The RAL Seminar Series

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Snowmelt Modeling for Hydrologic Prediction and Land-atmosphere Modeling

by

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Over three quarters of western U.S. streamflow originates as mountain snowpack, and nearly one-half of the North American continent experiences some seasonal snow cover. Because precipitation occurring as snow is stored for later release as melt, with lag times ranging from days to months, it is a key source of natural storage that tends to align the snowmelt period (typically late spring and early summer) with the time of highest evaporative demand (and hence roughly consumptive water demands). Therefore, in areas like the western U.S., mountain snowpacks have critical implications for water management. In addition, the albedo of snow cover - which can be as high as 0.85 for new fallen snow - is much larger than snow free landscapes, resulting in large contrasts in absorbed solar radiation. For this reason, snow cover patterns, especially over large areas like the U.S. Great Plains and upper Midwest, have important implications for the land surface energy balance on a seasonal basis. Accurate representation of snowpacks in both the hydrological models used by hydrologists for streamflow prediction and the land surface schemes used by weather and climate modelers in coupled land-atmosphere models is of great importance and concern, although for much different reasons. I summarize experience at the University of Washington in both areas over recent years, specifically with respect to a) Evaluation of the performance of snow accumulation and ablation models in off-line simulations, especially in mountainous regions; b) Implications of surface forcing biases on snow simulations in coupled land-atmosphere simulations; c) results of high spatial resolution simulations of snowpack sensitivity to temperature, and d) snowpack and passive microwave emissions simulations over the 1200 km SnowSTAR2002 transect across Alaska. I conclude with some comments on outstanding problems and challenges in snow simulations.