The use of the Deep Convective Cloud Technique (DCCT) to monitor on-orbit performance of the Geostationary Lightning Mapper (GLM): Use of Lightning Imaging Sensor (LIS) data as proxy

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ABSTRACT: The Geostationary Lightning Mapper (GLM) on the next generation Geostationary Operational Environmental Satellite-R (GOES-R) will not have onboard calibration capability to monitor its performance. The Lightning Imaging Sensor (LIS) onboard the Tropical Rainfall Measuring Mission (TRMM) satellite has been providing observations of total lightning over the Earth's Tropics since 1997. The GLM design is based on LIS heritage, making it a good proxy dataset. This study examines the performance of LIS throughout its time in orbit. This was accomplished through application of the Deep Convective Cloud Technique (DCCT) (Doelling et al., 2004) to LIS background pixel radiance data. The DCCT identifies deep convective clouds by their cold Infrared (IR) brightness temperatures and using them as invariant targets in the solar reflective portion of the solar spectrum. The GLM and LIS operate in the near-IR at a wavelength of 777.4 nm. In the present study the IR data is obtained from the Visible Infrared Sensor (VIRS) which is collocated with LIS onboard the Tropical Rainfall Measuring Mission (TRMM) satellite.

The DCCT is applied to LIS observations for July and August of each year from 1998-2010. The resulting distributions of LIS background DCC pixel radiance for each July August are very similar, indicating stable performance. The mean radiance of the DCCT analysis does not show a long term trend and the maximum deviation of the July August mean radiance for each year is within 0.7% of the overall mean. These results demonstrate that there has been no discernible change in LIS performance throughout its lifetime. A similar approach will used for monitoring the performance of GLM, with cold clouds identified using IR data from the Advanced Baseline Imager (ABI) which will also be located on GOES-R. Since GLM is based on LIS design heritage, the LIS results indicate that GLM should also experience stable performance over its lifetime.

Doelling, D.R., L., Nguyen, and P. Minnis, 2004 : On the use of deep convective clouds to calibrate AVHRR data. Earth Observing Systems IX, W.L Barnes and J.J Butler, Eds., International Society for Optical Engineering (SPIE Proceedings, Vol. 5542), 281-289.