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Validation of two SVAT models for different periods of the West African monsoon

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The impact of soil moisture on surface-atmosphere interactions in West Africa is evident from several observations and model studies. In global and weather forecast models multi-layer soil-vegetation models (SVAT) predict this soil-atmosphere exchange.
Model validation is difficult due to the scarcity of comprehensive data sets; therefore the continuous in-situ measurements of soil moisture and soil temperature as well as near-surface meteorological parameters and energy balance components, performed during the AMMA campaign at Bontioli, Burkina Faso Faso (3 °W, 11 °N), offered a good opportunity to validate SVAT-models on a local scale. The measurements covered the pre-onset of monsoon from 1-15 June 2006 (SOP 1) as well as the mature monsoon phase from 25 July – 20 August 2006 (SOP 2).
The SVAT-models VEG3D and TERRA-ML were used in offline mode forced by atmospheric conditions observed during the campaign. TERRA-ML is implemented as standard SVAT scheme in the COSMO-model, which is used operationally by several Weather Services and VEG3D was implemented in COSMO as an alternative SVAT. Setup parameters like leaf area index and plant cover were obtained by remote sensing techniques. Roughness length and vegetation height were derived from local observations and root depth was estimated. Soil parameters, like soil texture and thermal conductivity, were determined from the analysis of soil samples. The local soil texture was found to be loamy sand.
To compare the results the models were run with the same setup. The soil texture loamy sand does not exist in TERRA-ML, therefore the TERRA-ML simulations were performed with two adjoining soil textures, sand and sandy loam. Model results were validated by statistical analysis and the index of agreement was calculated to evaluate the model results.
Linked to rainfall events all models show an overestimation of the soil moisture content in the top 20 cm of the soil. Additionally after rainfall the penetration depth is overestimated, a strong soil moisture signal is simulated below 10 cm which does not coincide with observation. It was also found that the performance of the different model runs depend on whether there are dry or wet periods. In general as a result of the validation it can be stated that VEG3D with the soil texture loamy sand and TERRA-ML with the soil texture sand represent the observations fairly well. Whereas TERRA-ML with the soil texture sandy loam is only partly in good agreement with the measurements. This indicates that beside other setup parameters (LAI, plant cover etc.) it is essential to use correct soil textures to achieve reliable model results.