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Real-time ecohydrological modelling in the Elbe river basin to assess the current weather trend

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The ecohydrological model SWIM (Soil and Water Integrated Model) was applied to the German part of the Elbe River basin on a day-to-day basis using real-time data from 19 weather stations. An available parameterised version of the model was used, which was calibrated and validated in previous studies considering the runoff at the basin outlet and various interior stations. In this study, the range of analysed model outputs was extended to soil water dynamics, plant growth and yields. To evaluate these outputs, a validation study was conducted on different spatial scales. The data used for validation includes runoff, yield and evapotranspiration data, each corresponding to a specific spatial scale. The simulated runoff at the basin outlet and subbasin outlets was validated using gauge data, simulated crop yield was validated on basin and subbasin scale with yield data that was available for administrative districts. Lysimeter measurements were used to validate percolation, evapotranspiration rates and crop yield. The results for the runoff at basin scale are satisfactory, while there are discrepancies between the simulated and observed runoff of the Havel and Saale subbasins, due to modification of the runoff regime by hydrological management. The simulated yield is in agreement with observations on basin and subbasin scale. The inter-annual fluctuation, however, could not always be reproduced adequately. On the field scale, the comparison of the simulated yield with the lysimeter data shows a good fit. The monthly aggregated values of evapotranspiration rates and percolation water, that differ between soil types, exhibit some mismatches, especially in Loess soil. Apart from these deviations, the model performed well at the different scales and is capable of providing real-time simulations at watershed-, subbasin- and field scale. Since it integrates hydrology, soil water dynamics and plant growth, it provides useful information, e. g. the development of the soil water content, to indicate weather conditions that lead to droughts or floods.