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Preparing for the assimilation of remote sensing products by large-scale models with updated land surface process schemes

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Data assimilation and integration of remote sensing with dynamic process models

We present a computer efficient inversion software procedure enabling us to retrieve optimally, from operational Terra broadband surface albedo products, a series of key vegetation characteristics such as the Leaf Area Index (LAI), the leaf optical properties and the brightness of the soil underneath the canopy. The approach uses an advanced two-stream radiation transfer model dedicated to climate and carbon flux model applications. This inversion procedure itself implements the adjoint code, generated using automatic differentiation techniques, of a cost function. This cost function balances two main contributions reflecting 1) the a priori knowledge on the model parameter values and, 2) the remotely sensed flux and associated uncertainties together with the requirement to minimize the mismatch between these measurements and the two-stream model simulations. The individual weights of these contributions are specified notably via covariance matrices of the uncertainties in the a priori knowledge on the model parameters and the observations. This package also reports on the probability density functions of the retrieved model parameter values that thus permit the user to evaluate the a posteriori uncertainties on these retrievals.

We will discuss results from applications conducted using MODIS and MISR operational surface albedo products over selected EOS validation sites spanning a range of vegetation type conditions and where ground-based estimates are available. These applications are performed over full phenological vegetation cycles and include snow contaminated conditions. Our results are compared to those available from operational MODIS and MISR algorithms (LAI and Fraction of Absorbed Photosynthetically Active Radiation, among others) and are shown to exhibit much more accurate and consistent temporal patterns.