NASA SPoRT Overview

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The NASA Short-term Prediction Research and Transition (SPoRT) Center
Primary focus on utilizing total lightning observations
Other SPoRT capabilities
SPoRT Mission

**Mission:** Transition unique NASA and NOAA observations and research capabilities to the operational weather community to improve short-term weather forecasts on a regional and local scale

Bridge the “Valley of Death” through interactive partnership with end users and product or algorithm developers

Concept has been used to successfully transition more than 40 satellite datasets to operational users for nearly 15 years

Other groups in the community have adopted this Research to Operations/Operations to Research paradigm
Total Lightning

- Total lighting = cloud-to-ground and intra-cloud
- Physical reasoning for total lightning
  - Charging occurs in mixed phase region
  - Larger, stronger updrafts = more total lightning
- Advantages
  - Intra-cloud usually precedes first cloud-to-ground
  - Total lightning serves as proxy for storm strength
  - Monitor convective development / weakening
  - Observe the spatial extent
- How do we detect this?

**3.4° Reflectivity ~6100 m (mixed phase region)**

- **1450 UTC**
  - Total Lightning
  - Spatial extent
  - Developing updraft
  - Lightning 10s of km from updraft
  - Maximum of lightning coincident with updraft

- **1452 UTC**
  - Reflectivity ~6100 m (mixed phase region)
Geostationary Lightning Mapper (GLM)

- The GLM provides near hemispheric coverage
  - Generally consistent detection efficiency over most of the field of view
  - Available in data spare regions
  - 1 minute updates
  - Not proprietary (can show in real-time)
- Compared to traditional ground networks
  - GLM observes total lightning
  - GLM provides spatial extent
  - GLM detections consistent over land and water
- GOES-17 GLM available late 2018/early 2019
- Europe to launch similar instrument ~2022

GLM field of view for GOES-16 and -17 (above) and the corresponding field of view for the EUMETSAT Lightning Imager on Meteosat Third Generation (right)

13 June 2017 from 1719-1819 UTC (Preliminary, non-operational)
GLM Capabilities: Monitor Convection

- Identify spatial extent of lightning
  - Can extend well into the stratiform region
  - Signify possible updates to convective SIGMETs?
- Monitor convective updrafts
  - Train in regions with radar to earn trust
  - Use GLM alone in data sparse regions
- Identify convective / non-convective
- Monitor development

Example of GLM flash extent density overlaid on 10.3 micron ABI IR (left) compared to radar reflectivity (right)
Lightning Safety

- Flash extended 100+ miles
- GLM “connects the dots” – Earth Networks individual obs part of 1 contiguous flash
GLM Capabilities: The “stoplight” product

Example of the GLM stoplight product (left) with radar reflectivity covering 30 minutes from 1743-1813 UTC on 7 March 2018.

- New SPoRT ability
- Collaboration with local emergency managers
- Based on 30 min rule
- Show location and age of lightning obs in a single image
  - 0-9 min (red)
  - 10-19 min (yellow)
  - 20-29 min (green)
- Early reviews suggest not using green (may suggest safe)
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Cold Air Aloft Aviation Hazard

- Pockets of CAA (Temperature ≤ -65°C) can freeze airliner fuel and regularly occurs at flight level in the arctic
- The Anchorage, Alaska, Center Weather Service Unit (CWSU) provides Meteorological Impact Statements (MIS) to Air Traffic Controllers to direct flights around CAA
- In data sparse Alaska, forecasters have relied on analysis and model fields and limited radiosonde observations to guess the 3D extent of the Cold Air Aloft
- SPoRT is involved in a multi-organizational collaboration to provide satellite observations for forecasting Cold Air Aloft (CAA) events
- Use of satellite observations provides an opportunity for forecasters to observe the 3D extent of the Cold Air Aloft in real-time
Satellite Soundings

- Cross-track Infrared Sounder/Advanced Technology Microwave Sounder (CrIS/ATMS) vertical soundings processed through the NOAA Unique Combined Atmospheric Processing System (NUCAPS) are available in NWS Advanced Weather Interactive Processing System (AWIPS).

- Experimental capability to display plan view and cross section of temperature and moisture fields on millibar and flight levels (i.e. Gridded NUCAPS).
Product Displays

- CIRA developed the first display concept:
  - Displays CAA heights in units of flight level (hundreds of feet)
  - Polar-orbiting satellite data and Global Forecast System model output available for comparison
  - Includes microwave-only data
- Website used by forecasters as a backup when AWIPS data feed is down
- Website is publically available: http://rammb.cira.colostate.edu/ramsdis/online/cold_air_aloft.asp
Forecasters provided feedback that the satellite observations increased confidence in CAA events and had a large to very large impact on the decision to issue a MIS.

Large scale late February CAA event pivotal in raising awareness of CWSU CAA MIS beyond intended customer.

“The only way the pilots hear about our weather products [CAA MIS] is when they fly through our airspace and the ZAN controllers pass on our weather products to them.” – GW

CWSU Forecasters noticed a FEDEX aircraft traveling from MEM to ANC descended from FL360 to FL300 due to a freeze warning on their temperature indicator (PIREPS).

The CWSU CAA MIS was valid for temps < -65° C above FL340 in the same area.

This was one of the rare times the forecasters received feedback on aircraft in ZAN airspace changing their altitude due to CAA.
Cold Air Aloft Hazard Summary

• SPoRT is part of a multi-organizational effort to provide satellite observations to increase situational awareness of hazardous CAA events that occur at high latitudes

• These satellite observations are now routinely used by aviation forecasters at the Anchorage CWSU and are a valuable dataset for issuing CAA MIS statements

• SPoRT is looking for more opportunities to provide satellite observations to airlines or other international forecasting agencies concerned with CAA
Multispectral Composites

- Multispectral Composites combine several channels into one image to enable fast observation of features/hazards.
- SPoRT has a history of providing MODIS, VIIRS, AVHRR, and AHI Multispectral Composites to NWS National Centers, WFOs, AAWUs, and CWSUs to prepare for GOES-R and JPSS capabilities.
- SPoRT is part of the collaboration to baseline GOES-16/17 Multispectral Composites in AWIPS.
- Key Multispectral Composites for Aviation hazards:
  - Day-time/Night-time Microphysics
  - Dust
  - Volcanic Ash
  - Day Convection
  - Day Cloud Phase

(Imagery available on SPoRT web page and Web-Mapping Server)
Multispectral Composites

• Targeted, applications based-training with a peer-to-peer emphasis
• Types of training
  • Modules
  • Micro-lessons
  • Quick Guides
  • Interactive Quick Guides
  • Applications Library
• Applications Library
  • Short examples developed in collaboration with forecasters
  • Emphasis on regionally relevant, operational examples
• Viewable on SPoRT webpage or within AIR Tool in AWIPS
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