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LIGHTNING IMAGING FROM GEO: AN INNOVATIVE SENSOR FOR METEOSAT THIRD GENERATION

Abstract

The Lightning Imager for Meteosat Third Generation is an optical payload with on-board data processing for the detection of lightning. The instrument will provide a global monitoring of lightning events over the full Earth disk from geostationary orbit and will operate in day and night conditions. The requirements of the large field of view together with the high detection efficiency with small and weak optical pulses superimposed to a much brighter and highly spatial and temporal variable background (full operation during day and night conditions, seasonal variations and different albedos between clouds oceans and lands) are driving the design of the optical instrument. The main challenge is to distinguish a true lightning from false events generated by random noise (e.g. background shot noise) or sun glints diffusion or signal variations originated by micro-vibrations. This can be achieved thanks to a 'multi-dimensional' filtering, simultaneously working on the spectral, spatial and temporal domains. The spectral filtering is achieved with a very narrowband filter centred on the bright lightning O2 triplet line (777.4 nm 0.17 nm). The spatial filtering is achieved with a ground sampling distance significantly smaller (between 4 and 5 km at sub satellite pointing) than the dimensions of a typical lightning pulse. The temporal filtering is achieved by sampling continuously the Earth disk within a period close to 1 ms. This paper presents the status of the optical design addressing the trade-off between different configurations and detailing the design and the analyses of the current baseline. Emphasis is given to the discussion of the design drivers and the solutions implemented in particular concerning the spectral filtering and the optimisation of the signal to noise ratio.