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Model Evaluation with Multi-wavelength Satellite Observations Using a Neural Network

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A methodology has been developed to evaluate fields of modelled parameters against a set of satellite observations. The method employs a Neural Network (NN) to construct a statistical model capturing the relationship between the satellite observations and the parameter from a land surface model, in this case the Soil Moisture (SM). This statistical model is then used to estimate the parameter of interest from the set of satellite observations. These estimates are compared to the modelled parameter in order to detect local deviations indicating a possible problem in the model or in the satellite observations. Several synthetic tests, during which an artificial error was added to the"true" soil moisture fields, showed that the methodology is able to correct the errors (Jimenez et al., submitted, 2012). This evaluation technique is very general and can be applied to any modelled parameter for which sensitive satellite observations are available. The use of NNs simplifies the evaluation of the model against satellite observations and is particularly well-suited to utilize the synergy from the observations at different wavelengths (Aires et al., 2005, 2012).
In this study the proposed methodology has been applied to evaluate SM fields from a number of land surface models against a synergy of satellite observations from passive and active microwave, infrared and visible sensors. In an inter-comparison of the performance of several land surface models (ORCHIDEE (de Rosnay et al., 2002), HTESSEL (Balsamo et al., 2009), JULES (Best et al., 2011)) it was found that the soil moisture fields from JULES, HTESSEL and ORCHIDEE are very consistent with the observations, but ORCHIDEE soil moisture shows larger local deviations close to some river basins (Kolassa et al., in press, 2012; Jimenez et al., submitted, 2012). Differences between all models and the observations could also be observed in the Eastern US and over mountainous regions, however, the errors here are more likely linked to the retrieved SM uncertainties. The proposed methodology can also be used to evaluate the quality of the model forcings: two soil moisture fields from ORCHIDEE using WATCH (Weedon et al., 2011) and ERA-interim (Balsamo et al., 2010) forcings were analysed. It was shown that the WATCH forcing data are more optimal, underlining the importance of forcing data for the accuracy of model predictions (Kolassa et al., in press, 2012).

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