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Optimizing snow-rain transition temperature in a regional climate model using satellite snow cover data

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Snow-rain transition temperature in land surface schemes of the climate models is used to determine whether the precipitation is in the form of snow or rain. It is usually taken as 2.2 oC at reference level in such models. Precipitation is treated as snow below this temperature, and rain over it. In this study, we investigated the dependence of a regional climate model's performance in simulating the snow cover to this threshold temperature. The regional climate model was the latest version of RegCM3, which was developed (based on NCAR's RegCM2 model) at the International Center for Theoretical Physics located in Italy. The land surface scheme of RegCM3 was the Biosphere-Atmosphere Transfer Scheme. The model's domain, which was centralized at Turkey, covered an extensive area including Eastern Europe and most of the Middle East. The spatial resolution was chosen as 24 km to make it consistent with the resolution of satellite snow cover data, which was obtained from the NOAA's website for Interactive Multisensor Snow and Ice Mapping System (http://www.ssd.noaa.gov/PS/SNOW). The model was continuously run for the 8-month period between October 1, 2001 and June 1, 2002. A comparison between modeled snow cover and satellite snow cover showed that the model generally overestimated the snow cover. Subsequently, we repeated the simulation with different snow-rain transition temperatures including 1.8, 1.0, 0.2, and -0.6 oC. These simulations demonstrated that the modeled snow cover was reduced and usually improved as this temperature was decreased. Some noticeable improvements were also observed in modeled temperature when model results were compared with gridded station data over Turkey. Later, a similar modeling experiment was performed for the period between October 1, 2003 and June 2, 2004. The model overestimated the snow cover in the control simulation of this experiment, too. Again, implementing smaller snow-rain

transition temperatures into the model reduced the snow cover and improved the snow cover simulations.