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Measurement of daily spectral soil albedo over France from MODIS and MSG: comparison with soil moisture derived from ASCAT observations

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Surface albedo determines the partition of energy between land surface and atmosphere, which is a crucial parameter for climate studies. In particular, consistency of coarse scale soil background albedo data set is required to improve the radiative scheme in land surface modeling. As an important component of land surface, soil albedo depends on soil moisture, soil roughness, mineral content, tillage, etc. It can change rapidly at hourly or daily basis, revealing the variation of the state variables, particularly soil moisture. Over dense vegetation areas, radiation interactions exist between the soil background and the bottom of canopy, which adds to the difficulty to yield a clear separation between the respective soil and vegetation attributes. With the advent of a new-generation of Earth observing sensor systems, consistent sets of surface albedo products are regularly distributed at global and regional scales within expected accuracy, particularly MODIS and SEVIRI, which provides the potential of generating soil albedo from satellite observations.

The objective of this study is to derive soil background albedo from MODIS and SEVIRI data sets over France. A procedure was developed to derive a MODIS albedo on a daily basis in combining TERRA and AQUA observations and in considering the MODIS BRDF model at the appropriate dates. A novel 1D radiative transfer approach is applied to disentangle soil background albedo and vegetation albedo by using the albedo and LAI data sets of MODIS and SEVIRI. This background albedo from satellite observations is made evolving with the use of a Kalman filter approach. In order to generate a predictive model, temporal trajectories of soil background albedo are extracted for each soil mapping unit and further clustered into several clusters by using k-mean method.

The temporal coherence of the resulting soil background albedos was assessed with satellite and in-situ rainfall and soil moisture observations. It comes out that the derived soil background albedo compares favorably with the chronology of precipitation rates recorded by TRMM Multi-Satellite Precipitation Analysis (TMPA), ASCAT soil moisture products, and also with measurements by rain gauges at 12 anchor stations of the SMOS-MANIA network during 2007-2010.