XI. GROUND-BASED OPTICAL REMOTE SENSING MEASUREMENTS

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A. INTRODUCTION

There were two primary objectives to be satisfied with the acquisition of ground-based remotely sensed data in visible, near-infrared (nir) and thermal wavebands:

a) Estimate components of the surface energy balance using ground-based remote-sensing measurements and compare those estimates with the measurements of surface energy fluxes measured at the Bowen ratio and eddy correlation stations;

b) Use ground-based remote sensing measurements as "ground-truth" to check the calibration and atmospheric correction of aircraft and satellite data in the visible, near-infrared and thermal bands.

B. DATA ACQUISITION

1. Yoke-based measurements

a. General procedure. In order to satisfy these objectives, we attempted to acquire data over as large and uniform an area as possible near the fetch area of each ground-based flux station. This was accomplished by mounting the instruments in a backpack-type apparatus (referred to as a "yoke") which could be efficiently carried over relatively large area of ground surface within a short period of time. We acquired data at each of three flux station sites (MS001, MS002 and MS003) on different days. The days of occupation at each site are summarized

below. The area traversed at each site was somewhat different, depending on the uniformity of the land surface near the fetch area of the flux station. The area covered in each traverse ranged from approximately 6,300 m^2 near MS003 to 13,500m^2 near MS002. Each traverse took approximately 15-20 minutes, depending on the size of the area, and consisted of covering the area in a "forward" and "reverse" direction along a repeatable route. Approximately 10 data points were acquired along each 30 meters of the traverse route. The traverses were done at a given site approximately every hour from the hours of about 9 a.m. to 5 p.m., weather permitting. During special events such as aircraft or satellite overpasses, an attempt was made to center the data acquisition time as close as possible to the overpass time.

b. Instruments and Observables. The instruments mounted on the yoke consisted of an Exotech 4-band radiometer with interchangeable filters. Except for one data acquisition near the time of a SPOT overpass, the filters corresponding to the first 4 bands of the Thematic Mapper and NS001 (0.45-0.52 µm (blue), 0.53-0.61 µm (green), and 0.62-0.69 µm (red) and 0.78-0.90 µm (nir)) were installed in the radiometer. A separate Everest thermal infrared radiometer (IRT) with a bandpass of approximately 8-13 µm was also mounted on the yoke. The radiance values recorded by each of these instruments were logged in a data logger and intermittently downloaded to floppy disks. Yoke measurements were made frequently over a standard reflectance panel in order to convert surface radiances measured in the visible and nir into reflectance values.

2) Ancillary measurements

a. Pyranometer. Because of the partly cloudy conditions and high temporal variability of the incoming solar radiation, a separate pyranometer recorded values of incoming solar radiation at 5 second intervals during the yoke traverses in order to enable the conversion of measured upwelling radiances into reflectance estimates.

b. Optical depths. Near the time of C-130 overpasses and satellite overpasses, measurements were made with a GSFC sun photometer, from which a rough estimate of optical depth can be derived.

C. OVERALL DATA QUALITY

The partly cloudy conditions which existed during most of the experiment

present a very challenging environment under which to acquire high quality visible and nir reflectance data. The quality of the upwelling visible/nir radiances recorded over a particular area is almost always very high, however, the conversion of those radiances to high-quality reflectance values is a difficult task under those conditions. Sky conditions were monitored closely during each traverse and visible/nir data acquired under the least variable sky conditions represent the greatest potential for deriving good surface reflectance values. Overall, the thermal IR data acquired with the yoke-based instruments is of high quality, though the highly temporally variable incoming solar radiation may make it more difficult to interpret. The best optical data was acquired near the end of the experiment on the afternoon of 6/17, all day on 6/18, and the morning of 6/19.

D. SAMPLE DATA

As an example of the type of data acquired with the yoke, the traverse-area average surface temperature from the yoke traverses on June 18 are shown in Figure 1. The traverses were done that day near the fetch area of the flux station at Site MS003. The temperatures shown are radiometric surface temperatures which have not been corrected for the effects of surface emissivity or reflected incoming longwave radiation.

E. DATA SUMMARY

Instruments: Exotech 4-band radiometer (3 visible bands and 1 nir band; corresponding to first 4 bands of TM and TMS-NS001)

Observables: Surface reflectance and temperature (area average and frequency distributions)

Where and when:

Date	Site	# Traverses	Weather/data quality
6/10	MS002	6	Partly cldy; no pyranom msmts=>reflectances poor
6/11	MS002	9	AM: overcast; PM: partly cldy; pyranometer on PM
6/12	MS002	4	AM: overcast; PM: many cum clds; end at 13:00
6/13	MS002	10	Partly cloudy; most reflectances and temps good

6/14	MS001	8	Partly cloudy; data quality fair
6/15	MS001	1	Overcast
6/16	MS001	8	Cum clds in AM, mostly cirrus in PM; data fair
6/17(AM)	MS001	5	Partly cldy then clearing; data qual. generally good
6/17(PM)	MS003	3	Clear skies; data quality very good
6/18	MS003	8	AM: Clear; PM: mostly clear; Data qual very good
6/19	MS003	4	AM: Mostly clear; data qual. v. good; stop at 13:00 because flux station is going down.

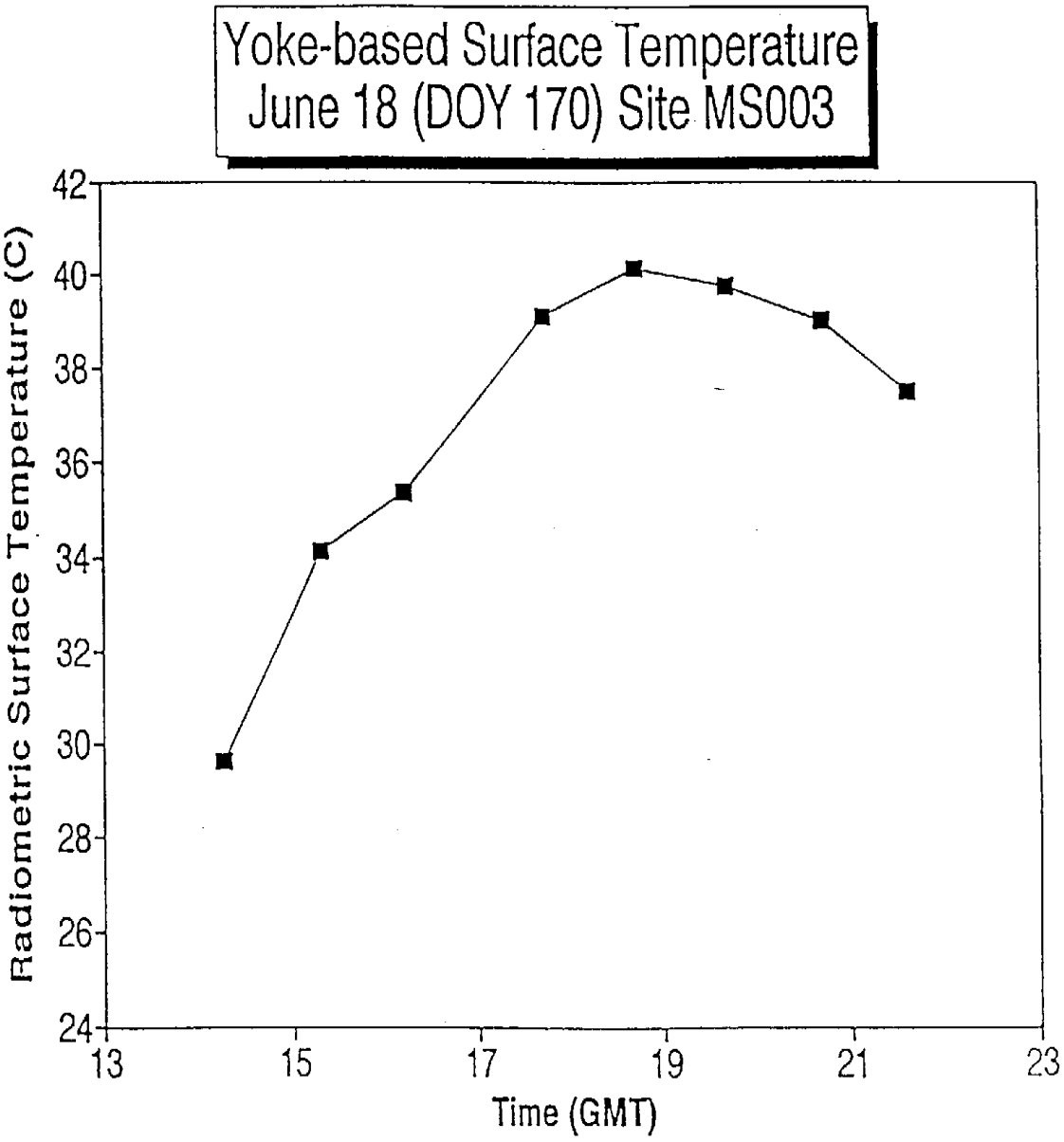

Figure XI-1. Radiometric surface temperature averaged over the yoke traverse area near MS003 on June 18,1992 (DOY 170).