Abstract

The estimation of the top-of-the-atmosphere (TOA) composite clear-sky fluxes is crucial in climate research. Indeed, such quantities serve as the starting point to assess the accuracy of General Circulation Models (GCMs). They can also, once inverted, provide the surface albedo which in turn can be ingested in GCMs or monitored for changes. Moreover, they allow to estimate the cloud radiative forcing as well as its variations when considering decadal time-series. This has drawn the need to generate a dedicated TOA clear-sky flux product within the Geostationary Earth Radiation Budget (GERB) experiment.

The majority of techniques found in the literature to infer the solar clear-sky flux at a given repeat cycle considers the average of the fluxes associated to clear-sky conditions over some time period. A refinement of this approach consists to substitute the averaging process by a spline fit. Similarly, other methods operate on a shorter time period but increase the sampling to the complete diurnal cycle.efting exclusively relies on theoretical models and not on measurements. This method is directly inspired from a previous technique which was developed to estimate composite TOA clear-sky footprints population.

The preliminary results shown here are computed by using \( \Delta = 120-\)days and selecting \( \alpha(x,y,t) \) as the most recent value relatively to the current day \( \Delta \) within the set \( \{\alpha\} \).

2 Preliminary results

Since the Edition 1 of the GERB HR products are only available after undergoing a strict quality assurance (QA) check, the fluxes of the sun-glint affected area within the POV which do not satisfy this QA are masked out. Thus, the development and the improvement of our algorithm is carried out on GERB-like HR products. These products are only differing from the GERB HR products in the sense that the fluxes are estimated through a narrowband-to-broadband estimation from SEVIRI data and not corrected by the GERB instrument measurements. Moreover, fluxes in these products are provided over sun-glint regions. The preliminary results \( I_{\alpha}^{\text{CS}} \) shown here are computed by using \( \Delta = 120-\)days and selecting \( \alpha(x,y,t) \) as the most recent value relatively to the current day \( \Delta \) within the set \( \{\alpha\} \).

3 Future validation

The foreseen validation of the TOA GERB solar clear-sky fluxes once the algorithm will be finalized is twofold:

- Instantaneous solar clear-sky fluxes should exhibit a symmetric diurnal cycle with respect to the local noon. Such property will be used to assess the accuracy of those composite fluxes compared to an ideal (fitted) diurnal cycle.
- Monthly averaged fluxes will be compared to the CERES Energy Balanced and Filled (EBAF) TOA monthly fluxes [5]. However, discrepancies are expected to occur to some extent due to different broadband radiances, scene IDs and satellite orbits. Moreover, to perform meaningful comparisons, both datasets will have first to be corrected for any systematic offset.

4 Perspectives

Once validated both on an instantaneous as well as on a monthly basis, these clear-sky fluxes will allow to study the radiative forcing of clouds and aerosols according to their type, thermodynamic phase (for clouds) and/or optical depth. Such instantaneous radiative forcing studies will surely improve various parameterization schemes within GCMs and NWP models. On a longer time-scale, decadal study of these radiative forcing could provide an insight on the response of the global circulation with respect to the climate change.

References


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