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Quality assessment of water cycle parameters in REMO by radar-lidar synergy

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Abstract. A comparison study of water cycle parameters derived from ground-based remote-sensing instruments and from the regional model REMO is presented. Observational data sets were collected during three measuring campaigns in summer/autumn 2003 and 2004 at Richard Aßmann Observatory, Lindenberg, Germany. The remote sensing instruments which were used are differential absorption lidar, Doppler lidar, ceilometer, cloud radar, and micro rain radar for the derivation of humidity profiles, ABL height, water vapour flux profiles, cloud parameters, and rain rate. Additionally, surface latent and sensible heat flux and soil moisture were measured. Error ranges and representativity of the data are discussed. For comparisons the regional model REMO was run for all measuring periods with a horizontal resolution of 18 km and 33 vertical levels. Parameter output was every hour. The measured data were transformed to the vertical model grid and averaged in time in order to better match with gridbox model values. The comparisons show that the atmospheric boundary layer is not adequately simulated, on most days it is too shallow and too moist. This is found to be caused by a wrong partitioning of energy at the surface, particularly a too large latent heat flux. The reason is obviously an overestimation of soil moisture during drying periods by the one-layer scheme in the model. The profiles of water vapour transport within the ABL appear to be realistically simulated. The comparison of cloud cover reveals an underestimation of low-level and mid-level clouds by the model, whereas the comparison of high-level clouds is hampered by the inability of the cloud radar to see cirrus clouds above 10 km. Simulated ABL clouds apparently have a too low cloud base, and the vertical extent is underestimated. The ice water content of clouds agree in model and observation whereas the liquid water content is unsufficiently derived from cloud radar reflectivity in the present study. Rain rates are similar, but the representativeness of both observations and grid box values is low.

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