Geophysical Research Abstracts
Vol. 13, EGU2011-1939, 2011
EGU General Assembly 2011

Lightning monitoring from a geostationary orbit: MTG Lightning Imager concept and processing challenges

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The Lightning Imaging Sensor (LIS) onboard the Tropical Rainfall Measurement Mission (TRMM) platform has provided a continuous source of lightning observations in the +/- 35 deg latitude region since 1998. LIS, together with its predecessor Optical Transient Detector (OTD) have established an unprecedented database of optical observations of lightning from a low-earth orbit, allowing a more consistent and uniform view of lightning that has been available from any ground-based system so far. The main disadvantage of LIS is that, since it operates on a low-earth orbit with a low inclination, only a small part of the globe is viewed at a time and only for a duration of $\sim$2 minutes, and for a rapidly changing phenomenon like convection and the lightning related thereto this is far from optimal. This temporal sampling deficiency can, however, be overcome with observations from a geostationary orbit. One such mission in preparation is the Lightning Imager on-board the Meteosat Third Generation (MTG) satellite, which will provide service continuation to the Meteosat Second Generation (MSG) system from 2018 onwards.

The current MSG system has become the primary European source of geostationary observations over Europe and Africa with the start of nominal operations in January 2004, and will be delivering observations and services at least until 2018. However, considering the typical development cycle for a new complex space system, it was already for a longer time necessary to plan for and define the MTG system. MTG needs to be available around 2017, before the end of the nominal lifetime of MSG-3.

One of the new missions selected for MTG is the previously mentioned Lightning Imager (LI) mission, detecting continuously over almost the full disc the lightning discharges taking place in clouds or between cloud and ground with a resolution around 10 km. The LI mission is intended to provide a real time lightning detection (cloud-to-cloud and cloud-to-ground strokes) and location capability in support to NWC and VSRF of severe storm hazards and lightning strike warning. As lightning is strongly correlated with storm related phenomena like precipitation, hail and gust, a further objective of the LI mission is to serve as proxy for intensive convection related to ice flux, updraft strength and convective rainfall. Lightning can also serve as proxy for adiabatic and latent heating to be assimilated in global/mesoscale NWP models. Finally, for atmospheric chemistry, lightning plays a significant role in generating nitrogen oxide. The natural nitrogen oxide budget is a matter of great uncertainty at this time, and long-term observations of one of its sources will prove valuable as the subject develops.

The MTG LI mission concept and status will be presented and discussed. An emphasis will be put on describing the processing concepts from raw data to end-user products, and the various related challenges in processing, such as false lightning event filtering.