Global Weather Hazards Project

The Global Weather Hazards (GWH) Project, operational since 2015, has proven that the capability exists to unlink and display weather products in the flight deck that are accurate, timely and useful for strategic decision making by commercial pilots (Kessinger et al. 2017a; Kessinger et al. 2017b; Olivo et al. 2018). For the past few years, a suite of standard and convective hazard products have been unlinked and displayed on the Electronic Flight Bag (EFB) as an overlay on the navigational charts. Standard products include Significant Meteorological Information (SIGMETs) and Aeronet's Meteorological Information (AIRMETs) for convection, turbulence and icing as well as Volcanic Ash Advisories are displayed to give hazard information to pilots. In addition, two convective weather products, the Convective Top Height (CTH) and the Convective Diagnosis Oceanic (CDO), are displayed for flight on the EFB on Lufthansa Airlines aircraft 747-8 and the future replacement of GOES-15 with GOES-16 and the future replacement of GOES-15 with GOES-17, will result in much simpler processing steps within the GWH system as well as considerable improvements in resolution and accuracy of the products. Also, the GOES-16 and GOES-17 include the Geostationary Lightning Mapper (GLM) instrument, whose data will be input into the CDO as an additional source of lightning data that augments the ground-based lightning data.

Better Decisions for Safety and Flight Efficiency achieved by augmenting the Cockpit WX Radar with Global/Regional WX Products

Conventional Cockpit Based Radar Display

Weather Phenomena limited to line of sight

Real-time Data Display

Limited Lateral Awareness

125 NM Look Ahead

~ 120 Degree Cone

Reliable On-Board Feed

Limited Range

Approved for Navigation

125 NM Look Ahead

Best tool for flying through Wx

Lacks global awareness

Adds potential of “flying into box”

Trans-Oceanic Flight Routes demand Regional to Global Weather Products

Geostationary Lightning Mapper (GLM)

The GOES-16 and GOES-17 satellites are equipped with the Geostationary Lightning Mapper (GLM) instrument, a new capability in lightning detection. The GLM has an advantage to see lightning over remote, oceanic regions with the same fidelity as over continental regions. Ground based detection networks have a reduced detection efficiency in remote, oceanic regions due to long distances between measuring stations.

The GLM updates at 20 second intervals and has about a 20 second latency. The coverage region for the GOES-16 GLM is from 50S to 50N in latitude. Lightning strike accumulations are done at 15 minute intervals, matching the satellite mosaic update rate. The GOES-17 GLM will have a similar latitude coverage, once available. The GWH is not yet ingesting the GLM data but plans to begin in 2019. Quality control processing to combine the lightning flashes into lightning groups is done as is examination of the quality control flags. We are investigating whether a parallel correction is needed.

EarthNetworks provides global lightning data to the GWH and updates at 1 min intervals. Lightning accumulations are done for 15 minutes, 30 minutes and 60 minutes. For remote, oceanic storms where the detection efficiency may be reduced, using three accumulation periods ensures a margin of aviation safety in case only a few of the lightning strikes are detected.

The lightning accumulations from EarthNetworks and from the GLM are merged into a combined lightning interest field before being input into the CDO (Kessinger, 2017). CDO results using only the EarthNetworks data are shown at upper right figure while CDO results using both EarthNetworks and the GLM are shown in the lower right figure. As can be seen by comparing the two figures, more lightning strikes are measured with the GLM (note the increase in the areas with interest values >2). Also, for regions of lightning detected by EarthNetworks, when adding in the GLM strike accumulation, the regions become slightly larger.

Advanced Baseline Imager (ABI)

The GOES-7 ABI developed a problem with overheating that causes data outages for limited periods and for particular channels. The CDO uses the 6.2 micron water vapor channel, and that is one of the channels that has an outage each night. The 11.2 micron channel, also used by CDO, is less effected. While both GOES-15 and GOES-17 are operating in tandem, the GOES-15 data will be substituted for the GOES-17 data when there are outages. The GWH plans to ingest the GOES-17 data early in 2019.