GPS Estimates of Integrated Precipitable Water Aid Weather Forecasters

This technique improves weather-forecasting operations.

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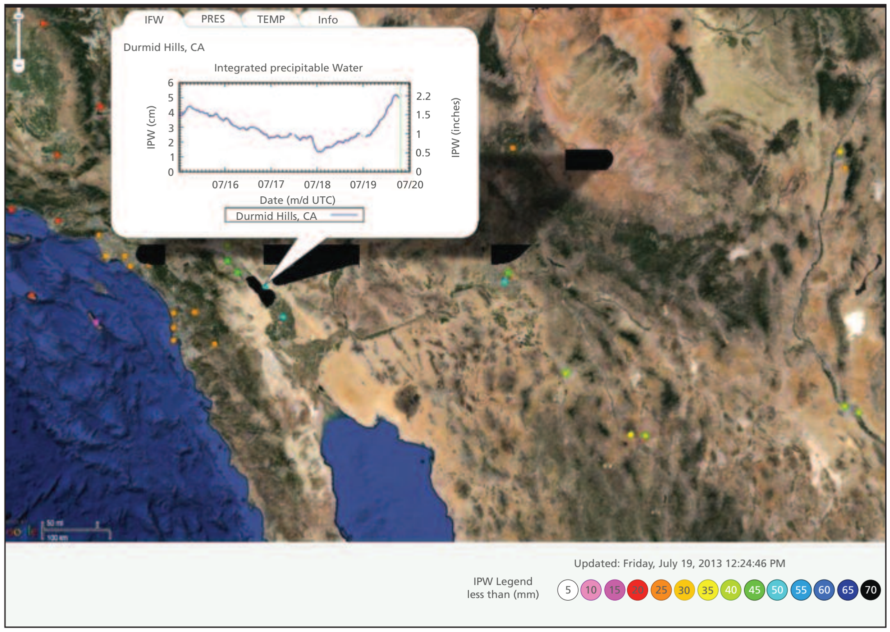
Global Positioning System (GPS) meteorology provides enhanced density, low-latency (30-min resolution), integrated precipitable water (IPW) estimates to NOAA NWS (National Oceanic and Atmospheric Administration National Weather Service) Weather Forecast Offices (WFOs) to provide improved model and satellite data verification capability and more accurate forecasts of extreme weather such as flooding. An early activity of this project was to increase the number of stations contributing to the NOAA Earth System Research Laboratory (ESRL) GPS meteorology observing network in Southern California by about 27 stations. Following this, the Los Angeles/Oxnard and San Diego WFOs began using the enhanced GPS-based IPW measurements provided by ESRL in the 2012 and 2013 monsoon seasons. Forecasters found GPS IPW to be an effective tool in evaluating model performance, and in monitoring monsoon development between weather model runs for improved flood forecasting.



A screenshot from http://gpsmet.noaa.gov of ground GPS-based **Integrated Water Vapor Information** utilized by NOAA NWS San Diego Weather Forecasting Office during the 2013 monsoon season. The upward IWV trend supported satellite data and contributed to the issuance of a flood watch.

GPS stations are multi-purpose, and routine processing for position solutions also yields estimates of tropospheric zenith delays, which can be converted into mm-accuracy PWV (precipitable water vapor) using in situ pressure and temperature measurements, the basis for GPS meteorology. NOAA ESRL has implemented this concept with a nationwide distribution of more than 300 "GPS-Met" stations providing IPW estimates at sub-hourly resolution currently used in operational weather models in the U.S.

This work was done by Angelyn W. Moore of Caltech; Seth I. Gutman and Kirk Holub of NOAA Earth System Research Laboratory; Yehuda Bock of UC San Diego's Scripps Institution of Oceanography; and David Danielson, Jayme Laber, and Ivory Small of NOAA National Weather Service. Further information is contained in a TSP (see page 1). NPO-48881

Integrating a Microwave Radiometer into Radar Hardware for Simultaneous Data Collection Between the Instruments

Electronics are shared between the instruments.

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The conventional method for integrating a radiometer into radar hardware is to share the RF front end between the instruments, and to have separate IF receivers that take data at separate times. Alternatively, the radar and radiometer could share the antenna through the use of a diplexer, but have completely independent receivers. This novel method shares the radar's RF electronics and digital receiver with the radiometer, while allowing for simultaneous operation of the radar and radiometer.

Radars and radiometers, while often having near-identical RF receivers, generally have substantially different IF and baseband receivers. Operation of the two instruments simultaneously is difficult, since airborne radars will pulse at a rate of hundreds of microseconds. Radiometer integration time is typically 10s or 100s of milliseconds. The bandwidth of radar may be 1 to 25 MHz, while a radiometer will have an RF bandwidth of up to a GHz. As such, the conventional method of integrating radar and radiometer hardware is to share the high-frequency RF receiver, but to have separate IF subsystems and digitizers. To avoid corruption of the radiometer data, the radar is turned off during the radiometer dwell time.

This method utilizes a modern radar digital receiver to allow simultaneous operation of a radiometer and radar