Reconstructing snow water equivalent in the Rio Grande headwaters using remotely sensed snow cover data and a spatially distributed snowmelt model.

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Abstract. A spatially distributed snowmelt model was used to simulate pixel-specific daily snowmelt and snow water equivalent (SWE) over the Rio Grande headwaters (3,419 km^2). Melt flux estimates were coupled with three different time-series of snow covered area (SCA) observations from the Landsat Enhanced Thematic Mapper (ETM+), the Advanced Very High Resolution Radiometer, and the Moderate Resolution Imaging Spectroradiometer (MODIS). Modeled melt flux for each pixel was integrated over the 2001 and 2002 snowmelt seasons to obtain estimates of maximum SWE accumulation. Evaluation of model performance using snow survey data collected at 7 different intensive study areas indicated that SWE was reasonably simulated using the MODIS SCA data. Multi-resolution comparisons revealed tradeoffs in accuracy associated with the relatively fine temporal resolution of MODIS (~ daily) versus the high spatial resolution of ETM+ (i.e. 30 m). As the first application of this modeling approach at the operations-scale (e.g. > 1000 km^2), this work has implications for developing physically based water supply forecasts and for understanding spatially explicit hydrological / biogeochemical feedbacks.

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