

Relative Sensitivity of the Seasonal Snow Zones to Climate Warming in the Western United States

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Abstract. Snowpack accumulation and timing of melt impact the availability of water resources for the Western United States. Climate warming could therefore significantly impact the hydrology of the Western U.S. by decreasing the amount of precipitation falling as snow and altering the timing of melt and associated snowmelt runoff. Therefore, it is essential to identify areas that may be especially sensitive to climate warming, so resource managers can take appropriate steps to plan for hydrologic changes. This study utilizes 11 year average (2000 – 2010) MODIS Snow Cover Area (SCA) data from January to July to delineate zones of intermittent, transitional, persistent and seasonal snow based on the duration of snow cover persistence. Within the seasonal snow zone, we use 11 year average (2000 – 2010) MODIS Land Surface Temperature data for January-February-March (LST_{JFM}) to categorize five different snow sensitivity zones. Areas with the highest land surface temperatures are assumed to be most sensitive to climate warming, whereas areas with the lowest land surface temperature are assumed to be least sensitive. The snow zones in the highest sensitivity category occur at lower elevations of the Cascades and Sierra Nevada and in seasonal snow zones of the southwest, whereas snow zones with the least sensitivity to climate change occur in the interior northern Rockies, mid to higher elevations of the Cascades, and the higher elevations of the Colorado Rockies and the Sierra Nevada. These findings are comparable to other climate change sensitivity studies for the Western U.S.