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Combining point and distributed snowpack data with landscape-based discretization for hydrologic modeling of the snow-dominated Maipo River basin, in the semi-arid Andes of Central Chile.

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The 5000-km^2 upper Maipo River Basin, in central Chile's Andes, has an adequate streamgage network but almost no meteorological or snow accumulation data. Therefore, hydrologic model parameterization is strongly subject to model errors stemming from input and model-state uncertainty. In this research, we apply the Cold Regions Hydrologic Model (CRHM) to the basin, force it with reanalysis data downscaled to an appropriate resolution, and inform a parsimonious basin discretization, based on the hydrologic response unit concept, with distributed data on snowpack properties obtained through snow surveys for two seasons. With minimal calibration the model is able to reproduce the seasonal accumulation and melt cycle as recorded in the one snow pillow available for the basin, and although a bias in maximum accumulation persists, snowpack persistence in time is appropriately simulated based on snow water equivalent and snow covered area observations. Blowing snow events were simulated by the model whenever daily wind speed surpassed 8 m/s, although the use of daily instead of hourly data to force the model suggests that this phenomenon could be underestimated. We investigate the representation of snow redistribution by the model, and compare it with small-scale observations of wintertime snow accumulation on glaciers, in a first step towards characterizing ice distribution within a HRU spatial discretization. Although built at a different spatial scale, we present a comparison of simulated results with distributed snow depth data obtained within a 40 km^2 sub-basin of the main Maipo watershed in two snow surveys carried out at the end of winter seasons 2011 and 2012, and compare basin-wide SWE estimates with a regression tree extrapolation of the observed data.