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Root water uptake compensation in land surface modelling

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Plant root water uptake is a central process in land surface modelling. It mainly depends on the available soil water and the ability of plants to react to water stress. In some instances, plants may compensate for water stress in the upper soil by increasing water uptake from deeper soil zones with higher water potential. The objective of the present study was to test the root water uptake compensation scheme implemented in the Noah land surface model. The model was tested against a set of soil water and eddy covariance flux data collected on a winter wheat stand in the season of 2009. Our results show that for the site under study, the Noah land surface model (LSM) was unable to simulate the observed soil water dynamics. While the measurements showed a distinct water content gradient between top- and subsoil during drying in June, the Noah LSM tended to uniformly deplete the soil profile. As a consequence, during the drought phase in June the Noah LSM underestimated soil drying in topsoil (0-30 cm), but significantly overestimated the depletion of the lowermost rooted subsoil layer (60-90 cm). While the simulated soil water content in 15 cm depth never fell below 21 Vol.%, the minimum observed value was 13 Vol.% in early July. A reanalysis of the simulation results showed, that, besides the simplifying assumption of a uniform root distribution and a homogeneous soil profile, the main reason for the observed systematical discrepancy between model and observation lies in the the root water uptake compensation scheme of Noah and its standard parameterization. We will present a modified root water uptake compensation scheme and with improved parameterization that produces better agreement between simulations and field observations.