Operational Validation of Space-based Albedo Products from Upscaled Tower-based Albedometer Measurements

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Surface albedo is a fundamental radiative parameter which controls the Earth’s energy budget by determining the amount of solar radiation which is either absorbed by the surface or reflected back to atmosphere. Satellite observations have long been used to capture the temporal and spatial variations of surface albedo because of their repeated global coverage. In this work, a new method of upscaling surface albedo from ground level footprints of a few tens of metres to coarse satellite scales (≈1km) is reported [1]. Tower-mounted albedometer measurements are upscaled and used to validate global space-based albedo products, including Copernicus Global Land Service (CGLS) 1km albedo data (from Proba-V and previously form VEGETATION-2), MODerate resolution Imaging Spectroradiometer (MODIS) 500m albedo data, and Multi-angle Imaging SpectroRadiometer (MISR) 1.1km albedo data. MODIS albedo retrievals show the closest agreement with tower measurements, followed by the MISR retrievals, and then followed by the CGLS retrievals. The upscaling method uses high-resolution surface reflectance retrievals (from Landsat-8, Sentinel-2) to fill the spatial gaps between the albedometer’s field-of-view (FoV) and coarse satellite scales. High-resolution surface albedo products are generated by combining high-resolution surface reflectance data and MODIS bi-directional reflectance distribution function (BRDF) climatology data. This upscaling framework also uses a novel Sensor Invariant Atmospheric Correction (SIAC) method [2] to improve the accuracy of upscaled tower albedo values. Total uncertainties of upscaled albedo products are estimated by considering uncertainties from both the tower albedometer raw measurements and SIAC atmospheric corrections. This surface albedo upscaling method can be used over both heterogenous and homogenous land surfaces, and has been examined at the SURFRAD, BSRN and FLUXNET tower sites.

Keywords: surface albedo, upscale, CGLS, MODIS, MISR, SIAC

