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The effect of background hydrometeorological conditions on the sensitivity of evapotranspiration to model parameters: analysis with measurements from an Italian alpine catchment

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Abstract. Recent developments have made land-surface models (LSMs) more complex through the inclusion of more processes and controlling variables, increasing numbers of parameters and uncertainty in their estimates. To overcome these uncertainties, prior to applying a distributed LSM over the whole Toce basin (Italian Alps), a field campaign was carried out at an experimental plot within the basin before exploring the skill and parameter importance (sensitivity) using the TOPLATS model, an existing LSM. In the summer and autumn of 1999, which included both wet (atmosphere controlled) and dry (soil controlled) periods, actual evapotranspiration estimates were performed using Bowen ratio and, for a short period, eddy correlation methods. Measurements performed with the two methods are in good agreement. The calibrated LSM predicts actual evapotranspiration quite well over the whole observation period. A sensitivity analysis of the evapotranspiration to model parameters was performed through the global multivariate technique during both wet and dry periods of the campaign. This approach studies the influence of each parameter without conditioning on certain values of the other variables. Hence, all parameters are varied simultaneously using, for instance, a uniform sampling strategy through a Monte Carlo simulation framework. The evapotranspiration is highly sensitive to the soil parameters, especially during wet periods. However, the evapotranspiration is also sensitive to some vegetation parameters and, during dry periods, wilting point is the most critical for evapotranspiration predictions. This result confirms the importance of correct representation of vegetation properties which, in water-limited conditions, control evapotranspiration.

Keywords: evapotranspiration, sensitivity analysis, land surface model, eddy correlation, Alpine basin

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