

Improving Water Management During the California Drought: Snow Model and Airborne LiDAR

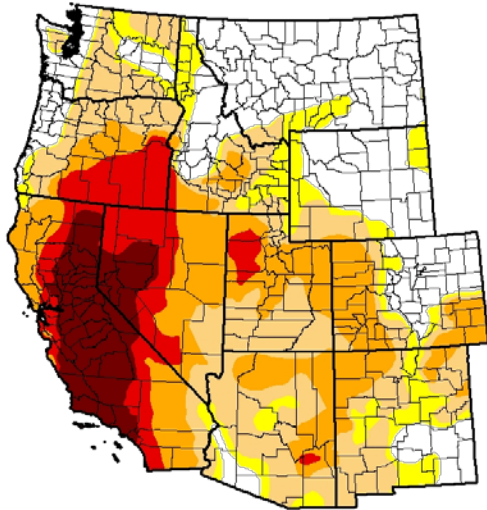
ARS and NASA JPL Partnership

Transitioning Research Tools for Operational Applications



The Western US Drought

U.S. Drought Monitor
West



- ◆ Widespread, multi-year drought
- ◆ Intensified by warming temperatures, increasing demand
- ◆ Economic Impacts:
 - ◆ Estimated loss of \$2.2 billion to agriculture (2015)
 - ◆ Energy production
 - ◆ Natural habitat
 - ◆ Land subsidence
 - ◆ Increased wildfire activity
 - ◆ Thousands of jobs lost



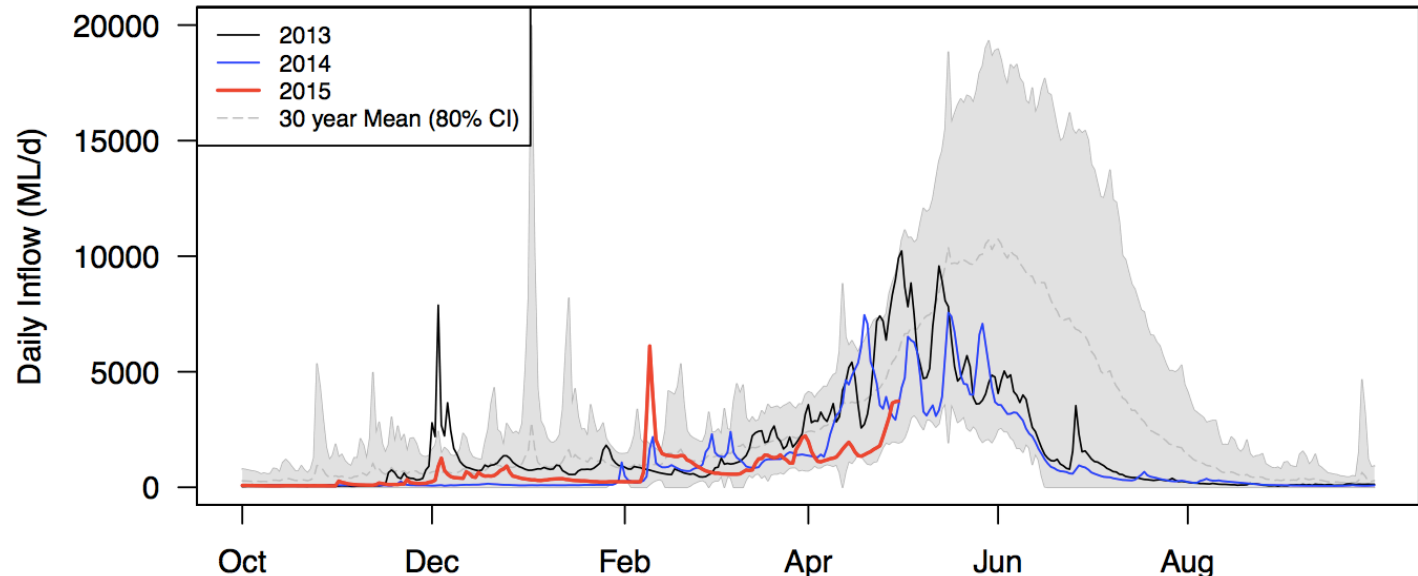
February 3, 2014



October 5, 2014

The California Drought

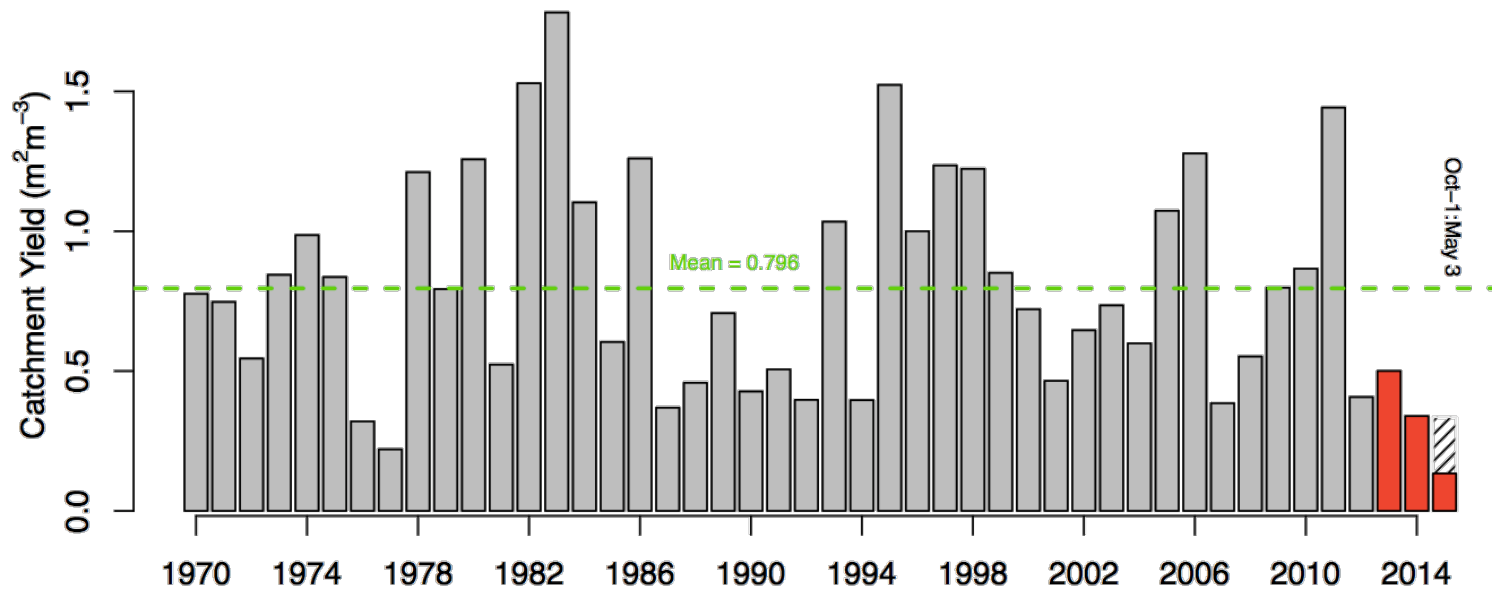
- Very low reservoir inflows from the snow-dominated high Sierra
- Earlier peak discharge impacts late summer water supply for agriculture
- Operational forecasting models are unreliable during droughts



Hetch Hetchy reservoir – San Francisco water supply

How does 2015 Compare?

- 45 years of inflow to Hetch Hetchy reservoir
- Longest drought on record, 2015 historical low



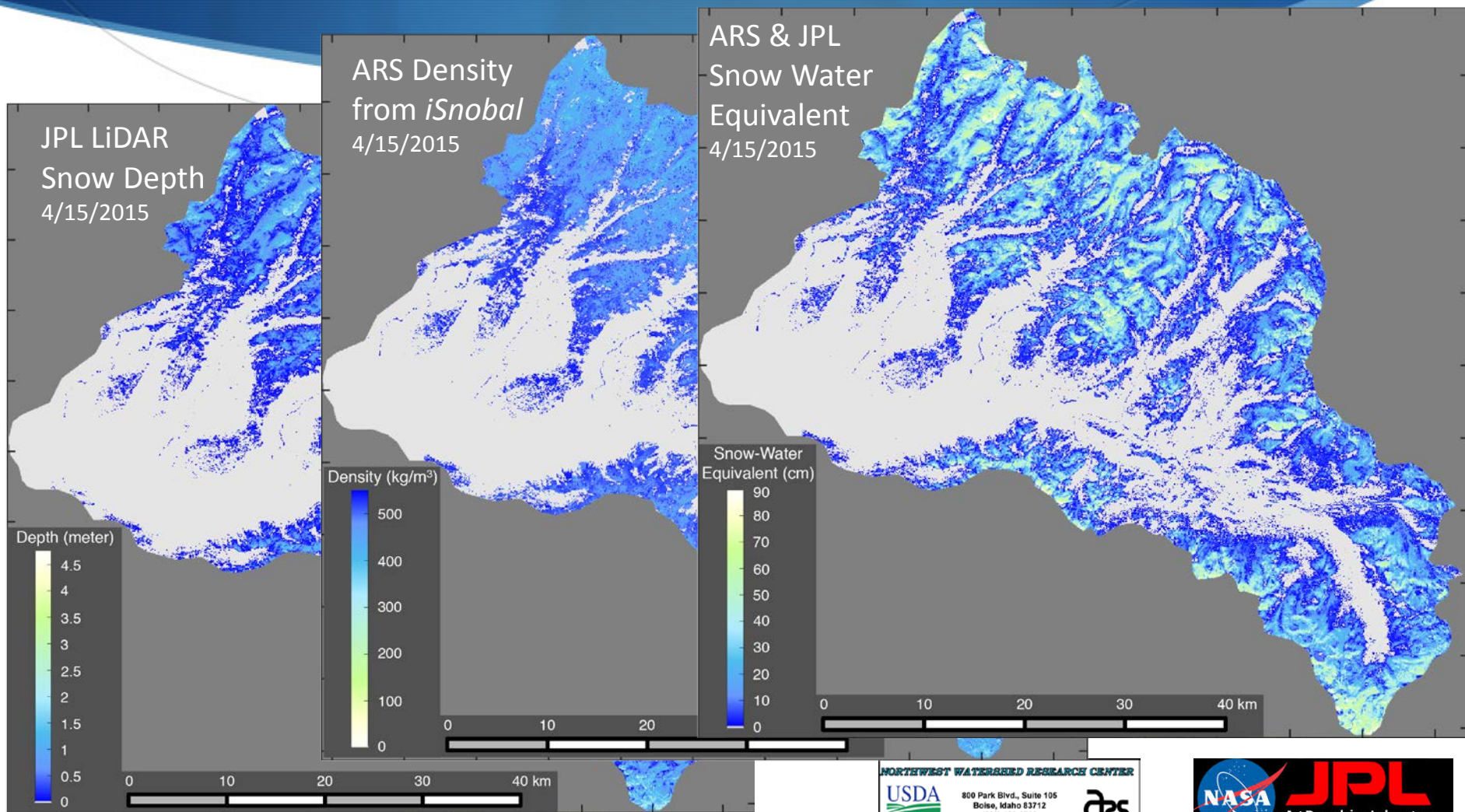
The Airborne Snow Observatory



- ◆ Basin-scale airborne monitoring in the high Sierra
- ◆ Weekly acquisitions during spring (2013, 2014, 2015)
- ◆ LiDAR and Spectrometer
- ◆ Produces high resolution snow depth and albedo maps (3m)
- ◆ Product shared with Hetch Hetchy water managers and other stakeholders for operations

iSnobal: the ARS snow model

Providing densities to determine SWE



Reynolds Creek Experimental Watershed & CZO

A Mountain Hydro-Climate Laboratory for the 21st Century

RCEW (239 km²)

- 32 climate stations
- 36 precipitation stations
- 7 EC systems
- 14 weirs (nested)
- 10 soil microclimate stations
- 4 hill-slope hydrology sites
- 5 instrumented catchments
- 3 instrumented headwater basins

