



## **Optimization of vegetation model parameters through sequential assimilation of surface albedo observations**

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The dynamic global vegetation model JSBACH, which is the land component of the MPI Earth System Model, uses cover fractions of up to 21 plant functional types (PFT) to represent the vegetation in a grid box. Each PFT is described by a set of parameters and the global distribution of PFTs allows for a spatially differentiated description of the land surface. The PFT parameters, however, are constant over time and thus neglect processes that lead to seasonal changes of the described properties.

In the case of land surface albedo, this simplification leads to decreased seasonal variability within model results compared to observations of the Moderate Resolution Imaging Spectroradiometer (MODIS), because the fixed canopy albedo parameters of JSBACH do not adequately represent the seasonal changes of the leaves' radiative properties.

To judge the seasonal variability of these parameters and to derive an appropriate seasonally varying parameterization, we set up a flexible and extensible data assimilation framework that allows to estimate a time series of parameter values. We incorporated a standalone version of JSBACH forced by ERA-Interim reanalysis data into the Data Assimilation Research Testbed (DART). Within DART, an Ensemble Kalman Filter is applied to sequentially update an ensemble of model states and parameters as new observations become available. To handle the non-Gaussian distributions of a bounded quantity like albedo we use a Gaussian anamorphosis technique.

We performed perfect model experiments to show that the assimilation system is able to retrieve seasonally varying parameters. The synthetic observations for these experiments are generated in a control run of JSBACH with seasonally varying canopy albedo parameters. They were perturbed to mimic observation error and subsequently used in an assimilation run. The results of the assimilation were evaluated with respect to reproducing the parameters of the control run.