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The GEOLAND algorithm to estimate the solar radiation at surface level from geostationary sensors: Method, case studies and influence of the atmospheric composition

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The Downwelling surface Shortwave Radiation flux (DSR) is a radiative forcing of Soil Vegetation Atmospheric Transfer schemes employed for climate modelling (Global Circulation Models and Numerical Weather Predictions) and for evaluation of the inter-annual variability of the terrestrial carbon cycle at global and regional scales, in support of the implementation of the Kyoto Protocol. The GEOLAND Observatory on Natural Carbon Fluxes estimates the response of vegetation to the solar energy reaching the ground level through the DSR input delivered by the GEOLAND Core Service on Bio-Geophysical Parameters. Spatial sensors on geostationary platforms are most appropriate to estimate DSR with the GEOLAND requirements of hourly products and global coverage.

The GEOLAND DSR algorithm will be presented. Top Of the Atmosphere (TOA) radiance measurement processing is differentiated into the cloudy-sky processing line and the clear-sky processing line. The cloudy-sky algorithm already developed at Meteo France and applied for O&SI SAF and Land SAF is chosen for GEOLAND and an innovative method was developed for the clear-sky cases. The clear-sky algorithm combines statistical and physical methods to select DSR from a Look-Up-Table of DSR and TOA radiance values generated precisely with the 6S radiative transfer code sweeping the input parameters representing around 2000 surface atmosphere system models. The great advantage of the method is twofold: no ancillary information about the atmosphere and the surface properties is necessary and a simultaneous retrieval of the surface albedo range and of the aerosol optical thickness range is possible. The

method is tested for clear-sky cases by comparing GEOLAND estimates to ground-based measurements performed at Baseline Surface Radiation Network sites located in Europe, Africa and Middle Orient for August 2000. The clear-sky algorithm achieves the 5% precision specification whatever the observation geometry is and for variable aerosol loadings.