Application to MISR land BRFs of the RPV model inversion package to assess environmental patterns

Thomas Lavergne [(1)], Thomas Kaminski [(2)], Bernard Pinty [(1)], Malcolm Taberner [(1)], Nadine Gobron [(1)], Michel Verstraete [(1)], Michael Vossbeck [(2)], Jean-Luc Widlowski [(1)], Ralf Giering[(2)] and Ophélie Aussedat[(1)]

(1) Global Environment Monitoring Unit, IES, EC Joint Research Centre,
TP 440, via E. Fermi, I-21020 Ispra (VA), Italy.

(2) FastOpt, Schanzenstrasse 36, D-20357 Hamburg, Germany.

Thomas.lavergne@jrc.it

Environmental change detection

The capability of the non-linear Rahman-Pinty-Verstraete (RPV) model to 1) accurately fit a large variety of Bidirectional Reflectance Factor (BRF) fields and 2) return parameter values of interest for land surface applications motivate the development of a computer efficient inversion package. The present paper describes such a package based on the 3 and 4 parameter versions of the RPV model. This software environment implements the adjoint code, generated using automatic differentiation techniques, of the cost function. This cost function itself balances two main contributions reflecting 1) the a priori knowledge on the model parameter values and, 2) BRF uncertainties together with the requirement to minimize the mismatch between the measurements and the RPV 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. This is achieved by evaluating the Hessian of the cost function at its minimum. Results from a variety of tests are shown in order to document and analyze software performance against complex synthetic BRF fields simulated by radiation transfer models as well as against actual MISR-derived surface BRF products. These RPV parameters are then used to detect a number of surface features and there associated changes.