Global land surface albedo maps from MODIS using the Google Earth Engine

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The land surface albedo (LSA) is a critical physical variable, which influences the Earth's climate by affecting the energy budget and distribution in the Earth-atmosphere system. Its role is highly significant in both global and local scales; hence, LSA measurements provide a quantitative means for better constraining global and regional scale climate modelling efforts. The Moderate Resolution Imaging Spectroradiometer (MODIS) sensor, on board NASA's Terra and Aqua platforms, provides the parameters needed for the computation of LSA on an 8-day temporal scale and a variety of spatial scales (ranging between 0.5 - 5 km). This dataset was used here for the LSA estimation and its changes over the study area at 0.5 km spatial resolution. More specifically, the MODIS albedo product was used, which includes both the directional-hemispherical surface reflectance (black-sky albedo) and the bi-hemispherical surface reflectance (white-sky albedo). The LSA was estimated for the whole globe on an 8–day basis for the whole time period covered by MODIS acquisitions (i.e. 2000 until today). To estimate LSA from black-sky and white-sky albedos, the fraction of the diffused radiation is needed, a function of the Aerosol Optical Thickness (AOT). Required AOT information was acquired from the MODIS AOT product at $1° \times 1°$ spatial resolution. Since LSA also depends on solar zenith angle (SZA), 8-day mean LSA values were computed as averages of corresponding LSA values for representative SZAs covering the 24-hour day. The estimated LSA was analysed in terms of both spatial and seasonal characteristics, while LSA changes during the period examined were assessed. All computation were performed using the Google Earth Engine (GEE). The GEE provided access to all the MODIS products needed for the analysis without the need of searching or downloading. Moreover, the combination of MODIS products in both temporal and spatial terms was fast and effecting using the GEE API (Application Program Interface). All the products covering the globe and for the time period of 15 years were processed via a single collection. Most importantly, GEE allowed for including the calculation of SZAs covering the 24-hour day which improves the quality of the overall product. The 8-day global products of land surface albedo are available for further use and analysis.