Exploring key geophysical processes influencing water supply and extreme precipitation in a changing climate on the U.S. West Coast

CalWater Science Workshop; Scripps Institution of Oceanography (SIO), La Jolla, California, 8-10 June 2011

CalWater is a multi-year, multi-agency research project with two primary research themes: the impact of changing climate on atmospheric rivers (AR) and associated extreme events, and the potential role of aerosols in modulating cloud properties and precipitation, especially regarding orographic precipitation and water supply. Advances made in CalWater have implications for both water supply and flood control in California and other west coast areas, both in the near term and in a changing climate. CalWater is a continuation of prior studies on the role of aerosols on climate sponsored by the California Energy Commission (CEC) and heavily leverages observations and research on extreme precipitation in NOAA's Hydrometeorology Testbed (HMT; hmt.noaa.gov).

The June 2011 workshop focused on results from field observations, numerical modeling and diagnostic analyses, and future research plans. The workshop brought together scientists from several disciplines, state and federal agencies and universities to discuss results from CalWater "Early Start" research that began in 2009, and share initial impressions from new data. Workshop participants were from CEC, SIO, UC San Diego (UCSD), USGS, NOAA, NASA, DOE, several other universities and other state agencies.

During winter 2010/11 a set of unique observations during a very active winter storm season was collected and analyses are emerging. The research requires close collaborations between dynamical meteorologists, cloud aerosol and air chemistry experts, atmospheric modelers, and hydrologists. Cloud microphysics and aerosols were collected by DOE/PNNL's G-1 aircraft using a suite of state of the art cloud probes and aerosol measurements from several institutions. Ground-based meteorological sensors, both in-situ and remote sensors, primarily from NOAA's HMT collected unique hydrometeorological data. Aerosol and meteorological measurements were co-located at several sites.

Workshop highlights:

- Data collected in the three field seasons captured 10 AR events, 13 Sierra Barrier Jet (SBJ) cases, and >20 cloud/aerosol flights of the G-1 aircraft.
- Observations of aerosols from local, regional and distant sources being integrated into clouds and precipitation in the Sierra Nevada. Several of the samples, both from surface observations and aircraft data aloft, contained Asian dust. Evidence of the role of dust as ice nuclei during 2011 are consistent with back trajectories and with observational findings now in press at JGR using CalWater Early Start data from 2009.
- Clear evidence of changes in cloud microphysics associated with the presence of aerosols.
- Model diagnostic results that show changes in AR characteristics in climate simulations.
- Documentation of the role of the SBJ in modulating precipitation associated with ARs.
- Recommendations on what spatial resolutions are needed for climate downscaling to capture ARs and SBJs, and their impacts on precipitation.

- Recognition of the need for continued monitoring of aerosols and key meteorological conditions associated with long-range-transported species such as Asian dust and their incorporation into regional precipitation.

A special session on CalWater will be held at the fall 2012 AGU meeting. CalWater is sponsored primarily by CEC, NOAA, and SIO. For more background information on CalWater, please see http://www.esrl.noaa.gov/psd/calwater/.

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