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Multiobjective calibration of coupled soil-vegetation-atmosphere models

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Abstract The modular system Expert-N is adopted to analyse the effect of the complexity of soil-vegetation-atmosphere models on their calibration results. Four different models with increasing complexity are calibrated using time series of observed soil moisture, evapotranspiration, and LAI field data from a winter wheat field plot in Kraichgau, southwest Germany. The calibration of each model is posed in a multiobjective framework and three different objective functions are used to summarize the distance between measurements and simulations of different data types. The AMALGAM evolutionary search algorithm is utilized to simultaneously estimate the most important soil hydraulic and plant module parameters. Results show for most models a considerable trade-off appears in the fitting of different data types. If a mechanistic description of plant growth is considered the trade-off reduces considerably. The simplest plant model in our study performs relatively well but requires the availability of key development data of the plant. If such data are not available to the user, such models are rather useless for predictive purposes.

Key words soil-vegetation-atmosphere modelling; evapotranspiration; soil moisture; leaf area index; multiobjective parameter optimization; AMALGAM; Pareto analysis; model calibration