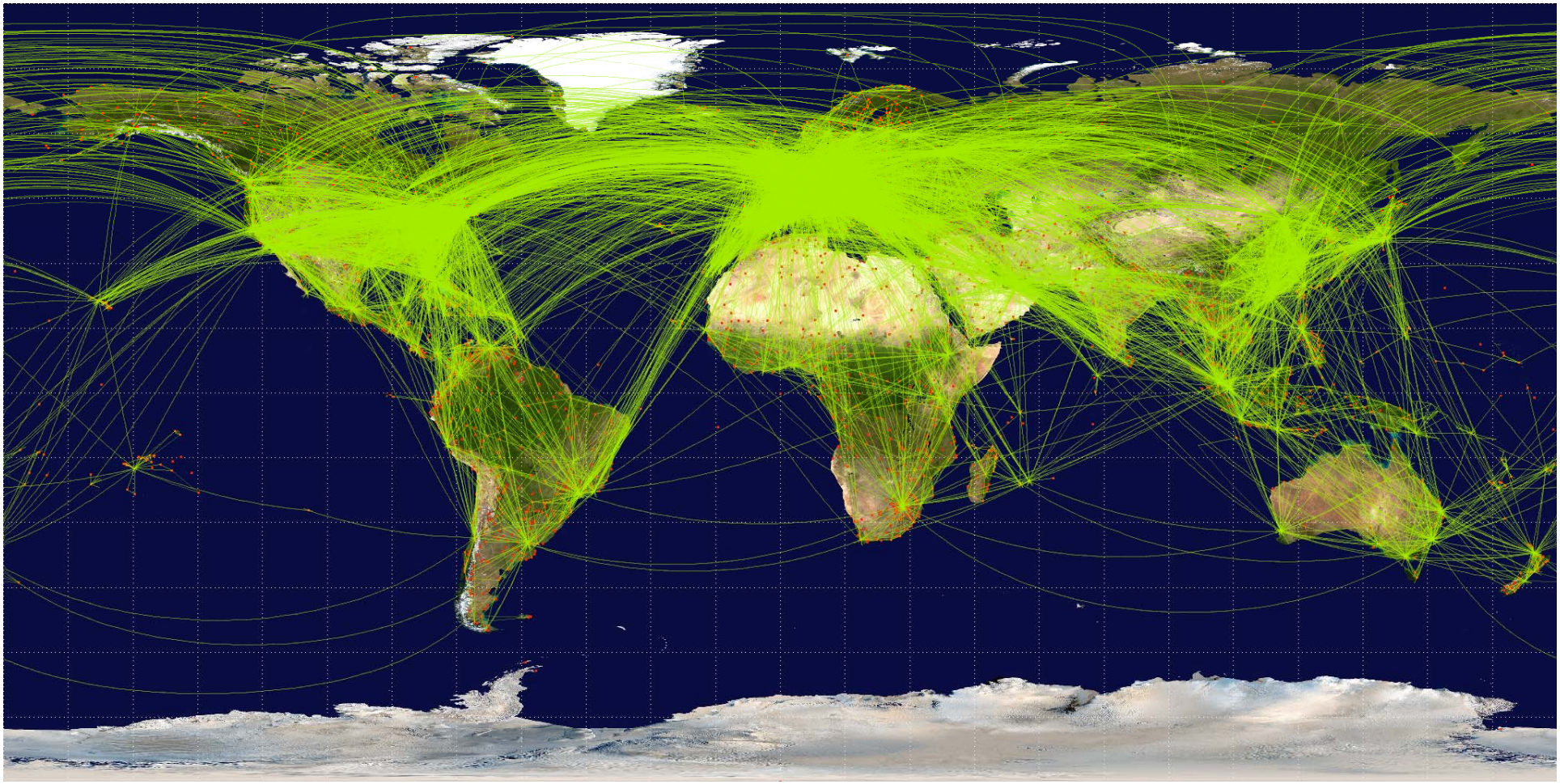
The Aviation Weather Center delivers consistent, timely and accurate weather information for the world airspace system. We are a team of highly skilled people dedicated to working with customers and partners to enhance safe and efficient flight.

A PERSPECTIVE FROM THE SKIES: SATELLITE APPLICATIONS AT THE AVIATION WEATHER CENTER

11 April 2013
College Park, MD

Amanda Terborg
Univ. of Wisc./CIMSS and Aviation Weather Center

The Impact… global

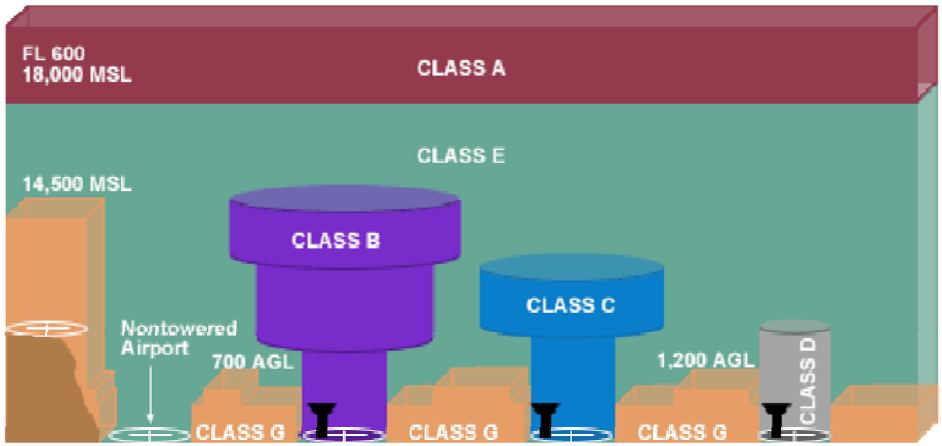


Flights around the globe

http://openflights.org/demo/openflights-routedb-2048.png

The Impact… National Airspace System

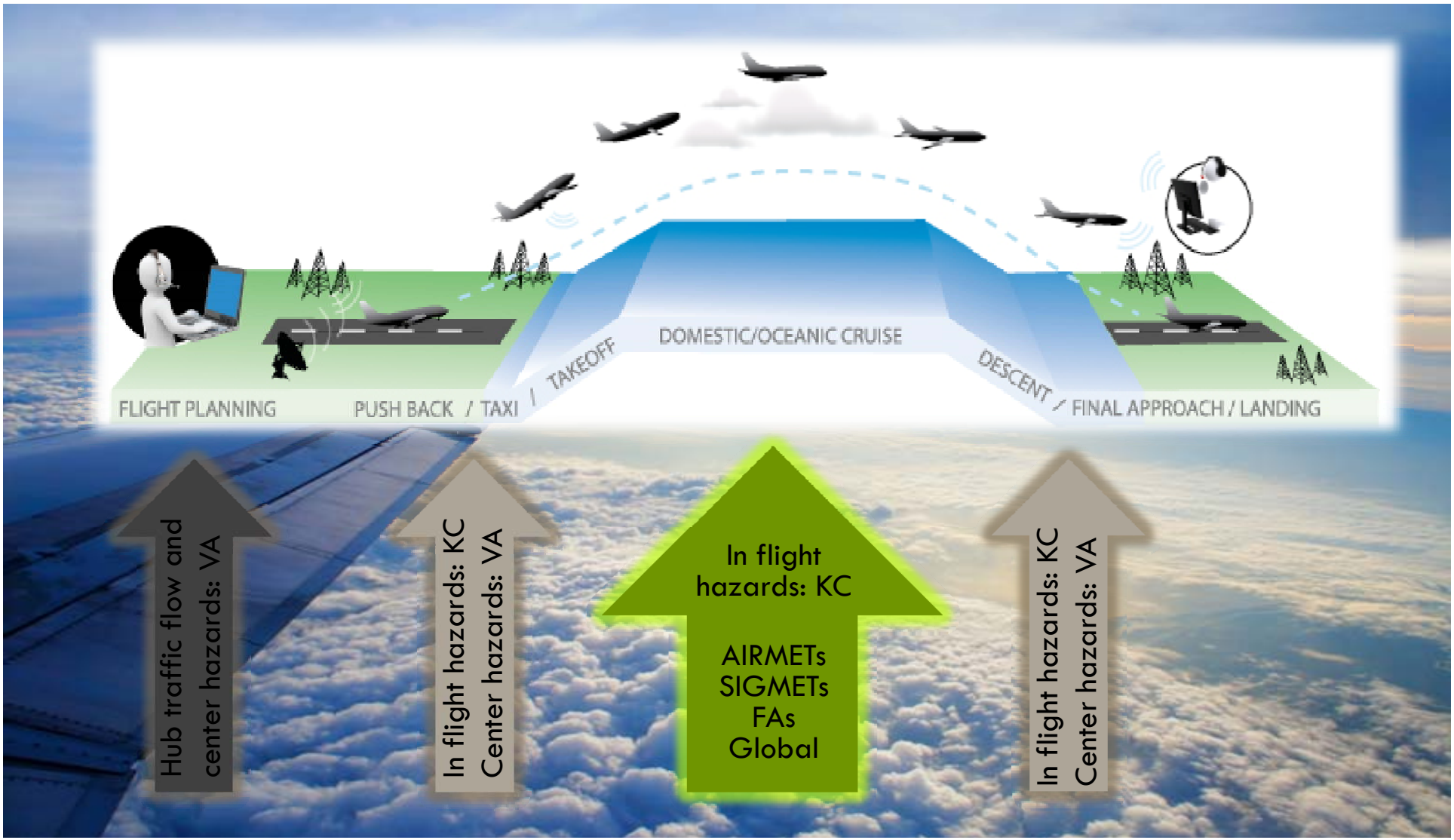
- **Class A:** FL180 – FL600 MSL
- **Class B:** SFC – FL180 MSL surrounding busiest airports (hubs)
- **Class C:** SFC – FL040 MSL surrounding airports with towers
- **Class D:** SFC – FL025 MSL surrounding airports with towers
- **Class E:** Everything else that is controlled
- **Class G:** Everything else that is uncontrolled



Airspace Features	Class A	Class B	Class C	Class D	Class E	Class G
ATC Facility	ARTCC	TRACON	TRACON or ATCT	ATCT	ARTCC	None
Operations Permitted	IFR	IFR & VFR	IFR & VFR	IFR & VFR	IFR & VFR	IFR & VFR
Entry Requirements	ATC Clearance	ATC Clearance	ATC Clearance for IFR. All require radio contact	ATC Clearance for IFR. All require radio contact	ATC Clearance for IFR. All require radio contact	None
VFR Minimum Distance from Clouds	N/A	Clear of clouds	500' below, 1,000' above, and 2000' horizontal	500' below, 1,000' above, and 2000' horizontal	500' below, 1,000' above, and 2000' horizontal	Clear of clouds
Aircraft Separation	All	All	IFR, SVFR, and runway operations	IFR, SVFR, and runway operations	IFR and SVFR	None

Courtesy of FAA

The Impact… forecasting



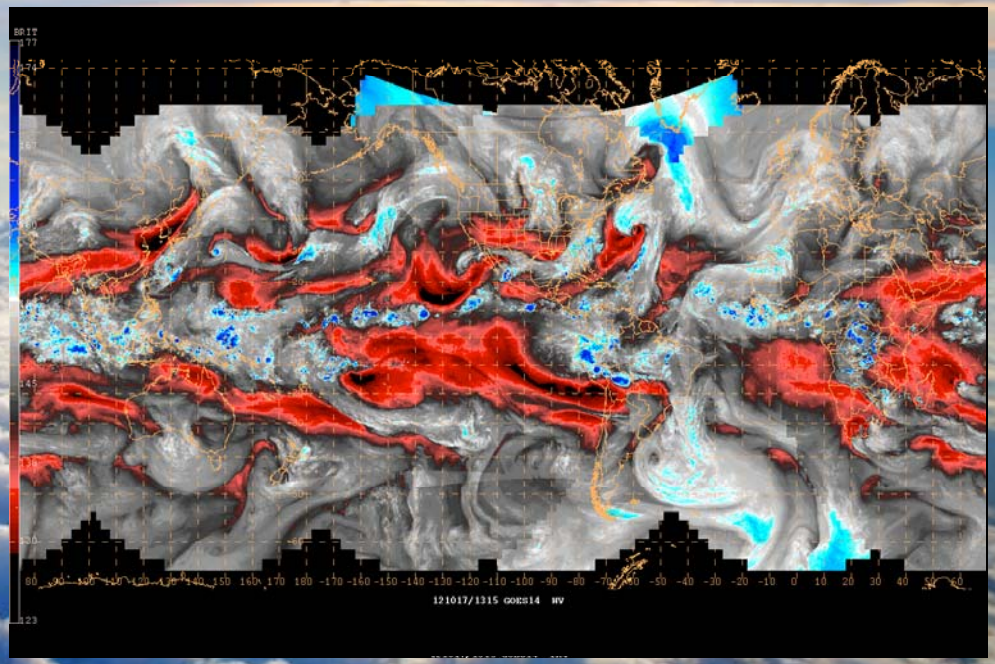
The Impact… satellite data

- **Satellites:**
  - GOES: domestic/offshore forecasting
  - Polar: polar/oceanic flight routes
  - International GEO: International flight routes and planning, oceanic flight routes
- **Applications at the AWC:**
  - Mosaics and global imagery – incorporation of new data
  - Winter and Summer Experiments
  - Aviation tool overlays: ASDI (flight tracking) and EDR (turbulence reports)
  - Research

Satellite Applications… mosaics

- Polar mosaics
  - Polar flight routes and global graphics
  - Preparing for GOES-R integration into stereographic imagery
  - Integration of VIIRS data into stereographic imagery?

- Global mosaics
  - Global graphics
  - Integration of VIIRS data into global mosaics
  - Integration of GOES-R data into global mosaics



Applications… AWC Proving Ground

GOES-R Product	Operational Status
Fog and Low Stratus*	AWC ops – July 2012
Cloud Top Cooling#	AWC ops – Oct. 2012
Overshooting Top/Enhanced "V" Detection#	AWC ops/testbed – Oct. 2012
Simulated Satellite Imagery (NSSL-WRF and NAM Nest)*#	Testbed – ops 2013
Pseudo Geostationary Lightning Mapper#	Testbed – ops 2013
NearCasting Model#	Testbed
ACHA Cloud Height Algorithms*#	Testbed
Flight Icing Threat*	Testbed
GOES-R Convective Initiation (UAH)#	Testbed
RGB Airmass	NAM ops – Oct. 2012

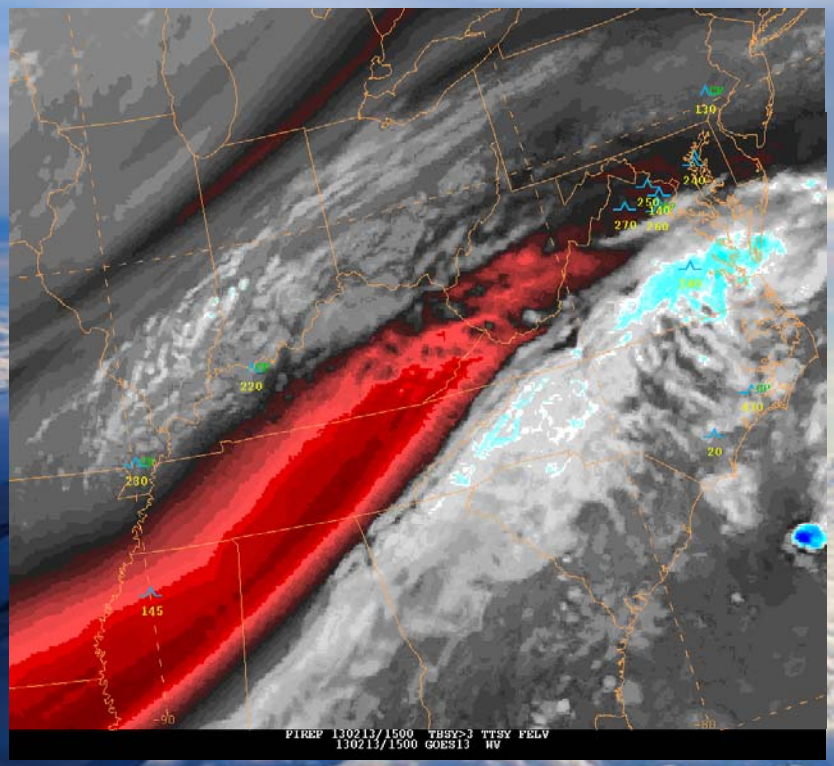
*Winter Experiment: 11-22 February 2013
#Summer Experiment: 12-23 August 2013

Applications… Winter Experiment

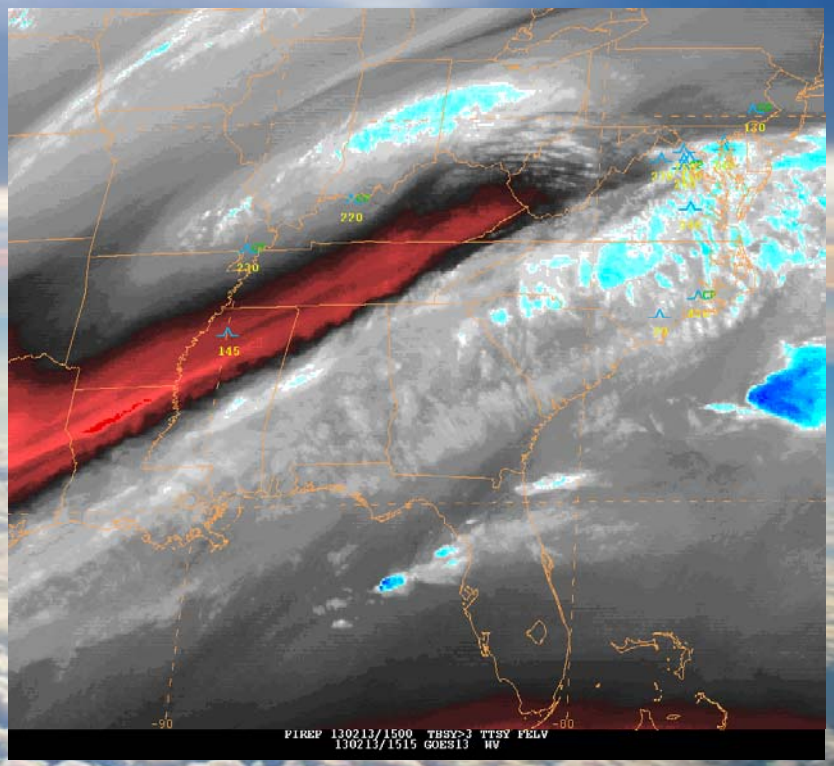
- February 11th – 22nd
- GOES-R Proving Ground
  - Flight Icing Threat
    - FIT
    - SLD, tops, bases
  - Synthetic imagery
    - WRF simulated ABI (bands 8 – 16, diff 10.35 – 3.9)
    - NAM simulated ABI (band 13 only)
  - Fog and Low Stratus
    - IFR probabilities
    - Cloud Thickness and Phase

Simulated Imagery - Turb

Feb. 13th, 2013 1500 UTC synthetic WV and 1500 UTC turbulence PIREPs

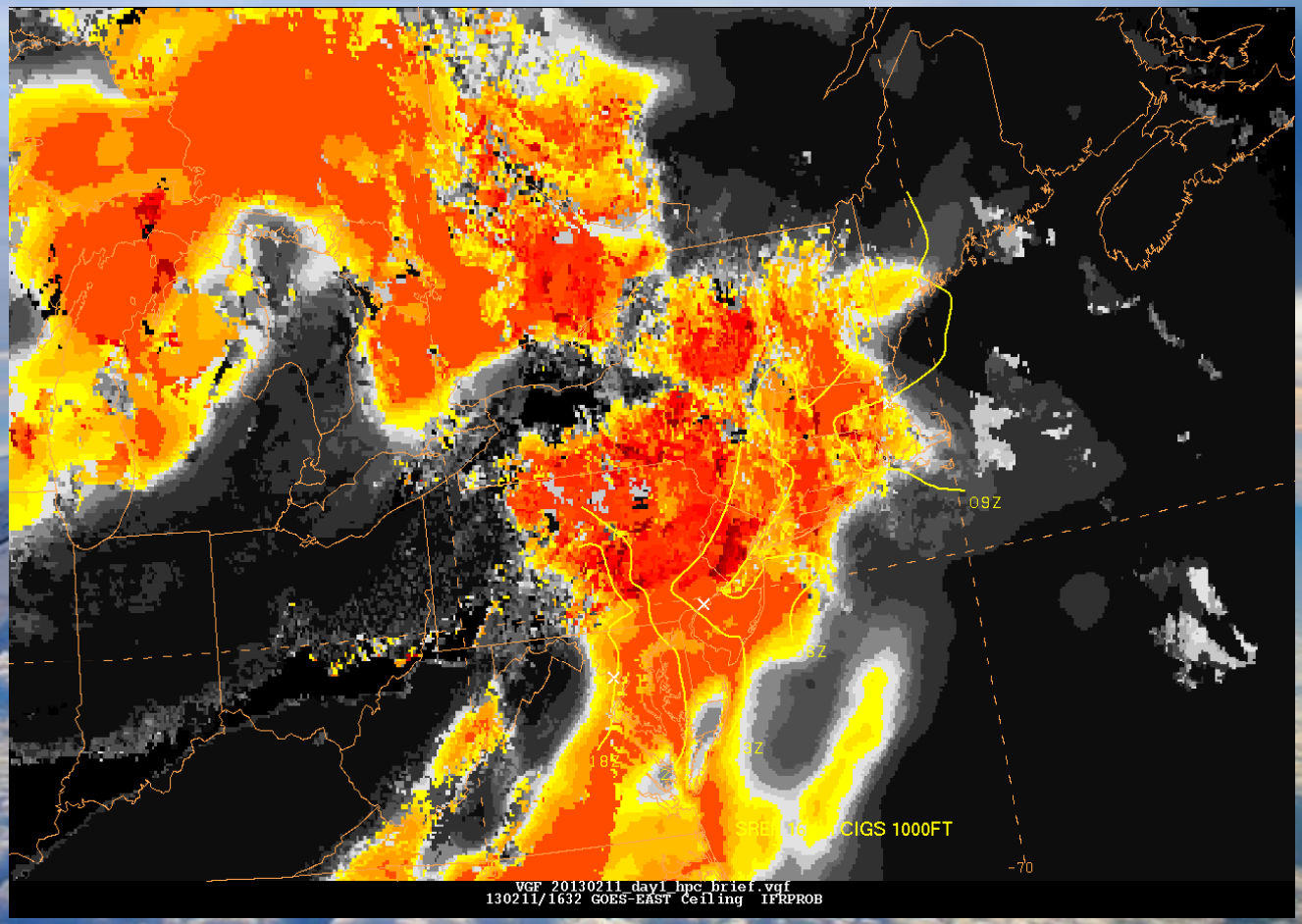


Feb. 13th, 2013 1515 UTC WV and 1500 UTC turbulence PIREPs



Fog and Low Stratus

Feb. 11th, 2013
1632 - 1902
UTC FLS and the
Feb. 11th NAM
desk forecast
(EXP)



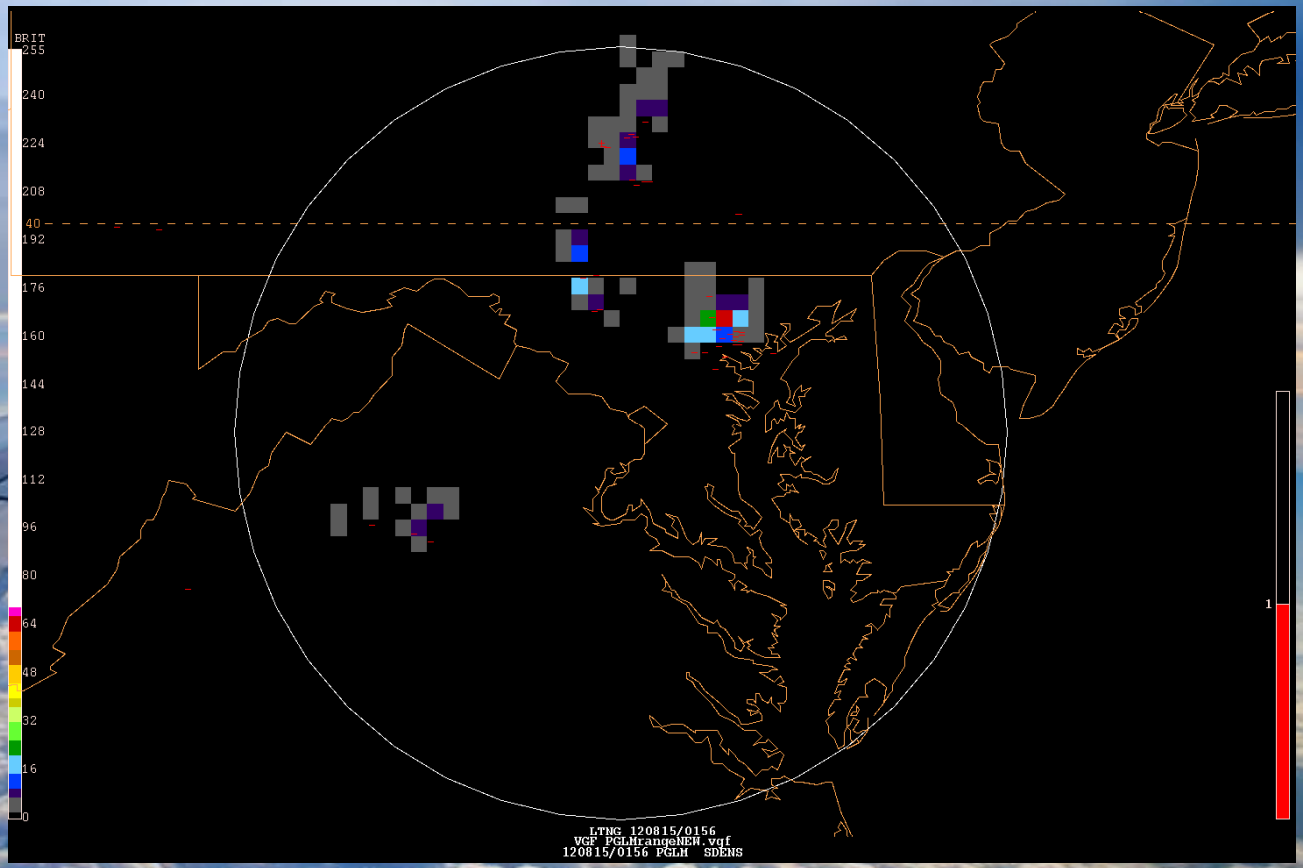
Applications… Summer Experiment

- August 12th – 23rd, 2013
- GOES-R Proving Ground
  - Synthetic imagery
    - WRF simulated ABI (bands 8 – 16, diff 10.35 – 3.9)
    - NAM simulated ABI (band 9 and 13)
  - Pseudo Geostationary Lightning Mapper (PGLM)
  - Convective Toolbox
    - Cloud Top Cooling
    - Overshooting Tops/Enhanced "V" Detection
    - GOES-R Convective Initiation
  - NearCasting Model
  - ACHA Algorithms

Pseudo Geostationary Lightning Mapper

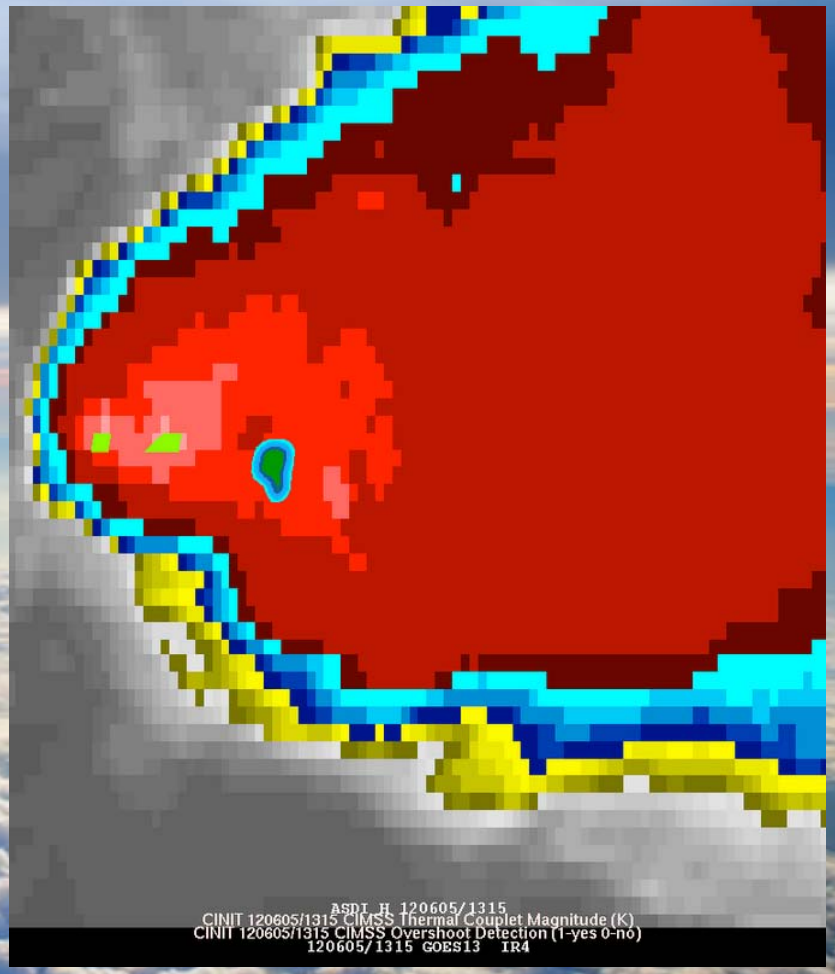
August 15th, 2012
0156 UTC PGLM total lightning and NLDN CG strikes

Uses: Convective SIGMET issuance and short term convection forecasting for centers/terminals



Overshooting Top Detection and Enhanced "V" Detection products

- June 5th, 2012, 1315 UTC IR Imagery and Overshooting Top/Enhanced "V" Detection
- Uses:
  - Finding divert routes in broad areas of convection
  - Data sparse regions (i.e. oceans, etc.)



Applications… ASDI and EDR

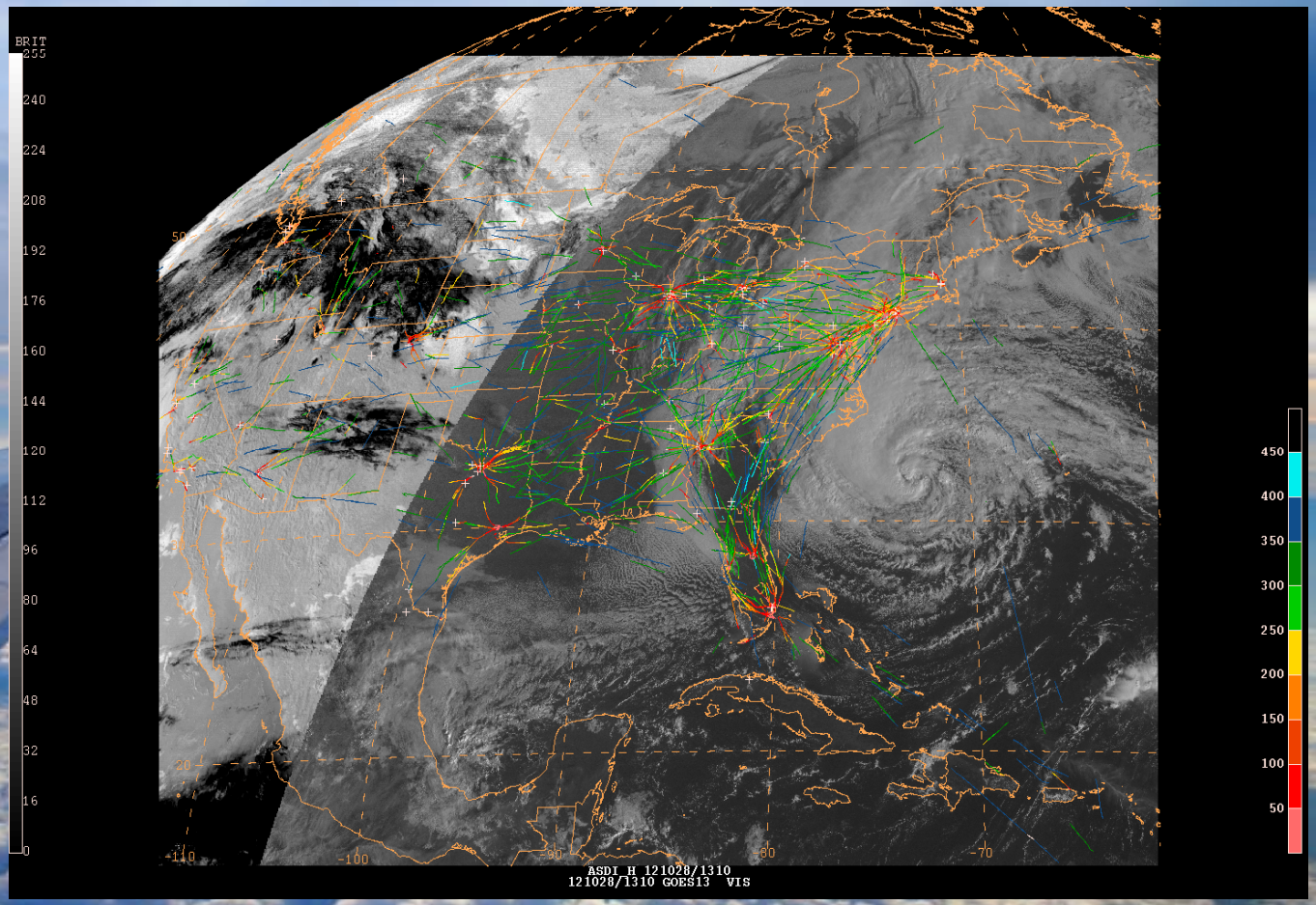
- Aircraft Situational Display to Industry (ASDI) data
  - 10 minute flight tracking data; available in both height (FL – feet) and time (Age – 2 min increments out to 14 min)
  - Can be overlaid with any satellite imagery (visible is the most common)
- Eddy Dissipation Rate (EDR) data
  - Provides in-situ data of atmospheric 'sea-state' from Delta and United Airlines B737s and B757s
  - Display includes intensity intervals, flight level, and ASDI data
  - Can be overlaid with any satellite imagery (WV is the most common)

Applications… ASDI; before Sandy…

October 28th, 2012, 1310 – 1615 UTC

ASDI flight routes and visible imagery showing Sandy's approach into the Northeast.

Note the busy airspace near D.C. and N.Y.

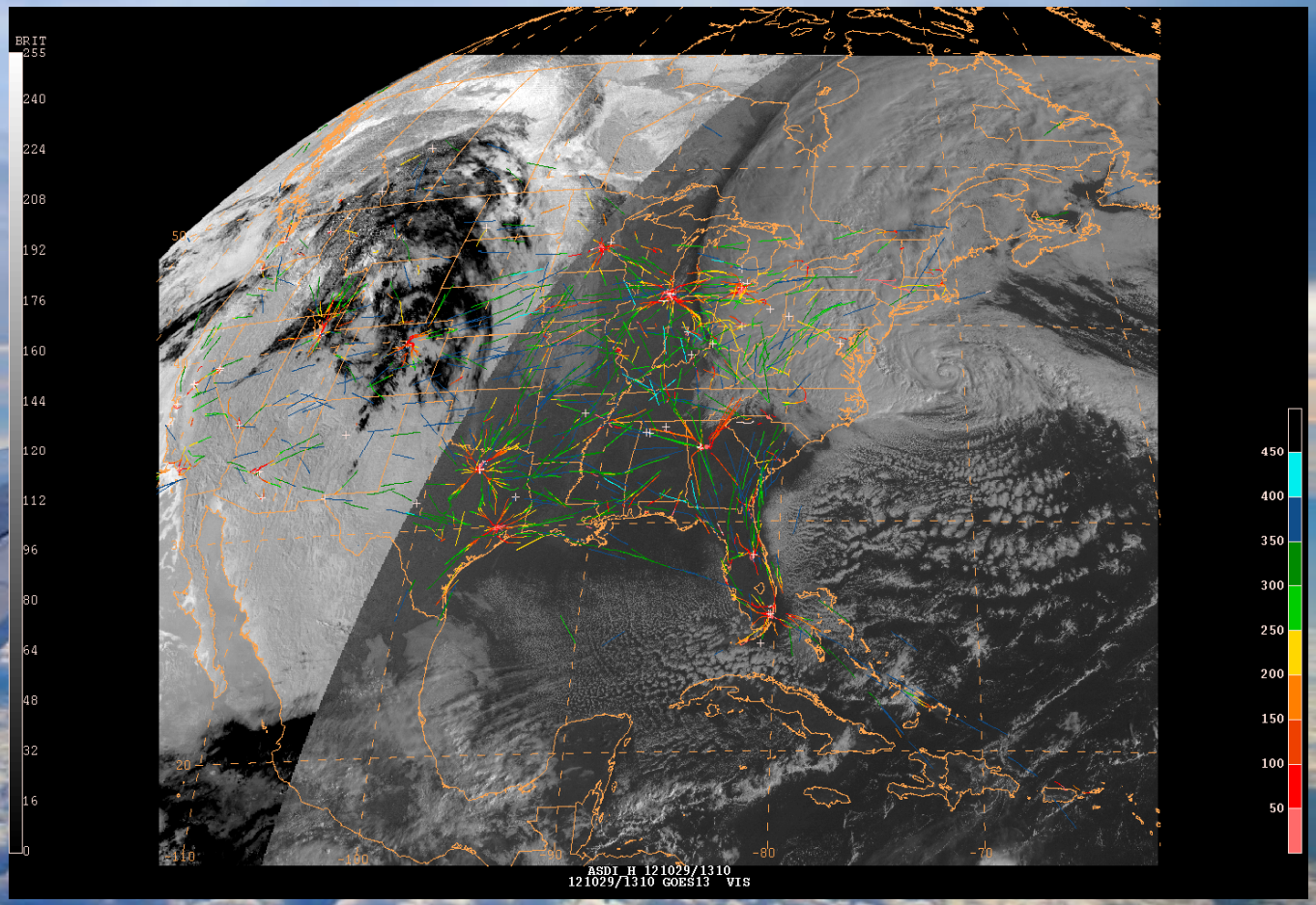


… and during Sandy

October 29th, 2012, 1310 – 1610 UTC

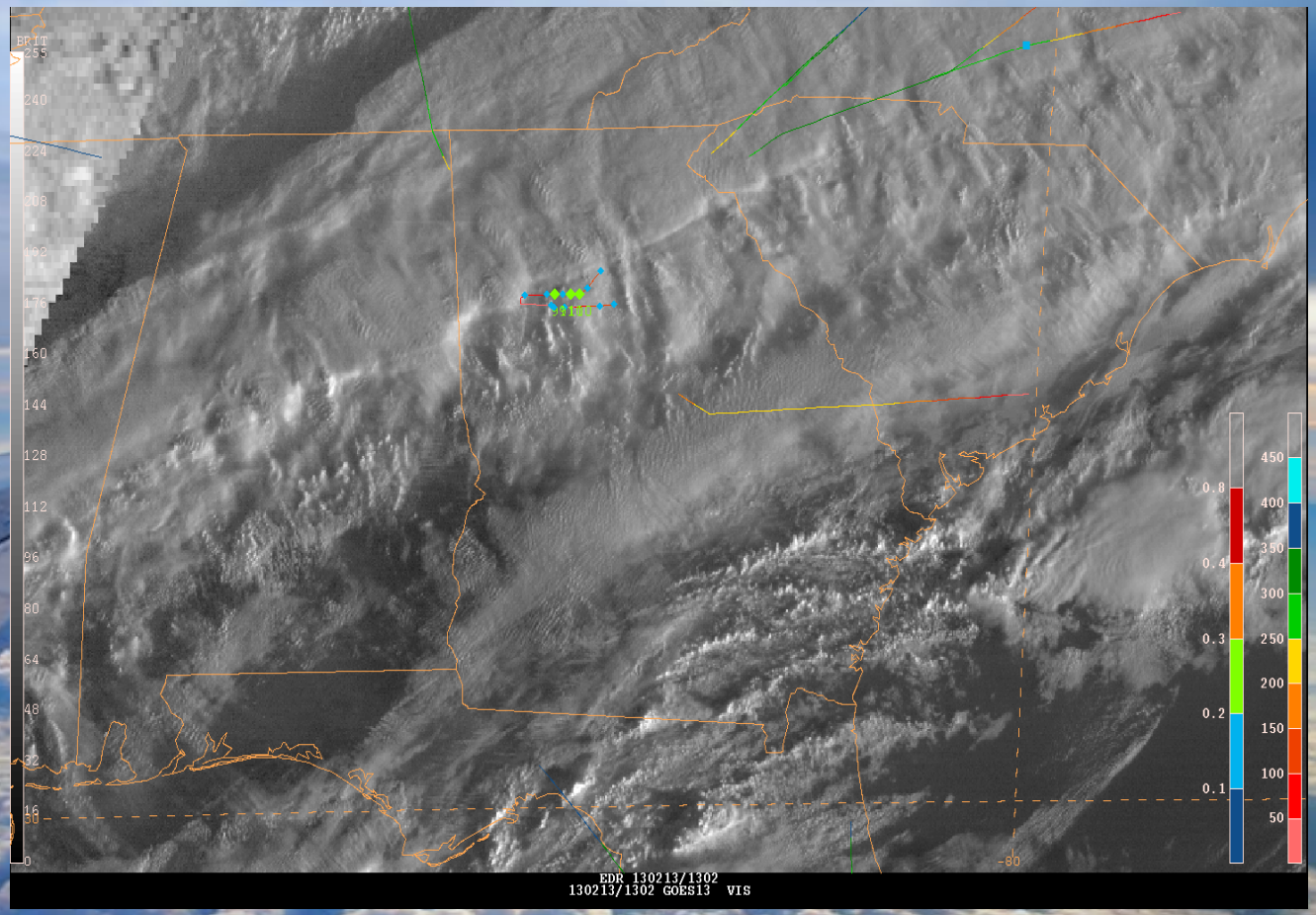
ASDI flight routes and visible imagery showing Sandy's landfall in the Northeast.

Note the nearly empty airspace in the New England area.



Applications… Eddy Dissipation Rate (EDR)

Feb. 13, 2013
1302 – 1415
UTC Eddy
Dissipation Rate
(EDR) turbulence
reports and
visible imagery



Applications… research

- Satellite Observed Signatures Associated with Moderate or Greater Turbulence Events
  - Compares MOG EDR turbulence events with MODIS IR, Visible, and WV imagery
  - Looks for signatures associated with MOG reports
- AWC involvement in the development of a turbulence detection product?
  - Enhance operational involvement in research
  - Involve forecasters in the research effort for products that will ultimately end up in front of them

In Summary…

- The AWC domain is global and considers all atmospheric levels
- Satellite data is heavily relied upon, particularly for data sparse regions like polar regions and over large bodies of water
- A variety of satellite applications have been designed to address the large and broad domain:
  - Mosaics/global imagery
  - New tools: GOES-R and VIIRS data; demonstrations
  - Additional tools: ASDI and EDR
  - Future collaborative research projects…

Thanks!