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Validation of POLDER surface BRDF and albedo products based on a review of other satellites, ground and climate databases

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Space-borne POLDER (Polarization and Directionality of Earth Reflectance) experiment has provided the first opportunity to sample the BRDF (Bi-directional Reflectance Distribution Function) of every point on Earth for viewing angles up to 60˚-70˚, and for the full azimuth range, at a spatial resolution of about 6km. The POLDER instrument is a wide field of view imaging radiometer equipped of a CCD matrix and a wheel carrying spectral filters. The ground resolution of the POLDER pixel is between 6 and 7 km. POLDER can acquire up to 14 multi-angular measurements almost everyday on a daily coverage basis. Therefore, a comprehensive sampling of the BRDF of land surface targets is usually available within a few days period. The frequency of revisit is even enhanced towards the pole, which is convenient due to a high cloud occurrence at high latitudes.

This study is devoted to a global verification of the reliability of the POLDER-derived BRDF and albedo products over land surfaces based on an exhaustive review of similar existing products. This concerns POLDER observations from ADEOS-II for year 2003 and from PARASOL for year 2005. Actually, the BRDF informs about the anisotropic properties of a given terrestrial target in describing how the solar radiation propagates within this medium. Not only BRDF knowledge is crucial for albedo de-

termination but it also has demonstrated its great potential for a retrieval of additional biophysical variables. The POLDER BRDF and albedo are collected at 443, 565, 670, 765, and 865 nm. Narrow to broadband conversion coefficients are then applied to derive spectrally-averaged products that are can be judged more useful for climate applications. In POLDER project, a modified version of the Li-Ross kernel-driven model is considered to model BRDF and derive spectral albedos.

The present albedos comparisons are carried on with satellite-derived products (MODIS, MISR, Meteosat-7, MSG), radiative transfer outputs (ISCCP-II), and NWP (Numerical Weather Prediction) models (ECMWF, ARPEGE for Météo-France) and ground data (ARM). POLDER products are used at their nominal resolutions for MODIS and Meteosat-7, then degraded at 0.5 degree for other products. MODIS golden tiles over Africa and Canada are selected to investigate in details the differences under various environments and biomes. It comes out there exists a bias around 0.05 for any broadband albedo between POLDER and MODIS in Sahel region due to the systematic use of a back-up BRDF database with MODIS. Generally speaking, a large underestimate of the albedos from climate databases are noticed over desert and semi-desert regions. The interest of NWP models is they yield and update of the snow albedo, typically every three-hour. Nonetheless, large discrepancies are noticed, with an overestimate of NWP albedo by 0.4 over mountainous regions, compared to either POLDER or MODIS. Reverse trend is observed at high latitudes in the case of residual snow cover under forested areas. Clearly, upgrading snow albedo in NWP modeling should have a significant impact. As a conclusion, it comes out the multi-angular capabilities offered by POLDER yields a unique tool to estimate surface albedo with the relative accuracy of 5% as required by the users.