

# Benefits and the main challenges of estimating sunshine duration through geostationary data

07. Data and products for emerging services

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Maria Livia Lins Mattos Gava<sup>1</sup> , Simone Costa<sup>1</sup> , Caio Sena<sup>1</sup>

<sup>1</sup> National Institute For Space Research

Sunshine duration (SDU) is a crucial variable for many applications such as agriculture and energy sector. Despite its significance, in situ networks tasked with measuring SDU are usually sparse and insufficient to cover large areas. Moreover, in situ records are point-based observations. Consequently, SDU data in surrounding regions has to be obtained through interpolation techniques. The accuracy of these interpolations hinges largely upon the quantity and spatial distribution of meteorological stations, typically leading to interpolated fields that are inadequate to capture the temporal and spatial variability of SDU. An alternative to these caveats is the employment of geostationary data to estimate SDU. This approach benefits from the high spatial and temporal resolution, along with large data coverage. The Satellite and Meteorological Sensors Division of the National Institute for Space Research (DISSM-INPE) and the Satellite Application Facility on Climate Monitoring (CM SAF) from EUMETSAT have developed SDU products based on visible imagery obtained through GOES and METEOSAT, respectively. Validation against in situ measurements in Brazil indicated an overall good performance of the products. However, some deficiencies have been identified. In the present work, these identified deficiencies are explored, and the main challenges in the process of estimating SDU through geostationary data are pinpointed. Four key aspects were disclosed: (i) The time gap between sunrise/sunset and the first/last image available as input for the SDU's estimate algorithm; (ii) The number of observations available to estimate SDU; (iii) The assessment of clear-sky reflectance and (iii) The diurnal cycle of clear-sky reflectance. Effectively addressing these features can enhance the overall accuracy and positive outcomes of the SDU satellite-based product. Nevertheless, it is known that some constraints are inherent to satellite-derived SDU, emphasizing the need for ongoing optimization efforts between data developers and users.