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A Generic Retrieval Package for Land Parameters applied to Surface Albedo Products

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We present a generic inversion package (the JRC-TIP) enabling us to optimally retrieve land surface fluxes and associated land parameters based on a 1D two-stream radiation transfer model. This package implements the Adjoint and Hessian codes of a cost function balancing 1) the misfit between observed and modeled remote sensing fluxes and 2) the deviation from prior knowledge on the 1D model parameter values. This procedure delivers a Gaussian approximation of the PDFs of the retrieved model parameters which characterize the radiative status of the vegetation-soil system. In this procedure the adjoint code is used to efficiently provide the derivative of the cost function with respect to the parameters to an gradient algorithm for minimization. The propagation of uncertainties from the observations to the model parameters is achieved via the Hessian of the cost function and yields a covariance matrix of posterior parameter uncertainties. This matrix is propagated to the radiation fluxes via the model's Jacobian matrix of first derivatives. This provides a Gaussian approximation of the posterior PDFs of the transmitted, absorbed and scattered fluxes within the vegetation layer, included those that are not measured, for example, the absorbed fraction by the background below vegetation. The detailed analyses of the retrieval uncertainties highlight the central role and contribution of the LAI, the main process parameter to interpret radiation transfer observations over vegetated surfaces.

The system is highly flexible and can assimilate any combination of narrowband, broadband or hyperspectral radiation flux observations. Another definite asset of the JRC-TIP lies in its capability to control and ultimately relax a number of assumptions that are often implicit in traditional approaches. Through a series of selected examples, the inverse procedure implemented in the JRC-TIP is shown to be robust, reliable and compliant with large scale processing requirements. The accuracy of the radiant fluxes retrieved by this inversion package is assessed using 3D MC simulations of realistic vegetation canopy scenarios. Finally, results from a comparison study of the JRC-TIP products, including the effective single scattering albedo of the canopy, against in-situ information available from a Fluxnet site will also be presented.