Geophysical Research Abstracts
Vol. 14, EGU2012-12202, 2012
EGU General Assembly 2012

The use of eigendecomposition in sensitivity analysis of a complex land surface model

M. Göhler, Mr Cuntz, Ms Mai, and Ms Attinger
Germany (maren.goehler@ufz.de)

This study presents a parameter sensitivity analysis of a complex land surface model, the Community Land Model (CLM), revision 3.5. We use different output fluxes, i.e. the fluxes of latent- and sensible heat, and C3/C4 photosynthesis for the analysis. Our objective function represents the sum of the normalized relative deviations of these fluxes. We extended the standard method by weighting the deviations with the flux magnitudes. We use all (66) parameters of CLM in a random sampling design, including different vegetation and soil properties. Parameter sensitivities at the random parameter combinations result in a sensitivity matrix S. The use of eigendecomposition of the STS matrix gives information about parameter importance while taking into account interactions between the different parameters.
We examine seven methods to determine parameter importance from the eigenvector matrix and associated eigenvalues. The most elaborate method focuses on parameters that become relevant due to their interactions with others. It distinguishes between parameters of high, medium and low relevance by using three arbitrary thresholds. We created a new criterion with only one threshold acting on the parameter importance index.

In the results strikes one outstandingly sensitive parameter that is used in the description of soil evaporation resistance. We therefore excluded the oversensitive parameter from further analysis and suggest rather reformulation of the process. Five methods for parameter importance determination result in a very similar picture. The elaborate method, on the other site, marks comparatively more parameters as relevant. We show that the new criterion performs very similar to the elaborate method. it retains two thirds of the CLM parameters for a later parameter estimation procedure. It ensures that these parameters generate 99% of the overall model variation.
The used method gives a consistent picture if different combinations of output fluxes are used. This means, for example, that specific leaf area and nitrogen limitation become important only if sensitivity is limited with respect to photosynthesis.