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Assessing Snowpack from Colorados' Headwater Basins using a Very High Resolution Atmospheric Model

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Water is essential for the economic development of the western United States, from basic needs such as drinking water to irrigation and hydropower generation. An adequate supply of water in the future is critical to maintaining many of these important functions. With the increasing recognition of global and regional climate warming, water managers are rightly concerned about the potential impact of climate change on water in the western U.S., especially given that recent studies have indicated that global warming may lead to unprecedented drought conditions in the Southwest U.S.(4^{th} IPCC assessment).

Snowpack is the most important water source in the western U.S., and thus it is critical that water managers be provided with, as accurately as possible, 1) an improved understanding of the mechanisms that give rise to snow pack variability from year-to-year and 2) estimates of the likely changes expected of this resource in the future under various assumptions about future global climate. Previous climate studies have shown a wide variety of possible impacts, from no impact, to significantly reduced snowpack, especially in the Sierra Nevada and the Cascade mountains along the Pacific coast. The headwaters region of Colorado that includes (among others) the Colorado, the Platte River, and Arkansas Rivers seem to be a particularly difficult area for climate models to properly handle, with inconsistent snowpack trends in this region from both the 3^{rd} and 4^{th} IPCC reports (2001, 2007), despite consistent predictions of temperature

increases in this region from all climate models. This region is particularly important, since ∼85% of the stream flow for the Colorado river comes from snowmelt in this region.

This study will use the high resolution Weather Research and Forecast model to simulate snowpack formation and evolution over normal, dry, and wet snowpack years. Model horizontal resolution will be as high as 1 km in order to study the detailed interaction of the airflow and clouds with the complex terrain. These high resolution results will be compared to low resolution simulations in order to assess the role of small scale updrafts/downdrafts and circulations on the formation of snowpack in this important region.