Meteosat Third Generation Lightning Imager

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The MTG Lightning Imager (LI) mission is planned in line with the recommendation of WMO 'Commission for Basic Systems' (11 July 2008) to add lightning imagers to the operational geostationary satellites to specifically measure cloud to cloud lightning for better locating areas of intensive convection within extended storm systems. As recommended several agencies plan to add lightning observation capabilities to their next generation of geostationary satellites. In view of a more unified operational geo observing system the MTG LI is intended to provide a real time total lightning detection capability of cloud-to-cloud (IC) and cloud-to-ground (CG) flashes, with no direct discrimination between the two types.

The MTG LI will observe continuously and simultaneously the full visible disk, with high temporal resolution and it has the highest timeliness among the MTG instruments, since it has no scanning cycle. Such a lightning detection of IC and CG flashes from a geostationary orbit is regarded as a complementary source of lightning data to that provided by the ground-based lightning location systems (LLSs). Global LLS networks which are limiting their detection capability to mainly CG flashes will be supported by the delivery of the IC flashes. Regional LLS networks, delivering data on IC and CG flashes with good quality, are limited to industrialized countries and equivalent information is lacking or provided with considerably less quality over the oceans, over Africa and other less developed parts of the world. Data combined over Europe from several regional LLS networks are inhomogeneous as a consequence of network geometry, national borders, orography, network changes and also varying data quality across the networks. The MTG LI, in contrast, will provide over the hemisphere lightning data with high spatial homogeneity facilitating the development of operational NWC applications on the European or hemispheric scale. Providing additionally the IC flash information for the global LLS networks and serving as reference system for the divers regional LLS networks the ground-based LLS and satellite-based lightning imagers clearly complement each other.

A long-term stable system delivering spatially homogeneous information on total lightning will benefit to assess the impact of climate change on thunderstorm activity by globally monitoring and long-term analysing the lightning characteristics. It further will be a prerequisite for studying and monitoring the physical and chemical processes in the atmosphere regarding NOx, which does play a key role in the ozone conversion process and acid rain generation. With LI on MTG in cooperation with the two NOAA GLMs (Geostationary Lightning Mappers) placed on the GOES-R/S satellites a major part of the globe will already be covered assuring also the long term availability of such a system.

As a summary, several unique benefits can be identified from the use of LI data in applications. These are derived from studies which were initiated by the EUMETSAT Secretariat, which in turn are based on e.g. reviewing the existing literature on the use of lightning information from space. According to these, the MTG LI:

- provides the ability to detect the very first cloud flashes, thus giving valuable additional lead-time for precise warnings of lightning strikes,
- can provide the total lightning rate continuously for any location in the field of view and thus enable the application of warning algorithms for the most dangerous storm related hazards, with its capability to detect total lightning (IC+CG) provides this essential information for the air traffic safety and complement ground-based observations which may, for example, be covering only the immediate vicinity of the airport,
- provides an additional data source for monitoring ground strike risk, and in remote areas it supports an early detection and reaction to these phenomena (e.g. ignition of forest fires),

- Facilitate the development of a new approach for more accurate satellite rainfall measurements when combined with other satellite measurements,
- obtained data that can be ingested and assimilated in mesoscale models to improve significantly the very short range forecast of severe convection events,
- can be used for verification/validation of NWP models and would be especially beneficial in areas outside of Europe,
- is specifically suitable to provide NOx data supporting atmospheric chemistry since long-range ground-based lightning detection systems do not detect IC lightning,
- provides long-term monitoring of severe weather events and potential relations with effects from global and regional climate change,
- provides independent and guaranteed access to lightning data for the weather services,
- will be a contribution of EUMETSAT in support of nowcasting and warning of severe weather events in developing countries, particularly in Africa,
- provides an independent lightning data access for security operations.

There are further benefits stemming from synergies between LI and the other MTG instruments, as it provides continuously lightning data between the successive scans of the imager and sounder. For example, combining sounding (IRS), imaging (FCI) and lightning detection (LI) capabilities on a geostationary observing system will allow tracking and characterizing convective systems from their cradle to the grave. In particular adding the lightning information will firstly extend the knowledge on the stage of the convective system over time and secondly, even more important, will provide the missing information on when and where within the system lightning occurs. This information is also essential to successfully validate the NWC algorithms applied within the very early stage of the lifetime of a developing convective system to forecast time and location of initiation of lightning with a long lead time.

For technical aspects please refer to EUMETSAT web site:
http://www.eumetsat.int/Home/Main/Satellites/MeteosatThirdGeneration/index.htm?l=en

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