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Assessing the impact of viewing and illumination geometry on LST retrievals

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Land surface temperature (LST) is a crucial parameter in a wide range of applications that include meteorological and climate modeling and the physics of land surface processes. Since 2005, the EUMETSAT Satellite Application Facility on Land Surface Analysis (LSA-SAF) has been disseminating in near real time and on a 15-minute basis estimates of LST based on SEVIRI instrument on-board Meteosat Second Generation (MSG). The product includes quality indicators estimated for each pixel that take into account the impact of several factors such as the uncertainty of surface emissivity, the water vapor content of the atmosphere and the satellite view angle. However, several studies have pointed out that retrieved values of LST over an heterogeneous pixel may strongly depend on the viewing and illumination angles as well as on the characteristics of the vegetation cover. The aim of the present study is to assess the impact of the latter factors as a first step towards deriving an uncertainty range in retrieved values of LST. For this purpose we have relied on the so-called Modified Geometric Projection (MGP) model, which is built on the geometric optics part of the Geometric Optical–Radiative Transfer (GORT) model. The MGP model was used to estimate the fraction of each MSG pixel that is viewed by each of the following three "pure" components: sunlit background, shaded background and vegetation. First, a study was performed on the sensitivity of retrieved LST to viewing and illumination angles, as well as to fraction of vegetation cover and to characteristics of vegetation. A calibration exercise of the MGP model was also done using a time series of in situ observations of upwelling radiation fluxes as obtained from the LSA-SAF validation site in Évora (Portugal). Measurements are performed by a rotating radiometer that allows discriminating between sunlit background, shaded background and vegetation. Data are supplied every 2 minutes and respect to the years of 2005 and 2006. An overview of the results will be given and a discussion will follow putting special emphasis on how this information may be used in to refine the quality flag of the LST product.