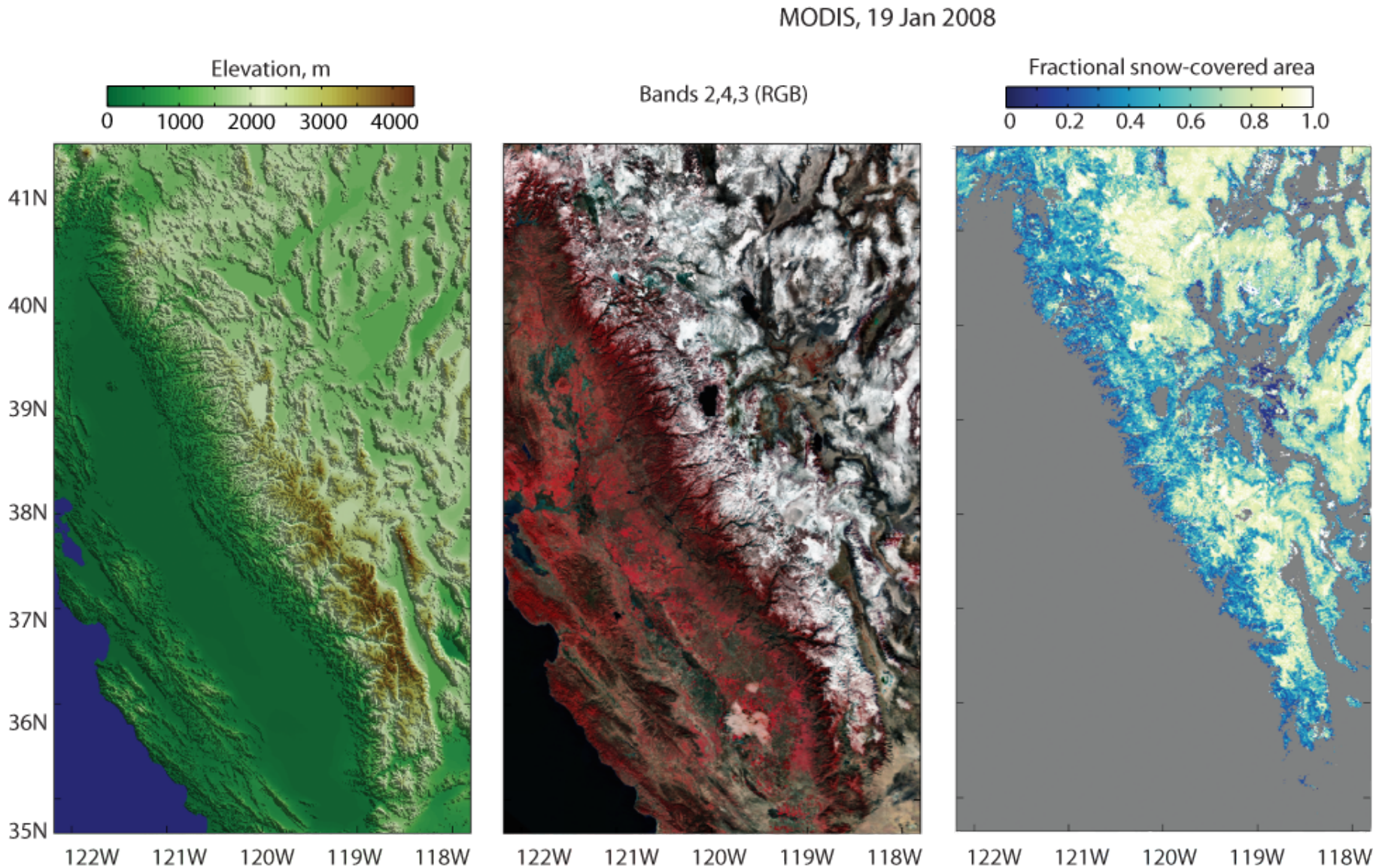
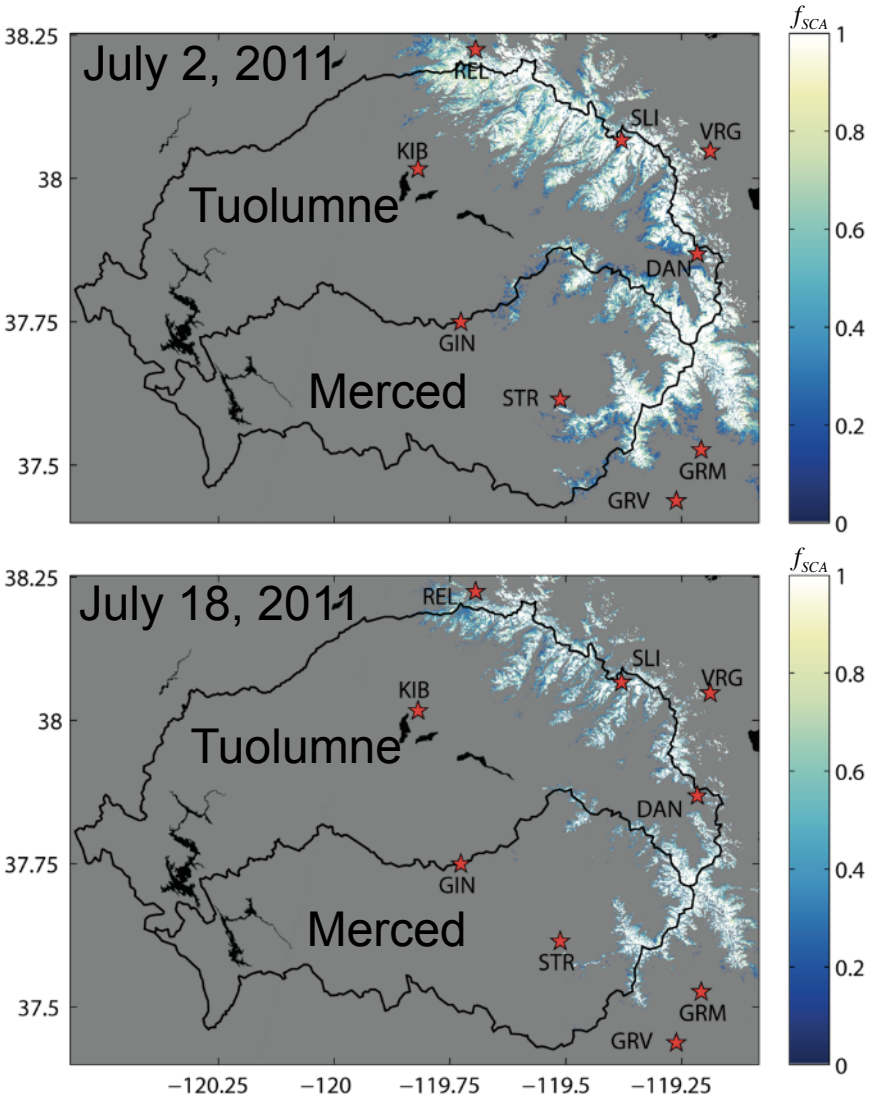
Spatially distributed snow water equivalent

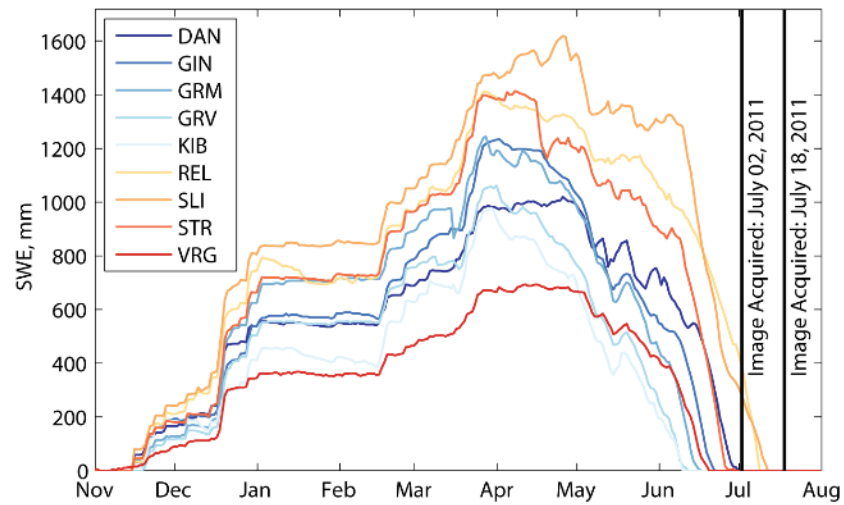
Jeff Dozier &
Karl Rittger

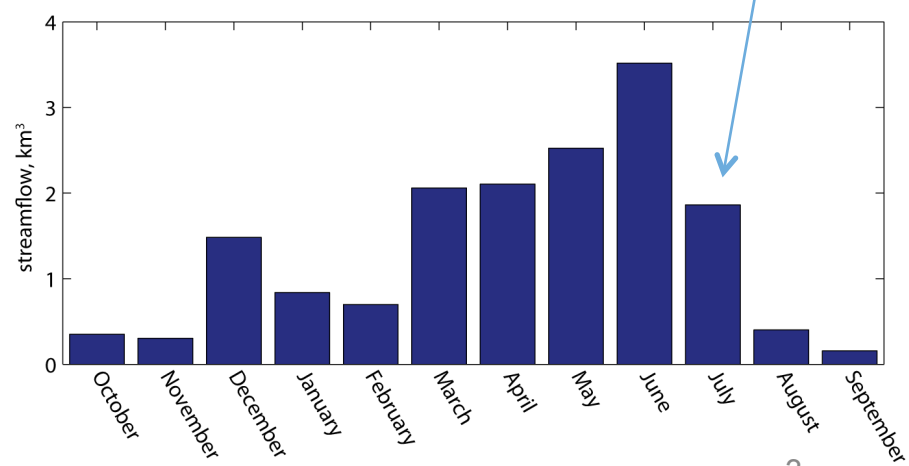
Fractional snow-covered area, Sierra Nevada (MODIS images available daily)



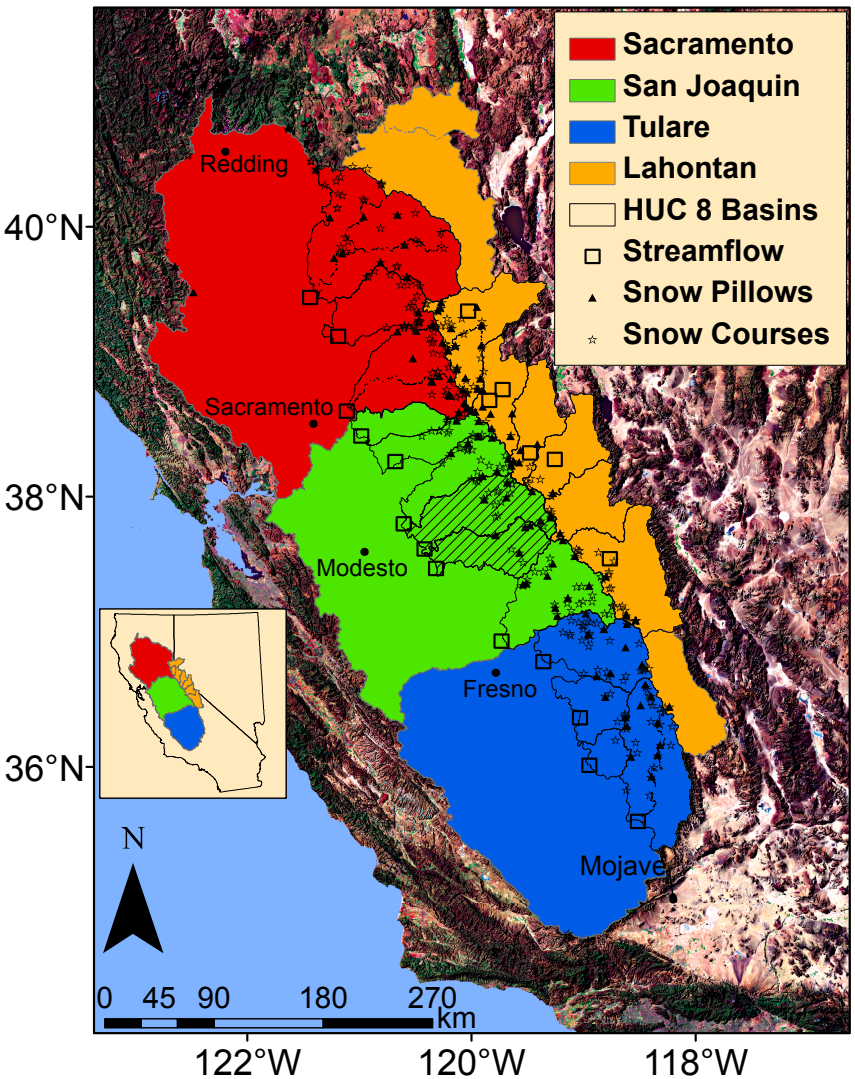
Snow sensors don't cover the highest elevations

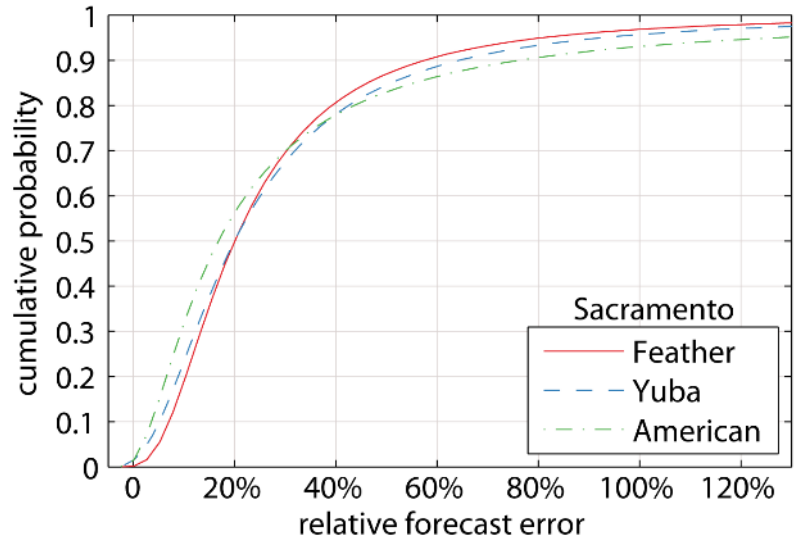


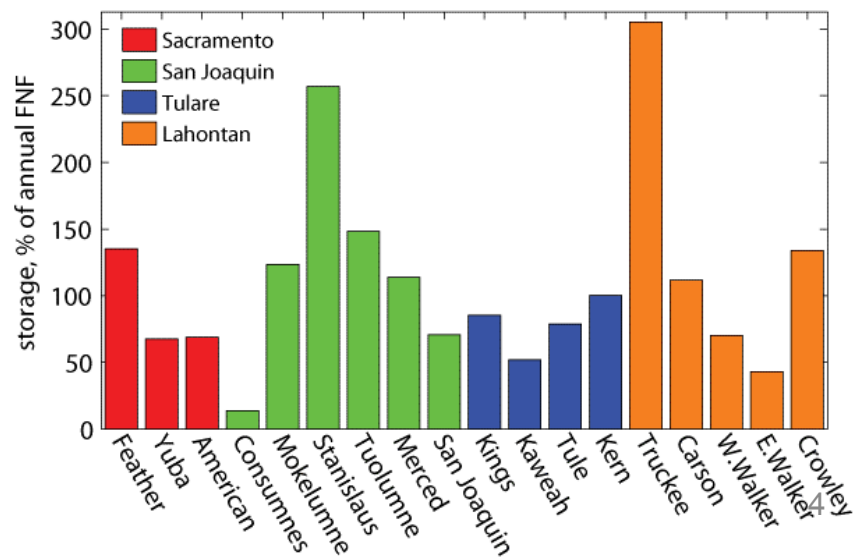




Forecasting errors and reservoir storage







Reconstruction model: combined energy balance & degree day

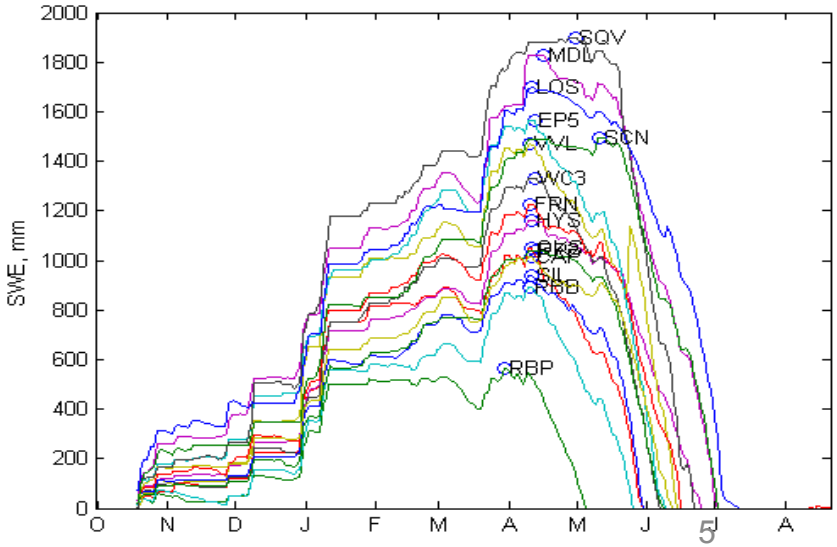
$$M_{p_j} = m_Q R_d + \alpha_r T_D$$

$$M_j = M_{p_j} * f_{SCA_j}$$

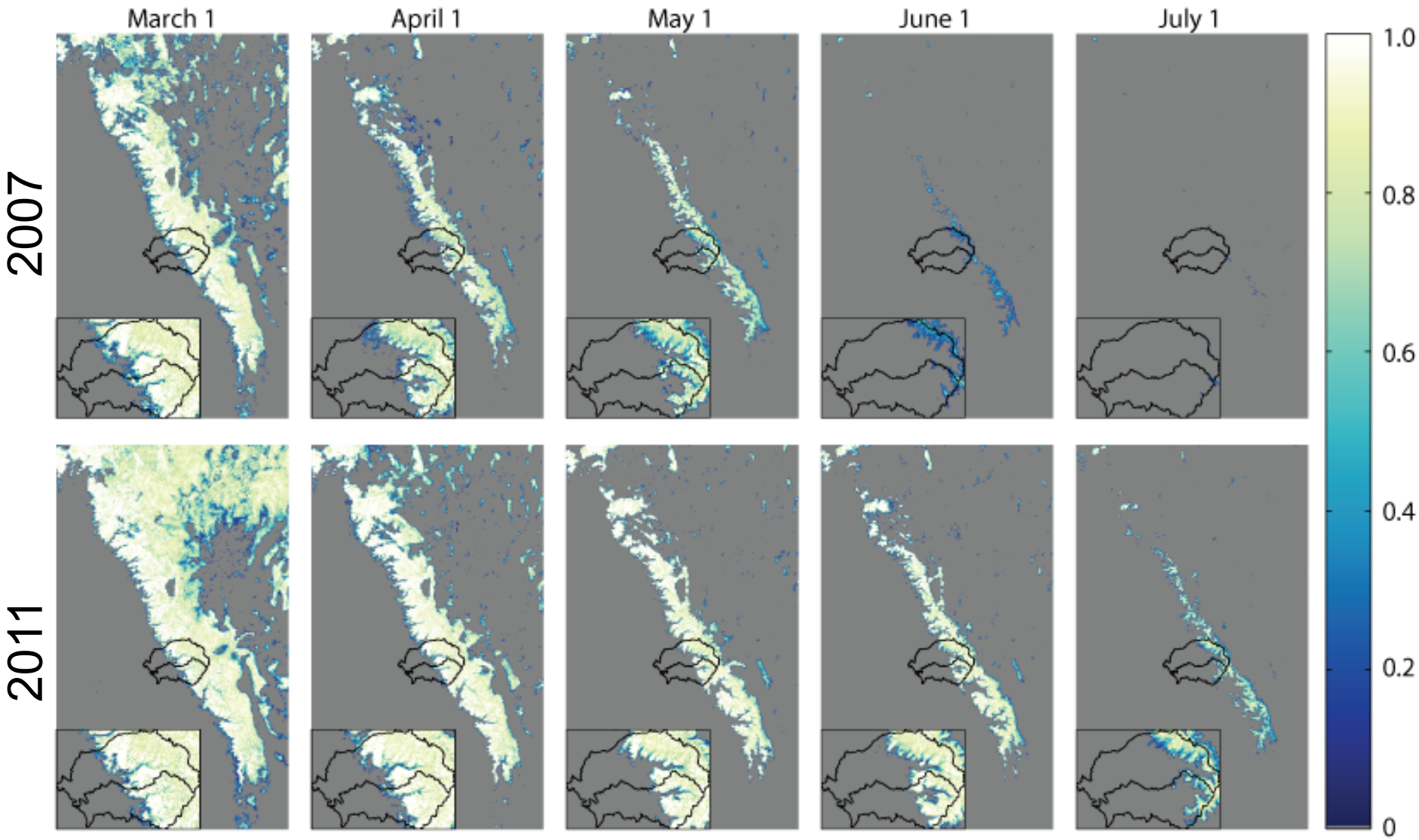
$$SWE_n = SWE_0 - \sum_{j=1}^{n} M_j$$

$$when\ SWE_n = 0, SWE_0 = \sum_{j=1}^{n} M_j$$

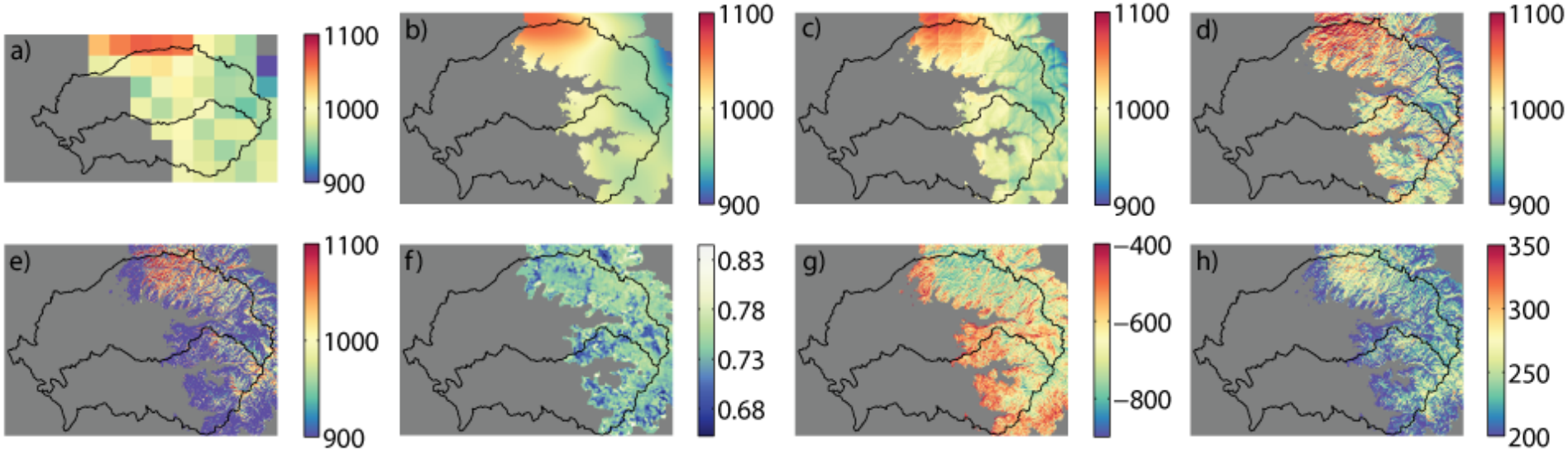
American River basin Snow Pillows. 20



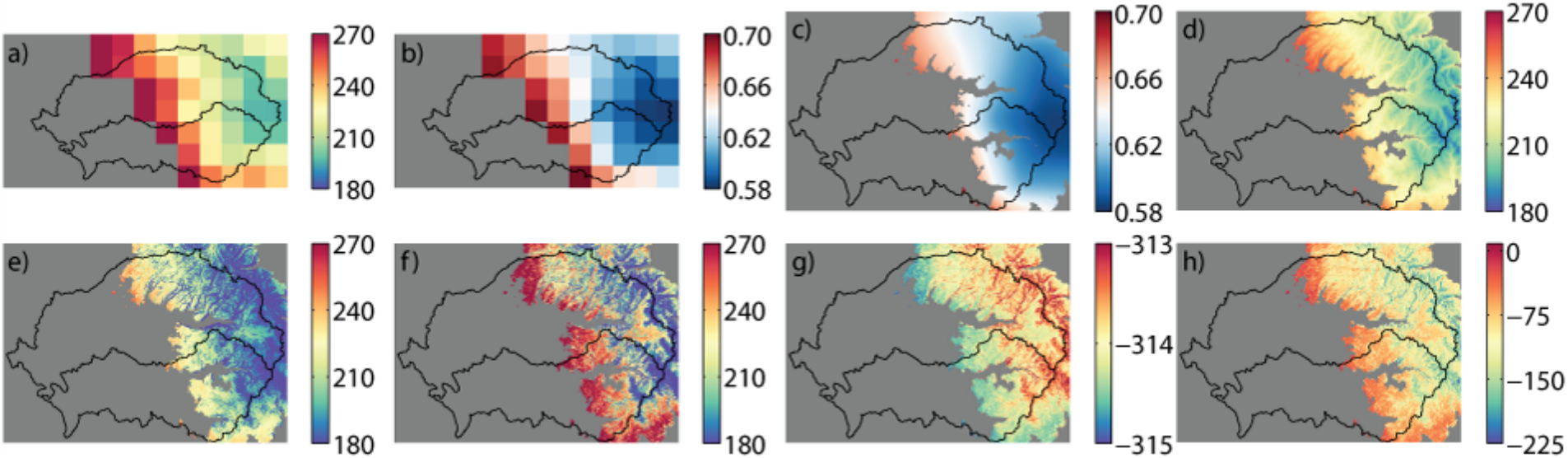
Snow-covered area, dry & wet year



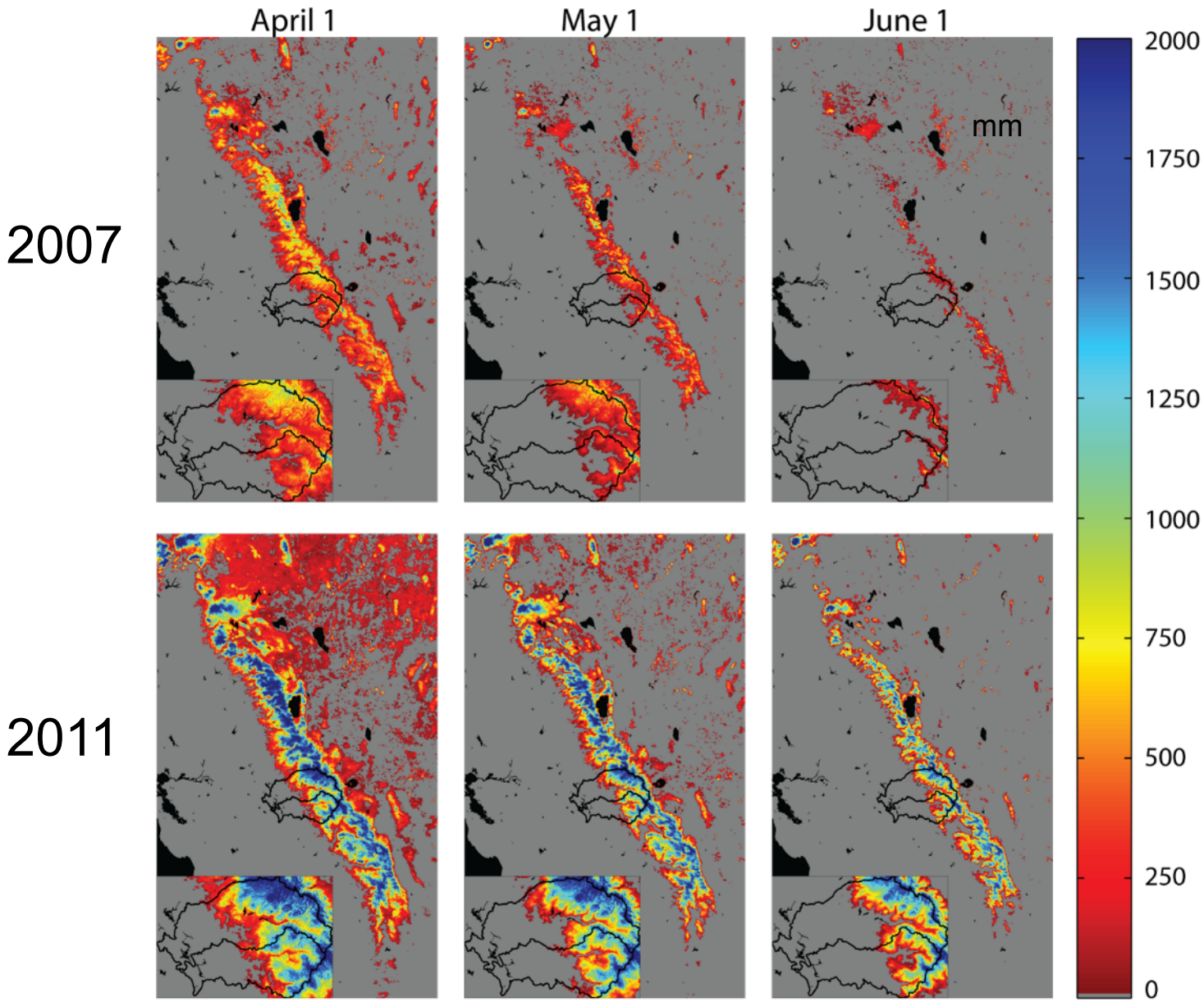
Shortwave



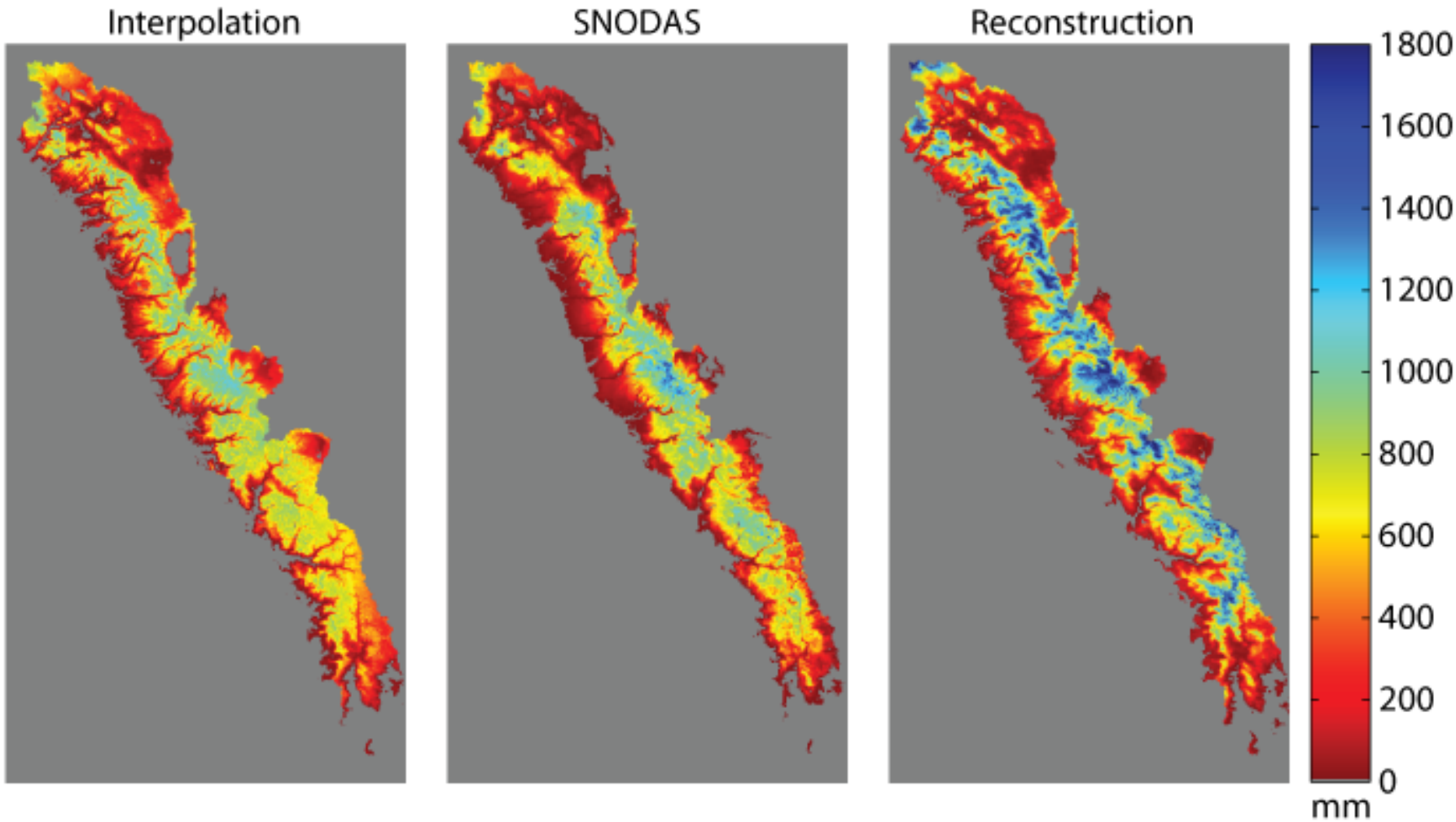
Longwave



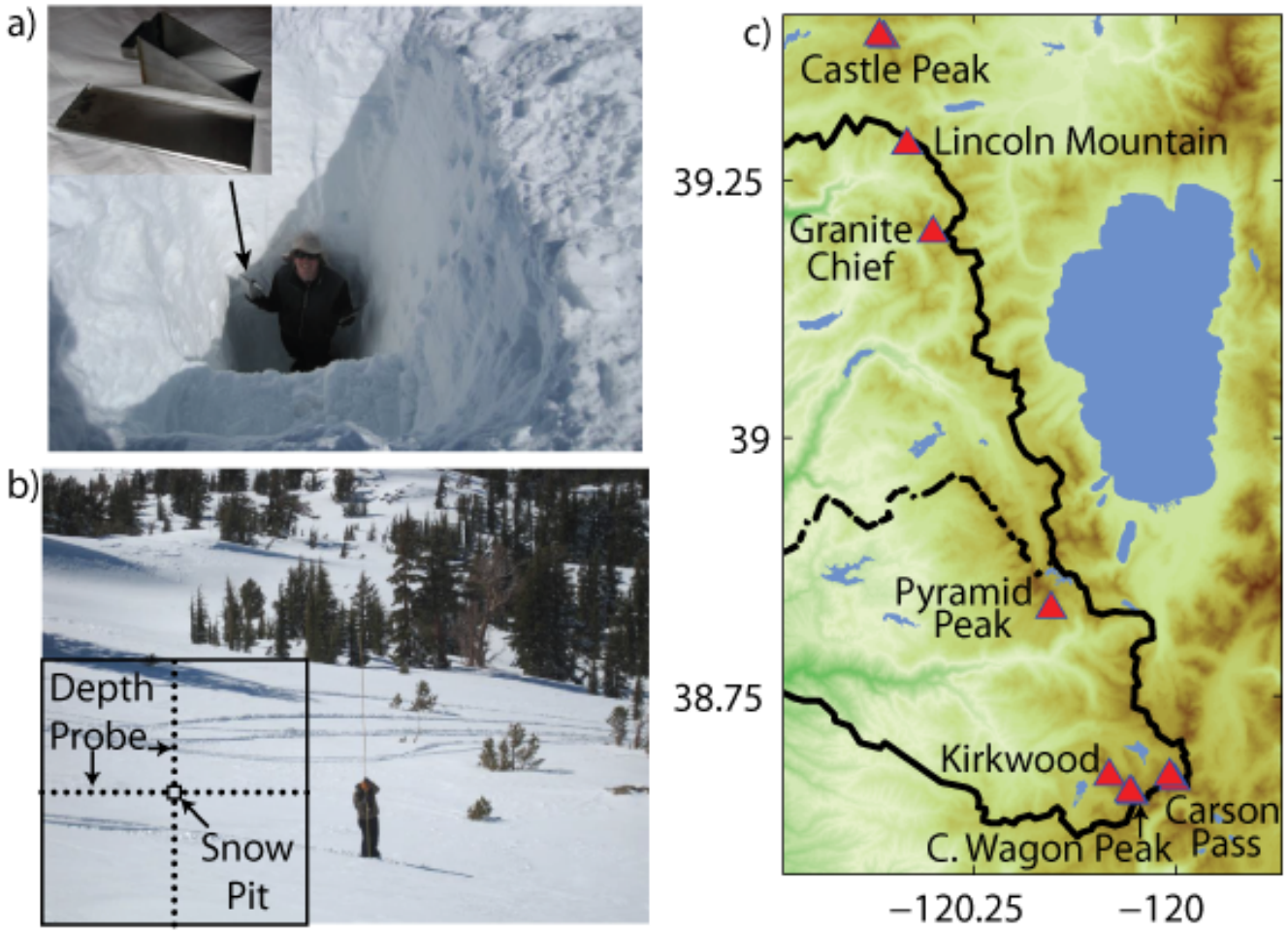
Reconstructed SWE: dry and wet years



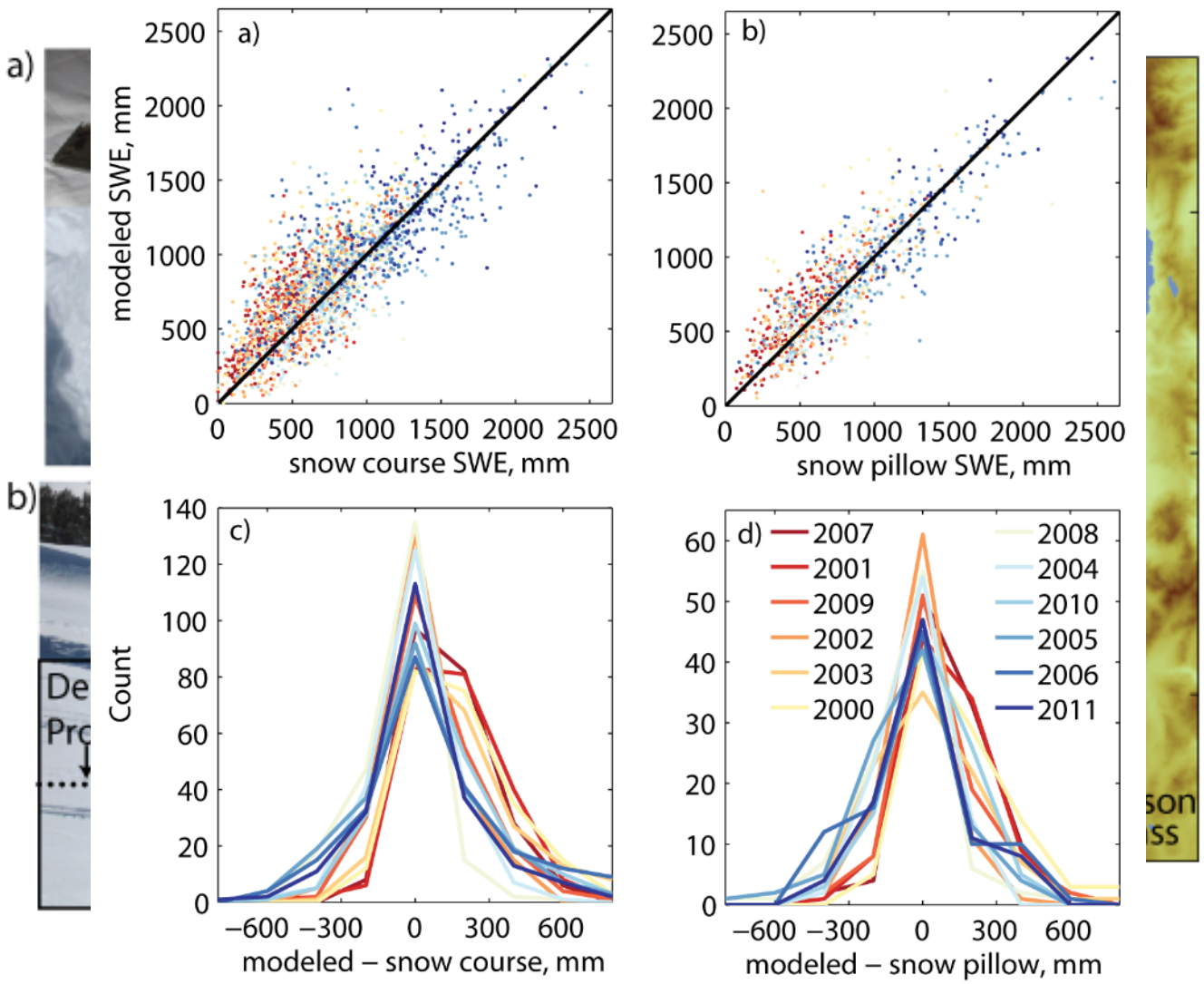
Comparison to real time models: median SWE, 2004-2011



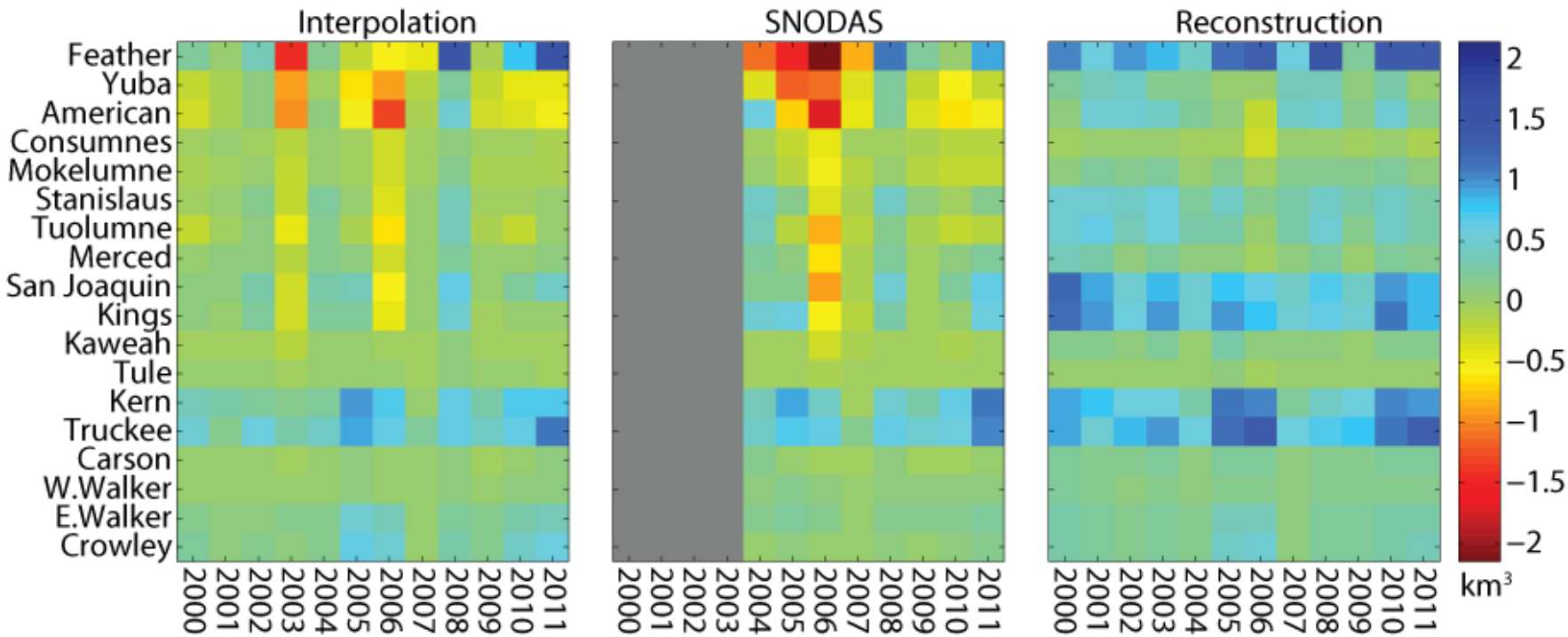
Validation of snow water equivalent



Validation of snow water equivalent

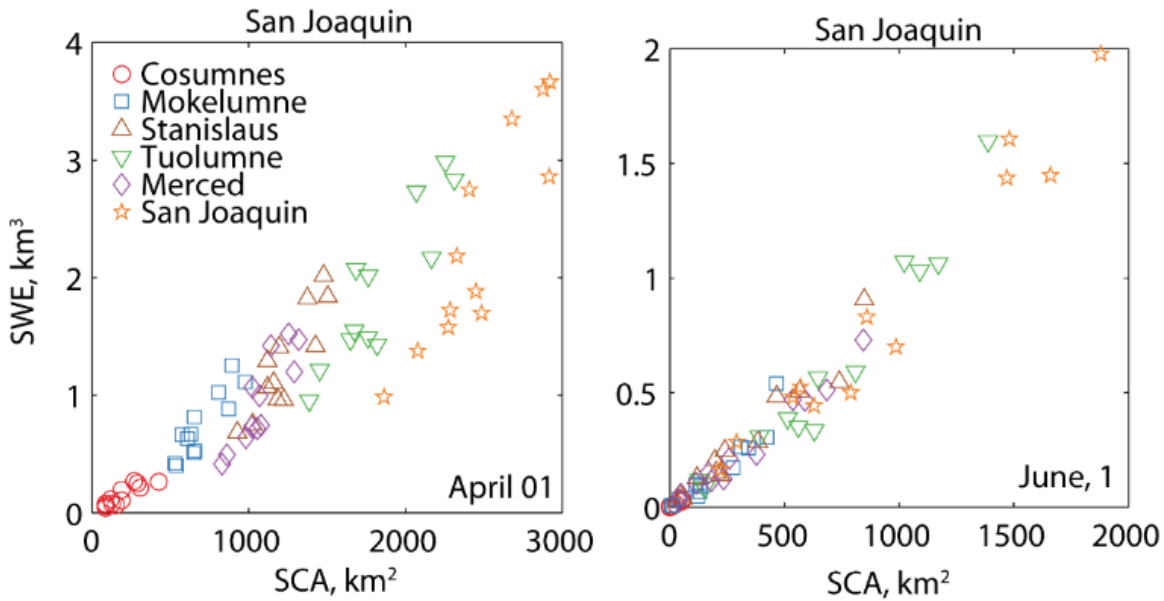


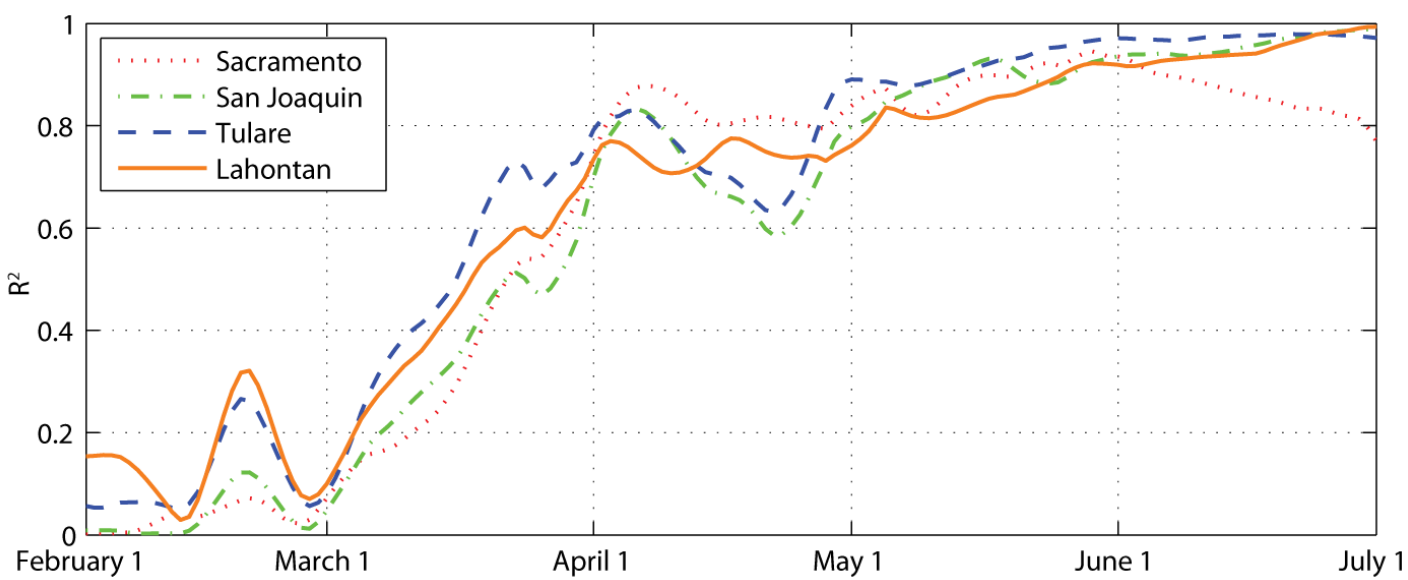
Water balance? Q$=P-E\pm\Delta S$
Over a season $\Delta S\approx 0$, so P$-Q>0$?



Only for Reconstruction

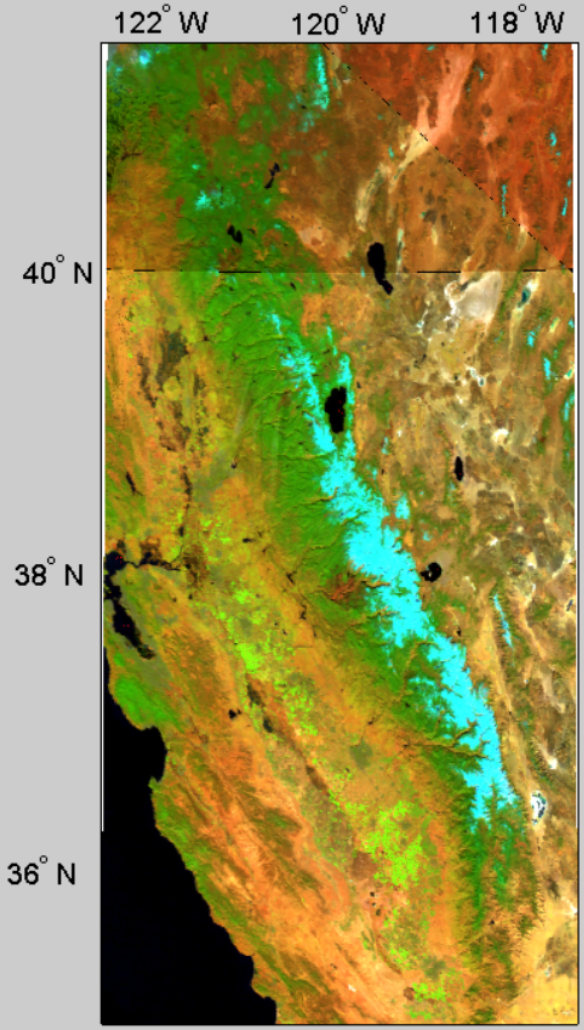
Relationship between snow cover and SWE

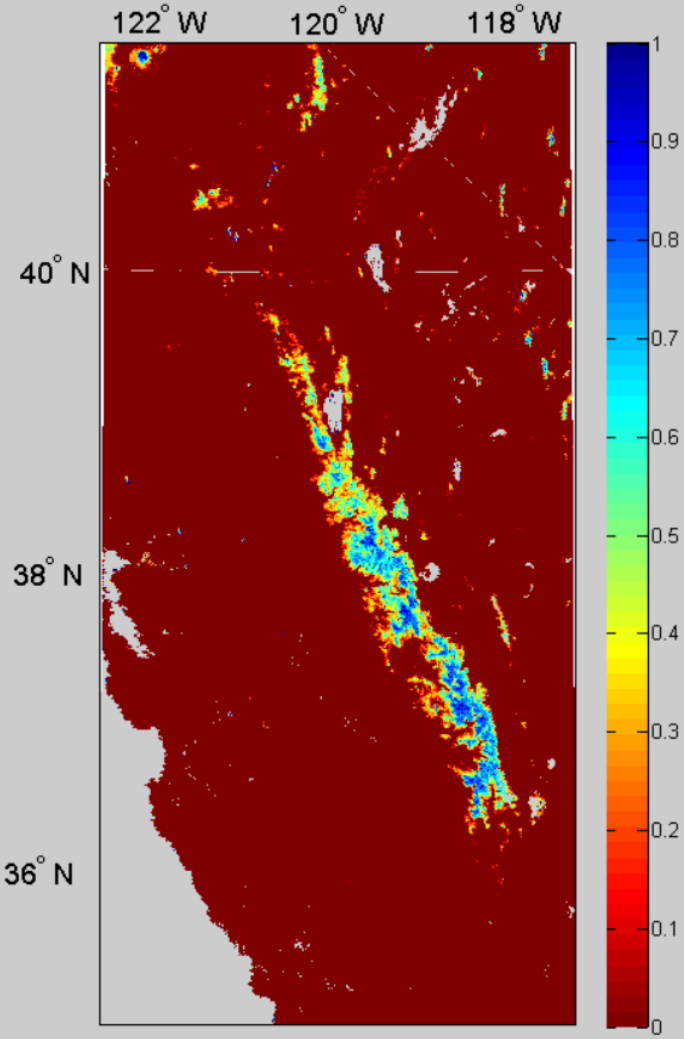
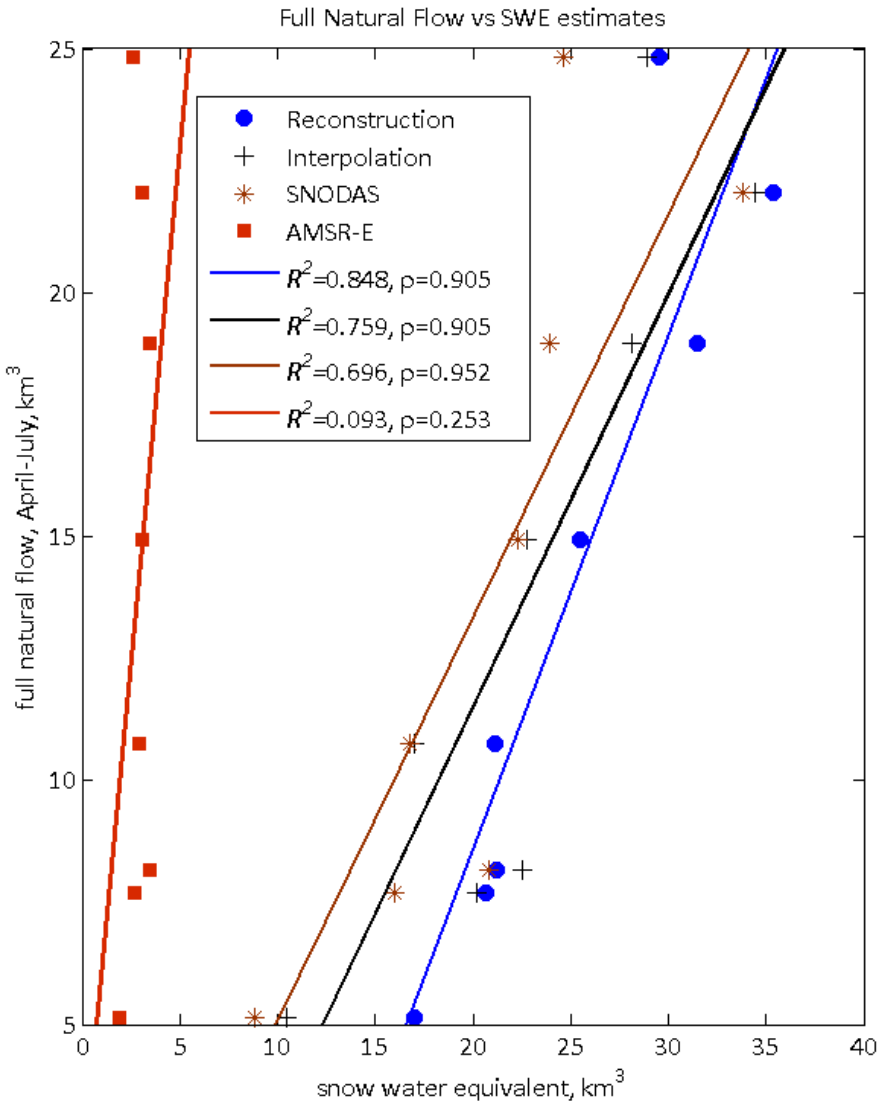
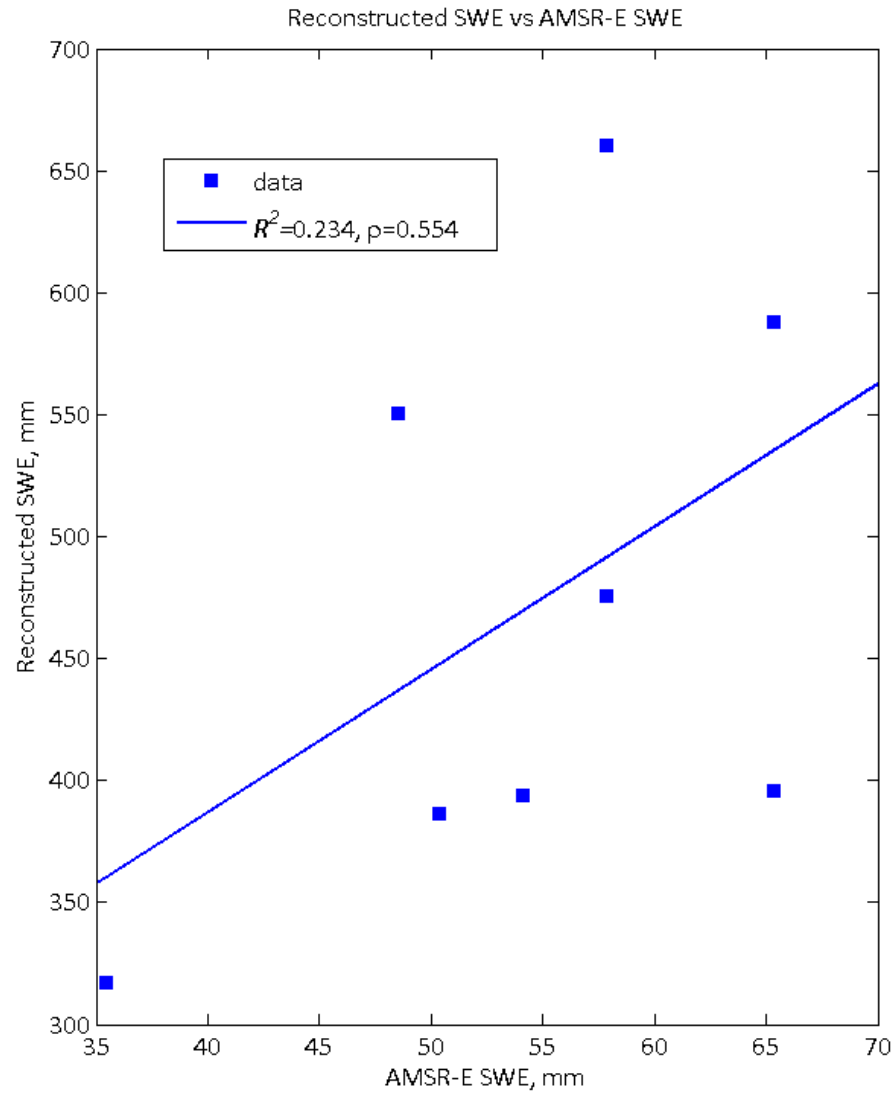




Snow-covered area

February 22, 2013





Sierra Nevada, AMSR-E & Reconstruction