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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Modelling of snow processes in catchment hydrology by means of downscaled WRF meteorological data fields" *by* K. Förster et al.

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We wish to thank Ryan Webb for his interest in our work and for his helpful comments on the manuscript. We will consider his recommendations in order to improve our manuscript. We agree that using observed precipitation defeats the downscaling approach. As explained in our reply to Anonymous Referee 1, we will revise our paper with respect to this issue. This will be done by showing snowmelt results based on simulated precipitation. A subsequent comparison with respective results based on observed precipitation will however show that temperature, humidity, radiation, and wind speed can be downscaled with higher accuracy, making them suitable for snowmelt

simulations at both scales. This will show the limitations of the approach more clearly. Please refer to our explanations in our first comment and in our reply to Anonymous Referee 1 for further details.

We will complete the explanations with respect to Fig. 11: In contrast to the Utah Energy Balance Model Version 2.2 ESCIMO+Canopy sub-divides the snowpack into two layers (canopy and sub-canopy), which are exposed to different meteorological conditions. Since intercepted snow is more exposed to shortwave radiation and turbulent exchange, it is generally more intensively depleted by sublimation than the sub-canopy snowpack. In the model, these effects are taken into consideration by using the physically based scaling approach of Pomeroy and Schmidt (1993), which has been validated in several studies (see, e.g., Pomeroy et al, 1998; Montesi et al., 2004). In contrast, the Utah model simply scales wind speed and shortwave radiation to approximate the different meteorological conditions in the canopy. Since the Harz Mountains are generally exposed to moist air masses during the winter, the simulation of condensation is realistic for open-site conditions as it is simulated for Torfhaus meteorological station (moist air above 0°C and melting snowpack). The higher exposure to turbulence and radiation is not captured by this approach. To conclude, a net loss (sublimation) is more realistic for forest stands. The discussion with regard to Fig. 11 is meant for plausibility purposes only. Unfortunately, there isn't any information available to estimate the actual fluxes. The net water vapour flux only accounts for approximately 5% of the total precipitation input. In essence, our intention to discuss the different model results was to underline the need to keep these processes in mind, which may be more relevant for other regions (e.g., continental climate, dry air, high wind speed).

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