Geophysical Research Abstracts
Vol. 14, EGU2012-7265, 2012
EGU General Assembly 2012

A Review of the Strategy for the Meteosat Solar Band Calibration

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One of the EUMETSAT missions is to operate European geostationary meteorological satellites. Up to now, 30 years of Meteosat observations in the visible and the infrared part of the spectrum have been retrieved and archived. These observations have been acquired first by the MVIRI instruments aboard Meteosat 2 to 7, and since 2004 by the SEVIRI radiometers on-board Meteosat 8 and 9. More data will come with Meteosat 10 and 11, and the future Meteosat Third Generation Flexible Combined Imager (MTG-FCI). During the course of the years, technology and data processing capabilities have improved significantly, leading to higher observation frequencies, pixel resolutions, and number of bands available in the visible part of the spectrum. Whereas MVIRI channels include only one broad solar band (ranging from 0.45 to $1\mu m$), SEVIRI senses the Earth disc in four solar band channels (from a total of twelve channels), and the future FCI instrument will have eight solar band channels (from a total of sixteen channels). In order to support real-time, near real-time, and long-term applications such as climate monitoring, the definition of a framework for the operational calibration of the solar band channels is essential in order to ensure data quality and traceability to community agreed calibration references. This framework must integrate more and more stringent requirements on the calibration accuracy and on the long-term behaviour of the instruments. This paper describes the strategy adopted by EUMETSAT for the calibration of the solar band channels for the past, present and future geostationary imagers. This strategy includes the implementation of recommendations and standards as formulated by the Global Space-based Inter-Calibration System (GSICS) and QA4EO (a quality assurance framework for Earth Observation).
We will present work done on the development of a vicarious calibration system that is based on the comparison between observed and modelled radiances over desert targets (Govaerts et al. 2004). This system is pre-eminently suited for calibrating observations from radiometers that are not equipped with on-board calibration systems, such as for the MVIRI and SEVIRI radiometers. Although MTG-FCI, the next generation of radiometers, will be calibrated via on-board calibration units, vicarious calibration will still be needed to track temporal instrument drifts, to monitor the temporal degradation of the on-board calibration units, or to face more dramatic scenarios such as unit failure. To cover the full dynamic range of the instruments will require a combination of methods, such as the use of deep convective clouds (DCCs), Rayleigh scattering (over ocean targets), or lunar observations. Additionally, new inter-calibration algorithms are being implemented to enhance traceability to common references, and to homogenize the Earth observation data sets that are currently provided by the weather satellite operators.