Snow—stored during the winter across America’s West until the dry spring and summer months—provides trillions of gallons of water in the form of snowmelt to rivers like the Sacramento and San Joaquin, the Columbia, the Colorado, and the Rio Grande. Usually a more reliable source of water than rain, the snow that accumulates each winter also influences climate and weather, and the glaciers formed in the high mountains are sensitive indicators of climate change. Accurate measurements of snow area, snow albedo (which affects the amount of solar radiation the snow absorbs), and snow-water equivalence, which represents potential water runoff, are essential to predicting and planning for changes in the West’s—and the world’s—water supply.

Until now, precise snow measurements have been impossible. Snow hydrologists have relied on Earth satellite imagery, which uses optical sensors to produce maps at the vast scale of continents with drainage basins. As a result, remotely sensed snow is overestimated because the massive swaths imaged include rock, soil, and vegetation.

Under a five-year, $3.9 million cooperative agreement with NASA, however, pioneering snow hydrologist Jeffrey Dozier and environmental information-management scientist James Frew are using a technique invented at UCSB that uses “spectral un-mixing” algorithms to provide improved regional and global estimates of snow cover and its water content. Normally, when scientists view a 500 m chunk of imaging data, they see the spectral colors reflected from trees, rocks, soil, and snow mixed together as an apparently homogenous blur. But knowing the typical spectral signatures of these components, Dozier and Frew can “unmix” the snowy blur and statistically exclude whatever is not snow from their measurements.

Measurements of snow properties from these new techniques will be provided on the Internet in near-real time to water-resource managers, climate modelers, and the entire research community. “A new paradigm is emerging for managing Earth science data,” explains Dozier, who has done groundbreaking work in snow hydrology for 30 years at UCSB. “The amount of data produced is so vast that information must be disseminated directly to the world. One of the technologies we’re building will handle snow modeling so rapidly that we can generate data on a daily basis.”

“We’re building a system that allows us to publish not only our conclusions but our data—which others might use, for example, to create a reservoir model to better predict water and water use,” says Frew. “People can take our data and run it through our system. It can convert snow-area measurements and convert them to runoff predictions or turn aggregated snow measurements into forecasts of global snow-cover recession. We’re building the fundamental piece of the current information-management puzzle— assembling new distributed systems so that they work together for everyone.”

*Multi-Resolution Snow Products for the Hydrologic Sciences* is administered by the Institute for Computational Earth System Science.

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For more information: http://www.icess.ucsb.edu/hydro/hydro.html