0.171	0.148	0.865	58.5	0.010
			1185	0.796	0.176	0.151	0.858	50.2	0.010
			1200	0.800	0.176	0.154	0.875	51.3	0.010
			1215	0.806	0.178	0.155	0.871	47.2	0.009
			1230	0.821	0.171	0.155	0.906	53.5	0.010
			1245	0.844	0.177	0.152	0.859	66.9	0.010
			1260	0.861	0.176	0.144	0.818	66.5	0.010

			1275	0.879	0.176	0.147	0.835	67.2	0.010
			1290	0.883	0.178	0.136	0.764	56.3	0.010
			1305	0.910	0.177	0.140	0.791	52.9	0.010
			1320	0.941	0.193	0.153	0.793	58.3	0.011
			1335	0.943	0.200	0.149	0.745	61.6	0.010
			1350	0.975	0.199	0.162	0.814	66.7	0.010
			1365	0.984	0.198	0.156	0.788	67.8	0.010
			1380	0.994	0.201	0.160	0.796	62.9	0.010
			1395	1.007	0.201	0.159	0.791	70.0	0.010
			1410	1.019	0.200	0.150	0.750	61.6	0.010
			1425	1.037	0.200	0.169	0.845	53.1	0.010
9	9	3-Apr-97	15	0.007	0.025	0.019	0.760	26.1	0.008
			30	0.010	0.038	0.035	0.921	45.2	0.008
			45	0.011	0.056	0.057	1.018	19.2	0.008
			60	0.016	0.061	0.063	1.033	46.9	0.008
			75	0.023	0.078	0.076	0.974	47.7	0.009
			90	0.031	0.092	0.091	0.989	33.4	0.008
			105	0.036	0.100	0.099	0.990	49.0	0.008
			120	0.040	0.108	0.101	0.935	49.5	0.012
			135	0.048	0.110	0.096	0.873	45.8	0.008
			150	0.058	0.112	0.094	0.839	41.3	0.008
			165	0.072	0.116	0.107	0.922	49.0	0.008
			180	0.081	0.118	0.104	0.881	49.0	0.008
			195	0.088	0.117	0.105	0.897	53.5	0.008
			210	0.093	0.116	0.110	0.948	51.8	0.009
			225	0.106	0.119	0.105	0.882	58.8	0.008
			240	0.116	0.117	0.111	0.949	42.6	0.008
			255	0.131	0.121	0.109	0.901	52.9	0.009
			270	0.139	0.125	0.107	0.856	52.4	0.010
			285	0.149	0.126	0.105	0.833	50.7	0.010
			300	0.156	0.127	0.106	0.835	54.8	0.009
			315	0.169	0.127	0.108	0.850	57.5	0.010
			330	0.177	0.132	0.111	0.841	48.0	0.010
			345	0.181	0.132	0.104	0.788	50.2	0.010
			360	0.196	0.131	0.123	0.939	61.3	0.010
			375	0.209	0.126	0.124	0.984	53.9	0.010
			390	0.222	0.133	0.119	0.895	54.5	0.010
			405	0.227	0.136	0.110	0.809	61.6	0.009
			420	0.239	0.135	0.111	0.822	61.6	0.008
			435	0.245	0.139	0.109	0.784	54.8	0.009
			450	0.264	0.139	0.109	0.784	66.0	0.009
			465	0.272	0.140	0.112	0.800	60.0	0.009
			480	0.276	0.140	0.111	0.793	62.2	0.008
			495	0.287	0.140	0.111	0.793	62.9	0.009
			510	0.300	0.140	0.119	0.850	52.4	0.010
			525	0.311	0.139	0.115	0.827	59.1	0.009
			540	0.324	0.144	0.124	0.861	56.7	0.010
			555	0.334	0.146	0.124	0.849	62.9	0.008
			570	0.340	0.151	0.114	0.755	67.4	0.009
			585	0.347	0.151	0.109	0.722	57.7	0.010
			600	0.349	0.149	0.112	0.752	61.9	0.090
			615	0.353	0.147	0.106	0.721	58.3	0.010
			630	0.358	0.149	0.111	0.745	54.5	0.009
			645	0.374	0.150	0.118	0.787	62.9	0.008

			660	0.378	0.148	0.110	0.743	58.0	0.009
			675	0.381	0.146	0.119	0.815	53.9	0.010
			690	0.387	0.149	0.119	0.799	60.9	0.009
			705	0.395	0.149	0.120	0.805	58.8	0.009
			720	0.410	0.150	0.124	0.827	60.3	0.008
			735	0.413	0.149	0.123	0.826	52.4	0.009
			750	0.417	0.146	0.110	0.753	62.5	0.009
			765	0.433	0.145	0.110	0.759	66.5	0.008
			780	0.438	0.143	0.100	0.699	64.3	0.009
			795	0.445	0.148	0.105	0.709	69.3	0.009
			810	0.452	0.149	0.110	0.738	68.2	0.009
			825	0.462	0.148	0.114	0.770	61.6	0.009
			840	0.480	0.147	0.095	0.646	64.0	0.009
			855	0.490	0.146	0.122	0.836	62.2	0.009
			870	0.497	0.149	0.098	0.658	56.3	0.008
			885	0.499	0.147	0.109	0.741	65.1	0.009
			900	0.508	0.151	0.121	0.801	61.6	0.009
			915	0.512	0.150	0.125	0.833	61.2	0.009
			930	0.514	0.151	0.127	0.841	66.0	0.009
			945	0.522	0.151	0.125	0.828	63.4	0.009
			960	0.532	0.150	0.123	0.820	67.5	0.009
			975	0.541	0.150	0.132	0.880	66.0	0.008
			990	0.548	0.160	0.116	0.725	60.9	0.008
			1005	0.565	0.155	0.111	0.716	68.2	0.009
			1018	0.572	0.156	0.105	0.673	65.6	0.008
			1035	0.578	0.158	0.101	0.639	69.7	0.009
			1050	0.582	0.158	0.107	0.677	69.7	0.009
			1065	0.590	0.160	0.105	0.656	71.6	0.008
			1080	0.592	0.160	0.107	0.669	64.0	0.008
			1095	0.606	0.164	0.106	0.646	59.8	0.009
			1110	0.614	0.167	0.109	0.653	68.6	0.009
			1125	0.618	0.170	0.106	0.624	74.1	0.008
			1140	0.632	0.176	0.107	0.608	69.0	0.009
			1155	0.645	0.170	0.110	0.647	68.2	0.009
			1170	0.649	0.168	0.131	0.780	69.7	0.009
			1195	0.662	0.174	0.132	0.759	66.5	0.009
			1210	0.670	0.171	0.122	0.713	69.0	0.009
			1225	0.685	0.170	0.114	0.671	77.2	0.010
			1240	0.691	0.173	0.111	0.642	69.0	0.009
			1255	0.703	0.170	0.115	0.676	62.9	0.009
			1270	0.715	0.170	0.120	0.706	58.8	0.009
			1285	0.726	0.172	0.127	0.738	66.7	0.009
			1300	0.729	0.172	0.127	0.738	68.4	0.009
			1315	0.742	0.175	0.124	0.709	69.7	0.009
			1330	0.751	0.177	0.128	0.723	55.4	0.009
			1345	0.755	0.179	0.134	0.749	69.0	0.009
			1360	0.761	0.186	0.121	0.651	67.4	0.009
			1375	0.768	0.186	0.132	0.710	69.7	0.009
			1390	0.776	0.182	0.121	0.665	61.3	0.009
			1405	0.790	0.186	0.134	0.720	66.9	0.009
			1420	0.798	0.192	0.123	0.641	69.5	0.009
			1435	0.809	0.192	0.132	0.688	67.4	0.009
			1450	0.824	0.193	0.131	0.679	69.0	0.009
			1465	0.841	0.200	0.129	0.645	69.0	0.009
			1480	0.847	0.192	0.112	0.583	67.8	0.009

			1495	0.860	0.189	0.119	0.630	63.4	0.008
			1510	0.869	0.189	0.117	0.619	70.7	0.008
			1525	0.882	0.190	0.112	0.589	60.5	0.008
10	10	3-Jun-97	15	0.014	0.028	0.024	0.857	42.9	0.008
			30	0.034	0.042	0.048	1.143	37.6	0.008
			45	0.034	0.058	0.064	1.103	47.2	0.008
			60	0.046	0.085	0.084	0.988	43.5	0.008
			75	0.050	0.089	0.091	1.022	51.3	0.009
			90	0.060	0.096	0.104	1.083	47.2	0.009
			105	0.069	0.104	0.104	1.000	61.6	0.008
			120	0.083	0.104	0.092	0.885	52.4	0.010
			135	0.095	0.111	0.092	0.829	50.2	0.010
			150	0.100	0.110	0.085	0.773	59.1	0.010
			165	0.116	0.113	0.092	0.814	56.1	0.009
			180	0.129	0.121	0.088	0.727	59.5	0.009
			195	0.143	0.118	0.085	0.720	60.3	0.009
			210	0.159	0.121	0.091	0.752	58.0	0.010
			225	0.176	0.122	0.091	0.746	60.3	0.009
			240	0.188	0.122	0.084	0.689	64.5	0.009
			255	0.214	0.125	0.090	0.720	60.3	0.008
			270	0.219	0.124	0.097	0.782	60.3	0.008
			285	0.235	0.126	0.096	0.762	59.5	0.009
			300	0.251	0.125	0.095	0.760	60.9	0.008
			315	0.273	0.127	0.098	0.772	61.6	0.008
			330	0.284	0.128	0.097	0.758	58.0	0.008
			345	0.306	0.129	0.082	0.636	67.4	0.008
			360	0.320	0.133	0.090	0.677	61.6	0.008
			375	0.336	0.133	0.085	0.639	68.2	0.008
			390	0.351	0.135	0.101	0.748	65.6	0.008
			405	0.363	0.135	0.099	0.733	64.5	0.008
			420	0.376	0.142	0.090	0.634	56.3	0.008
			435	0.389	0.142	0.112	0.789	66.9	0.008
			450	0.403	0.142	0.096	0.676	71.8	0.008
			465	0.423	0.148	0.095	0.642	64.5	0.008
			480	0.439	0.146	0.077	0.527	66.0	0.008
			495	0.447	0.147	0.075	0.510	73.4	0.008
			510	0.459	0.146	0.085	0.582	65.1	0.008
			525	0.474	0.147	0.084	0.571	67.8	0.008
			540	0.482	0.150	0.086	0.573	70.0	0.008
			555	0.498	0.151	0.089	0.589	77.2	0.008
			571	0.515	0.151	0.095	0.629	70.0	0.009
			585	0.522	0.156	0.093	0.596	74.1	0.008
			600	0.530	0.151	0.091	0.603	66.9	0.008
			615	0.542	0.150	0.088	0.587	71.0	0.008
			630	0.553	0.159	0.083	0.522	74.1	0.008
			645	0.565	0.158	0.083	0.525	71.3	0.008
			660	0.577	0.154	0.087	0.565	68.6	0.007
			675	0.584	0.160	0.096	0.600	71.0	0.007
			690	0.595	0.158	0.090	0.570	60.9	0.008
			712	0.611	0.157	0.101	0.643	68.2	0.008
			722	0.619	0.161	0.109	0.677	74.5	0.008
			735	0.625	0.163	0.091	0.558	69.3	0.007
			750	0.632	0.168	0.104	0.619	69.3	0.008
			765	0.634	0.164	0.093	0.567	75.3	0.007

			780	0.641	0.170	0.095	0.559	67.8	0.007
			795	0.648	0.168	0.102	0.607	73.4	0.008
			810	0.661	0.180	0.112	0.622	60.9	0.008
			825	0.671	0.176	0.118	0.670	73.6	0.008
			840	0.674	0.181	0.102	0.564	77.2	0.007
			870	0.693	0.187	0.096	0.513	73.6	0.007

Appendix C

Time variation in sediment yield (kg s^{-1}) for each experimental run.

Sediment Yield: Experiment 1						
Run	Discharge	Date	Time	Fluid Volume	Sediment Mass	Sediment Yield
	(l min^{-1})		(s)	(l)	(kg)	(kg s^{-1})
1	23.9	26-Aug-96	9	0.36152	0.00189	0.00209
			15	0.34846	0.00210	0.00241
			21	0.42892	0.00321	0.00299
			28	0.46056	0.00516	0.00448
			35	0.43962	0.00603	0.00548
			41	0.46610	0.00768	0.00659
			47	0.43363	0.00760	0.00701
			53	0.44842	0.00743	0.00663
			59	0.45982	0.00864	0.00751
			65	0.48331	0.00905	0.00749
			71	0.43514	0.00848	0.00779
			77	0.39820	0.00828	0.00832
			83	0.39412	0.00896	0.00909
			120	0.41544	0.01005	0.00967
			150	0.42044	0.00954	0.00907
			180	0.43176	0.00993	0.00920
			210	0.43494	0.00994	0.00914
			240	0.39432	0.00963	0.00977
			270	0.42590	0.00924	0.00868
			300	0.41070	0.00869	0.00847
			330	0.50167	0.01104	0.00881
			360	0.40525	0.00758	0.00748
			390	0.39031	0.00782	0.00801
			420	0.43307	0.00751	0.00693
			450	0.38390	0.00672	0.00700
			480	0.39608	0.00679	0.00686
			510	0.39873	0.00704	0.00706
			540	0.39120	0.00651	0.00666
			600	0.38949	0.00581	0.00597
			630	0.43184	0.00683	0.00633
2	32.7	16-Sep-96	29	0.46911	0.00891	0.01035
			36	0.46139	0.00990	0.01170
			42	0.45255	0.00940	0.01132
			50	0.46161	0.00955	0.01128
			57	0.43606	0.00921	0.01151
			65	0.45573	0.00466	0.00557
			72	0.46830	0.00939	0.01093
			79	0.47026	0.01004	0.01164
			87	0.48774	0.01330	0.01486
			94	0.43875	0.01082	0.01344
			102	0.45553	0.00956	0.01144
			120	0.48134	0.00947	0.01072
			150	0.43173	0.00819	0.01033
			180	0.41703	0.00811	0.01059
			210	0.44335	0.00839	0.01032

			240	0.48184	0.00846	0.00957
			270	0.48100	0.00878	0.00995
			300	0.47430	0.00743	0.00854
			330	0.46024	0.00701	0.00830
			360	0.43994	0.00677	0.00839
			390	0.45801	0.00659	0.00784
			420	0.48266	0.00775	0.00876
			450	0.41754	0.00656	0.00856
			480	0.46626	0.00723	0.00845
			510	0.45375	0.00685	0.00823
			540	0.40818	0.00579	0.00772
3	39.9	7-Aug-96	8	0.40617	0.00232	0.00382
			16	0.45625	0.00323	0.00475
			22	0.31939	0.00389	0.00816
			28	0.45791	0.00671	0.00982
			34	0.40302	0.00631	0.01050
			40	0.39446	0.00759	0.01289
			47	0.44695	0.00893	0.01339
			54	0.42819	0.00868	0.01358
			61	0.44198	0.00904	0.01370
			67	0.44152	0.00965	0.01464
			74	0.43531	0.00934	0.01437
			80	0.45168	0.00909	0.01349
			87	0.45870	0.00926	0.01352
			93	0.41396	0.00840	0.01360
			99	0.43190	0.00847	0.01314
			106	0.42759	0.00834	0.01307
			113	0.48947	0.01048	0.01435
			119	0.47730	0.00993	0.01393
			150	0.40574	0.00872	0.01439
			180	0.43988	0.00827	0.01259
			210	0.39328	0.00774	0.01319
			240	0.45714	0.00874	0.01282
			270	0.35354	0.00650	0.01233
			300	0.47311	0.00842	0.01193
			330	0.43445	0.00774	0.01194
			360	0.45570	0.00721	0.01060
			390	0.46523	0.00877	0.01262
			420	0.45215	0.00717	0.01063
			450	0.40670	0.00692	0.01141
			480	0.48156	0.00742	0.01032
			510	0.47284	0.00741	0.01049
			540	0.47098	0.00707	0.01006
			570	0.45593	0.00769	0.01130
			600	0.46670	0.00748	0.01073
4	41.5	25-Sep-96	6	0.46705	0.00735	0.01090
			12	0.45843	0.00308	0.00466
			17	0.47830	0.00503	0.00729
			22	0.38058	0.00684	0.01245
			27	0.45071	0.00802	0.01233
			33	0.43672	0.00819	0.01300
			39	0.43028	0.00901	0.01451
			44	0.43488	0.00918	0.01463

			50	0.44950	0.01138	0.01754
			55	0.43560	0.01111	0.01767
			59	0.46214	0.00977	0.01465
			64	0.47281	0.00959	0.01406
			69	0.45268	0.01000	0.01531
			75	0.46313	0.00952	0.01424
			80	0.38646	0.00756	0.01355
			85	0.47389	0.00999	0.01461
			90	0.44653	0.00908	0.01410
			94	0.44498	0.00917	0.01427
			99	0.47834	0.00880	0.01275
			120	0.47770	0.00857	0.01243
			150	0.45444	0.00690	0.01052
			180	0.44072	0.00855	0.01344
			210	0.46979	0.00798	0.01178
			240	0.47654	0.00863	0.01255
			270	0.46505	0.00681	0.01015
			300	0.46199	0.00746	0.01119
			330	0.49008	0.00744	0.01051
			360	0.46554	0.00691	0.01028
			390	0.45744	0.00676	0.01024
			420	0.44214	0.00825	0.01293
			450	0.47414	0.00848	0.01240
			480	0.47378	0.00685	0.01002
			510	0.48744	0.00708	0.01006
5	53.4	12-Sep-96	8	0.43565	0.00204	0.00417
			14	0.42536	0.00131	0.00275
			20	0.46638	0.00144	0.00274
			26	0.48352	0.00286	0.00526
			33	0.43375	0.00439	0.00900
			40	0.46803	0.00580	0.01104
			46	0.46995	0.00621	0.01176
			53	0.45814	0.00666	0.01293
			59	0.45340	0.00776	0.01522
			65	0.43672	0.00653	0.01331
			71	0.46017	0.00732	0.01415
			77	0.46071	0.00710	0.01372
			84	0.47007	0.00675	0.01278
			90	0.45187	0.00737	0.01451
			96	0.44163	0.00651	0.01312
			103	0.45538	0.00682	0.01333
			109	0.45834	0.00644	0.01250
			115	0.46002	0.00651	0.01260
			121	0.42193	0.00562	0.01186
			128	0.41850	0.00561	0.01194
			135	0.45805	0.00625	0.01215
			144	0.43903	0.00578	0.01172
			151	0.45552	0.00648	0.01266
			158	0.45495	0.00554	0.01085
			163	0.46032	0.00598	0.01157
			210	0.43968	0.00529	0.01071
			240	0.45561	0.00577	0.01127
			270	0.47300	0.00590	0.01110
			300	0.45330	0.00495	0.00971

			330	0.44401	0.00442	0.00886
			360	0.46463	0.00435	0.00834
			420	0.43161	0.00408	0.00840
			450	0.46499	0.00497	0.00951
			480	0.45140	0.00430	0.00849
			510	0.45702	0.00454	0.00884
			540	0.45179	0.00450	0.00887
			600	0.46288	0.00502	0.00965
			630	0.48627	0.00478	0.00875
			660	0.41353	0.00417	0.00898
			690	0.45377	0.00447	0.00877
6	63.5	30-Aug-96	7	0.48295	0.00916	0.00969
			12	0.36815	0.00482	0.00510
			17	0.41059	0.00744	0.00787
			22	0.42689	0.01240	0.01312
			28	0.45497	0.01344	0.01422
			33	0.43452	0.01351	0.01430
			40	0.44428	0.01336	0.01414
			45	0.46145	0.01750	0.01851
			50	0.42572	0.01297	0.01373
			56	0.43295	0.01598	0.01691
			62	0.43478	0.01327	0.01404
			67	0.45569	0.01323	0.01400
			73	0.44031	0.01334	0.01412
			78	0.41906	0.01146	0.01213
			83	0.41428	0.01228	0.01300
			88	0.46229	0.01189	0.01257
			93	0.38995	0.00978	0.01035
			104	0.43844	0.01100	0.01163
			109	0.45709	0.01092	0.01155
			115	0.45019	0.00985	0.01042
			120	0.41344	0.00832	0.00880
			126	0.46093	0.00890	0.00942
			150	0.37687	0.00694	0.00735
			180	0.44816	0.00757	0.00801
			210	0.45865	0.00711	0.00753
			240	0.45161	0.00719	0.00761
			270	0.45475	0.00673	0.00712
			300	0.43812	0.00550	0.00582
			330	0.46462	0.00627	0.00664
			360	0.44841	0.00611	0.00647
			390	0.44058	0.00563	0.00595
			420	0.45053	0.00519	0.00549
			450	0.46326	0.00568	0.00601
			480	0.47923	0.00565	0.00598
			510	0.45142	0.00546	0.00578
			540	0.45755	0.00533	0.00564
			570	0.46809	0.00545	0.00577
7	68.2	1-Oct-96	7	0.48392	0.00920	0.02165
			13	0.43916	0.00564	0.01462
			18	0.44207	0.00676	0.01741
			22	0.46763	0.00837	0.02040
			28	0.47365	0.00948	0.02281

			32	0.42954	0.01035	0.02746
			36	0.38176	0.00795	0.02373
			41	0.44502	0.01117	0.02860
			45	0.48016	0.01727	0.04097
			49	0.48371	0.01522	0.03583
			54	0.45685	0.01236	0.03081
			59	0.46299	0.01229	0.03025
			63	0.45312	0.01212	0.03047
			69	0.29301	0.00813	0.03159
			74	0.47500	0.01385	0.03322
			80	0.39858	0.00807	0.02306
			86	0.40024	0.01003	0.02854
			93	0.39122	0.00912	0.02654
			97	0.49233	0.01389	0.03213
			118	0.42229	0.00898	0.02423
			150	0.36025	0.00617	0.01949
			180	0.43150	0.00648	0.01710
			210	0.24887	0.00356	0.01627
			240	0.46148	0.00677	0.01671
			278	0.28547	0.00345	0.01375
			300	0.27996	0.00356	0.01448
			330	0.31660	0.00430	0.01548
			360	0.38192	0.00461	0.01375
			390	0.40981	0.00531	0.01476
			420	0.44789	0.00566	0.01439
			450	0.46467	0.00619	0.01517
			480	0.41536	0.00508	0.01394
			510	0.41415	0.00532	0.01464
			540	0.48146	0.00569	0.01346
			570	0.43552	0.00500	0.01306
			600	0.40231	0.00500	0.01416
8	72.6	9-Sep-96	6	0.47402	0.00499	0.01273
			11	0.40185	0.00532	0.01603
			17	0.45548	0.00740	0.01967
			23	0.45167	0.00980	0.02626
			29	0.44200	0.01061	0.02903
			35	0.44162	0.01191	0.03264
			41	0.45451	0.01239	0.03297
			47	0.42365	0.01237	0.03534
			54	0.38549	0.01116	0.03503
			60	0.39335	0.01153	0.03548
			66	0.45224	0.01190	0.03183
			73	0.44715	0.01124	0.03041
			79	0.42411	0.00982	0.02802
			86	0.44407	0.01064	0.02900
			93	0.44273	0.01031	0.02817
			99	0.44670	0.01056	0.02861
			105	0.43525	0.00836	0.02325
			112	0.44635	0.01043	0.02827
			118	0.43107	0.00903	0.02534
			124	0.41072	0.00893	0.02631
			130	0.42660	0.00817	0.02318
			150	0.45947	0.00830	0.02186
			180	0.42230	0.00660	0.01892

			210	0.45482	0.00678	0.01804
			240	0.44350	0.00665	0.01813
			300	0.44844	0.00539	0.01453
			330	0.42697	0.00534	0.01513
			360	0.45386	0.00496	0.01322
			390	0.44667	0.00550	0.01489
			420	0.47086	0.00606	0.01556
			450	0.41549	0.00518	0.01509
			480	0.45347	0.00578	0.01542
			510	0.47010	0.00669	0.01722
			540	0.43641	0.00455	0.01261
9	82.4	4-Sep-96	6	0.47437	0.00511	0.01476
			11	0.41794	0.00300	0.00983
			15	0.44343	0.00446	0.01377
			20	0.41655	0.00513	0.01687
			25	0.44463	0.00490	0.01510
			30	0.41362	0.00449	0.01486
			35	0.43099	0.00545	0.01732
			40	0.30981	0.00481	0.02126
			45	0.40507	0.00652	0.02203
			50	0.42068	0.00749	0.02440
			55	0.38578	0.00739	0.02624
			62	0.44627	0.01244	0.03819
			67	0.44001	0.01004	0.03125
			74	0.36539	0.01032	0.03870
			80	0.41995	0.01171	0.03820
			86	0.41428	0.01065	0.03522
			92	0.43855	0.01076	0.03361
			99	0.38579	0.00940	0.03338
			105	0.39451	0.00852	0.02957
			112	0.46865	0.01138	0.03325
			118	0.32573	0.00748	0.03146
			124	0.40886	0.00721	0.02417
			131	0.41676	0.00749	0.02462
			138	0.41471	0.00731	0.02415
			144	0.41318	0.00735	0.02438
			151	0.44251	0.00728	0.02253
			160	0.43066	0.00731	0.02326
			166	0.44361	0.00783	0.02420
			210	0.45616	0.00633	0.01902
			240	0.41496	0.00537	0.01774
			270	0.39458	0.00448	0.01556
			300	0.44216	0.00442	0.01370
			330	0.46999	0.00470	0.01371
			360	0.45458	0.00397	0.01197
			390	0.47279	0.00431	0.01249
			420	0.46168	0.00379	0.01126
			450	0.46408	0.00314	0.00926
			480	0.47303	0.00399	0.01154
			510	0.49490	0.00383	0.01060
			540	0.42659	0.00356	0.01144
			600	0.43965	0.00344	0.01070
			630	0.46770	0.00409	0.01199
			660	0.47381	0.00378	0.01094

			720	0.44808	0.00385	0.01176
			750	0.45160	0.00371	0.01124
			780	0.47081	0.00406	0.01182
			810	0.46545	0.00428	0.01260
	Sediment Yield: Experiment 2					
Run	Discharge	Date	Time	Fluid Volume	Sediment Mass	Sediment Yield
	($l\ min^{-1}$)		(s)	(l)	(kg)	($kg\ s^{-1}$)
1	1	28-Feb-97	8	0.30358	0.00312	0.00898
			14	0.45075	0.00117	0.00227
			19	0.46521	0.00132	0.00248
			23	0.43946	0.00142	0.00283
			27	0.45164	0.00198	0.00384
			31	0.31874	0.00161	0.00442
			34	0.43453	0.00206	0.00416
			38	0.43183	0.00229	0.00464
			41	0.41120	0.00262	0.00557
			44	0.42592	0.00288	0.00591
			47	0.43587	0.00340	0.00681
			51	0.45887	0.00411	0.00783
			56	0.44382	0.00443	0.00872
			60	0.43197	0.00509	0.01031
			65	0.45468	0.00699	0.01344
			69	0.44922	0.00694	0.01352
			72	0.42439	0.00649	0.01337
			76	0.41579	0.00718	0.01511
			80	0.43351	0.00725	0.01462
			84	0.44270	0.00758	0.01497
			87	0.44673	0.00860	0.01683
			90	0.44936	0.00886	0.01724
			93	0.44676	0.00924	0.01809
			97	0.43073	0.00921	0.01871
			104	0.44572	0.00894	0.01755
			107	0.44264	0.00777	0.01536
			111	0.45157	0.00888	0.01719
			115	0.44745	0.00762	0.01489
			120	0.42601	0.00768	0.01576
			123	0.44528	0.00807	0.01585
			127	0.38629	0.00721	0.01632
			131	0.43692	0.00771	0.01543
			135	0.43108	0.00753	0.01527
			150	0.42343	0.00687	0.01418
			180	0.44044	0.00617	0.01226
			210	0.44140	0.00577	0.01144
			240	0.45349	0.00616	0.01188
			270	0.43615	0.00586	0.01176
			300	0.44879	0.00521	0.01014
			330	0.41950	0.00419	0.00872
			360	0.45935	0.00520	0.00989
			390	0.37986	0.00434	0.00999
			420	0.37929	0.00372	0.00857

			450	0.44591	0.00463	0.00908
			480	0.43646	0.00422	0.00846
			510	0.41037	0.00449	0.00957
			540	0.44316	0.00453	0.00894
			570	0.45807	0.00425	0.00811
			600	0.43261	0.00403	0.00815
			630	0.45022	0.00411	0.00798
			660	0.44554	0.00388	0.00761
			690	0.43858	0.00380	0.00757
			720	0.45007	0.00412	0.00801
			750	0.45018	0.00429	0.00833
			780	0.45143	0.00419	0.00811
			810	0.44230	0.00404	0.00799
			840	0.46753	0.00469	0.00877
			870	0.44101	0.00415	0.00823
			900	0.44906	0.00407	0.00793
2	2	17-Jan-97	7	0.43973	0.00582	0.01163
			13	0.45374	0.01028	0.01990
			18	0.45369	0.01235	0.02390
			24	0.45660	0.01225	0.02355
			28	0.42300	0.01331	0.02762
			34	0.43312	0.01505	0.03050
			38	0.43869	0.01422	0.02847
			44	0.42650	0.01602	0.03298
			49	0.41765	0.01593	0.03350
			54	0.39076	0.01447	0.03251
			59	0.45015	0.01332	0.02597
			64	0.41682	0.01181	0.02487
			71	0.43849	0.01364	0.02731
			78	0.40590	0.01272	0.02753
			82	0.31901	0.00803	0.02211
			88	0.43931	0.01178	0.02355
			92	0.42975	0.01049	0.02144
			97	0.44189	0.01070	0.02126
			102	0.42503	0.00953	0.01969
			120	0.46966	0.01055	0.01973
			150	0.40703	0.00704	0.01518
			180	0.45738	0.00717	0.01377
			210	0.45684	0.00674	0.01295
			240	0.43720	0.00652	0.01309
			270	0.42842	0.00509	0.01043
			300	0.47060	0.00599	0.01117
			330	0.42293	0.00531	0.01102
			360	0.45984	0.00571	0.01091
			390	0.46194	0.00587	0.01116
			420	0.44165	0.00496	0.00985
			450	0.46311	0.00547	0.01037
			480	0.45022	0.00503	0.00981
			510	0.44778	0.00426	0.00835
			540	0.46096	0.00443	0.00845
			570	0.46044	0.00477	0.00910
			630	0.45949	0.00558	0.01065
			660	0.44913	0.00593	0.01159

			690	0.46313	0.00538	0.01019
			720	0.45807	0.00532	0.01019
3	3	24-Jan-97	8	0.44868	0.00897	0.01760
			14	0.46230	0.00945	0.01800
			20	0.44226	0.00873	0.01738
			25	0.43618	0.00949	0.01915
			31	0.46466	0.01213	0.02298
			37	0.41669	0.01161	0.02454
			42	0.44936	0.01246	0.02441
			49	0.41490	0.01529	0.03244
			54	0.43900	0.01162	0.02331
			59	0.45564	0.01488	0.02876
			65	0.45080	0.01146	0.02239
			72	0.44724	0.01450	0.02854
			79	0.44304	0.01241	0.02467
			84	0.44633	0.01297	0.02558
			90	0.43640	0.01280	0.02582
			96	0.33849	0.00992	0.02580
			101	0.44444	0.01063	0.02106
			120	0.45163	0.01322	0.02577
			150	0.45486	0.00937	0.01815
			180	0.43879	0.00674	0.01353
			210	0.43524	0.00669	0.01354
			240	0.44953	0.00728	0.01426
			270	0.45005	0.00730	0.01428
			300	0.44707	0.00632	0.01244
			330	0.46388	0.00797	0.01512
			360	0.48653	0.00780	0.01412
			390	0.43152	0.00677	0.01381
			420	0.45344	0.00671	0.01302
			450	0.46852	0.00668	0.01256
			480	0.46114	0.00671	0.01281
			510	0.45415	0.00644	0.01249
			540	0.46409	0.00658	0.01248
			570	0.45540	0.00599	0.01159
			600	0.46188	0.00674	0.01285
			630	0.47103	0.00591	0.01104
			660	0.46890	0.00684	0.01284
			690	0.45900	0.00696	0.01334
			720	0.46506	0.00614	0.01162
			750	0.46624	0.00656	0.01239
			780	0.46344	0.00651	0.01237
			810	0.45765	0.00676	0.01300
			840	0.44043	0.00711	0.01422
			870	0.44859	0.00673	0.01321
			900	0.44720	0.00673	0.01325
			930	0.47540	0.00739	0.01369
4	4	31-Jan-97	6	0.27879	0.00563	0.01964
			13	0.38666	0.00893	0.02248
			19	0.44989	0.01396	0.03019
			25	0.41455	0.01941	0.04557
			30	0.37724	0.01193	0.03077
			36	0.44105	0.01694	0.03738

			42	0.47880	0.02279	0.04631
			47	0.45280	0.02000	0.04297
			53	0.49878	0.01866	0.03640
			68	0.39399	0.01390	0.03433
			76	0.48490	0.01661	0.03334
			81	0.44466	0.01276	0.02792
			87	0.41932	0.01242	0.02882
			93	0.46370	0.01304	0.02736
			99	0.49773	0.01467	0.02869
			105	0.37496	0.01062	0.02755
			110	0.44752	0.01261	0.02741
			116	0.39468	0.01147	0.02827
			122	0.46330	0.01131	0.02375
			150	0.44749	0.00991	0.02155
			180	0.47714	0.00977	0.01991
			210	0.38693	0.00817	0.02054
			240	0.48082	0.00827	0.01674
			270	0.32659	0.00571	0.01702
			300	0.47698	0.00869	0.01772
			330	0.38621	0.00717	0.01806
			360	0.42555	0.00835	0.01909
			390	0.47059	0.00916	0.01893
			420	0.40848	0.00805	0.01916
			450	0.45979	0.00839	0.01775
			480	0.47578	0.00191	0.00390
			510	0.45437	0.00909	0.01946
			540	0.47271	0.00989	0.02037
			570	0.45794	0.00952	0.02023
			600	0.48838	0.00941	0.01874
			630	0.46349	0.01101	0.02311
			660	0.44669	0.01026	0.02236
			690	0.46960	0.01130	0.02342
			720	0.46779	0.01155	0.02402
			750	0.40212	0.00947	0.02292
			780	0.48376	0.01084	0.02181
5	5	12-Feb-97	5	0.33332	0.00553	0.01422
			10	0.44708	0.01200	0.02302
			15	0.38260	0.00491	0.01100
			20	0.50280	0.00468	0.00799
			26	0.49333	0.01049	0.01822
			33	0.37407	0.01574	0.03608
			39	0.44796	0.02862	0.05477
			44	0.42825	0.02841	0.05687
			49	0.33825	0.02266	0.05743
			56	0.44101	0.02383	0.04634
			61	0.43386	0.02226	0.04398
			67	0.45795	0.02242	0.04198
			72	0.45836	0.02007	0.03754
			80	0.45267	0.02004	0.03795
			84	0.37754	0.01342	0.03048
			120	0.38082	0.01068	0.02403
			150	0.47449	0.01106	0.01999
			180	0.44824	0.00997	0.01907
			210	0.36643	0.00748	0.01751

			240	0.37843	0.00633	0.01434
			270	0.47017	0.00717	0.01307
			300	0.46697	0.00678	0.01245
			330	0.42429	0.00628	0.01268
			360	0.42658	0.00638	0.01283
			390	0.39778	0.00519	0.01118
			420	0.45197	0.00526	0.00998
			450	0.46770	0.00609	0.01116
			480	0.42495	0.00544	0.01098
			510	0.44864	0.00593	0.01133
			540	0.45885	0.00652	0.01219
			570	0.48253	0.00690	0.01225
			600	0.43834	0.00565	0.01105
			630	0.38524	0.00483	0.01074
			660	0.44022	0.00607	0.01183
			690	0.42586	0.00644	0.01297
			720	0.46263	0.00679	0.01259
			750	0.48459	0.00729	0.01289
			780	0.43421	0.00659	0.01301
			810	0.47249	0.00714	0.01296
			840	0.46295	0.00678	0.01255
			870	0.47600	0.00793	0.01429
			900	0.42455	0.00745	0.01505
			930	0.45717	0.00707	0.01325
			960	0.46809	0.00778	0.01425
			990	0.47753	0.00785	0.01409
			1020	0.44589	0.00763	0.01467
			1050	0.42587	0.00797	0.01604
			1080	0.45640	0.00834	0.01567
			1110	0.46340	0.00797	0.01475
			1140	0.47278	0.00862	0.01563
6	6	10-Mar-97	14	0.45942	0.01329	0.02500
			20	0.45794	0.00259	0.00488
			25	0.45111	0.00167	0.00319
			30	0.45335	0.00172	0.00328
			35	0.48016	0.00245	0.00442
			40	0.46659	0.00496	0.00919
			45	0.45756	0.01483	0.02801
			50	0.44302	0.02508	0.04892
			55	0.44613	0.02743	0.05312
			60	0.43548	0.02376	0.04714
			65	0.46067	0.02295	0.04304
			70	0.45804	0.02406	0.04539
			83	0.45680	0.01947	0.03683
			88	0.48427	0.02117	0.03776
			94	0.45751	0.01491	0.02816
			99	0.42825	0.01404	0.02832
			120	0.43336	0.01238	0.02469
			150	0.45575	0.01133	0.02149
			180	0.43459	0.00807	0.01604
			210	0.43854	0.00719	0.01416
			240	0.41345	0.00571	0.01193
			270	0.41324	0.00658	0.01377
			300	0.46803	0.00734	0.01354

			330	0.47502	0.00900	0.01636
			360	0.42827	0.00799	0.01612
			390	0.45526	0.00769	0.01459
			420	0.43657	0.00803	0.01588
			450	0.47398	0.01187	0.02163
			480	0.46258	0.00976	0.01822
			505	0.46776	0.01120	0.02069
			510	0.42138	0.01049	0.02151
			540	0.46747	0.00976	0.01804
			570	0.46567	0.01126	0.02089
			600	0.46899	0.01060	0.01952
			630	0.43109	0.00953	0.01910
			660	0.46659	0.01127	0.02086
			690	0.48432	0.01329	0.02371
			720	0.45835	0.01337	0.02521
			750	0.45442	0.01268	0.02410
			780	0.45622	0.01042	0.01974
			810	0.47250	0.01239	0.02266
			840	0.44614	0.01239	0.02400
7	7	17-Mar-97	7	0.45891	0.01760	0.03263
			13	0.48193	0.00277	0.00489
			21	0.47973	0.00677	0.01200
			29	0.45138	0.02330	0.04393
			35	0.45945	0.02669	0.04943
			42	0.44099	0.02485	0.04795
			48	0.46995	0.01978	0.03583
			54	0.47001	0.02175	0.03938
			60	0.45206	0.01839	0.03461
			70	0.46819	0.01850	0.03362
			77	0.46781	0.01688	0.03071
			84	0.44158	0.01536	0.02961
			93	0.45519	0.01252	0.02340
			99	0.48555	0.01680	0.02944
			109	0.46126	0.01634	0.03014
			116	0.46355	0.01276	0.02343
			127	0.47875	0.01044	0.01855
			150	0.45178	0.01010	0.01902
			180	0.42693	0.00867	0.01728
			210	0.44573	0.00856	0.01635
			240	0.44907	0.00697	0.01321
			270	0.44010	0.00617	0.01193
			300	0.43660	0.00844	0.01644
			330	0.45041	0.00896	0.01692
			360	0.47059	0.01020	0.01844
			390	0.42406	0.00951	0.01909
			423	0.46443	0.00917	0.01681
			450	0.46232	0.00942	0.01733
			480	0.47997	0.01018	0.01805
			510	0.45609	0.00995	0.01856
			540	0.44782	0.00955	0.01815
			570	0.45462	0.00921	0.01724
			600	0.44579	0.00905	0.01727
			630	0.46521	0.01108	0.02026
			660	0.48039	0.01246	0.02208

			690	0.45248	0.01215	0.02284
			720	0.44243	0.01251	0.02407
			750	0.45955	0.01380	0.02556
			780	0.43893	0.01115	0.02161
			810	0.41424	0.01244	0.02556
8	8	24-Mar-97	5	0.45786	0.00606	0.01154
			14	0.46050	0.00256	0.00485
			21	0.46297	0.00396	0.00745
			28	0.46134	0.00934	0.01766
			34	0.46087	0.01635	0.03093
			42	0.43302	0.02151	0.04332
			49	0.43957	0.02368	0.04698
			55	0.44361	0.02160	0.04246
			62	0.43994	0.02234	0.04428
			68	0.43986	0.01692	0.03354
			74	0.42996	0.02031	0.04119
			81	0.44772	0.01939	0.03777
			89	0.45132	0.01589	0.03071
			97	0.46557	0.01822	0.03412
			104	0.44949	0.01565	0.03037
			110	0.44932	0.01464	0.02841
			118	0.44295	0.01451	0.02857
			150	0.45214	0.00965	0.01862
			180	0.45402	0.00585	0.01123
			210	0.44487	0.00566	0.01109
			240	0.42714	0.00446	0.00910
			270	0.44384	0.00581	0.01141
			300	0.43373	0.00524	0.01053
			330	0.45224	0.00494	0.00952
			360	0.43918	0.00464	0.00921
			390	0.43975	0.00503	0.00996
			420	0.43005	0.00543	0.01101
			450	0.45335	0.00596	0.01146
			480	0.45443	0.00629	0.01208
			510	0.45252	0.00703	0.01354
			540	0.47144	0.00766	0.01417
			570	0.43746	0.00680	0.01356
			600	0.46647	0.00708	0.01324
			660	0.45456	0.00758	0.01455
			690	0.46002	0.00746	0.01415
			720	0.44397	0.00620	0.01218
			750	0.48273	0.00838	0.01513
			780	0.46806	0.00667	0.01244
			810	0.47871	0.00659	0.01200
			840	0.46422	0.00554	0.01041
			870	0.46283	0.00614	0.01156
			900	0.44954	0.00739	0.01433
			930	0.47090	0.00812	0.01504
			960	0.49166	0.00594	0.01054
			990	0.46069	0.00643	0.01217
			1020	0.45647	0.00731	0.01397
			1050	0.46993	0.00789	0.01465
			1080	0.46361	0.00799	0.01502
			1110	0.46950	0.00727	0.01350

			1140	0.47490	0.00768	0.01410
			1170	0.47722	0.00703	0.01284
			1200	0.48466	0.00794	0.01429
			1230	0.45948	0.00857	0.01627
			1260	0.46374	0.00817	0.01536
			1290	0.45621	0.00827	0.01580
			1320	0.46421	0.00821	0.01543
			1350	0.47444	0.00970	0.01783
			1380	0.47721	0.00974	0.01780
			1410	0.45615	0.00913	0.01745
9	9	3-Apr-97	9	0.46257	0.02065	0.03820
			14	0.46801	0.00318	0.00581
			20	0.47503	0.00192	0.00346
			26	0.49123	0.00363	0.00633
			33	0.46853	0.00565	0.01031
			38	0.45234	0.00605	0.01144
			44	0.45839	0.01090	0.02035
			49	0.41227	0.01263	0.02621
			54	0.42464	0.01950	0.03931
			59	0.42289	0.02108	0.04267
			65	0.43210	0.01959	0.03880
			70	0.42954	0.02097	0.04178
			77	0.44088	0.02244	0.04355
			84	0.42095	0.02149	0.04368
			89	0.43886	0.02078	0.04052
			95	0.44570	0.01820	0.03495
			102	0.45857	0.01821	0.03398
			109	0.46875	0.01438	0.02626
			118	0.48697	0.01398	0.02458
			126	0.46355	0.01366	0.02521
			134	0.45485	0.01225	0.02305
			150	0.44122	0.00619	0.01200
			180	0.48308	0.00632	0.01119
			210	0.43175	0.00494	0.00980
			240	0.45302	0.00618	0.01167
			270	0.46460	0.00557	0.01027
			300	0.47490	0.00728	0.01312
			330	0.47249	0.00501	0.00907
			360	0.45884	0.00631	0.01177
			390	0.46300	0.00683	0.01263
			420	0.46070	0.00698	0.01297
			450	0.43656	0.00563	0.01104
			480	0.46355	0.00581	0.01072
			510	0.47284	0.00896	0.01622
			540	0.48269	0.00497	0.00882
			570	0.45854	0.00475	0.00887
			600	0.45073	0.00497	0.00943
			630	0.44328	0.00527	0.01017
			660	0.45686	0.00504	0.00944
			690	0.45413	0.00521	0.00981
			720	0.44082	0.00667	0.01296
			750	0.46924	0.00596	0.01087
			780	0.46912	0.00566	0.01032
			810	0.46298	0.00639	0.01182

			840	0.48344	0.00778	0.01377
			870	0.45905	0.00630	0.01175
			900	0.47539	0.00683	0.01229
			930	0.47008	0.00630	0.01148
			960	0.46127	0.00722	0.01340
			990	0.45402	0.00739	0.01392
			1020	0.46131	0.00630	0.01169
			1050	0.44242	0.00567	0.01097
			1110	0.47650	0.00686	0.01233
			1170	0.44876	0.00735	0.01401
			1230	0.47204	0.00829	0.01504
			1290	0.45386	0.00904	0.01705
			1350	0.44115	0.00953	0.01849
			1380	0.47447	0.01177	0.02124
			1410	0.45707	0.00206	0.00386
			1440	0.46052	0.01957	0.03637
			1470	0.46645	0.01054	0.01933
10	10	3-Jun-97	11	0.47068	0.01048	0.01890
			18	0.46693	0.00248	0.00451
			24	0.47333	0.00319	0.00572
			31	0.47396	0.00444	0.00795
			37	0.49112	0.00955	0.01650
			44	0.48026	0.01207	0.02134
			52	0.45958	0.02189	0.04043
			58	0.46582	0.02399	0.04372
			65	0.46698	0.02487	0.04521
			72	0.47295	0.02387	0.04285
			78	0.45059	0.02162	0.04074
			84	0.46321	0.02183	0.04001
			90	0.47597	0.01886	0.03364
			97	0.45642	0.01557	0.02895
			104	0.48740	0.01775	0.03092
			111	0.46880	0.01728	0.03130
			150	0.45030	0.01197	0.02257
			180	0.45405	0.00791	0.01480
			210	0.44033	0.00752	0.01450
			240	0.43116	0.00806	0.01587
			270	0.44171	-0.00071	-0.00136
			300	0.45810	0.00910	0.01687
			330	0.46543	0.01193	0.02176
			360	0.46654	0.01029	0.01873
			390	0.46634	0.01160	0.02111
			420	0.46778	0.01288	0.02338
			450	0.45479	0.01245	0.02324
			480	0.45869	0.01252	0.02317
			510	0.45303	0.01251	0.02344
			540	0.46076	0.01436	0.02646
			570	0.46447	0.01427	0.02608
			600	0.47158	0.01800	0.03241
			630	0.47541	0.01625	0.02902
			660	0.44973	0.02671	0.05042
			692	0.46831	0.02002	0.03630
			720	0.45748	0.01798	0.03336
			750	0.45837	0.01744	0.03230

			780	0.46880	0.01583	0.02867
			810	0.44619	0.00993	0.01889
			840	0.47715	0.01254	0.02231
			870	0.46037	0.01126	0.02077
			900	0.44487	0.00899	0.01716
			930	0.46771	0.00938	0.01703
			960	0.46717	0.00830	0.01508
			990	0.43831	0.00848	0.01642
			1020	0.47170	0.00884	0.01590
			1050	0.45881	0.00978	0.01809

Appendix D

Along-flume profiles of the initial bed surface, the final bed surface, and the trace of the scour hole for each experimental run.

Bed Profiles: Experiment 1

Run Number	Discharge (l min-1)	Date	Position (m)	Initial Bed Profile (m)	Final Bed Profile (m)	Scour Trace (m)
1	23.9	26-Aug-96	0.00	0.0000	0.0000	
			0.01	-0.0001	-0.0028	
			0.02	-0.0002	-0.0014	
			0.03	-0.0003	-0.0015	
			0.04	-0.0004	-0.0007	
			0.05	-0.0005	-0.0011	
			0.06	-0.0006	-0.0012	
			0.07	-0.0007	-0.0004	
			0.08	-0.0008	-0.0014	
			0.09	-0.0009	-0.0015	
			0.10	-0.0010	-0.0016	
			0.11	-0.0011	-0.0017	
			0.12	-0.0012	-0.0009	
			0.13	-0.0013	-0.0013	
			0.14	-0.0014	-0.0014	
			0.15	-0.0015	0.0003	
			0.16	-0.0016	-0.0025	
			0.17	-0.0017	-0.0011	
			0.18	-0.0018	-0.0012	
			0.19	-0.0019	-0.0022	
			0.20	-0.0020	-0.0011	
			0.21	-0.0021	-0.0015	
			0.22	-0.0022	-0.0013	
			0.23	-0.0023	-0.0026	
			0.24	-0.0024	-0.0006	
			0.25	-0.0025	-0.0016	
			0.26	-0.0026	-0.0020	
			0.27	-0.0027	-0.0027	
			0.28	-0.0028	-0.0004	
			0.29	-0.0029	-0.0011	
			0.30	-0.0030	-0.0027	
			0.31	-0.0031	-0.0028	
			0.32	-0.0032	-0.0026	
			0.33	-0.0033	-0.0015	
			0.34	-0.0034	-0.0019	
			0.35	-0.0035	-0.0026	
			0.36	-0.0036	-0.0036	
			0.37	-0.0037	-0.0043	
			0.38	-0.0038	-0.0044	
			0.39	-0.0039	-0.0045	
			0.40	-0.0040	-0.0046	
			0.41	-0.0041	-0.0047	
			0.42	-0.0042	-0.0054	
			0.43	-0.0043	-0.0061	
			0.44	-0.0044	-0.0035	
			0.45	-0.0045	-0.0048	

			0.46	-0.0046	-0.0153	
			0.47	-0.0047	-0.0181	
			0.48	-0.0048	-0.0182	
			0.49	-0.0049	-0.0226	
			0.50	-0.0050	-0.0272	
			0.51	-0.0051	-0.0316	
			0.52	-0.0052	-0.0326	
			0.53	-0.0053	-0.0327	
			0.54	-0.0054	-0.0295	
			0.55	-0.0055	-0.0268	-0.0268
			0.56	-0.0056	-0.0221	-0.0231
			0.57	-0.0057	-0.0188	-0.0218
			0.58	-0.0058	-0.0171	-0.0241
			0.59	-0.0059	-0.0160	-0.0260
			0.60	-0.0060	-0.0164	-0.0284
			0.61	-0.0061	-0.0159	-0.0279
			0.62	-0.0062	-0.0172	-0.0302
			0.63	-0.0063	-0.0167	-0.0287
			0.64	-0.0064	-0.0171	-0.0291
			0.65	-0.0065	-0.0172	-0.0272
			0.66	-0.0066	-0.0170	-0.0270
			0.67	-0.0067	-0.0177	-0.0277
			0.68	-0.0068	-0.0172	-0.0242
			0.69	-0.0069	-0.0185	-0.0215
			0.70	-0.0070	-0.0180	-0.0200
			0.71	-0.0071	-0.0193	-0.0203
			0.72	-0.0072	-0.0188	-0.0198
			0.73	-0.0073	-0.0195	-0.0205
			0.74	-0.0074	-0.0196	-0.0226
			0.75	-0.0075	-0.0200	-0.0250
			0.76	-0.0076	-0.0198	-0.0298
			0.77	-0.0077	-0.0208	-0.0328
			0.78	-0.0078	-0.0203	-0.0333
			0.79	-0.0079	-0.0204	-0.0334
			0.80	-0.0080	-0.0205	-0.0325
			0.81	-0.0081	-0.0203	-0.0303
			0.82	-0.0082	-0.0210	-0.0260
			0.83	-0.0083	-0.0214	-0.0244
			0.84	-0.0084	-0.0212	-0.0232
			0.85	-0.0085	-0.0222	-0.0242
			0.86	-0.0086	-0.0214	-0.0244
			0.87	-0.0087	-0.0221	-0.0271
			0.88	-0.0088	-0.0216	-0.0256
			0.89	-0.0089	-0.0223	-0.0273
			0.90	-0.0090	-0.0221	-0.0271
			0.91	-0.0091	-0.0225	-0.0305
			0.92	-0.0092	-0.0226	-0.0316
			0.93	-0.0093	-0.0224	-0.0324
			0.94	-0.0094	-0.0234	-0.0324
			0.95	-0.0095	-0.0226	-0.0306
			0.96	-0.0096	-0.0239	-0.0299
			0.97	-0.0097	-0.0240	-0.0310
			0.98	-0.0098	-0.0241	-0.0361
			0.99	-0.0099	-0.0242	-0.0342
			1.00	-0.0100	-0.0243	-0.0353

			1.01	-0.0101	-0.0263	-0.0383
			1.02	-0.0102	-0.0245	-0.0355
			1.03	-0.0103	-0.0255	-0.0355
			1.04	-0.0104	-0.0250	-0.0350
			1.05	-0.0105	-0.0263	-0.0373
			1.06	-0.0106	-0.0255	-0.0355
			1.07	-0.0107	-0.0272	-0.0382
			1.08	-0.0108	-0.0251	-0.0361
			1.09	-0.0109	-0.0261	-0.0381
			1.10	-0.0110	-0.0272	-0.0412
			1.11	-0.0111	-0.0276	-0.0416
			1.12	-0.0112	-0.0283	-0.0413
			1.13	-0.0113	-0.0268	-0.0388
			1.14	-0.0114	-0.0269	-0.0399
			1.15	-0.0115	-0.0277	-0.0427
			1.16	-0.0116	-0.0281	-0.0411
			1.17	-0.0117	-0.0288	-0.0418
			1.18	-0.0118	-0.0292	-0.0422
			1.19	-0.0119	-0.0281	-0.0441
			1.20	-0.0120	-0.0291	-0.0441
			1.21	-0.0121	-0.0292	-0.0452
			1.22	-0.0122	-0.0287	-0.0447
			1.23	-0.0123	-0.0294	-0.0454
			1.24	-0.0124	-0.0310	-0.0470
			1.25	-0.0125	-0.0299	-0.0459
			1.26	-0.0126	-0.0306	-0.0476
			1.27	-0.0127	-0.0298	-0.0458
			1.28	-0.0128	-0.0302	-0.0462
			1.29	-0.0129	-0.0315	-0.0485
			1.30	-0.0130	-0.0322	-0.0492
			1.31	-0.0131	-0.0320	-0.0490
			1.32	-0.0132	-0.0312	-0.0472
			1.33	-0.0133	-0.0310	-0.0470
			1.34	-0.0134	-0.0311	-0.0471
			1.35	-0.0135	-0.0324	-0.0494
			1.36	-0.0136	-0.0325	-0.0495
			1.37	-0.0137	-0.0326	-0.0496
			1.38	-0.0138	-0.0327	-0.0497
			1.39	-0.0139	-0.0319	-0.0489
			1.40	-0.0140	-0.0332	-0.0492
			1.41	-0.0141	-0.0324	-0.0494
			1.42	-0.0142	-0.0322	-0.0492
			1.43	-0.0143	-0.0323	-0.0483
			1.44	-0.0144	-0.0333	-0.0503
			1.45	-0.0145	-0.0334	-0.0504
			1.46	-0.0146	-0.0329	-0.0499
			1.47	-0.0147	-0.0339	-0.0509
			1.48	-0.0148	-0.0334	-0.0504
			1.49	-0.0149	-0.0335	-0.0515
			1.50	-0.0150	-0.0348	-0.0528
			1.51	-0.0151	-0.0343	-0.0523
			1.52	-0.0406	-0.0338	-0.0508
			1.53	-0.0407	-0.0342	-0.0502
			1.54	-0.0408	-0.0343	-0.0493
			1.55	-0.0409	-0.0344	-0.0424

			1.56	-0.0410	-0.0351	-0.0431
			1.57	-0.0411	-0.0346	-0.0446
			1.58	-0.0412	-0.0347	-0.0367
			1.59	-0.0413	-0.0357	-0.0377
			1.60	-0.0414	-0.0352	-0.0352
			1.61	-0.0415	-0.0335	-0.0335
			1.62	-0.0416	-0.0336	-0.0336
			1.63	-0.0417	-0.0346	-0.0346
			1.64	-0.0418	-0.0341	-0.0341
			1.65	-0.0419	-0.0345	-0.0365
			1.66	-0.0420	-0.0337	-0.0357
			1.67	-0.0421	-0.0347	-0.0357
			1.68	-0.0422	-0.0348	-0.0358
			1.69	-0.0423	-0.0352	-0.0372
			1.70	-0.0424	-0.0347	-0.0377
			1.71	-0.0425	-0.0345	-0.0375
			1.72	-0.0426	-0.0346	-0.0376
			1.73	-0.0427	-0.0350	-0.0380
			1.74	-0.0428	-0.0354	-0.0384
			1.75	-0.0429	-0.0352	-0.0372
			1.76	-0.0430	-0.0359	-0.0399
			1.77	-0.0431	-0.0369	-0.0399
			1.78	-0.0432	-0.0358	-0.0398
			1.79	-0.0433	-0.0368	-0.0398
			1.80	-0.0434	-0.0369	-0.0399
			1.81	-0.0435	-0.0367	-0.0397
			1.82	-0.0436	-0.0365	-0.0395
			1.83	-0.0437	-0.0372	-0.0392
			1.84	-0.0438	-0.0376	-0.0396
			1.85	-0.0439	-0.0374	-0.0394
			1.86	-0.0440	-0.0375	-0.0395
			1.87	-0.0441	-0.0385	-0.0405
			1.88	-0.0442	-0.0383	-0.0403
			1.89	-0.0443	-0.0390	-0.0400
			1.90	-0.0444	-0.0394	-0.0404
			1.91	-0.0445	-0.0392	-0.0412
			1.92	-0.0446	-0.0390	-0.0410
			1.93	-0.0447	-0.0400	-0.0410
			1.94	-0.0448	-0.0392	-0.0402
			1.95	-0.0449	-0.0414	-0.0414
			1.96	-0.0450	-0.0403	-0.0403
			1.97	-0.0451	-0.0401	-0.0401
			1.98	-0.0452	-0.0414	-0.0434
			1.99	-0.0453	-0.0406	-0.0416
			2.00	-0.0454	-0.0416	-0.0426
			2.01	-0.0455	-0.0420	-0.0430
			2.02	-0.0456	-0.0421	-0.0421
			2.03	-0.0457	-0.0422	-0.0422
2	32.7	16-Sep-96	0.00	0.0000	0.0000	
			0.01	-0.0001	-0.0022	
			0.02	-0.0002	-0.0026	
			0.03	-0.0003	-0.0021	
			0.04	-0.0004	-0.0001	
			0.05	-0.0005	-0.0008	

			0.06	-0.0006	-0.0006	
			0.07	-0.0007	-0.0010	
			0.08	-0.0008	-0.0011	
			0.09	-0.0009	-0.0009	
			0.10	-0.0010	-0.0013	
			0.11	-0.0011	-0.0008	
			0.12	-0.0012	-0.0012	
			0.13	-0.0013	-0.0013	
			0.14	-0.0014	-0.0014	
			0.15	-0.0015	-0.0018	
			0.16	-0.0016	-0.0016	
			0.17	-0.0017	-0.0017	
			0.18	-0.0018	-0.0018	
			0.19	-0.0019	-0.0019	
			0.20	-0.0020	-0.0014	
			0.21	-0.0021	-0.0045	
			0.22	-0.0022	-0.0046	
			0.23	-0.0023	-0.0023	
			0.24	-0.0024	-0.0024	
			0.25	-0.0025	-0.0028	
			0.26	-0.0026	-0.0032	
			0.27	-0.0027	-0.0027	
			0.28	-0.0028	-0.0031	
			0.29	-0.0029	-0.0029	
			0.30	-0.0030	-0.0030	
			0.31	-0.0031	-0.0031	
			0.32	-0.0032	-0.0032	
			0.33	-0.0033	-0.0030	
			0.34	-0.0034	-0.0034	
			0.35	-0.0035	-0.0059	
			0.36	-0.0036	-0.0039	
			0.37	-0.0037	-0.0037	
			0.38	-0.0038	-0.0041	
			0.39	-0.0039	-0.0060	
			0.40	-0.0040	-0.0043	
			0.41	-0.0041	-0.0041	
			0.42	-0.0042	-0.0045	
			0.43	-0.0043	-0.0046	
			0.44	-0.0044	-0.0056	
			0.45	-0.0045	-0.0060	
			0.46	-0.0046	-0.0061	
			0.47	-0.0047	-0.0062	
			0.48	-0.0048	-0.0054	
			0.49	-0.0049	-0.0049	
			0.50	-0.0050	-0.0053	
			0.51	-0.0051	-0.0054	
			0.52	-0.0052	-0.0058	
			0.53	-0.0053	-0.0053	
			0.54	-0.0054	-0.0103	
			0.55	-0.0055	-0.0134	
			0.56	-0.0056	-0.0144	
			0.57	-0.0057	-0.0182	
			0.58	-0.0058	-0.0232	
			0.59	-0.0059	-0.0269	
			0.60	-0.0060	-0.0383	

			0.61	-0.0061	-0.0433	
			0.62	-0.0062	-0.0452	
			0.63	-0.0063	-0.0459	
			0.64	-0.0064	-0.0457	
			0.65	-0.0065	-0.0440	-0.0440
			0.66	-0.0066	-0.0407	-0.0437
			0.67	-0.0067	-0.0375	-0.0445
			0.68	-0.0068	-0.0333	-0.0453
			0.69	-0.0069	-0.0291	-0.0441
			0.70	-0.0070	-0.0247	-0.0437
			0.71	-0.0071	-0.0229	-0.0439
			0.72	-0.0072	-0.0221	-0.0441
			0.73	-0.0073	-0.0216	-0.0446
			0.74	-0.0074	-0.0211	-0.0451
			0.75	-0.0075	-0.0212	-0.0432
			0.76	-0.0076	-0.0216	-0.0446
			0.77	-0.0077	-0.0214	-0.0444
			0.78	-0.0078	-0.0215	-0.0445
			0.79	-0.0079	-0.0222	-0.0452
			0.80	-0.0080	-0.0226	-0.0456
			0.81	-0.0081	-0.0227	-0.0447
			0.82	-0.0082	-0.0237	-0.0457
			0.83	-0.0083	-0.0235	-0.0465
			0.84	-0.0084	-0.0239	-0.0489
			0.85	-0.0085	-0.0250	-0.0510
			0.86	-0.0086	-0.0248	-0.0518
			0.87	-0.0087	-0.0245	-0.0495
			0.88	-0.0088	-0.0253	-0.0483
			0.89	-0.0089	-0.0254	-0.0504
			0.90	-0.0090	-0.0255	-0.0495
			0.91	-0.0091	-0.0262	-0.0492
			0.92	-0.0092	-0.0269	-0.0499
			0.93	-0.0093	-0.0264	-0.0494
			0.94	-0.0094	-0.0262	-0.0482
			0.95	-0.0095	-0.0263	-0.0493
			0.96	-0.0096	-0.0270	-0.0490
			0.97	-0.0097	-0.0271	-0.0491
			0.98	-0.0098	-0.0278	-0.0498
			0.99	-0.0099	-0.0270	-0.0490
			1.00	-0.0100	-0.0277	-0.0497
			1.01	-0.0101	-0.0281	-0.0511
			1.02	-0.0102	-0.0285	-0.0505
			1.03	-0.0103	-0.0292	-0.0522
			1.04	-0.0104	-0.0278	-0.0518
			1.05	-0.0105	-0.0288	-0.0548
			1.06	-0.0106	-0.0286	-0.0516
			1.07	-0.0107	-0.0293	-0.0503
			1.08	-0.0108	-0.0291	-0.0511
			1.09	-0.0109	-0.0292	-0.0522
			1.10	-0.0110	-0.0296	-0.0526
			1.11	-0.0111	-0.0291	-0.0531
			1.12	-0.0112	-0.0295	-0.0525
			1.13	-0.0113	-0.0293	-0.0533
			1.14	-0.0114	-0.0288	-0.0528
			1.15	-0.0115	-0.0292	-0.0512

			1.16	-0.0116	-0.0293	-0.0503
			1.17	-0.0117	-0.0294	-0.0494
			1.18	-0.0118	-0.0295	-0.0525
			1.19	-0.0119	-0.0296	-0.0526
			1.20	-0.0120	-0.0300	-0.0520
			1.21	-0.0121	-0.0307	-0.0537
			1.22	-0.0122	-0.0305	-0.0535
			1.23	-0.0123	-0.0306	-0.0536
			1.24	-0.0124	-0.0316	-0.0546
			1.25	-0.0125	-0.0308	-0.0518
			1.26	-0.0126	-0.0303	-0.0503
			1.27	-0.0127	-0.0313	-0.0493
			1.28	-0.0128	-0.0311	-0.0501
			1.29	-0.0129	-0.0309	-0.0489
			1.30	-0.0130	-0.0307	-0.0487
			1.31	-0.0131	-0.0311	-0.0481
			1.32	-0.0132	-0.0312	-0.0482
			1.33	-0.0133	-0.0316	-0.0486
			1.34	-0.0134	-0.0320	-0.0530
			1.35	-0.0135	-0.0318	-0.0568
			1.36	-0.0136	-0.0325	-0.0575
			1.37	-0.0137	-0.0320	-0.0570
			1.38	-0.0138	-0.0318	-0.0588
			1.39	-0.0139	-0.0325	-0.0575
			1.40	-0.0140	-0.0332	-0.0572
			1.41	-0.0141	-0.0324	-0.0564
			1.42	-0.0142	-0.0331	-0.0581
			1.43	-0.0143	-0.0335	-0.0585
			1.44	-0.0144	-0.0339	-0.0599
			1.45	-0.0145	-0.0340	-0.0620
			1.46	-0.0146	-0.0341	-0.0621
			1.47	-0.0147	-0.0348	-0.0648
			1.48	-0.0148	-0.0343	-0.0643
			1.49	-0.0149	-0.0350	-0.0630
			1.50	-0.0150	-0.0345	-0.0605
			1.51	-0.0151	-0.0343	-0.0583
			1.52	-0.0406	-0.0341	-0.0571
			1.53	-0.0407	-0.0342	-0.0562
			1.54	-0.0408	-0.0334	-0.0534
			1.55	-0.0409	-0.0332	-0.0492
			1.56	-0.0410	-0.0333	-0.0473
			1.57	-0.0411	-0.0325	-0.0345
			1.58	-0.0412	-0.0329	-0.0329
			1.59	-0.0413	-0.0336	
			1.60	-0.0414	-0.0331	
			1.61	-0.0415	-0.0323	
			1.62	-0.0416	-0.0324	
			1.63	-0.0417	-0.0334	
			1.64	-0.0418	-0.0329	
			1.65	-0.0419	-0.0330	
			1.66	-0.0420	-0.0334	
			1.67	-0.0421	-0.0319	
			1.68	-0.0422	-0.0326	
			1.69	-0.0423	-0.0324	
			1.70	-0.0424	-0.0332	

			1.71	-0.0425	-0.0333	
			1.72	-0.0426	-0.0334	
			1.73	-0.0427	-0.0335	
			1.74	-0.0428	-0.0332	
			1.75	-0.0429	-0.0340	
			1.76	-0.0430	-0.0334	
			1.77	-0.0431	-0.0332	
			1.78	-0.0432	-0.0343	
			1.79	-0.0433	-0.0347	
			1.80	-0.0434	-0.0351	
			1.81	-0.0435	-0.0343	
			1.82	-0.0436	-0.0347	
			1.83	-0.0437	-0.0354	
			1.84	-0.0438	-0.0361	
			1.85	-0.0439	-0.0362	
			1.86	-0.0440	-0.0363	
			1.87	-0.0441	-0.0364	
			1.88	-0.0442	-0.0365	
			1.89	-0.0443	-0.0363	
			1.90	-0.0444	-0.0367	
			1.91	-0.0445	-0.0368	
			1.92	-0.0446	-0.0369	
			1.93	-0.0447	-0.0370	
			1.94	-0.0448	-0.0371	
			1.95	-0.0449	-0.0372	
			1.96	-0.0450	-0.0373	
			1.97	-0.0451	-0.0374	
			1.98	-0.0452	-0.0375	
			1.99	-0.0453	-0.0379	
			2.00	-0.0454	-0.0377	
			2.01	-0.0455	-0.0390	
			2.02	-0.0456	-0.0400	
			2.03	-0.0457	-0.0432	
4	41.5	25-Sep-96	0.00	0.0000	0.0000	
			0.01	-0.0001	-0.0013	
			0.02	-0.0002	-0.0014	
			0.03	-0.0003	-0.0015	
			0.04	-0.0004	-0.0016	
			0.05	-0.0005	-0.0017	
			0.06	-0.0006	-0.0015	
			0.07	-0.0007	-0.0037	
			0.08	-0.0008	-0.0032	
			0.09	-0.0009	-0.0030	
			0.10	-0.0010	-0.0040	
			0.11	-0.0011	-0.0038	
			0.12	-0.0012	-0.0039	
			0.13	-0.0013	-0.0037	
			0.14	-0.0014	-0.0023	
			0.15	-0.0015	-0.0061	
			0.16	-0.0016	-0.0056	
			0.17	-0.0017	-0.0054	
			0.18	-0.0018	-0.0039	
			0.19	-0.0019	-0.0046	
			0.20	-0.0020	-0.0054	

			0.21	-0.0021	-0.0048	
			0.22	-0.0022	-0.0052	
			0.23	-0.0023	-0.0044	
			0.24	-0.0024	-0.0067	
			0.25	-0.0025	-0.0065	
			0.26	-0.0026	-0.0066	
			0.27	-0.0027	-0.0061	
			0.28	-0.0028	-0.0058	
			0.29	-0.0029	-0.0056	
			0.30	-0.0030	-0.0057	
			0.31	-0.0031	-0.0061	
			0.32	-0.0032	-0.0062	
			0.33	-0.0033	-0.0073	
			0.34	-0.0034	-0.0071	
			0.35	-0.0035	-0.0075	
			0.36	-0.0036	-0.0073	
			0.37	-0.0037	-0.0074	
			0.38	-0.0038	-0.0075	
			0.39	-0.0039	-0.0076	
			0.40	-0.0040	-0.0074	
			0.41	-0.0041	-0.0078	
			0.42	-0.0042	-0.0076	
			0.43	-0.0043	-0.0080	
			0.44	-0.0044	-0.0081	
			0.45	-0.0045	-0.0079	
			0.46	-0.0046	-0.0083	
			0.47	-0.0047	-0.0172	
			0.48	-0.0048	-0.0225	
			0.49	-0.0049	-0.0256	
			0.50	-0.0050	-0.0318	
			0.51	-0.0051	-0.0386	
			0.52	-0.0052	-0.0457	
			0.53	-0.0053	-0.0510	
			0.54	-0.0054	-0.0536	
			0.55	-0.0055	-0.0540	
			0.56	-0.0056	-0.0559	
			0.57	-0.0057	-0.0560	
			0.58	-0.0058	-0.0546	
			0.59	-0.0059	-0.0519	-0.0519
			0.60	-0.0060	-0.0471	-0.0501
			0.61	-0.0061	-0.0421	-0.0471
			0.62	-0.0062	-0.0345	-0.0455
			0.63	-0.0063	-0.0298	-0.0448
			0.64	-0.0064	-0.0268	-0.0458
			0.65	-0.0065	-0.0260	-0.0460
			0.66	-0.0066	-0.0267	-0.0457
			0.67	-0.0067	-0.0256	-0.0456
			0.68	-0.0068	-0.0260	-0.0470
			0.69	-0.0069	-0.0258	-0.0478
			0.70	-0.0070	-0.0262	-0.0472
			0.71	-0.0071	-0.0260	-0.0480
			0.72	-0.0072	-0.0255	-0.0485
			0.73	-0.0073	-0.0238	-0.0468
			0.74	-0.0074	-0.0251	-0.0481
			0.75	-0.0075	-0.0252	-0.0482

			0.76	-0.0076	-0.0238	-0.0478
			0.77	-0.0077	-0.0248	-0.0478
			0.78	-0.0078	-0.0252	-0.0482
			0.79	-0.0079	-0.0256	-0.0466
			0.80	-0.0080	-0.0266	-0.0476
			0.81	-0.0081	-0.0261	-0.0471
			0.82	-0.0082	-0.0265	-0.0495
			0.83	-0.0083	-0.0278	-0.0508
			0.84	-0.0084	-0.0267	-0.0517
			0.85	-0.0085	-0.0271	-0.0521
			0.86	-0.0086	-0.0272	-0.0492
			0.87	-0.0087	-0.0273	-0.0493
			0.88	-0.0088	-0.0274	-0.0494
			0.89	-0.0089	-0.0278	-0.0478
			0.90	-0.0090	-0.0279	-0.0479
			0.91	-0.0091	-0.0256	-0.0446
			0.92	-0.0092	-0.0275	-0.0455
			0.93	-0.0093	-0.0276	-0.0456
			0.94	-0.0094	-0.0277	-0.0457
			0.95	-0.0095	-0.0260	-0.0430
			0.96	-0.0096	-0.0282	-0.0452
			0.97	-0.0097	-0.0283	-0.0463
			0.98	-0.0098	-0.0284	-0.0474
			0.99	-0.0099	-0.0285	-0.0485
			1.00	-0.0100	-0.0286	-0.0496
			1.01	-0.0101	-0.0287	-0.0507
			1.02	-0.0102	-0.0288	-0.0498
			1.03	-0.0103	-0.0289	-0.0489
			1.04	-0.0104	-0.0290	-0.0480
			1.05	-0.0105	-0.0294	-0.0484
			1.06	-0.0106	-0.0295	-0.0485
			1.07	-0.0107	-0.0296	-0.0496
			1.08	-0.0108	-0.0297	-0.0517
			1.09	-0.0109	-0.0316	-0.0546
			1.10	-0.0110	-0.0317	-0.0547
			1.11	-0.0111	-0.0321	-0.0561
			1.12	-0.0112	-0.0319	-0.0549
			1.13	-0.0113	-0.0320	-0.0540
			1.14	-0.0114	-0.0321	-0.0531
			1.15	-0.0115	-0.0322	-0.0542
			1.16	-0.0116	-0.0323	-0.0543
			1.17	-0.0117	-0.0327	-0.0577
			1.18	-0.0118	-0.0328	-0.0568
			1.19	-0.0119	-0.0329	-0.0579
			1.20	-0.0120	-0.0333	-0.0583
			1.21	-0.0121	-0.0334	-0.0604
			1.22	-0.0122	-0.0357	-0.0627
			1.23	-0.0123	-0.0336	-0.0586
			1.24	-0.0124	-0.0337	-0.0587
			1.25	-0.0125	-0.0335	-0.0585
			1.26	-0.0126	-0.0339	-0.0619
			1.27	-0.0127	-0.0362	-0.0642
			1.28	-0.0128	-0.0366	-0.0646
			1.29	-0.0129	-0.0364	-0.0634
			1.30	-0.0130	-0.0365	-0.0625

			1.31	-0.0131	-0.0366	-0.0636
			1.32	-0.0132	-0.0367	-0.0647
			1.33	-0.0133	-0.0362	-0.0642
			1.34	-0.0134	-0.0369	-0.0649
			1.35	-0.0135	-0.0370	-0.0640
			1.36	-0.0136	-0.0371	-0.0641
			1.37	-0.0137	-0.0372	-0.0642
			1.38	-0.0138	-0.0376	-0.0656
			1.39	-0.0139	-0.0371	-0.0641
			1.40	-0.0140	-0.0375	-0.0645
			1.41	-0.0141	-0.0376	-0.0646
			1.42	-0.0142	-0.0374	-0.0654
			1.43	-0.0143	-0.0378	-0.0668
			1.44	-0.0144	-0.0382	-0.0682
			1.45	-0.0145	-0.0383	-0.0683
			1.46	-0.0146	-0.0384	-0.0684
			1.47	-0.0147	-0.0391	-0.0701
			1.48	-0.0148	-0.0389	-0.0679
			1.49	-0.0149	-0.0387	-0.0667
			1.50	-0.0150	-0.0385	-0.0665
			1.51	-0.0151	-0.0386	-0.0676
			1.52	-0.0406	-0.0381	-0.0661
			1.53	-0.0407	-0.0388	-0.0658
			1.54	-0.0408	-0.0395	-0.0645
			1.55	-0.0409	-0.0399	-0.0619
			1.56	-0.0410	-0.0394	-0.0614
			1.57	-0.0411	-0.0398	-0.0548
			1.58	-0.0412	-0.0399	-0.0469
			1.59	-0.0413	-0.0400	-0.0430
			1.60	-0.0414	-0.0398	-0.0398
			1.61	-0.0415	-0.0402	
			1.62	-0.0416	-0.0360	
			1.63	-0.0417	-0.0373	
			1.64	-0.0418	-0.0371	
			1.65	-0.0419	-0.0366	
			1.66	-0.0420	-0.0373	
			1.67	-0.0421	-0.0374	
			1.68	-0.0422	-0.0378	
			1.69	-0.0423	-0.0379	
			1.70	-0.0424	-0.0380	
			1.71	-0.0425	-0.0384	
			1.72	-0.0426	-0.0382	
			1.73	-0.0427	-0.0386	
			1.74	-0.0428	-0.0378	
			1.75	-0.0429	-0.0376	
			1.76	-0.0430	-0.0386	
			1.77	-0.0431	-0.0384	
			1.78	-0.0432	-0.0388	
			1.79	-0.0433	-0.0389	
			1.80	-0.0434	-0.0387	
			1.81	-0.0435	-0.0388	
			1.82	-0.0436	-0.0392	
			1.83	-0.0437	-0.0393	
			1.84	-0.0438	-0.0391	
			1.85	-0.0439	-0.0395	

			1.86	-0.0440	-0.0396	
			1.87	-0.0441	-0.0397	
			1.88	-0.0442	-0.0401	
			1.89	-0.0443	-0.0393	
			1.90	-0.0444	-0.0400	
			1.91	-0.0445	-0.0395	
			1.92	-0.0446	-0.0399	
			1.93	-0.0447	-0.0406	
			1.94	-0.0448	-0.0407	
			1.95	-0.0449	-0.0402	
			1.96	-0.0450	-0.0406	
			1.97	-0.0451	-0.0407	
			1.98	-0.0452	-0.0411	
			1.99	-0.0453	-0.0409	
			2.00	-0.0454	-0.0413	
			2.01	-0.0455	-0.0414	
			2.02	-0.0456	-0.0415	
			2.03	-0.0457	-0.0432	
5	53.4	12-Sep-96	0.00	0.0000	0.0129	
			0.01	-0.0001	0.0000	
			0.02	-0.0002	0.0017	
			0.03	-0.0003	-0.0002	
			0.04	-0.0004	-0.0006	
			0.05	-0.0005	-0.0004	
			0.06	-0.0006	-0.0005	
			0.07	-0.0007	-0.0009	
			0.08	-0.0008	-0.0010	
			0.09	-0.0009	-0.0008	
			0.10	-0.0010	-0.0009	
			0.11	-0.0011	-0.0004	
			0.12	-0.0012	0.0007	
			0.13	-0.0013	-0.0009	
			0.14	-0.0014	-0.0004	
			0.15	-0.0015	-0.0014	
			0.16	-0.0016	-0.0015	
			0.17	-0.0017	-0.0016	
			0.18	-0.0018	-0.0017	
			0.19	-0.0019	-0.0021	
			0.20	-0.0020	-0.0022	
			0.21	-0.0021	-0.0023	
			0.22	-0.0022	-0.0027	
			0.23	-0.0023	-0.0022	
			0.24	-0.0024	-0.0026	
			0.25	-0.0025	-0.0024	
			0.26	-0.0026	-0.0028	
			0.27	-0.0027	-0.0032	
			0.28	-0.0028	-0.0030	
			0.29	-0.0029	-0.0028	
			0.30	-0.0030	-0.0029	
			0.31	-0.0031	-0.0039	
			0.32	-0.0032	-0.0040	
			0.33	-0.0033	-0.0038	
			0.34	-0.0034	-0.0042	
			0.35	-0.0035	-0.0040	

			0.36	-0.0036	-0.0065	
			0.37	-0.0037	-0.0063	
			0.38	-0.0038	-0.0046	
			0.39	-0.0039	-0.0050	
			0.40	-0.0040	-0.0057	
			0.41	-0.0041	-0.0049	
			0.42	-0.0042	-0.0047	
			0.43	-0.0043	-0.0072	
			0.44	-0.0044	-0.0073	
			0.45	-0.0045	-0.0068	
			0.46	-0.0046	-0.0054	
			0.47	-0.0047	-0.0055	
			0.48	-0.0048	-0.0050	
			0.49	-0.0049	-0.0057	
			0.50	-0.0050	-0.0055	
			0.51	-0.0051	-0.0053	
			0.52	-0.0052	-0.0060	
			0.53	-0.0053	-0.0058	
			0.54	-0.0054	-0.0062	
			0.55	-0.0055	-0.0094	
			0.56	-0.0056	-0.0146	
			0.57	-0.0057	-0.0163	
			0.58	-0.0058	-0.0197	
			0.59	-0.0059	-0.0262	
			0.60	-0.0060	-0.0336	
			0.61	-0.0061	-0.0411	
			0.62	-0.0062	-0.0463	
			0.63	-0.0063	-0.0541	
			0.64	-0.0064	-0.0590	
			0.65	-0.0065	-0.0619	
			0.66	-0.0066	-0.0641	
			0.67	-0.0067	-0.0657	-0.0657
			0.68	-0.0068	-0.0664	-0.0714
			0.69	-0.0069	-0.0659	-0.0729
			0.70	-0.0070	-0.0633	-0.0713
			0.71	-0.0071	-0.0616	-0.0726
			0.72	-0.0072	-0.0583	-0.0723
			0.73	-0.0073	-0.0540	-0.0720
			0.74	-0.0074	-0.0500	-0.0700
			0.75	-0.0075	-0.0460	-0.0710
			0.76	-0.0076	-0.0410	-0.0700
			0.77	-0.0077	-0.0410	-0.0720
			0.78	-0.0078	-0.0400	-0.0750
			0.79	-0.0079	-0.0390	-0.0760
			0.80	-0.0080	-0.0397	-0.0777
			0.81	-0.0081	-0.0386	-0.0776
			0.82	-0.0082	-0.0378	-0.0768
			0.83	-0.0083	-0.0379	-0.0759
			0.84	-0.0084	-0.0367	-0.0777
			0.85	-0.0085	-0.0365	-0.0775
			0.86	-0.0086	-0.0366	-0.0766
			0.87	-0.0087	-0.0367	-0.0757
			0.88	-0.0088	-0.0378	-0.0768
			0.89	-0.0089	-0.0379	-0.0769
			0.90	-0.0090	-0.0376	-0.0756

			0.91	-0.0091	-0.0384	-0.0764
			0.92	-0.0092	-0.0388	-0.0778
			0.93	-0.0093	-0.0383	-0.0803
			0.94	-0.0094	-0.0390	-0.0830
			0.95	-0.0095	-0.0385	-0.0815
			0.96	-0.0096	-0.0376	-0.0796
			0.97	-0.0097	-0.0383	-0.0793
			0.98	-0.0098	-0.0381	-0.0791
			0.99	-0.0099	-0.0389	-0.0789
			1.00	-0.0100	-0.0383	-0.0783
			1.01	-0.0101	-0.0381	-0.0781
			1.02	-0.0102	-0.0379	-0.0779
			1.03	-0.0103	-0.0380	-0.0780
			1.04	-0.0104	-0.0381	-0.0781
			1.05	-0.0105	-0.0382	-0.0782
			1.06	-0.0106	-0.0383	-0.0783
			1.07	-0.0107	-0.0390	-0.0800
			1.08	-0.0108	-0.0391	-0.0801
			1.09	-0.0109	-0.0389	-0.0789
			1.10	-0.0110	-0.0390	-0.0790
			1.11	-0.0111	-0.0391	-0.0781
			1.12	-0.0112	-0.0392	-0.0792
			1.13	-0.0113	-0.0399	-0.0819
			1.14	-0.0114	-0.0397	-0.0817
			1.15	-0.0115	-0.0398	-0.0818
			1.16	-0.0116	-0.0399	-0.0819
			1.17	-0.0117	-0.0397	-0.0817
			1.18	-0.0118	-0.0401	-0.0801
			1.19	-0.0119	-0.0399	-0.0809
			1.20	-0.0120	-0.0403	-0.0813
			1.21	-0.0121	-0.0398	-0.0808
			1.22	-0.0122	-0.0402	-0.0802
			1.23	-0.0123	-0.0419	-0.0809
			1.24	-0.0124	-0.0417	-0.0787
			1.25	-0.0125	-0.0418	-0.0818
			1.26	-0.0126	-0.0419	-0.0809
			1.27	-0.0127	-0.0426	-0.0836
			1.28	-0.0128	-0.0421	-0.0841
			1.29	-0.0129	-0.0431	-0.0861
			1.30	-0.0130	-0.0429	-0.0859
			1.31	-0.0131	-0.0436	-0.0866
			1.32	-0.0132	-0.0437	-0.0867
			1.33	-0.0133	-0.0441	-0.0871
			1.34	-0.0134	-0.0439	-0.0859
			1.35	-0.0135	-0.0440	-0.0850
			1.36	-0.0136	-0.0435	-0.0845
			1.37	-0.0137	-0.0442	-0.0852
			1.38	-0.0138	-0.0443	-0.0833
			1.39	-0.0139	-0.0438	-0.0808
			1.40	-0.0140	-0.0426	-0.0796
			1.41	-0.0141	-0.0434	-0.0784
			1.42	-0.0142	-0.0438	-0.0768
			1.43	-0.0143	-0.0439	-0.0749
			1.44	-0.0144	-0.0440	-0.0720
			1.45	-0.0145	-0.0441	-0.0701

			1.46	-0.0146	-0.0442	-0.0692
			1.47	-0.0147	-0.0446	-0.0686
			1.48	-0.0148	-0.0438	-0.0688
			1.49	-0.0149	-0.0439	-0.0679
			1.50	-0.0150	-0.0443	-0.0653
			1.51	-0.0151	-0.0434	-0.0634
			1.52	-0.0406	-0.0435	-0.0645
			1.53	-0.0407	-0.0439	-0.0689
			1.54	-0.0408	-0.0437	-0.0707
			1.55	-0.0409	-0.0438	-0.0688
			1.56	-0.0410	-0.0439	-0.0689
			1.57	-0.0411	-0.0437	-0.0687
			1.58	-0.0412	-0.0438	-0.0678
			1.59	-0.0413	-0.0442	-0.0692
			1.60	-0.0414	-0.0437	-0.0557
			1.61	-0.0415	-0.0435	-0.0505
			1.62	-0.0416	-0.0436	-0.0486
			1.63	-0.0417	-0.0437	-0.0467
			1.64	-0.0418	-0.0429	-0.0429
			1.65	-0.0419	-0.0427	
			1.66	-0.0420	-0.0422	
			1.67	-0.0421	-0.0429	
			1.68	-0.0422	-0.0430	
			1.69	-0.0423	-0.0434	
			1.70	-0.0424	-0.0432	
			1.71	-0.0425	-0.0427	
			1.72	-0.0426	-0.0428	
			1.73	-0.0427	-0.0429	
			1.74	-0.0428	-0.0433	
			1.75	-0.0429	-0.0437	
			1.76	-0.0430	-0.0435	
			1.77	-0.0431	-0.0436	
			1.78	-0.0432	-0.0437	
			1.79	-0.0433	-0.0438	
			1.80	-0.0434	-0.0442	
			1.81	-0.0435	-0.0440	
			1.82	-0.0436	-0.0441	
			1.83	-0.0437	-0.0442	
			1.84	-0.0438	-0.0443	
			1.85	-0.0439	-0.0444	
			1.86	-0.0440	-0.0445	
			1.87	-0.0441	-0.0446	
			1.88	-0.0442	-0.0444	
			1.89	-0.0443	-0.0448	
			1.90	-0.0444	-0.0449	
			1.91	-0.0445	-0.0450	
			1.92	-0.0446	-0.0451	
			1.93	-0.0447	-0.0452	
			1.94	-0.0448	-0.0453	
			1.95	-0.0449	-0.0454	
			1.96	-0.0450	-0.0455	
			1.97	-0.0451	-0.0459	
			1.98	-0.0452	-0.0457	
			1.99	-0.0453	-0.0458	
			2.00	-0.0454	-0.0459	

			2.01	-0.0455	-0.0469	
			2.02	-0.0456	-0.0476	
			2.03	-0.0457	-0.0477	
6	63.5	30-Aug-96	0.00	0.0000	0.0000	
			0.01	-0.0001	-0.0010	
			0.02	-0.0002	-0.0002	
			0.03	-0.0003	-0.0064	
			0.04	-0.0004	-0.0077	
			0.05	-0.0005	-0.0078	
			0.06	-0.0006	-0.0091	
			0.07	-0.0007	-0.0083	
			0.08	-0.0008	-0.0096	
			0.09	-0.0009	-0.0085	
			0.10	-0.0010	-0.0095	
			0.11	-0.0011	-0.0005	
			0.12	-0.0012	-0.0006	
			0.13	-0.0013	-0.0001	
			0.14	-0.0014	-0.0020	
			0.15	-0.0015	-0.0009	
			0.16	-0.0016	-0.0031	
			0.17	-0.0017	-0.0005	
			0.18	-0.0018	-0.0021	
			0.19	-0.0019	-0.0028	
			0.20	-0.0020	-0.0020	
			0.21	-0.0021	-0.0024	
			0.22	-0.0022	-0.0022	
			0.23	-0.0023	0.0007	
			0.24	-0.0024	0.0006	
			0.25	-0.0025	-0.0013	
			0.26	-0.0026	-0.0023	
			0.27	-0.0027	-0.0030	
			0.28	-0.0028	-0.0052	
			0.29	-0.0029	-0.0023	
			0.30	-0.0030	-0.0018	
			0.31	-0.0031	-0.0034	
			0.32	-0.0032	-0.0026	
			0.33	-0.0033	-0.0036	
			0.34	-0.0034	-0.0043	
			0.35	-0.0035	-0.0038	
			0.36	-0.0036	-0.0030	
			0.37	-0.0037	-0.0037	
			0.38	-0.0038	-0.0041	
			0.39	-0.0039	-0.0051	
			0.40	-0.0040	-0.0064	
			0.41	-0.0041	-0.0065	
			0.42	-0.0042	-0.0033	
			0.43	-0.0043	-0.0067	
			0.44	-0.0044	-0.0062	
			0.45	-0.0045	-0.0048	
			0.46	-0.0046	-0.0067	
			0.47	-0.0047	-0.0077	
			0.48	-0.0048	-0.0045	
			0.49	-0.0049	-0.0064	
			0.50	-0.0050	-0.0068	

			0.51	-0.0051	-0.0075	
			0.52	-0.0052	-0.0131	
			0.53	-0.0053	-0.0236	
			0.54	-0.0054	-0.0261	
			0.55	-0.0055	-0.0341	
			0.56	-0.0056	-0.0403	
			0.57	-0.0057	-0.0505	
			0.58	-0.0058	-0.0552	
			0.59	-0.0059	-0.0602	
			0.60	-0.0060	-0.0682	
			0.61	-0.0061	-0.0713	
			0.62	-0.0062	-0.0742	
			0.63	-0.0063	-0.0770	
			0.64	-0.0064	-0.0759	
			0.65	-0.0065	-0.0769	
			0.66	-0.0066	-0.0770	-0.0770
			0.67	-0.0067	-0.0792	-0.0822
			0.68	-0.0068	-0.0784	-0.0844
			0.69	-0.0069	-0.0764	-0.0874
			0.70	-0.0070	-0.0728	-0.0858
			0.71	-0.0071	-0.0690	-0.0840
			0.72	-0.0072	-0.0608	-0.0788
			0.73	-0.0073	-0.0539	-0.0749
			0.74	-0.0074	-0.0482	-0.0772
			0.75	-0.0075	-0.0419	-0.0749
			0.76	-0.0076	-0.0369	-0.0739
			0.77	-0.0077	-0.0327	-0.0727
			0.78	-0.0078	-0.0316	-0.0736
			0.79	-0.0079	-0.0311	-0.0751
			0.80	-0.0080	-0.0312	-0.0762
			0.81	-0.0081	-0.0297	-0.0767
			0.82	-0.0082	-0.0298	-0.0768
			0.83	-0.0083	-0.0269	-0.0769
			0.84	-0.0084	-0.0279	-0.0799
			0.85	-0.0085	-0.0274	-0.0824
			0.86	-0.0086	-0.0287	-0.0837
			0.87	-0.0087	-0.0282	-0.0832
			0.88	-0.0088	-0.0280	-0.0850
			0.89	-0.0089	-0.0278	-0.0848
			0.90	-0.0090	-0.0273	-0.0863
			0.91	-0.0091	-0.0268	-0.0838
			0.92	-0.0092	-0.0278	-0.0868
			0.93	-0.0093	-0.0276	-0.0846
			0.94	-0.0094	-0.0289	-0.0869
			0.95	-0.0095	-0.0287	-0.0887
			0.96	-0.0096	-0.0291	-0.0911
			0.97	-0.0097	-0.0295	-0.0935
			0.98	-0.0098	-0.0299	-0.0909
			0.99	-0.0099	-0.0300	-0.0910
			1.00	-0.0100	-0.0313	-0.0903
			1.01	-0.0101	-0.0305	-0.0895
			1.02	-0.0102	-0.0306	-0.0896
			1.03	-0.0103	-0.0313	-0.0883
			1.04	-0.0104	-0.0314	-0.0884
			1.05	-0.0105	-0.0321	-0.0891

			1.06	-0.0106	-0.0316	-0.0906
			1.07	-0.0107	-0.0317	-0.0907
			1.08	-0.0108	-0.0324	-0.0894
			1.09	-0.0109	-0.0325	-0.0895
			1.10	-0.0110	-0.0326	-0.0896
			1.11	-0.0111	-0.0343	-0.0913
			1.12	-0.0112	-0.0334	-0.0914
			1.13	-0.0113	-0.0351	-0.0921
			1.14	-0.0114	-0.0352	-0.0902
			1.15	-0.0115	-0.0347	-0.0887
			1.16	-0.0116	-0.0348	-0.0848
			1.17	-0.0117	-0.0355	-0.0845
			1.18	-0.0118	-0.0350	-0.0810
			1.19	-0.0119	-0.0354	-0.0824
			1.20	-0.0120	-0.0355	-0.0855
			1.21	-0.0121	-0.0362	-0.0892
			1.22	-0.0122	-0.0369	-0.0919
			1.23	-0.0123	-0.0358	-0.0908
			1.24	-0.0124	-0.0365	-0.0935
			1.25	-0.0125	-0.0372	-0.0952
			1.26	-0.0126	-0.0382	-0.0962
			1.27	-0.0127	-0.0386	-0.0956
			1.28	-0.0128	-0.0396	-0.0946
			1.29	-0.0129	-0.0403	-0.0953
			1.30	-0.0130	-0.0389	-0.0939
			1.31	-0.0131	-0.0399	-0.0939
			1.32	-0.0132	-0.0394	-0.0934
			1.33	-0.0133	-0.0389	-0.0909
			1.34	-0.0134	-0.0393	-0.0893
			1.35	-0.0135	-0.0400	-0.0910
			1.36	-0.0136	-0.0398	-0.0878
			1.37	-0.0137	-0.0408	-0.0868
			1.38	-0.0138	-0.0406	-0.0856
			1.39	-0.0139	-0.0401	-0.0901
			1.40	-0.0140	-0.0402	-0.0912
			1.41	-0.0141	-0.0400	-0.0900
			1.42	-0.0142	-0.0404	-0.0904
			1.43	-0.0143	-0.0405	-0.0905
			1.44	-0.0144	-0.0397	-0.0887
			1.45	-0.0145	-0.0392	-0.0872
			1.46	-0.0146	-0.0399	-0.0839
			1.47	-0.0147	-0.0391	-0.0811
			1.48	-0.0148	-0.0398	-0.0788
			1.49	-0.0149	-0.0390	-0.0760
			1.50	-0.0150	-0.0397	-0.0747
			1.51	-0.0151	-0.0404	-0.0754
			1.52	-0.0406	-0.0405	-0.0695
			1.53	-0.0407	-0.0403	-0.0683
			1.54	-0.0408	-0.0389	-0.0639
			1.55	-0.0409	-0.0399	-0.0649
			1.56	-0.0410	-0.0391	-0.0641
			1.57	-0.0411	-0.0395	-0.0625
			1.58	-0.0412	-0.0390	-0.0570
			1.59	-0.0413	-0.0385	-0.0565
			1.60	-0.0414	-0.0389	-0.0559

			1.61	-0.0415	-0.0377	-0.0457
			1.62	-0.0416	-0.0366	-0.0436
			1.63	-0.0417	-0.0373	-0.0423
			1.64	-0.0418	-0.0371	-0.0401
			1.65	-0.0419	-0.0400	-0.0420
			1.66	-0.0420	-0.0385	-0.0385
			1.67	-0.0421	-0.0389	
			1.68	-0.0422	-0.0397	
			1.69	-0.0423	-0.0385	
			1.70	-0.0424	-0.0402	
			1.71	-0.0425	-0.0400	
			1.72	-0.0426	-0.0401	
			1.73	-0.0427	-0.0380	
			1.74	-0.0428	-0.0403	
			1.75	-0.0429	-0.0422	
			1.76	-0.0430	-0.0414	
			1.77	-0.0431	-0.0403	
			1.78	-0.0432	-0.0397	
			1.79	-0.0433	-0.0392	
			1.80	-0.0434	-0.0384	
			1.81	-0.0435	-0.0388	
			1.82	-0.0436	-0.0404	
			1.83	-0.0437	-0.0396	
			1.84	-0.0438	-0.0385	
			1.85	-0.0439	-0.0389	
			1.86	-0.0440	-0.0390	
			1.87	-0.0441	-0.0388	
			1.88	-0.0442	-0.0383	
			1.89	-0.0443	-0.0387	
			1.90	-0.0444	-0.0385	
			1.91	-0.0445	-0.0395	
			1.92	-0.0446	-0.0402	
			1.93	-0.0447	-0.0397	
			1.94	-0.0448	-0.0404	
			1.95	-0.0449	-0.0417	
			1.96	-0.0450	-0.0409	
			1.97	-0.0451	-0.0401	
			1.98	-0.0452	-0.0402	
			1.99	-0.0453	-0.0418	
			2.00	-0.0454	-0.0416	
			2.01	-0.0455	-0.0423	
			2.02	-0.0456	-0.0428	
			2.03	-0.0457	-0.0432	
7	68.2	1-Oct-96	0.00	0.0000	0.0000	
			0.01	-0.0001	-0.0031	
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			0.03	-0.0003	-0.0027	
			0.04	-0.0004	-0.0031	
			0.05	-0.0005	-0.0029	
			0.06	-0.0006	-0.0033	
			0.07	-0.0007	-0.0013	
			0.08	-0.0008	-0.0023	
			0.09	-0.0009	-0.0021	
			0.10	-0.0010	-0.0022	

			0.11	-0.0011	-0.0017	
			0.12	-0.0012	-0.0027	
			0.13	-0.0013	-0.0019	
			0.14	-0.0014	-0.0023	
			0.15	-0.0015	-0.0045	
			0.16	-0.0016	-0.0043	
			0.17	-0.0017	-0.0017	
			0.18	-0.0018	-0.0015	
			0.19	-0.0019	0.0002	
			0.20	-0.0020	-0.0002	
			0.21	-0.0021	-0.0018	
			0.22	-0.0022	-0.0022	
			0.23	-0.0023	-0.0020	
			0.24	-0.0024	-0.0021	
			0.25	-0.0025	-0.0025	
			0.26	-0.0026	-0.0026	
			0.27	-0.0027	-0.0006	
			0.28	-0.0028	-0.0013	
			0.29	-0.0029	-0.0029	
			0.30	-0.0030	-0.0030	
			0.31	-0.0031	-0.0031	
			0.32	-0.0032	-0.0032	
			0.33	-0.0033	-0.0033	
			0.34	-0.0034	-0.0031	
			0.35	-0.0035	-0.0047	
			0.36	-0.0036	-0.0024	
			0.37	-0.0037	-0.0037	
			0.38	-0.0038	-0.0200	
			0.39	-0.0039	-0.0289	
			0.40	-0.0040	-0.0406	
			0.41	-0.0041	-0.0553	
			0.42	-0.0042	-0.0591	
			0.43	-0.0043	-0.0650	
			0.44	-0.0044	-0.0669	
			0.45	-0.0045	-0.0703	
			0.46	-0.0046	-0.0756	
			0.47	-0.0047	-0.0754	
			0.48	-0.0048	-0.0758	
			0.49	-0.0049	-0.0774	
			0.50	-0.0050	-0.0757	
			0.51	-0.0051	-0.0743	
			0.52	-0.0052	-0.0719	-0.0719
			0.53	-0.0053	-0.0687	-0.0717
			0.54	-0.0054	-0.0648	-0.0718
			0.55	-0.0055	-0.0610	-0.0720
			0.56	-0.0056	-0.0538	-0.0678
			0.57	-0.0057	-0.0484	-0.0644
			0.58	-0.0058	-0.0442	-0.0662
			0.59	-0.0059	-0.0419	-0.0689
			0.60	-0.0060	-0.0346	-0.0656
			0.61	-0.0061	-0.0314	-0.0654
			0.62	-0.0062	-0.0278	-0.0638
			0.63	-0.0063	-0.0267	-0.0647
			0.64	-0.0064	-0.0265	-0.0655
			0.65	-0.0065	-0.0254	-0.0654

			0.66	-0.0066	-0.0240	-0.0640
			0.67	-0.0067	-0.0222	-0.0632
			0.68	-0.0068	-0.0220	-0.0610
			0.69	-0.0069	-0.0243	-0.0643
			0.70	-0.0070	-0.0241	-0.0651
			0.71	-0.0071	-0.0239	-0.0669
			0.72	-0.0072	-0.0240	-0.0680
			0.73	-0.0073	-0.0241	-0.0711
			0.74	-0.0074	-0.0239	-0.0709
			0.75	-0.0075	-0.0246	-0.0716
			0.76	-0.0076	-0.0250	-0.0670
			0.77	-0.0077	-0.0251	-0.0651
			0.78	-0.0078	-0.0246	-0.0636
			0.79	-0.0079	-0.0241	-0.0621
			0.80	-0.0080	-0.0248	-0.0648
			0.81	-0.0081	-0.0249	-0.0629
			0.82	-0.0082	-0.0250	-0.0630
			0.83	-0.0083	-0.0251	-0.0631
			0.84	-0.0084	-0.0249	-0.0629
			0.85	-0.0085	-0.0250	-0.0630
			0.86	-0.0086	-0.0251	-0.0641
			0.87	-0.0087	-0.0255	-0.0685
			0.88	-0.0088	-0.0256	-0.0676
			0.89	-0.0089	-0.0254	-0.0664
			0.90	-0.0090	-0.0270	-0.0670
			0.91	-0.0091	-0.0268	-0.0658
			0.92	-0.0092	-0.0257	-0.0637
			0.93	-0.0093	-0.0270	-0.0640
			0.94	-0.0094	-0.0277	-0.0637
			0.95	-0.0095	-0.0278	-0.0628
			0.96	-0.0096	-0.0282	-0.0652
			0.97	-0.0097	-0.0286	-0.0696
			0.98	-0.0098	-0.0287	-0.0707
			0.99	-0.0099	-0.0306	-0.0736
			1.00	-0.0100	-0.0304	-0.0744
			1.01	-0.0101	-0.0314	-0.0744
			1.02	-0.0102	-0.0315	-0.0735
			1.03	-0.0103	-0.0316	-0.0746
			1.04	-0.0104	-0.0317	-0.0737
			1.05	-0.0105	-0.0315	-0.0735
			1.06	-0.0106	-0.0332	-0.0762
			1.07	-0.0107	-0.0336	-0.0766
			1.08	-0.0108	-0.0343	-0.0773
			1.09	-0.0109	-0.0350	-0.0780
			1.10	-0.0110	-0.0351	-0.0771
			1.11	-0.0111	-0.0346	-0.0766
			1.12	-0.0112	-0.0344	-0.0764
			1.13	-0.0113	-0.0348	-0.0768
			1.14	-0.0114	-0.0346	-0.0776
			1.15	-0.0115	-0.0353	-0.0773
			1.16	-0.0116	-0.0354	-0.0804
			1.17	-0.0117	-0.0352	-0.0802
			1.18	-0.0118	-0.0347	-0.0777
			1.19	-0.0119	-0.0357	-0.0777
			1.20	-0.0120	-0.0349	-0.0769

			1.21	-0.0121	-0.0350	-0.0770
			1.22	-0.0122	-0.0351	-0.0771
			1.23	-0.0123	-0.0349	-0.0769
			1.24	-0.0124	-0.0356	-0.0776
			1.25	-0.0125	-0.0360	-0.0760
			1.26	-0.0126	-0.0361	-0.0741
			1.27	-0.0127	-0.0359	-0.0709
			1.28	-0.0128	-0.0363	-0.0733
			1.29	-0.0129	-0.0364	-0.0754
			1.30	-0.0130	-0.0356	-0.0736
			1.31	-0.0131	-0.0360	-0.0740
			1.32	-0.0132	-0.0358	-0.0738
			1.33	-0.0133	-0.0362	-0.0742
			1.34	-0.0134	-0.0360	-0.0740
			1.35	-0.0135	-0.0357	-0.0757
			1.36	-0.0136	-0.0368	-0.0758
			1.37	-0.0137	-0.0363	-0.0743
			1.38	-0.0138	-0.0364	-0.0744
			1.39	-0.0139	-0.0361	-0.0731
			1.40	-0.0140	-0.0362	-0.0712
			1.41	-0.0141	-0.0370	-0.0720
			1.42	-0.0142	-0.0374	-0.0744
			1.43	-0.0143	-0.0372	-0.0742
			1.44	-0.0144	-0.0370	-0.0750
			1.45	-0.0145	-0.0374	-0.0774
			1.46	-0.0146	-0.0365	-0.0785
			1.47	-0.0147	-0.0369	-0.0819
			1.48	-0.0148	-0.0380	-0.0830
			1.49	-0.0149	-0.0371	-0.0801
			1.50	-0.0150	-0.0385	-0.0785
			1.51	-0.0151	-0.0386	-0.0776
			1.52	-0.0406	-0.0387	-0.0767
			1.53	-0.0407	-0.0385	-0.0755
			1.54	-0.0408	-0.0380	-0.0750
			1.55	-0.0409	-0.0384	-0.0744
			1.56	-0.0410	-0.0375	-0.0665
			1.57	-0.0411	-0.0376	-0.0646
			1.58	-0.0412	-0.0377	-0.0597
			1.59	-0.0413	-0.0378	-0.0558
			1.60	-0.0414	-0.0367	-0.0507
			1.61	-0.0415	-0.0368	-0.0418
			1.62	-0.0416	-0.0369	-0.0369
			1.63	-0.0417	-0.0364	
			1.64	-0.0418	-0.0353	
			1.65	-0.0419	-0.0354	
			1.66	-0.0420	-0.0355	
			1.67	-0.0421	-0.0350	
			1.68	-0.0422	-0.0354	
			1.69	-0.0423	-0.0358	
			1.70	-0.0424	-0.0362	
			1.71	-0.0425	-0.0360	
			1.72	-0.0426	-0.0361	
			1.73	-0.0427	-0.0359	
			1.74	-0.0428	-0.0360	
			1.75	-0.0429	-0.0364	

			1.76	-0.0430	-0.0359	
			1.77	-0.0431	-0.0369	
			1.78	-0.0432	-0.0367	
			1.79	-0.0433	-0.0374	
			1.80	-0.0434	-0.0369	
			1.81	-0.0435	-0.0364	
			1.82	-0.0436	-0.0359	
			1.83	-0.0437	-0.0366	
			1.84	-0.0438	-0.0370	
			1.85	-0.0439	-0.0371	
			1.86	-0.0440	-0.0375	
			1.87	-0.0441	-0.0376	
			1.88	-0.0442	-0.0383	
			1.89	-0.0443	-0.0372	
			1.90	-0.0444	-0.0379	
			1.91	-0.0445	-0.0380	
			1.92	-0.0446	-0.0390	
			1.93	-0.0447	-0.0391	
			1.94	-0.0448	-0.0398	
			1.95	-0.0449	-0.0381	
			1.96	-0.0450	-0.0385	
			1.97	-0.0451	-0.0398	
			1.98	-0.0452	-0.0402	
			1.99	-0.0453	-0.0403	
			2.00	-0.0454	-0.0410	
			2.01	-0.0455	-0.0411	
			2.02	-0.0456	-0.0412	
			2.03	-0.0457	-0.0432	
8	72.6	9-Sep-96	0.00	0.0000	0.0000	
			0.01	-0.0001	0.0014	
			0.02	-0.0002	0.0010	
			0.03	-0.0003	0.0012	
			0.04	-0.0004	0.0011	
			0.05	-0.0005	0.0010	
			0.06	-0.0006	0.0009	
			0.07	-0.0007	0.0008	
			0.08	-0.0008	0.0004	
			0.09	-0.0009	0.0006	
			0.10	-0.0010	0.0005	
			0.11	-0.0011	0.0004	
			0.12	-0.0012	0.0003	
			0.13	-0.0013	0.0002	
			0.14	-0.0014	0.0001	
			0.15	-0.0015	0.0022	
			0.16	-0.0016	-0.0001	
			0.17	-0.0017	-0.0002	
			0.18	-0.0018	-0.0003	
			0.19	-0.0019	-0.0016	
			0.20	-0.0020	0.0017	
			0.21	-0.0021	-0.0006	
			0.22	-0.0022	-0.0007	
			0.23	-0.0023	-0.0008	
			0.24	-0.0024	-0.0012	
			0.25	-0.0025	-0.0010	

			0.26	-0.0026	-0.0011	
			0.27	-0.0027	-0.0012	
			0.28	-0.0028	-0.0013	
			0.29	-0.0029	-0.0014	
			0.30	-0.0030	-0.0018	
			0.31	-0.0031	-0.0016	
			0.32	-0.0032	-0.0017	
			0.33	-0.0033	-0.0024	
			0.34	-0.0034	-0.0034	
			0.35	-0.0035	-0.0044	
			0.36	-0.0036	-0.0036	
			0.37	-0.0037	-0.0046	
			0.38	-0.0038	-0.0047	
			0.39	-0.0039	-0.0054	
			0.40	-0.0040	-0.0055	
			0.41	-0.0041	-0.0050	
			0.42	-0.0042	-0.0051	
			0.43	-0.0043	-0.0064	
			0.44	-0.0044	-0.0053	
			0.45	-0.0045	-0.0048	
			0.46	-0.0046	-0.0049	
			0.47	-0.0047	-0.0172	
			0.48	-0.0048	-0.0206	
			0.49	-0.0049	-0.0308	
			0.50	-0.0050	-0.0379	
			0.51	-0.0051	-0.0459	
			0.52	-0.0052	-0.0503	
			0.53	-0.0053	-0.0562	
			0.54	-0.0054	-0.0609	
			0.55	-0.0055	-0.0680	
			0.56	-0.0056	-0.0745	
			0.57	-0.0057	-0.0782	
			0.58	-0.0058	-0.0805	
			0.59	-0.0059	-0.0830	
			0.60	-0.0060	-0.0831	
			0.61	-0.0061	-0.0823	
			0.62	-0.0062	-0.0824	-0.0824
			0.63	-0.0063	-0.0791	-0.0811
			0.64	-0.0064	-0.0765	-0.0795
			0.65	-0.0065	-0.0732	-0.0802
			0.66	-0.0066	-0.0679	-0.0799
			0.67	-0.0067	-0.0631	-0.0791
			0.68	-0.0068	-0.0586	-0.0756
			0.69	-0.0069	-0.0529	-0.0759
			0.70	-0.0070	-0.0475	-0.0715
			0.71	-0.0071	-0.0431	-0.0731
			0.72	-0.0072	-0.0389	-0.0739
			0.73	-0.0073	-0.0350	-0.0730
			0.74	-0.0074	-0.0336	-0.0736
			0.75	-0.0075	-0.0322	-0.0742
			0.76	-0.0076	-0.0311	-0.0741
			0.77	-0.0077	-0.0299	-0.0749
			0.78	-0.0078	-0.0288	-0.0728
			0.79	-0.0079	-0.0280	-0.0730
			0.80	-0.0080	-0.0275	-0.0735

			0.81	-0.0081	-0.0270	-0.0730
			0.82	-0.0082	-0.0271	-0.0741
			0.83	-0.0083	-0.0266	-0.0746
			0.84	-0.0084	-0.0267	-0.0747
			0.85	-0.0085	-0.0268	-0.0718
			0.86	-0.0086	-0.0269	-0.0729
			0.87	-0.0087	-0.0270	-0.0740
			0.88	-0.0088	-0.0271	-0.0751
			0.89	-0.0089	-0.0269	-0.0769
			0.90	-0.0090	-0.0270	-0.0790
			0.91	-0.0091	-0.0268	-0.0788
			0.92	-0.0092	-0.0269	-0.0799
			0.93	-0.0093	-0.0273	-0.0793
			0.94	-0.0094	-0.0274	-0.0794
			0.95	-0.0095	-0.0278	-0.0808
			0.96	-0.0096	-0.0279	-0.0809
			0.97	-0.0097	-0.0286	-0.0816
			0.98	-0.0098	-0.0287	-0.0807
			0.99	-0.0099	-0.0297	-0.0817
			1.00	-0.0100	-0.0292	-0.0792
			1.01	-0.0101	-0.0299	-0.0799
			1.02	-0.0102	-0.0297	-0.0787
			1.03	-0.0103	-0.0301	-0.0801
			1.04	-0.0104	-0.0302	-0.0792
			1.05	-0.0105	-0.0303	-0.0803
			1.06	-0.0106	-0.0307	-0.0807
			1.07	-0.0107	-0.0305	-0.0775
			1.08	-0.0108	-0.0309	-0.0779
			1.09	-0.0109	-0.0313	-0.0763
			1.10	-0.0110	-0.0311	-0.0731
			1.11	-0.0111	-0.0315	-0.0725
			1.12	-0.0112	-0.0310	-0.0720
			1.13	-0.0113	-0.0311	-0.0711
			1.14	-0.0114	-0.0318	-0.0738
			1.15	-0.0115	-0.0322	-0.0742
			1.16	-0.0116	-0.0323	-0.0743
			1.17	-0.0117	-0.0336	-0.0776
			1.18	-0.0118	-0.0337	-0.0767
			1.19	-0.0119	-0.0338	-0.0768
			1.20	-0.0120	-0.0346	-0.0796
			1.21	-0.0121	-0.0340	-0.0780
			1.22	-0.0122	-0.0348	-0.0788
			1.23	-0.0123	-0.0349	-0.0789
			1.24	-0.0124	-0.0353	-0.0793
			1.25	-0.0125	-0.0354	-0.0796
			1.26	-0.0126	-0.0358	-0.0788
			1.27	-0.0127	-0.0362	-0.0792
			1.28	-0.0128	-0.0354	-0.0754
			1.29	-0.0129	-0.0358	-0.0758
			1.30	-0.0130	-0.0359	-0.0769
			1.31	-0.0131	-0.0372	-0.0772
			1.32	-0.0132	-0.0379	-0.0729
			1.33	-0.0133	-0.0371	-0.0711
			1.34	-0.0134	-0.0375	-0.0715
			1.35	-0.0135	-0.0382	-0.0662

			1.36	-0.0136	-0.0380	-0.0630
			1.37	-0.0137	-0.0375	-0.0625
			1.38	-0.0138	-0.0373	-0.0613
			1.39	-0.0139	-0.0380	-0.0530
			1.40	-0.0140	-0.0375	-0.0535
			1.41	-0.0141	-0.0382	-0.0512
			1.42	-0.0142	-0.0380	-0.0470
			1.43	-0.0143	-0.0381	-0.0451
			1.44	-0.0144	-0.0388	-0.0438
			1.45	-0.0145	-0.0389	-0.0429
			1.46	-0.0146	-0.0387	-0.0417
			1.47	-0.0147	-0.0388	-0.0398
			1.48	-0.0148	-0.0386	-0.0386
			1.49	-0.0149	-0.0381	
			1.50	-0.0150	-0.0385	
			1.51	-0.0151	-0.0380	
			1.52	-0.0406	-0.0378	
			1.53	-0.0407	-0.0385	
			1.54	-0.0408	-0.0383	
			1.55	-0.0409	-0.0377	
			1.56	-0.0410	-0.0375	
			1.57	-0.0411	-0.0376	
			1.58	-0.0412	-0.0371	
			1.59	-0.0413	-0.0363	
			1.60	-0.0414	-0.0364	
			1.61	-0.0415	-0.0359	
			1.62	-0.0416	-0.0357	
			1.63	-0.0417	-0.0352	
			1.64	-0.0418	-0.0347	
			1.65	-0.0419	-0.0354	
			1.66	-0.0420	-0.0324	
			1.67	-0.0421	-0.0332	
			1.68	-0.0422	-0.0333	
			1.69	-0.0423	-0.0349	
			1.70	-0.0424	-0.0353	
			1.71	-0.0425	-0.0351	
			1.72	-0.0426	-0.0346	
			1.73	-0.0427	-0.0350	
			1.74	-0.0428	-0.0336	
			1.75	-0.0429	-0.0355	
			1.76	-0.0430	-0.0359	
			1.77	-0.0431	-0.0360	
			1.78	-0.0432	-0.0346	
			1.79	-0.0433	-0.0362	
			1.80	-0.0434	-0.0366	
			1.81	-0.0435	-0.0364	
			1.82	-0.0436	-0.0368	
			1.83	-0.0437	-0.0366	
			1.84	-0.0438	-0.0370	
			1.85	-0.0439	-0.0368	
			1.86	-0.0440	-0.0369	
			1.87	-0.0441	-0.0370	
			1.88	-0.0442	-0.0371	
			1.89	-0.0443	-0.0372	
			1.90	-0.0444	-0.0373	

			1.91	-0.0445	-0.0374	
			1.92	-0.0446	-0.0375	
			1.93	-0.0447	-0.0376	
			1.94	-0.0448	-0.0377	
			1.95	-0.0449	-0.0381	
			1.96	-0.0450	-0.0382	
			1.97	-0.0451	-0.0383	
			1.98	-0.0452	-0.0387	
			1.99	-0.0453	-0.0385	
			2.00	-0.0454	-0.0383	
			2.01	-0.0455	-0.0408	
			2.02	-0.0456	-0.0388	
			2.03	-0.0457	-0.0422	
9	82.4	4-Sep-96	0.00	0.0000	0.0000	
			0.01	-0.0001	-0.0013	
			0.02	-0.0002	-0.0020	
			0.03	-0.0003	-0.0021	
			0.04	-0.0004	-0.0019	
			0.05	-0.0005	-0.0014	
			0.06	-0.0006	-0.0006	
			0.07	-0.0007	-0.0019	
			0.08	-0.0008	-0.0029	
			0.09	-0.0009	-0.0018	
			0.10	-0.0010	-0.0016	
			0.11	-0.0011	-0.0026	
			0.12	-0.0012	-0.0018	
			0.13	-0.0013	-0.0019	
			0.14	-0.0014	-0.0029	
			0.15	-0.0015	-0.0030	
			0.16	-0.0016	-0.0034	
			0.17	-0.0017	-0.0026	
			0.18	-0.0018	-0.0015	
			0.19	-0.0019	-0.0019	
			0.20	-0.0020	-0.0032	
			0.21	-0.0021	-0.0036	
			0.22	-0.0022	-0.0016	
			0.23	-0.0023	-0.0038	
			0.24	-0.0024	-0.0030	
			0.25	-0.0025	-0.0037	
			0.26	-0.0026	-0.0032	
			0.27	-0.0027	-0.0039	
			0.28	-0.0028	-0.0028	
			0.29	-0.0029	-0.0035	
			0.30	-0.0030	-0.0036	
			0.31	-0.0031	-0.0037	
			0.32	-0.0032	-0.0017	
			0.33	-0.0033	-0.0039	
			0.34	-0.0034	-0.0055	
			0.35	-0.0035	-0.0041	
			0.36	-0.0036	-0.0054	
			0.37	-0.0037	-0.0058	
			0.38	-0.0038	-0.0059	
			0.39	-0.0039	-0.0057	
			0.40	-0.0040	-0.0061	

			0.41	-0.0041	-0.0059	
			0.42	-0.0042	-0.0057	
			0.43	-0.0043	-0.0064	
			0.44	-0.0044	-0.0068	
			0.45	-0.0045	-0.0072	
			0.46	-0.0046	-0.0061	
			0.47	-0.0047	-0.0065	
			0.48	-0.0048	-0.0066	
			0.49	-0.0049	-0.0070	
			0.50	-0.0050	-0.0080	
			0.51	-0.0051	-0.0078	
			0.52	-0.0052	-0.0076	
			0.53	-0.0053	-0.0202	
			0.54	-0.0054	-0.0289	
			0.55	-0.0055	-0.0357	
			0.56	-0.0056	-0.0416	
			0.57	-0.0057	-0.0520	
			0.58	-0.0058	-0.0604	
			0.59	-0.0059	-0.0675	
			0.60	-0.0060	-0.0761	
			0.61	-0.0061	-0.0820	
			0.62	-0.0062	-0.0882	
			0.63	-0.0063	-0.0935	
			0.64	-0.0064	-0.0978	
			0.65	-0.0065	-0.0982	
			0.66	-0.0066	-0.1017	
			0.67	-0.0067	-0.1021	
			0.68	-0.0068	-0.1013	
			0.69	-0.0069	-0.1023	-0.1023
			0.70	-0.0070	-0.1018	-0.1048
			0.71	-0.0071	-0.0998	-0.1038
			0.72	-0.0072	-0.0983	-0.1053
			0.73	-0.0073	-0.0960	-0.1060
			0.74	-0.0074	-0.0937	-0.1057
			0.75	-0.0075	-0.0898	-0.1068
			0.76	-0.0076	-0.0853	-0.1053
			0.77	-0.0077	-0.0784	-0.1024
			0.78	-0.0078	-0.0727	-0.0997
			0.79	-0.0079	-0.0698	-0.0998
			0.80	-0.0080	-0.0653	-0.0973
			0.81	-0.0081	-0.0593	-0.1003
			0.82	-0.0082	-0.0548	-0.0988
			0.83	-0.0083	-0.0513	-0.1013
			0.84	-0.0084	-0.0477	-0.1017
			0.85	-0.0085	-0.0436	-0.1026
			0.86	-0.0086	-0.0430	-0.1040
			0.87	-0.0087	-0.0438	-0.1068
			0.88	-0.0088	-0.0439	-0.1079
			0.89	-0.0089	-0.0357	-0.1007
			0.90	-0.0090	-0.0355	-0.1025
			0.91	-0.0091	-0.0335	-0.1005
			0.92	-0.0092	-0.0336	-0.1006
			0.93	-0.0093	-0.0337	-0.1007
			0.94	-0.0094	-0.0332	-0.1012
			0.95	-0.0095	-0.0333	-0.1013

			0.96	-0.0096	-0.0334	-0.1014
			0.97	-0.0097	-0.0326	-0.0996
			0.98	-0.0098	-0.0342	-0.1012
			0.99	-0.0099	-0.0337	-0.1007
			1.00	-0.0100	-0.0332	-0.1002
			1.01	-0.0101	-0.0323	-0.1003
			1.02	-0.0102	-0.0334	-0.1004
			1.03	-0.0103	-0.0322	-0.1022
			1.04	-0.0104	-0.0326	-0.1006
			1.05	-0.0105	-0.0327	-0.1007
			1.06	-0.0106	-0.0322	-0.1012
			1.07	-0.0107	-0.0320	-0.1020
			1.08	-0.0108	-0.0330	-0.1020
			1.09	-0.0109	-0.0325	-0.1005
			1.10	-0.0110	-0.0329	-0.0979
			1.11	-0.0111	-0.0343	-0.0953
			1.12	-0.0112	-0.0338	-0.0938
			1.13	-0.0113	-0.0339	-0.0939
			1.14	-0.0114	-0.0336	-0.0936
			1.15	-0.0115	-0.0334	-0.0914
			1.16	-0.0116	-0.0335	-0.0915
			1.17	-0.0117	-0.0352	-0.0932
			1.18	-0.0118	-0.0353	-0.0933
			1.19	-0.0119	-0.0360	-0.0930
			1.20	-0.0120	-0.0364	-0.0914
			1.21	-0.0121	-0.0359	-0.0899
			1.22	-0.0122	-0.0363	-0.0893
			1.23	-0.0123	-0.0367	-0.0897
			1.24	-0.0124	-0.0371	-0.0901
			1.25	-0.0125	-0.0366	-0.0866
			1.26	-0.0126	-0.0370	-0.0860
			1.27	-0.0127	-0.0374	-0.0884
			1.28	-0.0128	-0.0384	-0.0884
			1.29	-0.0129	-0.0385	-0.0885
			1.30	-0.0130	-0.0374	-0.0874
			1.31	-0.0131	-0.0390	-0.0950
			1.32	-0.0132	-0.0394	-0.0954
			1.33	-0.0133	-0.0386	-0.0926
			1.34	-0.0134	-0.0402	-0.0942
			1.35	-0.0135	-0.0397	-0.0937
			1.36	-0.0136	-0.0407	-0.0927
			1.37	-0.0137	-0.0399	-0.0919
			1.38	-0.0138	-0.0409	-0.0919
			1.39	-0.0139	-0.0404	-0.0914
			1.40	-0.0140	-0.0402	-0.0912
			1.41	-0.0141	-0.0397	-0.0917
			1.42	-0.0142	-0.0407	-0.0927
			1.43	-0.0143	-0.0408	-0.0948
			1.44	-0.0144	-0.0409	-0.0939
			1.45	-0.0145	-0.0410	-0.0960
			1.46	-0.0146	-0.0408	-0.0958
			1.47	-0.0147	-0.0406	-0.0956
			1.48	-0.0148	-0.0410	-0.0950
			1.49	-0.0149	-0.0405	-0.0945
			1.50	-0.0150	-0.0397	-0.0937

			1.51	-0.0151	-0.0407	-0.0957
			1.52	-0.0406	-0.0402	-0.0942
			1.53	-0.0407	-0.0412	-0.0942
			1.54	-0.0408	-0.0410	-0.0930
			1.55	-0.0409	-0.0408	-0.0938
			1.56	-0.0410	-0.0412	-0.0932
			1.57	-0.0411	-0.0416	-0.0866
			1.58	-0.0412	-0.0411	-0.0831
			1.59	-0.0413	-0.0409	-0.0789
			1.60	-0.0414	-0.0407	-0.0747
			1.61	-0.0415	-0.0396	-0.0696
			1.62	-0.0416	-0.0388	-0.0628
			1.63	-0.0417	-0.0392	-0.0562
			1.64	-0.0418	-0.0386	-0.0506
			1.65	-0.0419	-0.0375	-0.0455
			1.66	-0.0420	-0.0367	-0.0437
			1.67	-0.0421	-0.0377	-0.0437
			1.68	-0.0422	-0.0378	-0.0418
			1.69	-0.0423	-0.0370	-0.0400
			1.70	-0.0424	-0.0353	-0.0353
			1.71	-0.0425	-0.0357	
			1.72	-0.0426	-0.0358	
			1.73	-0.0427	-0.0359	
			1.74	-0.0428	-0.0363	
			1.75	-0.0429	-0.0361	
			1.76	-0.0430	-0.0359	
			1.77	-0.0431	-0.0360	
			1.78	-0.0432	-0.0358	
			1.79	-0.0433	-0.0353	
			1.80	-0.0434	-0.0363	
			1.81	-0.0435	-0.0358	
			1.82	-0.0436	-0.0359	
			1.83	-0.0437	-0.0363	
			1.84	-0.0438	-0.0370	
			1.85	-0.0439	-0.0371	
			1.86	-0.0440	-0.0369	
			1.87	-0.0441	-0.0370	
			1.88	-0.0442	-0.0374	
			1.89	-0.0443	-0.0372	
			1.90	-0.0444	-0.0373	
			1.91	-0.0445	-0.0368	
			1.92	-0.0446	-0.0375	
			1.93	-0.0447	-0.0382	
			1.94	-0.0448	-0.0392	
			1.95	-0.0449	-0.0399	
			1.96	-0.0450	-0.0388	
			1.97	-0.0451	-0.0392	
			1.98	-0.0452	-0.0390	
			1.99	-0.0453	-0.0388	
			2.00	-0.0454	-0.0398	
			2.01	-0.0455	-0.0390	
			2.02	-0.0456	-0.0434	
			2.03	-0.0457	-0.0425	

Bed Profiles: Experiment 2

Run Number	Slope (%)	Date	Position (m)	Initial Bed Profile (m)	Final Bed Profile (m)	Scour Trace (m)
1	1	28-Feb-97	0.00	0.0000	0.0000	
			0.01	-0.0001	-0.0001	
			0.02	-0.0002	-0.0002	
			0.03	-0.0003	0.0000	
			0.04	-0.0004	-0.0010	
			0.05	-0.0005	-0.0008	
			0.06	-0.0006	-0.0003	
			0.07	-0.0007	0.0008	
			0.08	-0.0008	0.0007	
			0.09	-0.0009	-0.0006	
			0.10	-0.0010	-0.0004	
			0.11	-0.0011	0.0004	
			0.12	-0.0012	0.0003	
			0.13	-0.0013	-0.0001	
			0.14	-0.0014	-0.0002	
			0.15	-0.0015	-0.0006	
			0.16	-0.0016	-0.0013	
			0.17	-0.0017	-0.0011	
			0.18	-0.0018	-0.0003	
			0.19	-0.0019	-0.0007	
			0.20	-0.0020	-0.0014	
			0.21	-0.0021	-0.0015	
			0.22	-0.0022	-0.0013	
			0.23	-0.0023	-0.0011	
			0.24	-0.0024	-0.0015	
			0.25	-0.0025	-0.0010	
			0.26	-0.0026	-0.0005	
			0.27	-0.0027	-0.0018	
			0.28	-0.0028	-0.0013	
			0.29	-0.0029	-0.0026	
			0.30	-0.0030	-0.0027	
			0.31	-0.0031	-0.0022	
			0.32	-0.0032	-0.0020	
			0.33	-0.0033	-0.0030	
			0.34	-0.0034	-0.0028	
			0.35	-0.0035	-0.0026	
			0.36	-0.0036	-0.0033	
			0.37	-0.0037	-0.0031	
			0.38	-0.0038	-0.0035	
			0.39	-0.0039	-0.0045	
			0.40	-0.0040	-0.0043	
			0.41	-0.0041	-0.0044	
			0.42	-0.0042	-0.0042	
			0.43	-0.0043	-0.0055	
			0.44	-0.0044	-0.0047	
			0.45	-0.0045	-0.0045	
			0.46	-0.0046	-0.0049	

			0.47	-0.0047	-0.0053	
			0.48	-0.0048	-0.0051	
			0.49	-0.0049	-0.0058	
			0.50	-0.0050	-0.0056	
			0.51	-0.0051	-0.0060	
			0.52	-0.0052	-0.0058	
			0.53	-0.0053	-0.0062	
			0.54	-0.0054	-0.0060	
			0.55	-0.0055	-0.0061	
			0.56	-0.0056	-0.0062	
			0.57	-0.0057	-0.0066	
			0.58	-0.0058	-0.0061	
			0.59	-0.0059	-0.0065	
			0.60	-0.0060	-0.0066	
			0.61	-0.0061	-0.0070	
			0.62	-0.0062	-0.0059	
			0.63	-0.0063	-0.0231	
			0.64	-0.0064	-0.0290	
			0.65	-0.0065	-0.0391	
			0.66	-0.0066	-0.0584	
			0.67	-0.0067	-0.0683	
			0.68	-0.0068	-0.0754	
			0.69	-0.0069	-0.0807	
			0.70	-0.0070	-0.0862	
			0.71	-0.0071	-0.0903	
			0.72	-0.0072	-0.0916	-0.0916
			0.73	-0.0073	-0.0942	-0.0972
			0.74	-0.0074	-0.0943	-0.0993
			0.75	-0.0075	-0.0944	-0.1024
			0.76	-0.0076	-0.0920	-0.1050
			0.77	-0.0077	-0.0900	-0.1060
			0.78	-0.0078	-0.0797	-0.1047
			0.79	-0.0079	-0.0750	-0.1040
			0.80	-0.0080	-0.0693	-0.1013
			0.81	-0.0081	-0.0633	-0.1003
			0.82	-0.0082	-0.0576	-0.0976
			0.83	-0.0083	-0.0525	-0.0945
			0.84	-0.0084	-0.0480	-0.0930
			0.85	-0.0085	-0.0436	-0.0916
			0.86	-0.0086	-0.0376	-0.0886
			0.87	-0.0087	-0.0349	-0.0869
			0.88	-0.0088	-0.0344	-0.0864
			0.89	-0.0089	-0.0324	-0.0844
			0.90	-0.0090	-0.0303	-0.0833
			0.91	-0.0091	-0.0295	-0.0815
			0.92	-0.0092	-0.0293	-0.0813
			0.93	-0.0093	-0.0291	-0.0811
			0.94	-0.0094	-0.0286	-0.0806
			0.95	-0.0095	-0.0278	-0.0788
			0.96	-0.0096	-0.0276	-0.0776
			0.97	-0.0097	-0.0274	-0.0774
			0.98	-0.0098	-0.0278	-0.0768
			0.99	-0.0099	-0.0270	-0.0740
			1.00	-0.0100	-0.0274	-0.0764
			1.01	-0.0101	-0.0275	-0.0775

			1.02	-0.0102	-0.0273	-0.0763
			1.03	-0.0103	-0.0286	-0.0766
			1.04	-0.0104	-0.0287	-0.0767
			1.05	-0.0105	-0.0279	-0.0759
			1.06	-0.0106	-0.0286	-0.0776
			1.07	-0.0107	-0.0290	-0.0780
			1.08	-0.0108	-0.0285	-0.0785
			1.09	-0.0109	-0.0292	-0.0802
			1.10	-0.0110	-0.0290	-0.0800
			1.11	-0.0111	-0.0300	-0.0800
			1.12	-0.0112	-0.0298	-0.0798
			1.13	-0.0113	-0.0308	-0.0808
			1.14	-0.0114	-0.0315	-0.0845
			1.15	-0.0115	-0.0316	-0.0846
			1.16	-0.0116	-0.0323	-0.0853
			1.17	-0.0117	-0.0324	-0.0844
			1.18	-0.0118	-0.0331	-0.0851
			1.19	-0.0119	-0.0323	-0.0833
			1.20	-0.0120	-0.0342	-0.0852
			1.21	-0.0121	-0.0334	-0.0844
			1.22	-0.0122	-0.0344	-0.0844
			1.23	-0.0123	-0.0342	-0.0852
			1.24	-0.0124	-0.0343	-0.0853
			1.25	-0.0125	-0.0344	-0.0854
			1.26	-0.0126	-0.0355	-0.0855
			1.27	-0.0127	-0.0356	-0.0856
			1.28	-0.0128	-0.0357	-0.0867
			1.29	-0.0129	-0.0364	-0.0884
			1.30	-0.0130	-0.0368	-0.0868
			1.31	-0.0131	-0.0375	-0.0875
			1.32	-0.0132	-0.0376	-0.0886
			1.33	-0.0133	-0.0377	-0.0907
			1.34	-0.0134	-0.0378	-0.0898
			1.35	-0.0135	-0.0385	-0.0905
			1.36	-0.0136	-0.0377	-0.0887
			1.37	-0.0137	-0.0381	-0.0881
			1.38	-0.0138	-0.0388	-0.0878
			1.39	-0.0139	-0.0389	-0.0859
			1.40	-0.0140	-0.0387	-0.0817
			1.41	-0.0141	-0.0400	-0.0820
			1.42	-0.0142	-0.0401	-0.0801
			1.43	-0.0143	-0.0408	-0.0798
			1.44	-0.0144	-0.0409	-0.0809
			1.45	-0.0145	-0.0395	-0.0785
			1.46	-0.0146	-0.0399	-0.0759
			1.47	-0.0147	-0.0406	-0.0746
			1.48	-0.0148	-0.0404	-0.0714
			1.49	-0.0149	-0.0393	-0.0683
			1.50	-0.0150	-0.0394	-0.0674
			1.51	-0.0151	-0.0398	-0.0668
			1.52	-0.0406	-0.0393	-0.0643
			1.53	-0.0407	-0.0400	-0.0660
			1.54	-0.0408	-0.0395	-0.0695
			1.55	-0.0409	-0.0399	-0.0689
			1.56	-0.0410	-0.0394	-0.0664

			1.57	-0.0411	-0.0395	-0.0635
			1.58	-0.0412	-0.0396	-0.0566
			1.59	-0.0413	-0.0397	-0.0497
			1.60	-0.0414	-0.0398	-0.0478
			1.61	-0.0415	-0.0399	-0.0459
			1.62	-0.0416	-0.0378	-0.0428
			1.63	-0.0417	-0.0389	-0.0389
			1.64	-0.0418	-0.0386	
			1.65	-0.0419	-0.0387	
			1.66	-0.0420	-0.0388	
			1.67	-0.0421	-0.0389	
			1.68	-0.0422	-0.0394	
			1.69	-0.0423	-0.0391	
			1.70	-0.0424	-0.0392	
			1.71	-0.0425	-0.0393	
			1.72	-0.0426	-0.0401	
			1.73	-0.0427	-0.0395	
			1.74	-0.0428	-0.0403	
			1.75	-0.0429	-0.0397	
			1.76	-0.0430	-0.0398	
			1.77	-0.0431	-0.0399	
			1.78	-0.0432	-0.0400	
			1.79	-0.0433	-0.0411	
			1.80	-0.0434	-0.0406	
			1.81	-0.0435	-0.0410	
			1.82	-0.0436	-0.0404	
			1.83	-0.0437	-0.0405	
			1.84	-0.0438	-0.0410	
			1.85	-0.0439	-0.0414	
			1.86	-0.0440	-0.0405	
			1.87	-0.0441	-0.0409	
			1.88	-0.0442	-0.0410	
			1.89	-0.0443	-0.0415	
			1.90	-0.0444	-0.0412	
			1.91	-0.0445	-0.0407	
			1.92	-0.0446	-0.0414	
			1.93	-0.0447	-0.0412	
			1.94	-0.0448	-0.0416	
			1.95	-0.0449	-0.0421	
			1.96	-0.0450	-0.0422	
			1.97	-0.0451	-0.0419	
			1.98	-0.0452	-0.0424	
			1.99	-0.0453	-0.0425	
			2.00	-0.0454	-0.0432	
			2.01	-0.0455	-0.0430	
			2.02	-0.0456	-0.0424	
			2.03	-0.0457	-0.0432	
2	2	17-Jan-97	0.00	0.0000	0.0000	
			0.01	-0.0002	-0.0002	
			0.02	-0.0004	0.0008	
			0.03	-0.0006	-0.0006	
			0.04	-0.0008	0.0004	
			0.05	-0.0010	-0.0028	
			0.06	-0.0012	-0.0030	

			0.07	-0.0014	-0.0032	
			0.08	-0.0016	-0.0034	
			0.09	-0.0018	-0.0024	
			0.10	-0.0020	-0.0035	
			0.11	-0.0022	-0.0034	
			0.12	-0.0024	-0.0039	
			0.13	-0.0026	-0.0032	
			0.14	-0.0028	-0.0043	
			0.15	-0.0030	-0.0045	
			0.16	-0.0032	-0.0041	
			0.17	-0.0034	-0.0049	
			0.18	-0.0036	-0.0051	
			0.19	-0.0038	-0.0053	
			0.20	-0.0040	-0.0055	
			0.21	-0.0042	-0.0042	
			0.22	-0.0044	-0.0044	
			0.23	-0.0046	-0.0046	
			0.24	-0.0048	-0.0051	
			0.25	-0.0050	-0.0062	
			0.26	-0.0052	-0.0064	
			0.27	-0.0054	-0.0063	
			0.28	-0.0056	-0.0071	
			0.29	-0.0058	-0.0070	
			0.30	-0.0060	-0.0075	
			0.31	-0.0062	-0.0074	
			0.32	-0.0064	-0.0067	
			0.33	-0.0066	-0.0081	
			0.34	-0.0068	-0.0089	
			0.35	-0.0070	-0.0079	
			0.36	-0.0072	-0.0084	
			0.37	-0.0074	-0.0089	
			0.38	-0.0076	-0.0097	
			0.39	-0.0078	-0.0093	
			0.40	-0.0080	-0.0095	
			0.41	-0.0082	-0.0097	
			0.42	-0.0084	-0.0111	
			0.43	-0.0086	-0.0110	
			0.44	-0.0088	-0.0109	
			0.45	-0.0090	-0.0111	
			0.46	-0.0092	-0.0122	
			0.47	-0.0094	-0.0182	
			0.48	-0.0096	-0.0303	
			0.49	-0.0098	-0.0369	
			0.50	-0.0100	-0.0518	
			0.51	-0.0102	-0.0638	
			0.52	-0.0104	-0.0689	
			0.53	-0.0106	-0.0773	
			0.54	-0.0108	-0.0806	
			0.55	-0.0110	-0.0869	
			0.56	-0.0112	-0.0901	
			0.57	-0.0114	-0.0919	
			0.58	-0.0116	-0.0921	-0.0921
			0.59	-0.0118	-0.0926	-0.0956
			0.60	-0.0120	-0.0912	-0.0962
			0.61	-0.0122	-0.0899	-0.0969

			0.62	-0.0124	-0.0865	-0.0975
			0.63	-0.0126	-0.0818	-0.0968
			0.64	-0.0128	-0.0777	-0.0977
			0.65	-0.0130	-0.0718	-0.0948
			0.66	-0.0132	-0.0696	-0.0956
			0.67	-0.0134	-0.0664	-0.0964
			0.68	-0.0136	-0.0624	-0.0964
			0.69	-0.0138	-0.0580	-0.0970
			0.70	-0.0140	-0.0548	-0.0948
			0.71	-0.0142	-0.0535	-0.0985
			0.72	-0.0144	-0.0507	-0.0977
			0.73	-0.0146	-0.0484	-0.0954
			0.74	-0.0148	-0.0462	-0.0942
			0.75	-0.0150	-0.0440	-0.0920
			0.76	-0.0152	-0.0435	-0.0915
			0.77	-0.0154	-0.0407	-0.0877
			0.78	-0.0156	-0.0418	-0.0868
			0.79	-0.0158	-0.0405	-0.0845
			0.80	-0.0160	-0.0404	-0.0834
			0.81	-0.0162	-0.0403	-0.0853
			0.82	-0.0164	-0.0405	-0.0865
			0.83	-0.0166	-0.0404	-0.0874
			0.84	-0.0168	-0.0400	-0.0870
			0.85	-0.0170	-0.0405	-0.0875
			0.86	-0.0172	-0.0398	-0.0868
			0.87	-0.0174	-0.0412	-0.0882
			0.88	-0.0176	-0.0408	-0.0878
			0.89	-0.0178	-0.0404	-0.0814
			0.90	-0.0180	-0.0399	-0.0799
			0.91	-0.0182	-0.0401	-0.0861
			0.92	-0.0184	-0.0406	-0.0866
			0.93	-0.0186	-0.0405	-0.0875
			0.94	-0.0188	-0.0407	-0.0877
			0.95	-0.0190	-0.0406	-0.0876
			0.96	-0.0192	-0.0408	-0.0868
			0.97	-0.0194	-0.0410	-0.0880
			0.98	-0.0196	-0.0415	-0.0875
			0.99	-0.0198	-0.0420	-0.0870
			1.00	-0.0200	-0.0419	-0.0869
			1.01	-0.0202	-0.0421	-0.0871
			1.02	-0.0204	-0.0423	-0.0873
			1.03	-0.0206	-0.0425	-0.0885
			1.04	-0.0208	-0.0437	-0.0897
			1.05	-0.0210	-0.0439	-0.0889
			1.06	-0.0212	-0.0441	-0.0891
			1.07	-0.0214	-0.0446	-0.0896
			1.08	-0.0216	-0.0448	-0.0898
			1.09	-0.0218	-0.0450	-0.0900
			1.10	-0.0220	-0.0455	-0.0925
			1.11	-0.0222	-0.0466	-0.0936
			1.12	-0.0224	-0.0465	-0.0935
			1.13	-0.0226	-0.0458	-0.0918
			1.14	-0.0228	-0.0469	-0.0929
			1.15	-0.0230	-0.0468	-0.0908
			1.16	-0.0232	-0.0476	-0.0916

			1.17	-0.0234	-0.0478	-0.0918
			1.18	-0.0236	-0.0477	-0.0927
			1.19	-0.0238	-0.0476	-0.0916
			1.20	-0.0240	-0.0484	-0.0934
			1.21	-0.0242	-0.0489	-0.0949
			1.22	-0.0244	-0.0491	-0.0961
			1.23	-0.0246	-0.0490	-0.0960
			1.24	-0.0248	-0.0492	-0.0962
			1.25	-0.0250	-0.0500	-0.0980
			1.26	-0.0252	-0.0499	-0.0949
			1.27	-0.0254	-0.0498	-0.0948
			1.28	-0.0256	-0.0500	-0.0930
			1.29	-0.0258	-0.0502	-0.0932
			1.30	-0.0260	-0.0504	-0.0924
			1.31	-0.0262	-0.0500	-0.0920
			1.32	-0.0264	-0.0511	-0.0931
			1.33	-0.0266	-0.0513	-0.0933
			1.34	-0.0268	-0.0506	-0.0916
			1.35	-0.0270	-0.0511	-0.0931
			1.36	-0.0272	-0.0513	-0.0933
			1.37	-0.0274	-0.0509	-0.0929
			1.38	-0.0276	-0.0514	-0.0934
			1.39	-0.0278	-0.0519	-0.0939
			1.40	-0.0280	-0.0521	-0.0931
			1.41	-0.0282	-0.0529	-0.0929
			1.42	-0.0284	-0.0522	-0.0912
			1.43	-0.0286	-0.0527	-0.0897
			1.44	-0.0288	-0.0526	-0.0896
			1.45	-0.0290	-0.0528	-0.0888
			1.46	-0.0292	-0.0533	-0.0883
			1.47	-0.0294	-0.0532	-0.0882
			1.48	-0.0296	-0.0531	-0.0861
			1.49	-0.0298	-0.0533	-0.0853
			1.50	-0.0300	-0.0532	-0.0852
			1.51	-0.0302	-0.0524	-0.0844
			1.52	-0.0514	-0.0533	-0.0833
			1.53	-0.0516	-0.0522	-0.0772
			1.54	-0.0518	-0.0524	-0.0734
			1.55	-0.0520	-0.0526	-0.0696
			1.56	-0.0522	-0.0531	-0.0651
			1.57	-0.0524	-0.0524	-0.0574
			1.58	-0.0526	-0.0514	-0.0544
			1.59	-0.0528	-0.0510	-0.0530
			1.60	-0.0530	-0.0503	-0.0503
			1.61	-0.0532	-0.0505	
			1.62	-0.0534	-0.0507	
			1.63	-0.0536	-0.0509	
			1.64	-0.0538	-0.0502	
			1.65	-0.0540	-0.0519	
			1.66	-0.0542	-0.0515	
			1.67	-0.0544	-0.0517	
			1.68	-0.0546	-0.0519	
			1.69	-0.0548	-0.0521	
			1.70	-0.0550	-0.0532	
			1.71	-0.0552	-0.0522	

			1.72	-0.0554	-0.0515	
			1.73	-0.0556	-0.0541	
			1.74	-0.0558	-0.0510	
			1.75	-0.0560	-0.0527	
			1.76	-0.0562	-0.0541	
			1.77	-0.0564	-0.0543	
			1.78	-0.0566	-0.0545	
			1.79	-0.0568	-0.0547	
			1.80	-0.0570	-0.0552	
			1.81	-0.0572	-0.0551	
			1.82	-0.0574	-0.0556	
			1.83	-0.0576	-0.0555	
			1.84	-0.0578	-0.0551	
			1.85	-0.0580	-0.0559	
			1.86	-0.0582	-0.0564	
			1.87	-0.0584	-0.0578	
			1.88	-0.0586	-0.0577	
			1.89	-0.0588	-0.0582	
			1.90	-0.0590	-0.0578	
			1.91	-0.0592	-0.0580	
			1.92	-0.0594	-0.0591	
			1.93	-0.0596	-0.0584	
			1.94	-0.0598	-0.0595	
			1.95	-0.0600	-0.0591	
			1.96	-0.0602	-0.0587	
			1.97	-0.0604	-0.0589	
			1.98	-0.0606	-0.0594	
			1.99	-0.0608	-0.0602	
			2.00	-0.0610	-0.0613	
			2.01	-0.0612	-0.0612	
			2.02	-0.0614	-0.0614	
			2.03	-0.0616	-0.0628	
3	3	24-Jan-97	0.00	0.0000	0.0000	
			0.01	-0.0003	-0.0040	
			0.02	-0.0006	-0.0040	
			0.03	-0.0009	-0.0043	
			0.04	-0.0012	-0.0042	
			0.05	-0.0015	-0.0045	
			0.06	-0.0018	-0.0055	
			0.07	-0.0021	-0.0055	
			0.08	-0.0024	-0.0061	
			0.09	-0.0027	-0.0064	
			0.10	-0.0030	-0.0064	
			0.11	-0.0033	-0.0067	
			0.12	-0.0036	-0.0073	
			0.13	-0.0039	-0.0069	
			0.14	-0.0042	-0.0079	
			0.15	-0.0045	-0.0079	
			0.16	-0.0048	-0.0078	
			0.17	-0.0051	-0.0091	
			0.18	-0.0054	-0.0091	
			0.19	-0.0057	-0.0094	
			0.20	-0.0060	-0.0097	
			0.21	-0.0063	-0.0090	

			0.22	-0.0066	-0.0100	
			0.23	-0.0069	-0.0103	
			0.24	-0.0072	-0.0102	
			0.25	-0.0075	-0.0105	
			0.26	-0.0078	-0.0108	
			0.27	-0.0081	-0.0111	
			0.28	-0.0084	-0.0118	
			0.29	-0.0087	-0.0114	
			0.30	-0.0090	-0.0111	
			0.31	-0.0093	-0.0114	
			0.32	-0.0096	-0.0120	
			0.33	-0.0099	-0.0123	
			0.34	-0.0102	-0.0120	
			0.35	-0.0105	-0.0142	
			0.36	-0.0108	-0.0151	
			0.37	-0.0111	-0.0145	
			0.38	-0.0114	-0.0148	
			0.39	-0.0117	-0.0151	
			0.40	-0.0120	-0.0157	
			0.41	-0.0123	-0.0157	
			0.42	-0.0126	-0.0169	
			0.43	-0.0129	-0.0159	
			0.44	-0.0132	-0.0181	
			0.45	-0.0135	-0.0312	
			0.46	-0.0138	-0.0479	
			0.47	-0.0141	-0.0616	
			0.48	-0.0144	-0.0760	
			0.49	-0.0147	-0.0991	
			0.50	-0.0150	-0.1073	
			0.51	-0.0153	-0.1141	
			0.52	-0.0156	-0.1144	
			0.53	-0.0159	-0.1192	
			0.54	-0.0162	-0.1220	
			0.55	-0.0165	-0.1223	
			0.56	-0.0168	-0.1238	-0.1238
			0.57	-0.0171	-0.1223	-0.1263
			0.58	-0.0174	-0.1201	-0.1241
			0.59	-0.0177	-0.1171	-0.1271
			0.60	-0.0180	-0.1149	-0.1299
			0.61	-0.0183	-0.1106	-0.1276
			0.62	-0.0186	-0.1073	-0.1303
			0.63	-0.0189	-0.1024	-0.1314
			0.64	-0.0192	-0.0981	-0.1321
			0.65	-0.0195	-0.0951	-0.1331
			0.66	-0.0198	-0.0905	-0.1345
			0.67	-0.0201	-0.0862	-0.1332
			0.68	-0.0204	-0.0829	-0.1349
			0.69	-0.0207	-0.0765	-0.1315
			0.70	-0.0210	-0.0722	-0.1332
			0.71	-0.0213	-0.0685	-0.1375
			0.72	-0.0216	-0.0658	-0.1358
			0.73	-0.0219	-0.0643	-0.1363
			0.74	-0.0222	-0.0633	-0.1373
			0.75	-0.0225	-0.0633	-0.1383
			0.76	-0.0228	-0.0618	-0.1378

			0.77	-0.0231	-0.0618	-0.1378
			0.78	-0.0234	-0.0621	-0.1391
			0.79	-0.0237	-0.0618	-0.1378
			0.80	-0.0240	-0.0621	-0.1371
			0.81	-0.0243	-0.0615	-0.1345
			0.82	-0.0246	-0.0624	-0.1364
			0.83	-0.0249	-0.0624	-0.1354
			0.84	-0.0252	-0.0639	-0.1399
			0.85	-0.0255	-0.0636	-0.1386
			0.86	-0.0258	-0.0654	-0.1414
			0.87	-0.0261	-0.0639	-0.1389
			0.88	-0.0264	-0.0651	-0.1391
			0.89	-0.0267	-0.0648	-0.1378
			0.90	-0.0270	-0.0654	-0.1384
			0.91	-0.0273	-0.0654	-0.1374
			0.92	-0.0276	-0.0657	-0.1387
			0.93	-0.0279	-0.0663	-0.1393
			0.94	-0.0282	-0.0654	-0.1374
			0.95	-0.0285	-0.0651	-0.1351
			0.96	-0.0288	-0.0663	-0.1343
			0.97	-0.0291	-0.0666	-0.1346
			0.98	-0.0294	-0.0660	-0.1330
			0.99	-0.0297	-0.0660	-0.1330
			1.00	-0.0300	-0.0663	-0.1353
			1.01	-0.0303	-0.0669	-0.1339
			1.02	-0.0306	-0.0672	-0.1332
			1.03	-0.0309	-0.0669	-0.1309
			1.04	-0.0312	-0.0672	-0.1312
			1.05	-0.0315	-0.0675	-0.1285
			1.06	-0.0318	-0.0681	-0.1261
			1.07	-0.0321	-0.0687	-0.1287
			1.08	-0.0324	-0.0687	-0.1287
			1.09	-0.0327	-0.0690	-0.1290
			1.10	-0.0330	-0.0690	-0.1290
			1.11	-0.0333	-0.0696	-0.1286
			1.12	-0.0336	-0.0702	-0.1302
			1.13	-0.0339	-0.0702	-0.1302
			1.14	-0.0342	-0.0693	-0.1283
			1.15	-0.0345	-0.0702	-0.1312
			1.16	-0.0348	-0.0711	-0.1311
			1.17	-0.0351	-0.0711	-0.1321
			1.18	-0.0354	-0.0717	-0.1327
			1.19	-0.0357	-0.0717	-0.1327
			1.20	-0.0360	-0.0723	-0.1323
			1.21	-0.0363	-0.0714	-0.1314
			1.22	-0.0366	-0.0726	-0.1336
			1.23	-0.0369	-0.0729	-0.1349
			1.24	-0.0372	-0.0732	-0.1352
			1.25	-0.0375	-0.0726	-0.1316
			1.26	-0.0378	-0.0716	-0.1316
			1.27	-0.0381	-0.0728	-0.1348
			1.28	-0.0384	-0.0725	-0.1355
			1.29	-0.0387	-0.0734	-0.1374
			1.30	-0.0390	-0.0725	-0.1365
			1.31	-0.0393	-0.0722	-0.1342

			1.32	-0.0396	-0.0722	-0.1322
			1.33	-0.0399	-0.0734	-0.1304
			1.34	-0.0402	-0.0731	-0.1301
			1.35	-0.0405	-0.0740	-0.1280
			1.36	-0.0408	-0.0737	-0.1277
			1.37	-0.0411	-0.0737	-0.1287
			1.38	-0.0414	-0.0731	-0.1281
			1.39	-0.0417	-0.0737	-0.1257
			1.40	-0.0420	-0.0740	-0.1260
			1.41	-0.0423	-0.0737	-0.1267
			1.42	-0.0426	-0.0737	-0.1277
			1.43	-0.0429	-0.0737	-0.1287
			1.44	-0.0432	-0.0737	-0.1267
			1.45	-0.0435	-0.0743	-0.1273
			1.46	-0.0438	-0.0743	-0.1263
			1.47	-0.0441	-0.0740	-0.1250
			1.48	-0.0444	-0.0743	-0.1253
			1.49	-0.0447	-0.0749	-0.1279
			1.50	-0.0450	-0.0749	-0.1279
			1.51	-0.0453	-0.0746	-0.1266
			1.52	-0.0676	-0.0742	-0.1252
			1.53	-0.0679	-0.0745	-0.1255
			1.54	-0.0682	-0.0745	-0.1265
			1.55	-0.0685	-0.0745	-0.1265
			1.56	-0.0688	-0.0751	-0.1261
			1.57	-0.0691	-0.0751	-0.1261
			1.58	-0.0694	-0.0748	-0.1208
			1.59	-0.0697	-0.0751	-0.1181
			1.60	-0.0700	-0.0739	-0.1139
			1.61	-0.0703	-0.0730	-0.1060
			1.62	-0.0706	-0.0736	-0.0986
			1.63	-0.0709	-0.0730	-0.0890
			1.64	-0.0712	-0.0730	-0.0850
			1.65	-0.0715	-0.0736	-0.0806
			1.66	-0.0718	-0.0736	-0.0786
			1.67	-0.0721	-0.0736	-0.0786
			1.68	-0.0724	-0.0720	-0.0720
			1.69	-0.0727	-0.0723	
			1.70	-0.0730	-0.0726	
			1.71	-0.0733	-0.0726	
			1.72	-0.0736	-0.0735	
			1.73	-0.0739	-0.0741	
			1.74	-0.0742	-0.0735	
			1.75	-0.0745	-0.0738	
			1.76	-0.0748	-0.0744	
			1.77	-0.0751	-0.0738	
			1.78	-0.0754	-0.0735	
			1.79	-0.0757	-0.0738	
			1.80	-0.0760	-0.0744	
			1.81	-0.0763	-0.0750	
			1.82	-0.0766	-0.0768	
			1.83	-0.0769	-0.0768	
			1.84	-0.0772	-0.0759	
			1.85	-0.0775	-0.0771	
			1.86	-0.0778	-0.0765	

			1.87	-0.0781	-0.0777	
			1.88	-0.0784	-0.0783	
			1.89	-0.0787	-0.0786	
			1.90	-0.0790	-0.0774	
			1.91	-0.0793	-0.0786	
			1.92	-0.0796	-0.0789	
			1.93	-0.0799	-0.0795	
			1.94	-0.0802	-0.0804	
			1.95	-0.0805	-0.0807	
			1.96	-0.0808	-0.0810	
			1.97	-0.0811	-0.0820	
			1.98	-0.0814	-0.0810	
			1.99	-0.0817	-0.0813	
			2.00	-0.0820	-0.0829	
			2.01	-0.0823	-0.0835	
			2.02	-0.0826	-0.0835	
			2.03	-0.0829	-0.0856	
4	4	31-Jan-97	0.00	0.0000	0.0000	
			0.01	-0.0004	0.0002	
			0.02	-0.0008	-0.0002	
			0.03	-0.0012	-0.0009	
			0.04	-0.0016	-0.0007	
			0.05	-0.0020	-0.0014	
			0.06	-0.0024	-0.0021	
			0.07	-0.0028	-0.0025	
			0.08	-0.0032	-0.0014	
			0.09	-0.0036	-0.0021	
			0.10	-0.0040	-0.0034	
			0.11	-0.0044	-0.0038	
			0.12	-0.0048	-0.0033	
			0.13	-0.0052	-0.0037	
			0.14	-0.0056	-0.0041	
			0.15	-0.0060	-0.0045	
			0.16	-0.0064	-0.0049	
			0.17	-0.0068	-0.0053	
			0.18	-0.0072	-0.0060	
			0.19	-0.0076	-0.0064	
			0.20	-0.0080	-0.0062	
			0.21	-0.0084	-0.0069	
			0.22	-0.0088	-0.0073	
			0.23	-0.0092	-0.0086	
			0.24	-0.0096	-0.0078	
			0.25	-0.0100	-0.0094	
			0.26	-0.0104	-0.0101	
			0.27	-0.0108	-0.0093	
			0.28	-0.0112	-0.0094	
			0.29	-0.0116	-0.0098	
			0.30	-0.0120	-0.0093	
			0.31	-0.0124	-0.0109	
			0.32	-0.0128	-0.0119	
			0.33	-0.0132	-0.0123	
			0.34	-0.0136	-0.0121	
			0.35	-0.0140	-0.0119	
			0.36	-0.0144	-0.0126	

			0.37	-0.0148	-0.0130	
			0.38	-0.0152	-0.0134	
			0.39	-0.0156	-0.0141	
			0.40	-0.0160	-0.0145	
			0.41	-0.0164	-0.0146	
			0.42	-0.0168	-0.0153	
			0.43	-0.0172	-0.0157	
			0.44	-0.0176	-0.0173	
			0.45	-0.0180	-0.0165	
			0.46	-0.0184	-0.0467	
			0.47	-0.0188	-0.0621	
			0.48	-0.0192	-0.0829	
			0.49	-0.0196	-0.0958	
			0.50	-0.0200	-0.1032	
			0.51	-0.0204	-0.1115	-0.1115
			0.52	-0.0208	-0.1125	-0.1225
			0.53	-0.0212	-0.1181	-0.1331
			0.54	-0.0216	-0.1207	-0.1347
			0.55	-0.0220	-0.1186	-0.1326
			0.56	-0.0224	-0.1163	-0.1313
			0.57	-0.0228	-0.1164	-0.1314
			0.58	-0.0232	-0.1165	-0.1335
			0.59	-0.0236	-0.1108	-0.1288
			0.60	-0.0240	-0.1078	-0.1288
			0.61	-0.0244	-0.1036	-0.1296
			0.62	-0.0248	-0.0976	-0.1296
			0.63	-0.0252	-0.0944	-0.1314
			0.64	-0.0256	-0.0914	-0.1324
			0.65	-0.0260	-0.0873	-0.1353
			0.66	-0.0264	-0.0849	-0.1359
			0.67	-0.0268	-0.0820	-0.1350
			0.68	-0.0272	-0.0784	-0.1374
			0.69	-0.0276	-0.0767	-0.1367
			0.70	-0.0280	-0.0755	-0.1395
			0.71	-0.0284	-0.0741	-0.1411
			0.72	-0.0288	-0.0727	-0.1437
			0.73	-0.0292	-0.0728	-0.1428
			0.74	-0.0296	-0.0714	-0.1454
			0.75	-0.0300	-0.0699	-0.1449
			0.76	-0.0304	-0.0694	-0.1444
			0.77	-0.0308	-0.0695	-0.1445
			0.78	-0.0312	-0.0696	-0.1446
			0.79	-0.0316	-0.0700	-0.1450
			0.80	-0.0320	-0.0707	-0.1457
			0.81	-0.0324	-0.0717	-0.1467
			0.82	-0.0328	-0.0715	-0.1455
			0.83	-0.0332	-0.0722	-0.1452
			0.84	-0.0336	-0.0720	-0.1440
			0.85	-0.0340	-0.0727	-0.1447
			0.86	-0.0344	-0.0728	-0.1448
			0.87	-0.0348	-0.0735	-0.1475
			0.88	-0.0352	-0.0736	-0.1466
			0.89	-0.0356	-0.0743	-0.1473
			0.90	-0.0360	-0.0747	-0.1487
			0.91	-0.0364	-0.0754	-0.1494

			0.92	-0.0368	-0.0755	-0.1485
			0.93	-0.0372	-0.0756	-0.1466
			0.94	-0.0376	-0.0763	-0.1463
			0.95	-0.0380	-0.0773	-0.1463
			0.96	-0.0384	-0.0774	-0.1454
			0.97	-0.0388	-0.0772	-0.1402
			0.98	-0.0392	-0.0776	-0.1396
			0.99	-0.0396	-0.0783	-0.1383
			1.00	-0.0400	-0.0787	-0.1407
			1.01	-0.0404	-0.0788	-0.1408
			1.02	-0.0408	-0.0792	-0.1382
			1.03	-0.0412	-0.0799	-0.1389
			1.04	-0.0416	-0.0797	-0.1417
			1.05	-0.0420	-0.0792	-0.1432
			1.06	-0.0424	-0.0793	-0.1443
			1.07	-0.0428	-0.0794	-0.1454
			1.08	-0.0432	-0.0795	-0.1455
			1.09	-0.0436	-0.0796	-0.1456
			1.10	-0.0440	-0.0797	-0.1437
			1.11	-0.0444	-0.0807	-0.1427
			1.12	-0.0448	-0.0805	-0.1405
			1.13	-0.0452	-0.0815	-0.1395
			1.14	-0.0456	-0.0810	-0.1360
			1.15	-0.0460	-0.0807	-0.1357
			1.16	-0.0464	-0.0818	-0.1358
			1.17	-0.0468	-0.0819	-0.1389
			1.18	-0.0472	-0.0816	-0.1386
			1.19	-0.0476	-0.0820	-0.1400
			1.20	-0.0480	-0.0818	-0.1388
			1.21	-0.0484	-0.0816	-0.1366
			1.22	-0.0488	-0.0820	-0.1390
			1.23	-0.0492	-0.0809	-0.1409
			1.24	-0.0496	-0.0810	-0.1440
			1.25	-0.0500	-0.0817	-0.1437
			1.26	-0.0504	-0.0821	-0.1441
			1.27	-0.0508	-0.0819	-0.1419
			1.28	-0.0512	-0.0823	-0.1373
			1.29	-0.0516	-0.0821	-0.1391
			1.30	-0.0520	-0.0828	-0.1418
			1.31	-0.0524	-0.0823	-0.1423
			1.32	-0.0528	-0.0821	-0.1421
			1.33	-0.0532	-0.0825	-0.1425
			1.34	-0.0536	-0.0826	-0.1426
			1.35	-0.0540	-0.0826	-0.1426
			1.36	-0.0544	-0.0824	-0.1404
			1.37	-0.0548	-0.0828	-0.1418
			1.38	-0.0552	-0.0835	-0.1405
			1.39	-0.0556	-0.0833	-0.1383
			1.40	-0.0560	-0.0837	-0.1417
			1.41	-0.0564	-0.0841	-0.1421
			1.42	-0.0568	-0.0830	-0.1400
			1.43	-0.0572	-0.0834	-0.1404
			1.44	-0.0576	-0.0835	-0.1395
			1.45	-0.0580	-0.0845	-0.1385
			1.46	-0.0584	-0.0843	-0.1353

			1.47	-0.0588	-0.0844	-0.1354
			1.48	-0.0592	-0.0836	-0.1346
			1.49	-0.0596	-0.0834	-0.1314
			1.50	-0.0600	-0.0832	-0.1282
			1.51	-0.0604	-0.0839	-0.1239
			1.52	-0.0828	-0.0843	-0.1243
			1.53	-0.0832	-0.0841	-0.1241
			1.54	-0.0836	-0.0829	-0.1219
			1.55	-0.0840	-0.0833	-0.1163
			1.56	-0.0844	-0.0831	-0.1161
			1.57	-0.0848	-0.0835	-0.1085
			1.58	-0.0852	-0.0836	-0.0996
			1.59	-0.0856	-0.0834	-0.0904
			1.60	-0.0860	-0.0832	-0.0832
			1.61	-0.0864	-0.0824	
			1.62	-0.0868	-0.0822	
			1.63	-0.0872	-0.0817	
			1.64	-0.0876	-0.0811	
			1.65	-0.0880	-0.0806	
			1.66	-0.0884	-0.0810	
			1.67	-0.0888	-0.0814	
			1.68	-0.0892	-0.0821	
			1.69	-0.0896	-0.0819	
			1.70	-0.0900	-0.0823	
			1.71	-0.0904	-0.0830	
			1.72	-0.0908	-0.0822	
			1.73	-0.0912	-0.0838	
			1.74	-0.0916	-0.0842	
			1.75	-0.0920	-0.0846	
			1.76	-0.0924	-0.0847	
			1.77	-0.0928	-0.0866	
			1.78	-0.0932	-0.0874	
			1.79	-0.0936	-0.0881	
			1.80	-0.0940	-0.0875	
			1.81	-0.0944	-0.0879	
			1.82	-0.0948	-0.0893	
			1.83	-0.0952	-0.0897	
			1.84	-0.0956	-0.0901	
			1.85	-0.0960	-0.0889	
			1.86	-0.0964	-0.0899	
			1.87	-0.0968	-0.0916	
			1.88	-0.0972	-0.0914	
			1.89	-0.0976	-0.0921	
			1.90	-0.0980	-0.0925	
			1.91	-0.0984	-0.0935	
			1.92	-0.0988	-0.0945	
			1.93	-0.0992	-0.0946	
			1.94	-0.0996	-0.0950	
			1.95	-0.1000	-0.0945	
			1.96	-0.1004	-0.0949	
			1.97	-0.1008	-0.0962	
			1.98	-0.1012	-0.0966	
			1.99	-0.1016	-0.0976	
			2.00	-0.1020	-0.0980	
			2.01	-0.1024	-0.0996	

			2.02	-0.1028	-0.0994	
			2.03	-0.1032	-0.1031	
5	5	12-Feb-97	0.00	0.0000	0.0000	
			0.01	-0.0005	-0.0023	
			0.02	-0.0010	-0.0028	
			0.03	-0.0015	-0.0027	
			0.04	-0.0020	-0.0032	
			0.05	-0.0025	-0.0040	
			0.06	-0.0030	-0.0042	
			0.07	-0.0035	-0.0047	
			0.08	-0.0040	-0.0052	
			0.09	-0.0045	-0.0060	
			0.10	-0.0050	-0.0059	
			0.11	-0.0055	-0.0067	
			0.12	-0.0060	-0.0072	
			0.13	-0.0065	-0.0083	
			0.14	-0.0070	-0.0082	
			0.15	-0.0075	-0.0084	
			0.16	-0.0080	-0.0095	
			0.17	-0.0085	-0.0097	
			0.18	-0.0090	-0.0099	
			0.19	-0.0095	-0.0104	
			0.20	-0.0100	-0.0109	
			0.21	-0.0105	-0.0105	
			0.22	-0.0110	-0.0116	
			0.23	-0.0115	-0.0121	
			0.24	-0.0120	-0.0132	
			0.25	-0.0125	-0.0134	
			0.26	-0.0130	-0.0142	
			0.27	-0.0135	-0.0150	
			0.28	-0.0140	-0.0152	
			0.29	-0.0145	-0.0157	
			0.30	-0.0150	-0.0165	
			0.31	-0.0155	-0.0176	
			0.32	-0.0160	-0.0178	
			0.33	-0.0165	-0.0183	
			0.34	-0.0170	-0.0197	
			0.35	-0.0175	-0.0190	
			0.36	-0.0180	-0.0201	
			0.37	-0.0185	-0.0200	
			0.38	-0.0190	-0.0208	
			0.39	-0.0195	-0.0219	
			0.40	-0.0200	-0.0221	
			0.41	-0.0205	-0.0229	
			0.42	-0.0210	-0.0228	
			0.43	-0.0215	-0.0236	
			0.44	-0.0220	-0.0247	
			0.45	-0.0225	-0.0243	
			0.46	-0.0230	-0.0257	
			0.47	-0.0235	-0.0253	
			0.48	-0.0240	-0.0264	
			0.49	-0.0245	-0.0263	
			0.50	-0.0250	-0.0271	
			0.51	-0.0255	-0.0273	

			0.52	-0.0260	-0.0281	
			0.53	-0.0265	-0.0286	
			0.54	-0.0270	-0.0291	
			0.55	-0.0275	-0.0293	
			0.56	-0.0280	-0.0301	
			0.57	-0.0285	-0.0312	
			0.58	-0.0290	-0.0573	
			0.59	-0.0295	-0.0658	
			0.60	-0.0300	-0.0818	
			0.61	-0.0305	-0.0912	
			0.62	-0.0310	-0.1151	
			0.63	-0.0315	-0.1342	
			0.64	-0.0320	-0.1384	
			0.65	-0.0325	-0.1404	
			0.66	-0.0330	-0.1467	-0.1467
			0.67	-0.0335	-0.1493	-0.1543
			0.68	-0.0340	-0.1510	-0.1620
			0.69	-0.0345	-0.1521	-0.1671
			0.70	-0.0350	-0.1511	-0.1611
			0.71	-0.0355	-0.1501	-0.1621
			0.72	-0.0360	-0.1485	-0.1615
			0.73	-0.0365	-0.1453	-0.1623
			0.74	-0.0370	-0.1425	-0.1585
			0.75	-0.0375	-0.1390	-0.1540
			0.76	-0.0380	-0.1364	-0.1534
			0.77	-0.0385	-0.1342	-0.1552
			0.78	-0.0390	-0.1326	-0.1596
			0.79	-0.0395	-0.1294	-0.1614
			0.80	-0.0400	-0.1269	-0.1649
			0.81	-0.0405	-0.1237	-0.1677
			0.82	-0.0410	-0.1196	-0.1636
			0.83	-0.0415	-0.1162	-0.1652
			0.84	-0.0420	-0.1139	-0.1699
			0.85	-0.0425	-0.1099	-0.1739
			0.86	-0.0430	-0.1067	-0.1777
			0.87	-0.0435	-0.1048	-0.1818
			0.88	-0.0440	-0.1019	-0.1839
			0.89	-0.0445	-0.1003	-0.1833
			0.90	-0.0450	-0.0993	-0.1853
			0.91	-0.0455	-0.0994	-0.1864
			0.92	-0.0460	-0.0978	-0.1848
			0.93	-0.0465	-0.0974	-0.1874
			0.94	-0.0470	-0.0982	-0.1882
			0.95	-0.0475	-0.0981	-0.1891
			0.96	-0.0480	-0.0986	-0.1866
			0.97	-0.0485	-0.0985	-0.1865
			0.98	-0.0490	-0.0981	-0.1841
			0.99	-0.0495	-0.0980	-0.1830
			1.00	-0.0500	-0.0985	-0.1835
			1.01	-0.0505	-0.0987	-0.1827
			1.02	-0.0510	-0.0985	-0.1845
			1.03	-0.0515	-0.0984	-0.1844
			1.04	-0.0520	-0.0986	-0.1856
			1.05	-0.0525	-0.0994	-0.1864
			1.06	-0.0530	-0.0996	-0.1816

			1.07	-0.0535	-0.1004	-0.1824
			1.08	-0.0540	-0.1009	-0.1829
			1.09	-0.0545	-0.1014	-0.1834
			1.10	-0.0550	-0.1013	-0.1813
			1.11	-0.0555	-0.1009	-0.1799
			1.12	-0.0560	-0.1014	-0.1794
			1.13	-0.0565	-0.1013	-0.1783
			1.14	-0.0570	-0.1015	-0.1785
			1.15	-0.0575	-0.1014	-0.1784
			1.16	-0.0580	-0.1016	-0.1796
			1.17	-0.0585	-0.1018	-0.1798
			1.18	-0.0590	-0.1020	-0.1790
			1.19	-0.0595	-0.1025	-0.1795
			1.20	-0.0600	-0.1024	-0.1794
			1.21	-0.0605	-0.1026	-0.1786
			1.22	-0.0610	-0.1028	-0.1798
			1.23	-0.0615	-0.1026	-0.1796
			1.24	-0.0620	-0.1035	-0.1795
			1.25	-0.0625	-0.1036	-0.1796
			1.26	-0.0630	-0.1032	-0.1772
			1.27	-0.0635	-0.1043	-0.1783
			1.28	-0.0640	-0.1036	-0.1786
			1.29	-0.0645	-0.1038	-0.1808
			1.30	-0.0650	-0.1043	-0.1803
			1.31	-0.0655	-0.1039	-0.1799
			1.32	-0.0660	-0.1044	-0.1804
			1.33	-0.0665	-0.1055	-0.1805
			1.34	-0.0670	-0.1045	-0.1775
			1.35	-0.0675	-0.1053	-0.1803
			1.36	-0.0680	-0.1055	-0.1805
			1.37	-0.0685	-0.1054	-0.1784
			1.38	-0.0690	-0.1050	-0.1800
			1.39	-0.0695	-0.1055	-0.1785
			1.40	-0.0700	-0.1057	-0.1767
			1.41	-0.0705	-0.1062	-0.1812
			1.42	-0.0710	-0.1057	-0.1777
			1.43	-0.0715	-0.1062	-0.1792
			1.44	-0.0720	-0.1052	-0.1792
			1.45	-0.0725	-0.1063	-0.1773
			1.46	-0.0730	-0.1068	-0.1758
			1.47	-0.0735	-0.1055	-0.1725
			1.48	-0.0740	-0.1060	-0.1720
			1.49	-0.0745	-0.1059	-0.1719
			1.50	-0.0750	-0.1061	-0.1711
			1.51	-0.0755	-0.1066	-0.1706
			1.52	-0.0980	-0.1068	-0.1678
			1.53	-0.0985	-0.1058	-0.1658
			1.54	-0.0990	-0.1063	-0.1643
			1.55	-0.0995	-0.1065	-0.1595
			1.56	-0.1000	-0.1070	-0.1580
			1.57	-0.1005	-0.1068	-0.1538
			1.58	-0.1010	-0.1061	-0.1541
			1.59	-0.1015	-0.1060	-0.1430
			1.60	-0.1020	-0.1059	-0.1329
			1.61	-0.1025	-0.1067	-0.1227

			1.62	-0.1030	-0.1066	-0.1136
			1.63	-0.1035	-0.1062	-0.1082
			1.64	-0.1040	-0.1061	-0.1071
			1.65	-0.1045	-0.1051	-0.1051
			1.66	-0.1050	-0.1046	
			1.67	-0.1055	-0.1045	
			1.68	-0.1060	-0.1047	
			1.69	-0.1065	-0.1046	
			1.70	-0.1070	-0.1057	
			1.71	-0.1075	-0.1062	
			1.72	-0.1080	-0.1070	
			1.73	-0.1085	-0.1078	
			1.74	-0.1090	-0.1080	
			1.75	-0.1095	-0.1082	
			1.76	-0.1100	-0.1090	
			1.77	-0.1105	-0.1086	
			1.78	-0.1110	-0.1091	
			1.79	-0.1115	-0.1093	
			1.80	-0.1120	-0.1101	
			1.81	-0.1125	-0.1109	
			1.82	-0.1130	-0.1108	
			1.83	-0.1135	-0.1116	
			1.84	-0.1140	-0.1118	
			1.85	-0.1145	-0.1123	
			1.86	-0.1150	-0.1128	
			1.87	-0.1155	-0.1139	
			1.88	-0.1160	-0.1150	
			1.89	-0.1165	-0.1146	
			1.90	-0.1170	-0.1151	
			1.91	-0.1175	-0.1156	
			1.92	-0.1180	-0.1161	
			1.93	-0.1185	-0.1163	
			1.94	-0.1190	-0.1171	
			1.95	-0.1195	-0.1179	
			1.96	-0.1200	-0.1190	
			1.97	-0.1205	-0.1201	
			1.98	-0.1210	-0.1209	
			1.99	-0.1215	-0.1211	
			2.00	-0.1220	-0.1247	
			2.01	-0.1225	-0.1227	
			2.02	-0.1230	-0.1232	
			2.03	-0.1235	-0.1234	
6	6	10-Mar-97	0.00	0.0000	0.0000	
			0.01	-0.0006	-0.0015	
			0.02	-0.0012	-0.0021	
			0.03	-0.0018	-0.0027	
			0.04	-0.0024	-0.0027	
			0.05	-0.0030	-0.0036	
			0.06	-0.0036	-0.0033	
			0.07	-0.0042	-0.0051	
			0.08	-0.0048	-0.0048	
			0.09	-0.0054	-0.0060	
			0.10	-0.0060	-0.0051	
			0.11	-0.0066	-0.0063	

			0.12	-0.0072	-0.0063	
			0.13	-0.0078	-0.0069	
			0.14	-0.0084	-0.0072	
			0.15	-0.0090	-0.0090	
			0.16	-0.0096	-0.0090	
			0.17	-0.0102	-0.0096	
			0.18	-0.0108	-0.0105	
			0.19	-0.0114	-0.0120	
			0.20	-0.0120	-0.0117	
			0.21	-0.0126	-0.0117	
			0.22	-0.0132	-0.0129	
			0.23	-0.0138	-0.0135	
			0.24	-0.0144	-0.0132	
			0.25	-0.0150	-0.0150	
			0.26	-0.0156	-0.0147	
			0.27	-0.0162	-0.0165	
			0.28	-0.0168	-0.0165	
			0.29	-0.0174	-0.0171	
			0.30	-0.0180	-0.0174	
			0.31	-0.0186	-0.0165	
			0.32	-0.0192	-0.0186	
			0.33	-0.0198	-0.0192	
			0.34	-0.0204	-0.0201	
			0.35	-0.0210	-0.0213	
			0.36	-0.0216	-0.0210	
			0.37	-0.0222	-0.0231	
			0.38	-0.0228	-0.0237	
			0.39	-0.0234	-0.0243	
			0.40	-0.0240	-0.0252	
			0.41	-0.0246	-0.0255	
			0.42	-0.0252	-0.0261	
			0.43	-0.0258	-0.0267	
			0.44	-0.0264	-0.0273	
			0.45	-0.0270	-0.0276	
			0.46	-0.0276	-0.0285	
			0.47	-0.0282	-0.0291	
			0.48	-0.0288	-0.0285	
			0.49	-0.0294	-0.0291	
			0.50	-0.0300	-0.0297	
			0.51	-0.0306	-0.0306	
			0.52	-0.0312	-0.0318	
			0.53	-0.0318	-0.0315	
			0.54	-0.0324	-0.0470	
			0.55	-0.0330	-0.0723	
			0.56	-0.0336	-0.0851	
			0.57	-0.0342	-0.0985	
			0.58	-0.0348	-0.0997	
			0.59	-0.0354	-0.1247	
			0.60	-0.0360	-0.1460	-0.1460
			0.61	-0.0366	-0.1488	-0.1598
			0.62	-0.0372	-0.1518	-0.1668
			0.63	-0.0378	-0.1588	-0.1788
			0.64	-0.0384	-0.1628	-0.1828
			0.65	-0.0390	-0.1634	-0.1874
			0.66	-0.0396	-0.1624	-0.1904

			0.67	-0.0402	-0.1606	-0.1926
			0.68	-0.0408	-0.1584	-0.1924
			0.69	-0.0414	-0.1554	-0.1904
			0.70	-0.0420	-0.1517	-0.1877
			0.71	-0.0426	-0.1493	-0.1893
			0.72	-0.0432	-0.1487	-0.1927
			0.73	-0.0438	-0.1435	-0.1905
			0.74	-0.0444	-0.1425	-0.1935
			0.75	-0.0450	-0.1349	-0.1889
			0.76	-0.0456	-0.1322	-0.1892
			0.77	-0.0462	-0.1300	-0.1900
			0.78	-0.0468	-0.1257	-0.1897
			0.79	-0.0474	-0.1230	-0.1900
			0.80	-0.0480	-0.1190	-0.1900
			0.81	-0.0486	-0.1166	-0.1886
			0.82	-0.0492	-0.1144	-0.1864
			0.83	-0.0498	-0.1126	-0.1856
			0.84	-0.0504	-0.1123	-0.1863
			0.85	-0.0510	-0.1113	-0.1853
			0.86	-0.0516	-0.1116	-0.1866
			0.87	-0.0522	-0.1122	-0.1882
			0.88	-0.0528	-0.1119	-0.1879
			0.89	-0.0534	-0.1119	-0.1879
			0.90	-0.0540	-0.1125	-0.1895
			0.91	-0.0546	-0.1128	-0.1898
			0.92	-0.0552	-0.1134	-0.1904
			0.93	-0.0558	-0.1137	-0.1867
			0.94	-0.0564	-0.1131	-0.1841
			0.95	-0.0570	-0.1134	-0.1834
			0.96	-0.0576	-0.1137	-0.1837
			0.97	-0.0582	-0.1137	-0.1877
			0.98	-0.0588	-0.1143	-0.1893
			0.99	-0.0594	-0.1149	-0.1899
			1.00	-0.0600	-0.1146	-0.1896
			1.01	-0.0606	-0.1158	-0.1908
			1.02	-0.0612	-0.1164	-0.1914
			1.03	-0.0618	-0.1173	-0.1903
			1.04	-0.0624	-0.1179	-0.1829
			1.05	-0.0630	-0.1179	-0.1829
			1.06	-0.0636	-0.1182	-0.1892
			1.07	-0.0642	-0.1185	-0.1905
			1.08	-0.0648	-0.1178	-0.1878
			1.09	-0.0654	-0.1190	-0.1880
			1.10	-0.0660	-0.1199	-0.1859
			1.11	-0.0666	-0.1193	-0.1863
			1.12	-0.0672	-0.1202	-0.1862
			1.13	-0.0678	-0.1205	-0.1885
			1.14	-0.0684	-0.1205	-0.1895
			1.15	-0.0690	-0.1199	-0.1899
			1.16	-0.0696	-0.1196	-0.1906
			1.17	-0.0702	-0.1196	-0.1906
			1.18	-0.0708	-0.1187	-0.1887
			1.19	-0.0714	-0.1189	-0.1899
			1.20	-0.0720	-0.1177	-0.1887
			1.21	-0.0726	-0.1186	-0.1916

			1.22	-0.0732	-0.1192	-0.1922
			1.23	-0.0738	-0.1198	-0.1898
			1.24	-0.0744	-0.1198	-0.1898
			1.25	-0.0750	-0.1198	-0.1898
			1.26	-0.0756	-0.1210	-0.1930
			1.27	-0.0762	-0.1210	-0.1930
			1.28	-0.0768	-0.1216	-0.1946
			1.29	-0.0774	-0.1222	-0.1942
			1.30	-0.0780	-0.1219	-0.1949
			1.31	-0.0786	-0.1219	-0.1949
			1.32	-0.0792	-0.1225	-0.1955
			1.33	-0.0798	-0.1234	-0.1964
			1.34	-0.0804	-0.1240	-0.1980
			1.35	-0.0810	-0.1240	-0.1990
			1.36	-0.0816	-0.1237	-0.1987
			1.37	-0.0822	-0.1237	-0.1957
			1.38	-0.0828	-0.1236	-0.1946
			1.39	-0.0834	-0.1233	-0.1933
			1.40	-0.0840	-0.1242	-0.1962
			1.41	-0.0846	-0.1227	-0.1977
			1.42	-0.0852	-0.1233	-0.1983
			1.43	-0.0858	-0.1233	-0.1983
			1.44	-0.0864	-0.1242	-0.1972
			1.45	-0.0870	-0.1239	-0.2009
			1.46	-0.0876	-0.1236	-0.1986
			1.47	-0.0882	-0.1242	-0.1992
			1.48	-0.0888	-0.1248	-0.2008
			1.49	-0.0894	-0.1235	-0.1985
			1.50	-0.0900	-0.1244	-0.1994
			1.51	-0.0906	-0.1244	-0.1954
			1.52	-0.1132	-0.1253	-0.1953
			1.53	-0.1138	-0.1247	-0.1927
			1.54	-0.1144	-0.1250	-0.1900
			1.55	-0.1150	-0.1253	-0.1893
			1.56	-0.1156	-0.1244	-0.1854
			1.57	-0.1162	-0.1247	-0.1817
			1.58	-0.1168	-0.1247	-0.1777
			1.59	-0.1174	-0.1237	-0.1687
			1.60	-0.1180	-0.1222	-0.1592
			1.61	-0.1186	-0.1222	-0.1472
			1.62	-0.1192	-0.1219	-0.1349
			1.63	-0.1198	-0.1210	-0.1240
			1.64	-0.1204	-0.1206	-0.1206
			1.65	-0.1210	-0.1200	
			1.66	-0.1216	-0.1209	
			1.67	-0.1222	-0.1215	
			1.68	-0.1228	-0.1218	
			1.69	-0.1234	-0.1221	
			1.70	-0.1240	-0.1224	
			1.71	-0.1246	-0.1224	
			1.72	-0.1252	-0.1236	
			1.73	-0.1258	-0.1260	
			1.74	-0.1264	-0.1245	
			1.75	-0.1270	-0.1263	
			1.76	-0.1276	-0.1260	

			1.77	-0.1282	-0.1269	
			1.78	-0.1288	-0.1275	
			1.79	-0.1294	-0.1287	
			1.80	-0.1300	-0.1293	
			1.81	-0.1306	-0.1302	
			1.82	-0.1312	-0.1311	
			1.83	-0.1318	-0.1317	
			1.84	-0.1324	-0.1320	
			1.85	-0.1330	-0.1320	
			1.86	-0.1336	-0.1329	
			1.87	-0.1342	-0.1338	
			1.88	-0.1348	-0.1344	
			1.89	-0.1354	-0.1353	
			1.90	-0.1360	-0.1362	
			1.91	-0.1366	-0.1356	
			1.92	-0.1372	-0.1362	
			1.93	-0.1378	-0.1374	
			1.94	-0.1384	-0.1383	
			1.95	-0.1390	-0.1383	
			1.96	-0.1396	-0.1395	
			1.97	-0.1402	-0.1414	
			1.98	-0.1408	-0.1404	
			1.99	-0.1414	-0.1426	
			2.00	-0.1420	-0.1438	
			2.01	-0.1426	-0.1441	
			2.02	-0.1432	-0.1447	
			2.03	-0.1438	-0.1440	
7	7	17-Mar-97	0.00	0.0000	0.0000	
			0.01	-0.0007	0.0023	
			0.02	-0.0014	0.0026	
			0.03	-0.0021	0.0022	
			0.04	-0.0028	0.0024	
			0.05	-0.0035	0.0023	
			0.06	-0.0042	0.0007	
			0.07	-0.0049	-0.0003	
			0.08	-0.0056	-0.0010	
			0.09	-0.0063	-0.0008	
			0.10	-0.0070	-0.0021	
			0.11	-0.0077	-0.0034	
			0.12	-0.0084	-0.0035	
			0.13	-0.0091	-0.0045	
			0.14	-0.0098	-0.0049	
			0.15	-0.0105	-0.0050	
			0.16	-0.0112	-0.0072	
			0.17	-0.0119	-0.0076	
			0.18	-0.0126	-0.0080	
			0.19	-0.0133	-0.0078	
			0.20	-0.0140	-0.0088	
			0.21	-0.0147	-0.0104	
			0.22	-0.0154	-0.0105	
			0.23	-0.0161	-0.0109	
			0.24	-0.0168	-0.0116	
			0.25	-0.0175	-0.0126	
			0.26	-0.0182	-0.0127	

			0.27	-0.0189	-0.0137	
			0.28	-0.0196	-0.0147	
			0.29	-0.0203	-0.0160	
			0.30	-0.0210	-0.0155	
			0.31	-0.0217	-0.0156	
			0.32	-0.0224	-0.0175	
			0.33	-0.0231	-0.0185	
			0.34	-0.0238	-0.0198	
			0.35	-0.0245	-0.0184	
			0.36	-0.0252	-0.0206	
			0.37	-0.0259	-0.0198	
			0.38	-0.0266	-0.0214	
			0.39	-0.0273	-0.0221	
			0.40	-0.0280	-0.0231	
			0.41	-0.0287	-0.0238	
			0.42	-0.0294	-0.0248	
			0.43	-0.0301	-0.0252	
			0.44	-0.0308	-0.0259	
			0.45	-0.0315	-0.0275	
			0.46	-0.0322	-0.0276	
			0.47	-0.0329	-0.0280	
			0.48	-0.0336	-0.0296	
			0.49	-0.0343	-0.0300	
			0.50	-0.0350	-0.0304	
			0.51	-0.0357	-0.0323	
			0.52	-0.0364	-0.0327	
			0.53	-0.0371	-0.0328	
			0.54	-0.0378	-0.0341	
			0.55	-0.0385	-0.0342	
			0.56	-0.0392	-0.0349	
			0.57	-0.0399	-0.0356	
			0.58	-0.0406	-0.0360	
			0.59	-0.0413	-0.0364	
			0.60	-0.0420	-0.0368	
			0.61	-0.0427	-0.0467	
			0.62	-0.0434	-0.0788	
			0.63	-0.0441	-0.0947	
			0.64	-0.0448	-0.1036	
			0.65	-0.0455	-0.1165	
			0.66	-0.0462	-0.1510	
			0.67	-0.0469	-0.1618	
			0.68	-0.0476	-0.1659	
			0.69	-0.0483	-0.1672	-0.1672
			0.70	-0.0490	-0.1709	-0.1809
			0.71	-0.0497	-0.1744	-0.1874
			0.72	-0.0504	-0.1748	-0.1908
			0.73	-0.0511	-0.1706	-0.1876
			0.74	-0.0518	-0.1685	-0.1865
			0.75	-0.0525	-0.1665	-0.1855
			0.76	-0.0532	-0.1648	-0.1868
			0.77	-0.0539	-0.1639	-0.1889
			0.78	-0.0546	-0.1613	-0.1873
			0.79	-0.0553	-0.1589	-0.1859
			0.80	-0.0560	-0.1569	-0.1869
			0.81	-0.0567	-0.1555	-0.1875

			0.82	-0.0574	-0.1534	-0.1904
			0.83	-0.0581	-0.1501	-0.1881
			0.84	-0.0588	-0.1460	-0.1890
			0.85	-0.0595	-0.1430	-0.1930
			0.86	-0.0602	-0.1407	-0.1947
			0.87	-0.0609	-0.1365	-0.1965
			0.88	-0.0616	-0.1332	-0.2012
			0.89	-0.0623	-0.1303	-0.2063
			0.90	-0.0630	-0.1285	-0.2095
			0.91	-0.0637	-0.1262	-0.2092
			0.92	-0.0644	-0.1260	-0.2120
			0.93	-0.0651	-0.1261	-0.2141
			0.94	-0.0658	-0.1265	-0.2145
			0.95	-0.0665	-0.1253	-0.2103
			0.96	-0.0672	-0.1263	-0.2133
			0.97	-0.0679	-0.1267	-0.2147
			0.98	-0.0686	-0.1277	-0.2127
			0.99	-0.0693	-0.1281	-0.2131
			1.00	-0.0700	-0.1288	-0.2148
			1.01	-0.0707	-0.1286	-0.2146
			1.02	-0.0714	-0.1293	-0.2143
			1.03	-0.0721	-0.1282	-0.2132
			1.04	-0.0728	-0.1292	-0.2112
			1.05	-0.0735	-0.1299	-0.2119
			1.06	-0.0742	-0.1303	-0.2133
			1.07	-0.0749	-0.1295	-0.2115
			1.08	-0.0756	-0.1299	-0.2099
			1.09	-0.0763	-0.1293	-0.2073
			1.10	-0.0770	-0.1300	-0.2080
			1.11	-0.0777	-0.1304	-0.2094
			1.12	-0.0784	-0.1293	-0.2063
			1.13	-0.0791	-0.1297	-0.2077
			1.14	-0.0798	-0.1292	-0.2082
			1.15	-0.0805	-0.1296	-0.2096
			1.16	-0.0812	-0.1300	-0.2130
			1.17	-0.0819	-0.1304	-0.2144
			1.18	-0.0826	-0.1305	-0.2145
			1.19	-0.0833	-0.1315	-0.2165
			1.20	-0.0840	-0.1315	-0.2165
			1.21	-0.0847	-0.1326	-0.2146
			1.22	-0.0854	-0.1326	-0.2136
			1.23	-0.0861	-0.1330	-0.2140
			1.24	-0.0868	-0.1334	-0.2154
			1.25	-0.0875	-0.1329	-0.2149
			1.26	-0.0882	-0.1330	-0.2150
			1.27	-0.0889	-0.1337	-0.2137
			1.28	-0.0896	-0.1344	-0.2144
			1.29	-0.0903	-0.1342	-0.2142
			1.30	-0.0910	-0.1343	-0.2143
			1.31	-0.0917	-0.1332	-0.2132
			1.32	-0.0924	-0.1335	-0.2135
			1.33	-0.0931	-0.1324	-0.2114
			1.34	-0.0938	-0.1316	-0.2096
			1.35	-0.0945	-0.1323	-0.2113
			1.36	-0.0952	-0.1327	-0.2077

			1.37	-0.0959	-0.1328	-0.2078
			1.38	-0.0966	-0.1344	-0.2094
			1.39	-0.0973	-0.1351	-0.2121
			1.40	-0.0980	-0.1361	-0.2161
			1.41	-0.0987	-0.1374	-0.2194
			1.42	-0.0994	-0.1381	-0.2221
			1.43	-0.1001	-0.1382	-0.2222
			1.44	-0.1008	-0.1398	-0.2248
			1.45	-0.1015	-0.1393	-0.2223
			1.46	-0.1022	-0.1400	-0.2230
			1.47	-0.1029	-0.1401	-0.2221
			1.48	-0.1036	-0.1411	-0.2211
			1.49	-0.1043	-0.1406	-0.2216
			1.50	-0.1050	-0.1404	-0.2194
			1.51	-0.1057	-0.1398	-0.2188
			1.52	-0.1264	-0.1399	-0.2189
			1.53	-0.1271	-0.1382	-0.2142
			1.54	-0.1278	-0.1374	-0.2114
			1.55	-0.1285	-0.1368	-0.2068
			1.56	-0.1292	-0.1372	-0.2042
			1.57	-0.1299	-0.1364	-0.2014
			1.58	-0.1306	-0.1365	-0.1985
			1.59	-0.1313	-0.1360	-0.1960
			1.60	-0.1320	-0.1355	-0.1965
			1.61	-0.1327	-0.1356	-0.1916
			1.62	-0.1334	-0.1360	-0.1870
			1.63	-0.1341	-0.1357	-0.1837
			1.64	-0.1348	-0.1358	-0.1808
			1.65	-0.1355	-0.1359	-0.1679
			1.66	-0.1362	-0.1360	-0.1570
			1.67	-0.1369	-0.1361	-0.1461
			1.68	-0.1376	-0.1362	-0.1462
			1.69	-0.1383	-0.1363	-0.1363
			1.70	-0.1390	-0.1358	
			1.71	-0.1397	-0.1365	
			1.72	-0.1404	-0.1369	
			1.73	-0.1411	-0.1379	
			1.74	-0.1418	-0.1386	
			1.75	-0.1425	-0.1377	
			1.76	-0.1432	-0.1394	
			1.77	-0.1439	-0.1407	
			1.78	-0.1446	-0.1411	
			1.79	-0.1453	-0.1424	
			1.80	-0.1460	-0.1434	
			1.81	-0.1467	-0.1432	
			1.82	-0.1474	-0.1442	
			1.83	-0.1481	-0.1439	
			1.84	-0.1488	-0.1459	
			1.85	-0.1495	-0.1460	
			1.86	-0.1502	-0.1467	
			1.87	-0.1509	-0.1471	
			1.88	-0.1516	-0.1490	
			1.89	-0.1523	-0.1503	
			1.90	-0.1530	-0.1501	
			1.91	-0.1537	-0.1508	

			1.92	-0.1544	-0.1515	
			1.93	-0.1551	-0.1516	
			1.94	-0.1558	-0.1529	
			1.95	-0.1565	-0.1536	
			1.96	-0.1572	-0.1540	
			1.97	-0.1579	-0.1547	
			1.98	-0.1586	-0.1557	
			1.99	-0.1593	-0.1564	
			2.00	-0.1600	-0.1577	
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			2.02	-0.1614	-0.1588	
			2.03	-0.1621	-0.1601	
8	8	24-Mar-97	0.00	0.0000	0.0000	
			0.01	-0.0008	-0.0035	
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			0.03	-0.0024	-0.0036	
			0.04	-0.0032	-0.0044	
			0.05	-0.0040	-0.0049	
			0.06	-0.0048	-0.0063	
			0.07	-0.0056	-0.0065	
			0.08	-0.0064	-0.0073	
			0.09	-0.0072	-0.0081	
			0.10	-0.0080	-0.0089	
			0.11	-0.0088	-0.0091	
			0.12	-0.0096	-0.0102	
			0.13	-0.0104	-0.0101	
			0.14	-0.0112	-0.0100	
			0.15	-0.0120	-0.0102	
			0.16	-0.0128	-0.0110	
			0.17	-0.0136	-0.0121	
			0.18	-0.0144	-0.0129	
			0.19	-0.0152	-0.0140	
			0.20	-0.0160	-0.0148	
			0.21	-0.0168	-0.0156	
			0.22	-0.0176	-0.0167	
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			0.25	-0.0200	-0.0191	
			0.26	-0.0208	-0.0199	
			0.27	-0.0216	-0.0210	
			0.28	-0.0224	-0.0209	
			0.29	-0.0232	-0.0217	
			0.30	-0.0240	-0.0228	
			0.31	-0.0248	-0.0236	
			0.32	-0.0256	-0.0256	
			0.33	-0.0264	-0.0258	
			0.34	-0.0272	-0.0260	
			0.35	-0.0280	-0.0262	
			0.36	-0.0288	-0.0279	
			0.37	-0.0296	-0.0281	
			0.38	-0.0304	-0.0295	
			0.39	-0.0312	-0.0309	
			0.40	-0.0320	-0.0305	
			0.41	-0.0328	-0.0307	

			0.42	-0.0336	-0.0315	
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			0.44	-0.0352	-0.0343	
			0.45	-0.0360	-0.0354	
			0.46	-0.0368	-0.0359	
			0.47	-0.0376	-0.0361	
			0.48	-0.0384	-0.0366	
			0.49	-0.0392	-0.0383	
			0.50	-0.0400	-0.0382	
			0.51	-0.0408	-0.0393	
			0.52	-0.0416	-0.0962	
			0.53	-0.0424	-0.1052	
			0.54	-0.0432	-0.1151	
			0.55	-0.0440	-0.1235	
			0.56	-0.0448	-0.1390	
			0.57	-0.0456	-0.1684	
			0.58	-0.0464	-0.1832	-0.1832
			0.59	-0.0472	-0.1850	-0.1920
			0.60	-0.0480	-0.1873	-0.1993
			0.61	-0.0488	-0.1911	-0.2061
			0.62	-0.0496	-0.1950	-0.2150
			0.63	-0.0504	-0.1958	-0.2188
			0.64	-0.0512	-0.1966	-0.2226
			0.65	-0.0520	-0.1959	-0.2239
			0.66	-0.0528	-0.1945	-0.2255
			0.67	-0.0536	-0.1923	-0.2263
			0.68	-0.0544	-0.1891	-0.2241
			0.69	-0.0552	-0.1875	-0.2235
			0.70	-0.0560	-0.1849	-0.2229
			0.71	-0.0568	-0.1824	-0.2234
			0.72	-0.0576	-0.1804	-0.2264
			0.73	-0.0584	-0.1773	-0.2273
			0.74	-0.0592	-0.1735	-0.2265
			0.75	-0.0600	-0.1688	-0.2238
			0.76	-0.0608	-0.1653	-0.2243
			0.77	-0.0616	-0.1619	-0.2249
			0.78	-0.0624	-0.1587	-0.2217
			0.79	-0.0632	-0.1534	-0.2254
			0.80	-0.0640	-0.1496	-0.2276
			0.81	-0.0648	-0.1474	-0.2324
			0.82	-0.0656	-0.1451	-0.2331
			0.83	-0.0664	-0.1438	-0.2318
			0.84	-0.0672	-0.1437	-0.2307
			0.85	-0.0680	-0.1433	-0.2283
			0.86	-0.0688	-0.1432	-0.2262
			0.87	-0.0696	-0.1437	-0.2297
			0.88	-0.0704	-0.1432	-0.2352
			0.89	-0.0712	-0.1440	-0.2350
			0.90	-0.0720	-0.1445	-0.2385
			0.91	-0.0728	-0.1453	-0.2373
			0.92	-0.0736	-0.1458	-0.2388
			0.93	-0.0744	-0.1463	-0.2383
			0.94	-0.0752	-0.1462	-0.2372
			0.95	-0.0760	-0.1470	-0.2390
			0.96	-0.0768	-0.1475	-0.2395

			0.97	-0.0776	-0.1480	-0.2400
			0.98	-0.0784	-0.1485	-0.2395
			0.99	-0.0792	-0.1493	-0.2423
			1.00	-0.0800	-0.1501	-0.2451
			1.01	-0.0808	-0.1503	-0.2453
			1.02	-0.0816	-0.1505	-0.2455
			1.03	-0.0824	-0.1501	-0.2461
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			1.10	-0.0880	-0.1526	-0.2416
			1.11	-0.0888	-0.1531	-0.2441
			1.12	-0.0896	-0.1530	-0.2450
			1.13	-0.0904	-0.1526	-0.2446
			1.14	-0.0912	-0.1531	-0.2421
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			1.16	-0.0928	-0.1538	-0.2438
			1.17	-0.0936	-0.1546	-0.2446
			1.18	-0.0944	-0.1544	-0.2454
			1.19	-0.0952	-0.1543	-0.2453
			1.20	-0.0960	-0.1545	-0.2475
			1.21	-0.0968	-0.1544	-0.2484
			1.22	-0.0976	-0.1549	-0.2489
			1.23	-0.0984	-0.1557	-0.2487
			1.24	-0.0992	-0.1559	-0.2509
			1.25	-0.1000	-0.1561	-0.2511
			1.26	-0.1008	-0.1569	-0.2519
			1.27	-0.1016	-0.1568	-0.2498
			1.28	-0.1024	-0.1567	-0.2497
			1.29	-0.1032	-0.1565	-0.2505
			1.30	-0.1040	-0.1564	-0.2494
			1.31	-0.1048	-0.1566	-0.2516
			1.32	-0.1056	-0.1568	-0.2478
			1.33	-0.1064	-0.1567	-0.2487
			1.34	-0.1072	-0.1578	-0.2498
			1.35	-0.1080	-0.1571	-0.2481
			1.36	-0.1088	-0.1570	-0.2450
			1.37	-0.1096	-0.1568	-0.2458
			1.38	-0.1104	-0.1570	-0.2440
			1.39	-0.1112	-0.1569	-0.2429
			1.40	-0.1120	-0.1568	-0.2398
			1.41	-0.1128	-0.1576	-0.2416
			1.42	-0.1136	-0.1578	-0.2418
			1.43	-0.1144	-0.1580	-0.2430
			1.44	-0.1152	-0.1585	-0.2435
			1.45	-0.1160	-0.1584	-0.2444
			1.46	-0.1168	-0.1576	-0.2436
			1.47	-0.1176	-0.1581	-0.2451
			1.48	-0.1184	-0.1580	-0.2430
			1.49	-0.1192	-0.1582	-0.2452
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			1.51	-0.1208	-0.1589	-0.2419

			1.52	-0.1436	-0.1591	-0.2411
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			1.54	-0.1452	-0.1592	-0.2402
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			1.57	-0.1476	-0.1585	-0.2345
			1.58	-0.1484	-0.1578	-0.2288
			1.59	-0.1492	-0.1580	-0.2240
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			1.61	-0.1508	-0.1571	-0.2141
			1.62	-0.1516	-0.1564	-0.2094
			1.63	-0.1524	-0.1554	-0.2024
			1.64	-0.1532	-0.1550	-0.1950
			1.65	-0.1540	-0.1542	-0.1752
			1.66	-0.1548	-0.1541	-0.1641
			1.67	-0.1556	-0.1549	-0.1549
			1.68	-0.1564	-0.1554	
			1.69	-0.1572	-0.1553	
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			1.71	-0.1588	-0.1572	
			1.72	-0.1596	-0.1574	
			1.73	-0.1604	-0.1582	
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			1.78	-0.1644	-0.1619	
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			1.80	-0.1660	-0.1623	
			1.81	-0.1668	-0.1631	
			1.82	-0.1676	-0.1660	
			1.83	-0.1684	-0.1677	
			1.84	-0.1692	-0.1676	
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			1.86	-0.1708	-0.1695	
			1.87	-0.1716	-0.1676	
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			1.89	-0.1732	-0.1695	
			1.90	-0.1740	-0.1700	
			1.91	-0.1748	-0.1723	
			1.92	-0.1756	-0.1731	
			1.93	-0.1764	-0.1736	
			1.94	-0.1772	-0.1738	
			1.95	-0.1780	-0.1758	
			1.96	-0.1788	-0.1757	
			1.97	-0.1796	-0.1765	
			1.98	-0.1804	-0.1770	
			1.99	-0.1812	-0.1775	
			2.00	-0.1820	-0.1798	
			2.01	-0.1828	-0.1827	
			2.02	-0.1836	-0.1829	
			2.03	-0.1844	-0.1846	
9	9	3-Apr-97	0.00	0.0000	0.0000	
			0.01	-0.0009	-0.0027	

			0.02	-0.0018	-0.0033	
			0.03	-0.0027	-0.0036	
			0.04	-0.0036	-0.0036	
			0.05	-0.0045	-0.0039	
			0.06	-0.0054	-0.0057	
			0.07	-0.0063	-0.0063	
			0.08	-0.0072	-0.0069	
			0.09	-0.0081	-0.0084	
			0.10	-0.0090	-0.0090	
10	10	3-Jun-97	0.11	-0.0099	-0.0099	
			0.12	-0.0108	-0.0105	
			0.13	-0.0117	-0.0114	
			0.14	-0.0126	-0.0117	
			0.15	-0.0135	-0.0126	
			0.16	-0.0144	-0.0141	
			0.17	-0.0153	-0.0150	
			0.18	-0.0162	-0.0150	
			0.19	-0.0171	-0.0156	
			0.20	-0.0180	-0.0168	
			0.21	-0.0189	-0.0192	
			0.22	-0.0198	-0.0201	
			0.23	-0.0207	-0.0213	
			0.24	-0.0216	-0.0222	
			0.25	-0.0225	-0.0231	
			0.26	-0.0234	-0.0237	
			0.27	-0.0243	-0.0249	
			0.28	-0.0252	-0.0255	
			0.29	-0.0261	-0.0270	
			0.30	-0.0270	-0.0279	
			0.31	-0.0279	-0.0291	
			0.32	-0.0288	-0.0297	
			0.33	-0.0297	-0.0309	
			0.34	-0.0306	-0.0315	
			0.35	-0.0315	-0.0327	
			0.36	-0.0324	-0.0339	
			0.37	-0.0333	-0.0360	
			0.38	-0.0342	-0.0354	
			0.39	-0.0351	-0.0375	
			0.40	-0.0360	-0.0384	
			0.41	-0.0369	-0.0390	
			0.42	-0.0378	-0.0405	
			0.43	-0.0387	-0.0411	
			0.44	-0.0396	-0.0420	
			0.45	-0.0405	-0.0432	
			0.46	-0.0414	-0.0441	
			0.47	-0.0423	-0.0450	
			0.48	-0.0432	-0.0466	
			0.49	-0.0441	-0.0475	
			0.50	-0.0450	-0.0487	
			0.51	-0.0459	-0.0493	
			0.52	-0.0468	-0.0502	
			0.53	-0.0477	-0.0498	
			0.54	-0.0486	-0.0507	
			0.55	-0.0495	-0.0510	
			0.56	-0.0504	-0.0519	

			0.57	-0.0513	-0.0540	
			0.58	-0.0522	-0.0549	
			0.59	-0.0531	-0.0985	
			0.60	-0.0540	-0.1086	
			0.61	-0.0549	-0.1131	
			0.62	-0.0558	-0.1232	
			0.63	-0.0567	-0.1341	
			0.64	-0.0576	-0.1570	
			0.65	-0.0585	-0.1798	
			0.66	-0.0594	-0.2017	
			0.67	-0.0603	-0.2200	
			0.68	-0.0612	-0.2358	-0.2358
			0.69	-0.0621	-0.2419	-0.2479
			0.70	-0.0630	-0.2431	-0.2541
			0.71	-0.0639	-0.2465	-0.2605
			0.72	-0.0648	-0.2489	-0.2689
			0.73	-0.0657	-0.2510	-0.2740
			0.74	-0.0666	-0.2528	-0.2778
			0.75	-0.0675	-0.2534	-0.2794
			0.76	-0.0684	-0.2531	-0.2801
			0.77	-0.0693	-0.2510	-0.2780
			0.78	-0.0702	-0.2476	-0.2746
			0.79	-0.0711	-0.2436	-0.2736
			0.80	-0.0720	-0.2415	-0.2715
			0.81	-0.0729	-0.2372	-0.2682
			0.82	-0.0738	-0.2344	-0.2694
			0.83	-0.0747	-0.2304	-0.2694
			0.84	-0.0756	-0.2271	-0.2691
			0.85	-0.0765	-0.2237	-0.2787
			0.86	-0.0774	-0.2197	-0.2807
			0.87	-0.0783	-0.2167	-0.2857
			0.88	-0.0792	-0.2136	-0.2876
			0.89	-0.0801	-0.2084	-0.2894
			0.90	-0.0810	-0.2029	-0.2889
			0.91	-0.0819	-0.1980	-0.2850
			0.92	-0.0828	-0.1898	-0.2748
			0.93	-0.0837	-0.1864	-0.2694
			0.94	-0.0846	-0.1858	-0.2658
			0.95	-0.0855	-0.1852	-0.2602
			0.96	-0.0864	-0.1852	-0.2552
			0.97	-0.0873	-0.1845	-0.2525
			0.98	-0.0882	-0.1857	-0.2547
			0.99	-0.0891	-0.1857	-0.2557
			1.00	-0.0900	-0.1863	-0.2553
			1.01	-0.0909	-0.1869	-0.2559
			1.02	-0.0918	-0.1875	-0.2585
			1.03	-0.0927	-0.1878	-0.2588
			1.04	-0.0936	-0.1884	-0.2604
			1.05	-0.0945	-0.1890	-0.2610
			1.06	-0.0954	-0.1893	-0.2563
			1.07	-0.0963	-0.1899	-0.2559
			1.08	-0.0972	-0.1899	-0.2569
			1.09	-0.0981	-0.1904	-0.2514
			1.10	-0.0990	-0.1898	-0.2498
			1.11	-0.0999	-0.1898	-0.2528

			1.12	-0.1008	-0.1907	-0.2577
			1.13	-0.1017	-0.1910	-0.2580
			1.14	-0.1026	-0.1901	-0.2571
			1.15	-0.1035	-0.1898	-0.2528
			1.16	-0.1044	-0.1894	-0.2504
			1.17	-0.1053	-0.1897	-0.2517
			1.18	-0.1062	-0.1891	-0.2501
			1.19	-0.1071	-0.1891	-0.2491
			1.20	-0.1080	-0.1888	-0.2498
			1.21	-0.1089	-0.1897	-0.2517
			1.22	-0.1098	-0.1912	-0.2532
			1.23	-0.1107	-0.1912	-0.2532
			1.24	-0.1116	-0.1915	-0.2505
			1.25	-0.1125	-0.1930	-0.2530
			1.26	-0.1134	-0.1936	-0.2546
			1.27	-0.1143	-0.1942	-0.2542
			1.28	-0.1152	-0.1944	-0.2564
			1.29	-0.1161	-0.1944	-0.2554
			1.30	-0.1170	-0.1950	-0.2560
			1.31	-0.1179	-0.1953	-0.2563
			1.32	-0.1188	-0.1959	-0.2559
			1.33	-0.1197	-0.1959	-0.2559
			1.34	-0.1206	-0.1959	-0.2559
			1.35	-0.1215	-0.1965	-0.2555
			1.36	-0.1224	-0.1974	-0.2534
			1.37	-0.1233	-0.1971	-0.2541
			1.38	-0.1242	-0.1970	-0.2540
			1.39	-0.1251	-0.1964	-0.2534
			1.40	-0.1260	-0.1967	-0.2557
			1.41	-0.1269	-0.1952	-0.2552
			1.42	-0.1278	-0.1964	-0.2544
			1.43	-0.1287	-0.1964	-0.2564
			1.44	-0.1296	-0.1960	-0.2560
			1.45	-0.1305	-0.1966	-0.2566
			1.46	-0.1314	-0.1957	-0.2557
			1.47	-0.1323	-0.1957	-0.2557
			1.48	-0.1332	-0.1963	-0.2543
			1.49	-0.1341	-0.1960	-0.2540
			1.50	-0.1350	-0.1972	-0.2542
			1.51	-0.1359	-0.1975	-0.2545
			1.52	-0.1588	-0.1984	-0.2554
			1.53	-0.1597	-0.1990	-0.2560
			1.54	-0.1606	-0.1996	-0.2576
			1.55	-0.1615	-0.1998	-0.2548
			1.56	-0.1624	-0.1998	-0.2538
			1.57	-0.1633	-0.2010	-0.2560
			1.58	-0.1642	-0.2016	-0.2566
			1.59	-0.1651	-0.2013	-0.2533
			1.60	-0.1660	-0.2004	-0.2504
			1.61	-0.1669	-0.2019	-0.2469
			1.62	-0.1678	-0.2013	-0.2423
			1.63	-0.1687	-0.2010	-0.2340
			1.64	-0.1696	-0.2015	-0.2215
			1.65	-0.1705	-0.2006	-0.2096
			1.66	-0.1714	-0.2009	-0.2029

			1.67	-0.1723	-0.2012	-0.2012
			1.68	-0.1732	-0.2021	-0.2031
			1.69	-0.1741	-0.2012	-0.2022
			1.70	-0.1750	-0.2015	-0.2035
			1.71	-0.1759	-0.2018	-0.2048
			1.72	-0.1768	-0.2014	-0.2054
			1.73	-0.1777	-0.2017	-0.2067
			1.74	-0.1786	-0.2017	-0.2067
			1.75	-0.1795	-0.2017	-0.2067
			1.76	-0.1804	-0.2020	-0.2080
			1.77	-0.1813	-0.2017	-0.2077
			1.78	-0.1822	-0.2029	-0.2089
			1.79	-0.1831	-0.2029	-0.2099
			1.80	-0.1840	-0.2028	-0.2108
			1.81	-0.1849	-0.2028	-0.2108
			1.82	-0.1858	-0.2043	-0.2123
			1.83	-0.1867	-0.2040	-0.2130
			1.84	-0.1876	-0.2046	-0.2136
			1.85	-0.1885	-0.2043	-0.2133
			1.86	-0.1894	-0.2046	-0.2136
			1.87	-0.1903	-0.2052	-0.2162
			1.88	-0.1912	-0.2055	-0.2175
			1.89	-0.1921	-0.2055	-0.2265
			1.90	-0.1930	-0.2051	-0.2281
			1.91	-0.1939	-0.2051	-0.2291
			1.92	-0.1948	-0.2060	-0.2300
			1.93	-0.1957	-0.2060	-0.2310
			1.94	-0.1966	-0.2069	-0.2339
			1.95	-0.1975	-0.2075	-0.2385
			1.96	-0.1984	-0.2075	-0.2425
			1.97	-0.1993	-0.2078	-0.2428
			1.98	-0.2002	-0.2084	-0.2394
			1.99	-0.2011	-0.2093	-0.2423
			2.00	-0.2020	-0.2086	-0.2446
			2.01	-0.2029	-0.2095	-0.2515
			2.02	-0.2038	-0.2095	-0.2495
			2.03	-0.2047	-0.2049	-0.2049
10	10	3-Jun-97	0.00	0.0000	0.0000	
			0.01	-0.0010	-0.0007	
			0.02	-0.0020	-0.0011	
			0.03	-0.0030	-0.0003	
			0.04	-0.0040	-0.0025	
			0.05	-0.0050	-0.0026	
			0.06	-0.0060	-0.0030	
			0.07	-0.0070	-0.0046	
			0.08	-0.0080	-0.0065	
			0.09	-0.0090	-0.0069	
			0.10	-0.0100	-0.0085	
			0.11	-0.0110	-0.0086	
			0.12	-0.0120	-0.0105	
			0.13	-0.0130	-0.0106	
			0.14	-0.0140	-0.0116	
			0.15	-0.0150	-0.0129	
			0.16	-0.0160	-0.0136	

			0.17	-0.0170	-0.0152	
			0.18	-0.0180	-0.0159	
			0.19	-0.0190	-0.0166	
			0.20	-0.0200	-0.0176	
			0.21	-0.0210	-0.0189	
			0.22	-0.0220	-0.0205	
			0.23	-0.0230	-0.0203	
			0.24	-0.0240	-0.0222	
			0.25	-0.0250	-0.0229	
			0.26	-0.0260	-0.0239	
			0.27	-0.0270	-0.0246	
			0.28	-0.0280	-0.0265	
			0.29	-0.0290	-0.0278	
			0.30	-0.0300	-0.0288	
			0.31	-0.0310	-0.0286	
			0.32	-0.0320	-0.0302	
			0.33	-0.0330	-0.0309	
			0.34	-0.0340	-0.0325	
			0.35	-0.0350	-0.0338	
			0.36	-0.0360	-0.0354	
			0.37	-0.0370	-0.0355	
			0.38	-0.0380	-0.0371	
			0.39	-0.0390	-0.0372	
			0.40	-0.0400	-0.0391	
			0.41	-0.0410	-0.0401	
			0.42	-0.0420	-0.0417	
			0.43	-0.0430	-0.0418	
			0.44	-0.0440	-0.0431	
			0.45	-0.0450	-0.0447	
			0.46	-0.0460	-0.0451	
			0.47	-0.0470	-0.0473	
			0.48	-0.0480	-0.0483	
			0.49	-0.0490	-0.0490	
			0.50	-0.0500	-0.0500	
			0.51	-0.0510	-0.0504	
			0.52	-0.0520	-0.0517	
			0.53	-0.0530	-0.0530	
			0.54	-0.0540	-0.0546	
			0.55	-0.0550	-0.0547	
			0.56	-0.0560	-0.0557	
			0.57	-0.0570	-0.0573	
			0.58	-0.0580	-0.0568	
			0.59	-0.0590	-0.0581	
			0.60	-0.0600	-0.0588	
			0.61	-0.0610	-0.0598	
			0.62	-0.0620	-0.0620	
			0.63	-0.0630	-0.0624	
			0.64	-0.0640	-0.0637	
			0.65	-0.0650	-0.0635	
			0.66	-0.0660	-0.0645	
			0.67	-0.0670	-0.0661	
			0.68	-0.0680	-0.0671	
			0.69	-0.0690	-0.0678	
			0.70	-0.0700	-0.0685	
			0.71	-0.0710	-0.0686	

			0.72	-0.0720	-0.0726	
			0.73	-0.0730	-0.0718	
			0.74	-0.0740	-0.0722	
			0.75	-0.0750	-0.0735	
			0.76	-0.0760	-0.0748	
			0.77	-0.0770	-0.0901	
			0.78	-0.0780	-0.1134	
			0.79	-0.0790	-0.1515	
			0.80	-0.0800	-0.1912	
			0.81	-0.0810	-0.2090	
			0.82	-0.0820	-0.2225	-0.2225
			0.83	-0.0830	-0.2351	-0.2431
			0.84	-0.0840	-0.2440	-0.2560
			0.85	-0.0850	-0.2465	-0.2665
			0.86	-0.0860	-0.2509	-0.2779
			0.87	-0.0870	-0.2571	-0.2901
			0.88	-0.0880	-0.2642	-0.2992
			0.89	-0.0890	-0.2673	-0.3013
			0.90	-0.0900	-0.2680	-0.3030
			0.91	-0.0910	-0.2702	-0.3062
			0.92	-0.0920	-0.2706	-0.3116
			0.93	-0.0930	-0.2701	-0.3101
			0.94	-0.0940	-0.2693	-0.3093
			0.95	-0.0950	-0.2687	-0.3037
			0.96	-0.0960	-0.2694	-0.2954
			0.97	-0.0970	-0.2680	-0.2910
			0.98	-0.0980	-0.2678	-0.2878
			0.99	-0.0990	-0.2679	-0.2919
			1.00	-0.1000	-0.2685	-0.2935
			1.01	-0.1010	-0.2668	-0.2928
			1.02	-0.1020	-0.2635	-0.2895
			1.03	-0.1030	-0.2600	-0.2850
			1.04	-0.1040	-0.2561	-0.2801
			1.05	-0.1050	-0.2516	-0.2816
			1.06	-0.1060	-0.2477	-0.2837
			1.07	-0.1070	-0.2445	-0.2845
			1.08	-0.1080	-0.2381	-0.2841
			1.09	-0.1090	-0.2315	-0.2825
			1.10	-0.1100	-0.2252	-0.2802
			1.11	-0.1110	-0.2198	-0.2768
			1.12	-0.1120	-0.2156	-0.2746
			1.13	-0.1130	-0.2118	-0.2708
			1.14	-0.1140	-0.2109	-0.2699
			1.15	-0.1150	-0.2098	-0.2678
			1.16	-0.1160	-0.2102	-0.2682
			1.17	-0.1170	-0.2100	-0.2670
			1.18	-0.1180	-0.2110	-0.2620
			1.19	-0.1190	-0.2104	-0.2604
			1.20	-0.1200	-0.2108	-0.2608
			1.21	-0.1210	-0.2109	-0.2619
			1.22	-0.1220	-0.2104	-0.2634
			1.23	-0.1230	-0.2108	-0.2608
			1.24	-0.1240	-0.2118	-0.2618
			1.25	-0.1250	-0.2119	-0.2619
			1.26	-0.1260	-0.2123	-0.2613

			1.27	-0.1270	-0.2120	-0.2610
			1.28	-0.1280	-0.2121	-0.2611
			1.29	-0.1290	-0.2125	-0.2605
			1.30	-0.1300	-0.2132	-0.2592
			1.31	-0.1310	-0.2130	-0.2590
			1.32	-0.1320	-0.2134	-0.2584
			1.33	-0.1330	-0.2138	-0.2588
			1.34	-0.1340	-0.2135	-0.2555
			1.35	-0.1350	-0.2139	-0.2539
			1.36	-0.1360	-0.2140	-0.2550
			1.37	-0.1370	-0.2141	-0.2541
			1.38	-0.1380	-0.2145	-0.2565
			1.39	-0.1390	-0.2149	-0.2569
			1.40	-0.1400	-0.2153	-0.2593
			1.41	-0.1410	-0.2151	-0.2611
			1.42	-0.1420	-0.2155	-0.2615
			1.43	-0.1430	-0.2155	-0.2615
			1.44	-0.1440	-0.2156	-0.2596
			1.45	-0.1450	-0.2163	-0.2593
			1.46	-0.1460	-0.2167	-0.2617
			1.47	-0.1470	-0.2165	-0.2615
			1.48	-0.1480	-0.2163	-0.2623
			1.49	-0.1490	-0.2173	-0.2643
			1.50	-0.1500	-0.2174	-0.2644
			1.51	-0.1510	-0.2168	-0.2648
			1.52	-0.1740	-0.2166	-0.2626
			1.53	-0.1750	-0.2170	-0.2630
			1.54	-0.1760	-0.2177	-0.2627
			1.55	-0.1770	-0.2172	-0.2592
			1.56	-0.1780	-0.2179	-0.2589
			1.57	-0.1790	-0.2177	-0.2597
			1.58	-0.1800	-0.2177	-0.2597
			1.59	-0.1810	-0.2190	-0.2590
			1.60	-0.1820	-0.2194	-0.2584
			1.61	-0.1830	-0.2201	-0.2511
			1.62	-0.1840	-0.2211	-0.2421
			1.63	-0.1850	-0.2206	-0.2246
			1.64	-0.1860	-0.2210	-0.2210
			1.65	-0.1870	-0.2214	-0.2214
			1.66	-0.1880	-0.2218	-0.2218
			1.67	-0.1890	-0.2219	-0.2219
			1.68	-0.1900	-0.2216	-0.2216
			1.69	-0.1910	-0.2220	-0.2220
			1.70	-0.1920	-0.2215	-0.2225
			1.71	-0.1930	-0.2216	-0.2226
			1.72	-0.1940	-0.2229	-0.2259
			1.73	-0.1950	-0.2224	-0.2264
			1.74	-0.1960	-0.2222	-0.2242
			1.75	-0.1970	-0.2222	-0.2292
			1.76	-0.1980	-0.2232	-0.2272
			1.77	-0.1990	-0.2233	-0.2273
			1.78	-0.2000	-0.2234	-0.2284
			1.79	-0.2010	-0.2244	-0.2274
			1.80	-0.2020	-0.2248	-0.2288
			1.81	-0.2030	-0.2246	-0.2316

			1.82	-0.2040	-0.2253	-0.2333
			1.83	-0.2050	-0.2254	-0.2324
			1.84	-0.2060	-0.2255	-0.2335
			1.85	-0.2070	-0.2252	-0.2322
			1.86	-0.2080	-0.2259	-0.2359
			1.87	-0.2090	-0.2263	-0.2393
			1.88	-0.2100	-0.2270	-0.2440
			1.89	-0.2110	-0.2277	-0.2507
			1.90	-0.2120	-0.2281	-0.2531
			1.91	-0.2130	-0.2282	-0.2552
			1.92	-0.2140	-0.2295	-0.2585
			1.93	-0.2150	-0.2299	-0.2599
			1.94	-0.2160	-0.2294	-0.2584
			1.95	-0.2170	-0.2285	-0.2535
			1.96	-0.2180	-0.2295	-0.2565
			1.97	-0.2190	-0.2293	-0.2473
			1.98	-0.2200	-0.2285	-0.2415
			1.99	-0.2210	-0.2292	-0.2392
			2.00	-0.2220	-0.2293	-0.2413
			2.01	-0.2230	-0.2300	-0.2580
			2.02	-0.2240	-0.2313	-0.2613
			2.03	-0.2250	-0.2262	-0.2262