Towards Multi-parameter Assimilation in Land Surface Models

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As with atmospheric modeling, land surface models (LSM) suffer from uncertainties in forcing data and model parameterization, and therefore require continuous correction through the assimilation of state observations. An example of this is the inability of most LMS's to adequately represent the adaptation of plants to their environment (eg. change of average temperature at different altitudes [Brut et al., 2009]), with the same plant species generally being prescribed with the same model parameters regardless of the location.

Over the past 10 years the focus has been on assimilation of soil moisture observations. More recently, it has been shown that the assimilation of energy and water fluxes and also vegetation indices (eg. the leaf area index) can lead to significant improvements in LSM performance. However, the assimilation of only one observation typically leads to errors in other prognostic model states. Consequently, as in atmospheric models, all available observations should be assimilated at the same time.

This paper discusses results of multi-parameter assimilation, with a particular emphasis on the strengths and weaknesses of different types of observation. First, case studies are presented as examples for assimilation of the different observation types alone, before showing the potential that joint assimilation of these different observation types can have to improve the overall performance of the LSM.