

Multiplatform observations enabling albedo retrievals with high temporal resolution

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In this paper we show that combining observations from different polar orbiting satellite families (such as AVHRR and MODIS) is physically justifiable and technically feasible. Our proposed approach will lead to surface albedo retrievals at higher temporal resolution than the state of the art, with comparable or better accuracy. This study is carried out in the World Meteorological Organization (WMO) Sustained and coordinated processing of Environmental Satellite data for Climate Monitoring (SCOPE-CM) project SCM-02 (<http://www.scope-cm.org/projects/scm-02/>).

Following a spectral homogenization of the Top-of-Atmosphere reflectances of bands 1 & 2 from AVHRR and MODIS, both observation datasets are atmospherically corrected with a coherent atmospheric profile and algorithm. The resulting surface reflectances are then fed into an inversion of the RossThick-LiSparse-Reciprocal surface bidirectional reflectance distribution function (BRDF) model. The results of the inversion (BRDF kernels) may then be integrated to estimate various surface albedo quantities. A key principle here is that the larger number of valid surface observations with multiple satellites allows us to invert the BRDF coefficients within a shorter time span, enabling the monitoring of relatively rapid surface phenomena such as snowmelt.

The proposed multiplatform approach is expected to bring benefits in particular to the observation of the albedo of the polar regions, where persistent cloudiness and long atmospheric path lengths present challenges to satellite-based retrievals. Following a similar logic, the retrievals over tropical regions with high cloudiness should also benefit from the method.

We present results from a demonstrator dataset of a global combined AVHRR-GAC and MODIS dataset covering the year 2010. The retrieved surface albedo is compared against quality-monitored in situ albedo observations from the Baseline Surface Radiation Network (BSRN). Additionally, the combined retrieval dataset is compared against MODIS C6 albedo/BRDF datasets to assess the quality of the multiplatform approach against current state of the art.

This approach is not limited to AVHRR and MODIS observations. Provided that the spectral homogenization produces an acceptably good match, any instrument observing the Earth's surface in the visible and near-infrared wavelengths could, in principal, be included to further enhance the temporal resolution and accuracy of the retrievals. The SCOPE-CM initiative provides a potential framework for such expansion in the future.