1-1-2021

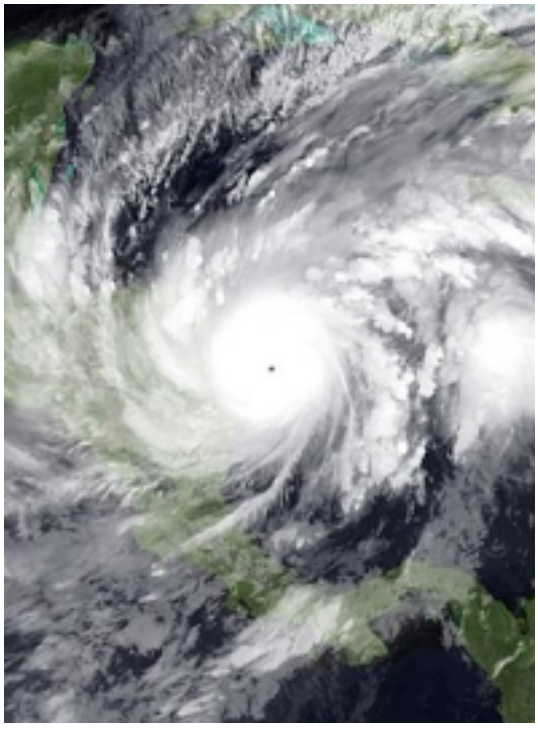
Monitoring Atlantic Hurricane Intensity Changes using 1-min GOES-16 Geostationary Lightning Mapper Data

John Mecikalski

Project ID: Mecikalski-GOES-STORM-UAH-2021
Title: Monitoring Atlantic Hurricane Intensity Changes using 1-min GOES-16 Geostationary Lightning Mapper Data
Mentor: Dr. John Mecikalski, Professor and Chair, Atmospheric and Earth Science Dept

With the advent of 1-minute data from GOES-16 and GOES-17, a considerable amount of otherwise hidden cloud information and processes can now be seen, which were under sampled or unavailable in older 15-minute resolution GOES data. In addition to the 16 visible and infrared channels from the Advanced Baseline Imager (ABI), the Geostationary Lightning Mapper (GLM) instrument is on GOES-16/-17 to provide near-continuous lightning data. GLM is a single-channel, near-infrared optical transient detector that is designed to detect the momentary (2 ms) changes in a cloud scene, indicating the presence of lightning. GLM data are integrated to 1 minute and 10 km resolutions, and made available for research and operational use, while all ABI data are available every 5 minutes.

The plan for this project will be to: (a) Analyze GOES-16/-17 GLM data over active hurricanes, which a focus on the Atlantic Ocean 2020 hurricane season (Fig. 1), in a manner that showsstorm aspects including intensity changes, eye-wall replacements, and outer rain band formation, or (b) Analyze GLM lightning or cloud-top features for the August 2020 Midwest derecho in comparison to radar observations and storm reports. Typically, radar observations depict precipitation and winds, while satellite imagery helps instead to characterize the updraft intensity within the clouds, which are linked to storm growth, the occurrence of severe weather, and lightning. Rapid 5-10 minute changes in cloud-top or lightning features observed in satellite imagery can subsequently help forecasters predict forthcoming severe weather, or identify severe weather where radar data are unavailable (e.g., over oceans, in remote land regions, in between radars).



For this project, the incumbent will perform the following analysis: (1) choose a region or storm of interest over which GOES 16/-17 imagery and GLM data are available, (2) download the key datasets for the day(s) of interest from the NOAA CLASS archive, (3) visualize and prepare the imagery for analysis in a common visualization and data analysis program (McIDAS, Python), (4) form analysis methods to collect infrared temperature, cloud top features and GLM lightning information for convective storms (e.g., the derecho) or hurricanes, (5) gain understanding of the evolving weather or storm phenomena in relationship to radar data or reports (i.e. hurricane intensity estimates or severe weather reports), (6) draw conclusions and present an analysis of the event, highlighting the unique information that becomes available when ABI

and GLM data were analyzed.

Figure 1: Hurricane Eta near peak intensity east of Nicaragua early on November 3, 2020.