Lightning Imaging Sensor (LIS) for the International Space Station (ISS): Mission Description and Science Goals

Lightning Detection Technologies

R. J. Blakeslee[1], H. J. Christian[2], M. F. Stewart[2], D.M Mach[3], D. E. Buechler[2], W. J. Koshak[4]

[1]NASA Marshall Space Flight Center, Huntsville, AL 35812, USA, rich.blakeslee@nasa.gov
[2]University of Alabama in Huntsville, Huntsville, AL 35899, USA
[3]University Space Research Association, Huntsville, AL 35805, USA
[4]NASA Marshall Space Flight Center, Huntsville, AL 35812, USA

ABSTRACT: In recent years, NASA Marshall Space Flight Center, the University of Alabama in Huntsville, and their partners have developed and demonstrated space-based lightning observations as an effective remote sensing tool for Earth science research and applications. The Lightning Imaging Sensor (LIS) on the Tropical Rainfall Measuring Mission (TRMM) continues to provide global observations of total lightning after 17 years on-orbit. In April 2013, a space-qualified LIS built as the flight spare for TRMM, was selected for flight as a science mission on the International Space Station. The ISS LIS (or I-LIS as Hugh Christian prefers) will be flown as a hosted payload on the Department of Defense Space Test Program (STP) H5 mission, which has a January 2016 baseline launch date aboard a SpaceX launch vehicle for a 2-4 year or longer mission. The LIS measures the amount, rate, and radiant energy of global lightning. More specifically, it measures lightning during both day and night, with storm scale resolution, millisecond timing, and high, uniform detection efficiency, without any land-ocean bias. Lightning is a direct and most impressive response to intense atmospheric convection. It has been found that the characteristics of lightning that LIS measures can be quantitatively coupled to both thunderstorm and other geophysical processes. Therefore, the ISS LIS lightning observations will provide important gap-filling inputs to pressing Earth system science issues across a broad range of disciplines, including weather, climate, atmospheric chemistry, and lightning physics. A unique contribution from the ISS platform will be the availability of real-time lightning, especially valuable for operational applications over data sparse regions such as the oceans. The ISS platform will also uniquely enable LIS to provide simultaneous and complementary observations with other payloads such as the European Space Agency's Atmosphere-Space Interaction Monitor (ASIM) that will be exploring the connection between thunderstorms and lightning with terrestrial gamma-ray flashes (TGFs). Another important function of the ISS LIS will be to provide cross-sensor calibration/validation with a number of other payloads, including the TRMM LIS and the next generation geostationary lightning mappers (e.g., GOES-R Geostationary Lightning Mapper and Meteosat Third Generation Lightning Imager). This inter-calibration will improve the long term climate monitoring provided by all these systems. Finally, the ISS LIS will extend the time-series climate record of LIS lightning observations and expand the latitudinal coverage of LIS lightning to the climate significant upper middle-latitudes.