

The Transition of Atmospheric Infrared Sounder Total Ozone Products to Operations

Emily Berndt¹, Bradley Zavodsky², Gary Jedlovec²

¹NASA Postdoctoral Program Marshall Space Flight Center, Huntsville, Alabama

²Short-term Prediction Research and Transition Center NASA/MSFC, Huntsville, Alabama



American Meteorological Society 94th Annual Meeting
4th Conference on Transition of Research to Operations



Transitioning unique data and research technologies to operations



Short-term Prediction Research and Transition (SPoRT) Project

NASA SPoRT is focused on transitioning 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.

Successful paradigm for end user involvement

– footbridge over the “valley of death”

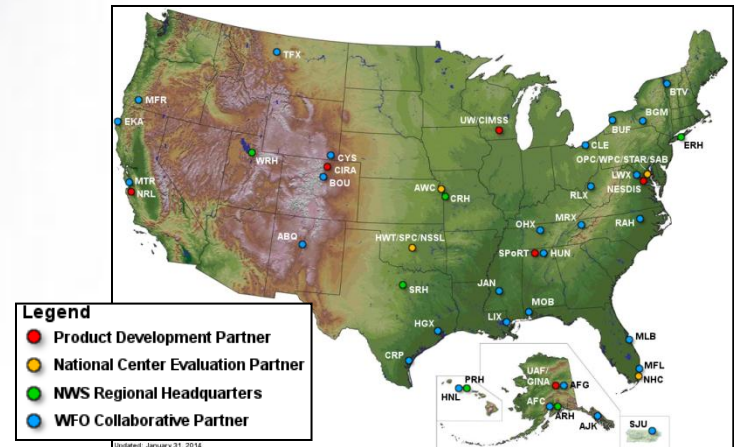
- link data to forecast problem
- test solution in “testbed” environment
- develop end user training
- transition solution to end user computer systems
- conduct assessment and impact studies
- involve end user in entire process – “ownership”

Partnering

- data and products: NOAA Cooperative Institutes and testbeds, NRL, universities
- end users: WFOs (>25) and National Centers (OPC, HPC, SPC, AWC, NHC) to evaluate/use experimental products

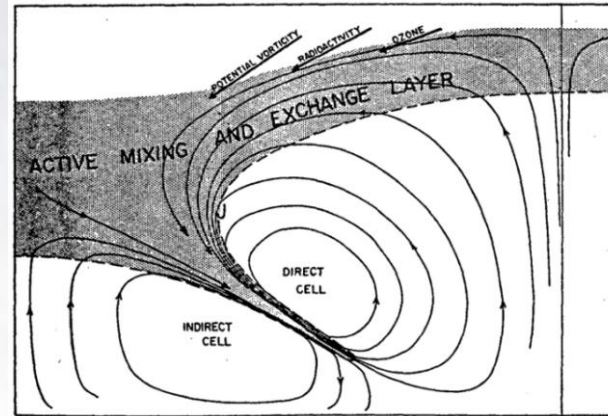
Observables and solutions to weather forecast problems provided by SPoRT

- Data for improved situational awareness of low clouds, fog, smoke and events causing obstructions to visibility
- Observations to cover data void regions (coastal and ocean regions) – coastal weather, ocean surface winds, SSTs
- Derived products to better understand regional atmospheric processes leading to storm development
- Lightning detection, safety, and severe weather forecasting
- Assimilating data into models for improved short-term forecasts of temperature, moisture, precipitation

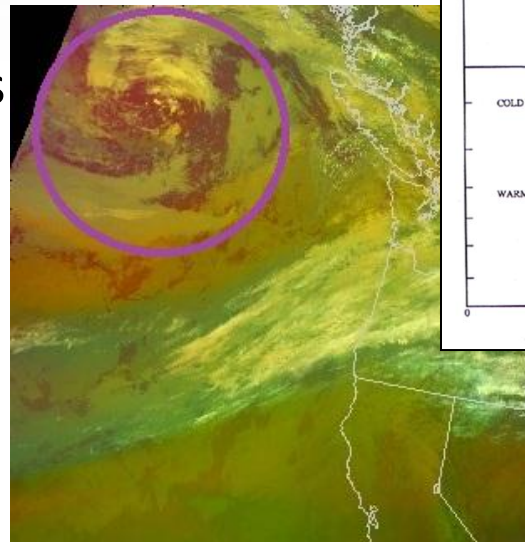


Why are AIRS Ozone Retrievals Important?

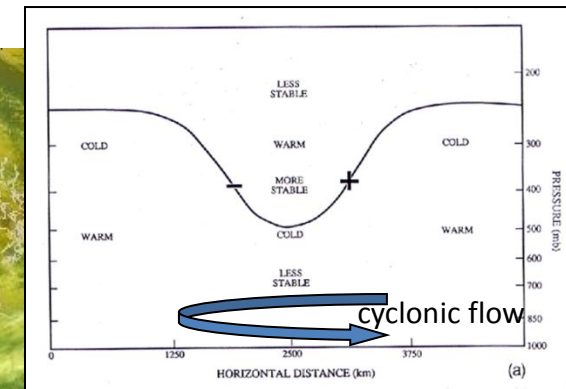
- High ozone values can indicate regions of stratospheric air and the potential for tropopause folding events
- Tropopause folds can be identified by potential vorticity and the presence of warm, dry, ozone-rich air
- Tropopause folds aid cyclogenesis or lead to non-convective wind events
- Complements the RGB Air mass product to identify stratospheric air and regions susceptible to tropopause folding



(Danielson 1968)



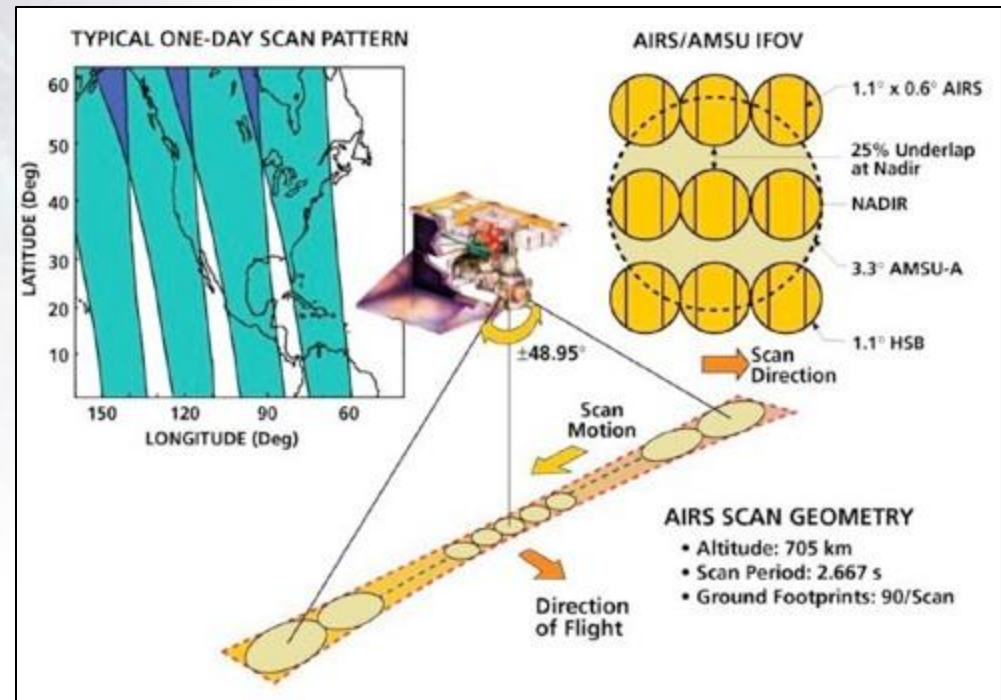
MODIS RGB Air Mass Image 26 June
2013 1027 UTC



Bluestein (1993, Synoptic-Dynamic Met., vol. II)

What is AIRS and when is it available?

- AIRS is a hyperspectral IR sounder on the polar-orbiting Aqua spacecraft
- AIRS measures temperature and water vapor with height as well as clouds, ozone, carbon monoxide, carbon dioxide, methane, sulfur dioxide, and dust
- 2378 channels from 3.75 – 15.4 μm
- Footprint of the L2 retrievals is 45 km at nadir; 100 km at limbs
- Swath width of 1650 km

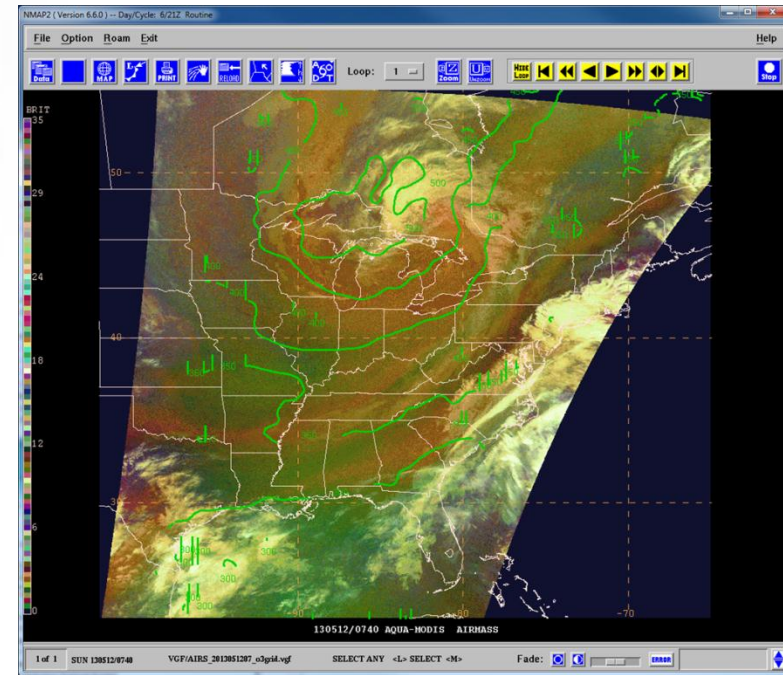


http://airs.jpl.nasa.gov/instrument/how_AIRS_works/

- 2x/day equatorial crossing time
1:30 AM and PM local time
(slight daily orbital variation)

What products does SPoRT create?

- Data obtained from NASA Land Atmosphere Near Real-time Capability for EOS (LANCER) with latency between 60 and 200 minutes
- SPoRT produces 2 products in image and gridded format:
 - Total Column Ozone
 - Ozone Anomaly
- Product is provided in hourly swaths, so SPoRT products have a 4-hour latency to utilize all granules



Real-Time Access

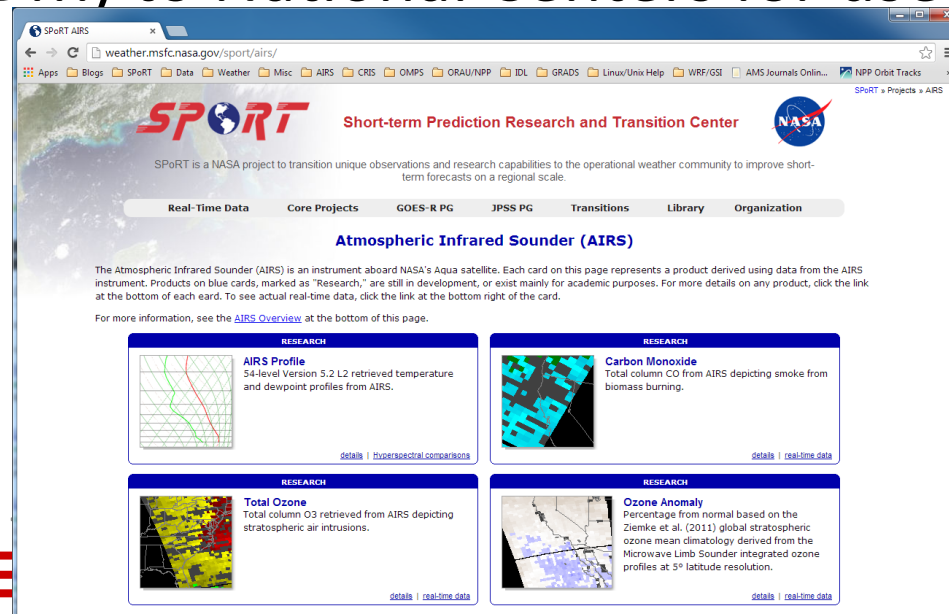
- Real-time image products are publicly accessible via the SPoRT webpage:

<http://weather.msfc.nasa.gov/sport/airs/>

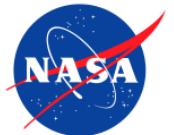
- Image products also available in KML/KMZ format

<http://weather.msfc.nasa.gov/sport/kml/getKml.html>

- Gridded products are sent via the Local Data Manager (LDM) to National Centers for use in NAWIPS

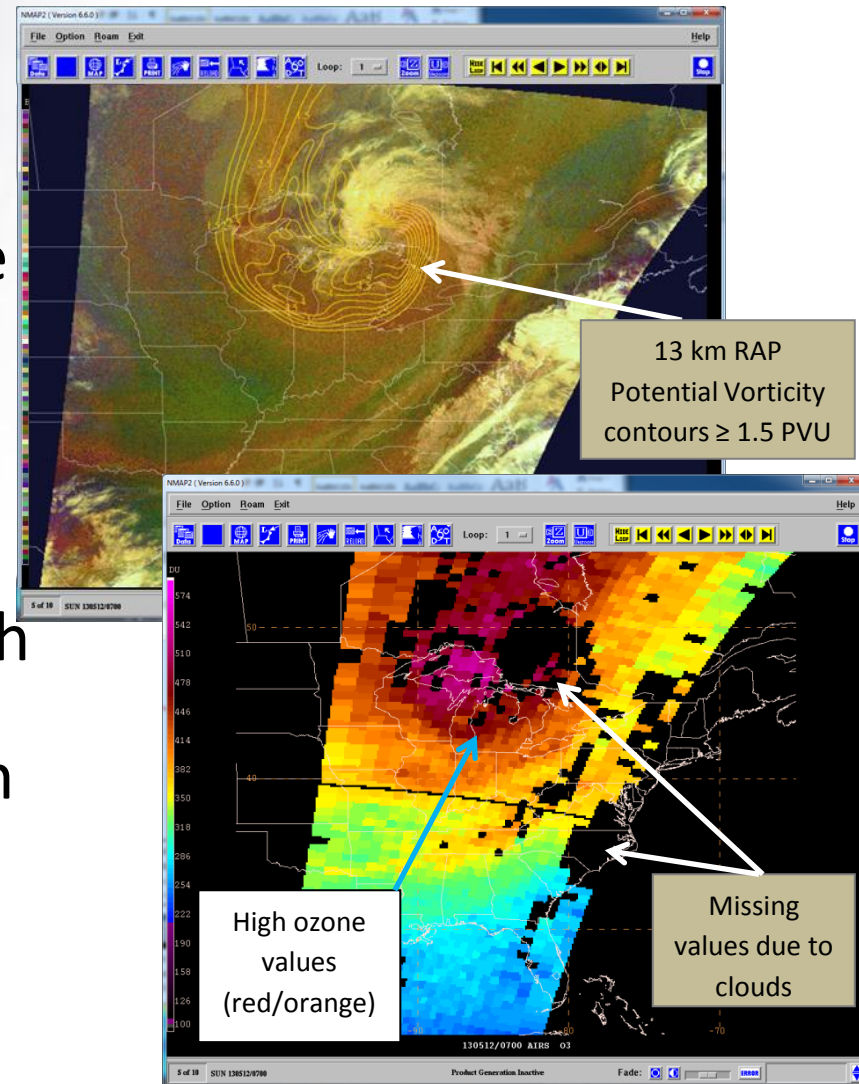


The screenshot shows the SPoRT website interface. At the top, there is a navigation bar with the SPoRT logo and the text "Short-term Prediction Research and Transition Center". Below this, a menu bar includes "Real-Time Data", "Core Projects", "GOES-R PG", "JPSS PG", "Transitions", "Library", and "Organization". The main content area is titled "Atmospheric Infrared Sounder (AIRS)" and contains a paragraph of text explaining the instrument and its data products. Below the text are four research cards, each with a small image and a title: "AIRS Profile", "Carbon Monoxide", "Total Ozone", and "Ozone Anomaly". Each card includes a brief description of the data and a link to "real-time data".



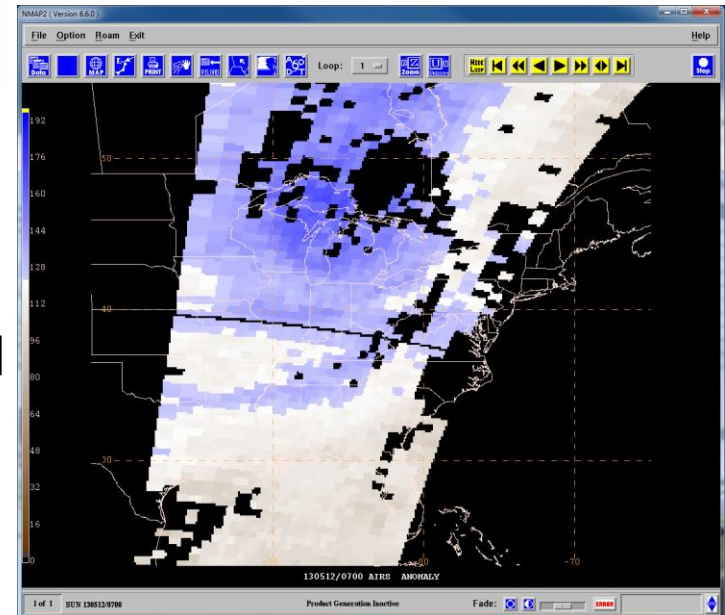
Example 12 May 2013

- SPoRT MODIS RGB Air Mass Image shows a region of red/orange coloring surrounding the low pressure center
- AIRS Total Column Ozone confirms there are high zone values in the region
- How do we know if these high ozone values represent stratospheric air or are within the climatological range?



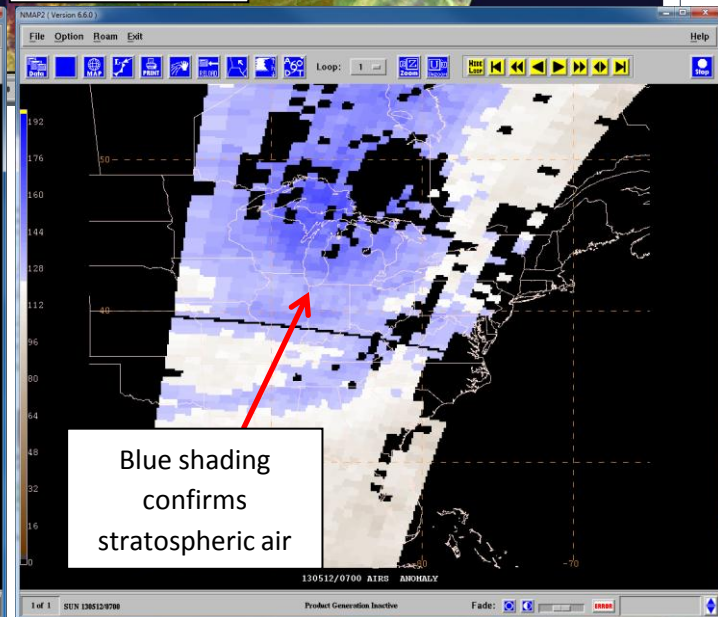
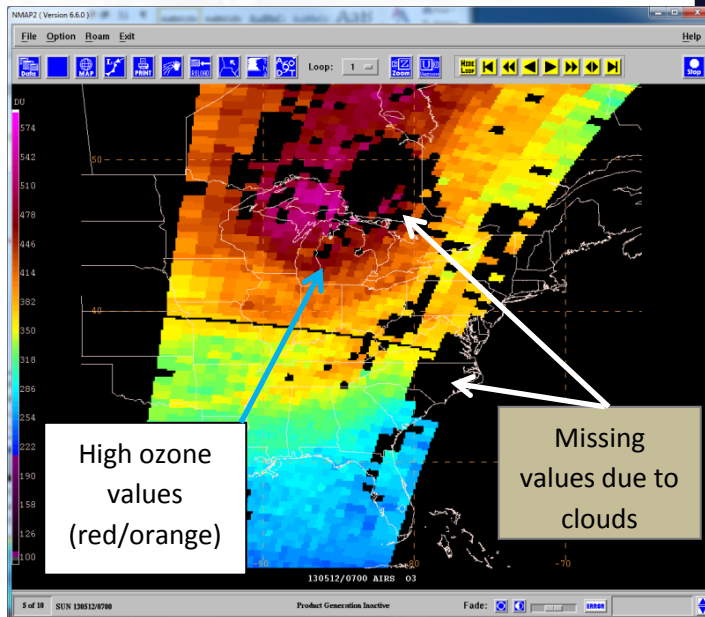
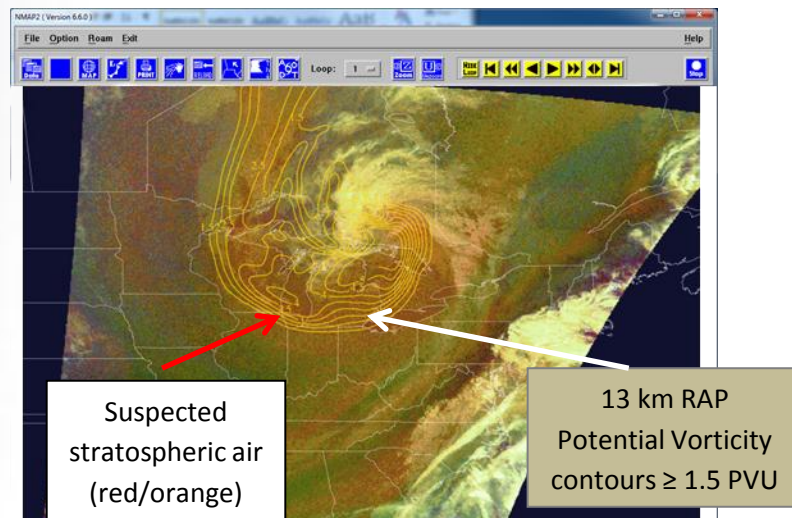
Ozone Anomaly Product

- Identification of stratospheric air based on high ozone values could be misleading if the values actually range within climatology since the mean varies seasonally and spatially
- The AIRS Ozone Anomaly product clarifies the presence of stratospheric air based on:
 - Stratospheric air has ozone values at least 25% larger than the climatological mean (Van Haver et al. 1996)
 - Global and zonal monthly mean climatology of stratospheric ozone derived from the NASA Microwave Limb Sounder (Ziemke et al. 2011)



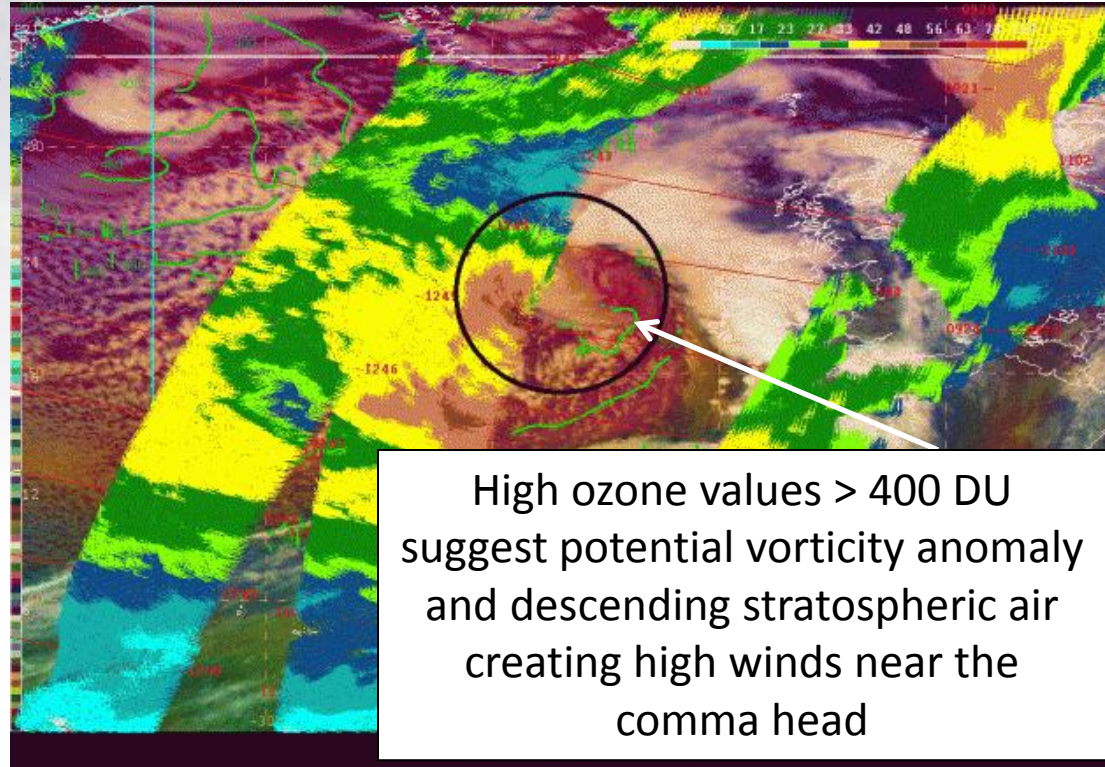
Example 12 May 2013

- SPoRT AIRS Ozone Anomaly product created as a percent of normal (0-200%)
- Shades of blue represent stratospheric air (ozone values $\geq 125\%$)



Transition to National Centers

- Gridded product currently under evaluation at Weather Prediction Center and Ocean Prediction Center
- Aid forecasting explosive cyclogenesis and hurricane force wind events in the Pacific and Atlantic Basins
- Example shows winds > 56 kts near the comma head and co-located with high ozone readings
- Product increases forecaster confidence in the mechanism producing the high winds



High ozone values > 400 DU suggest potential vorticity anomaly and descending stratospheric air creating high winds near the comma head

SEVIRI RGB Air Mass image, AIRS Total Column Ozone (green contours), and ASCAT winds valid at 1400 UTC on 12/18/13. The black circle highlights the descending stratospheric intrusion near the comma-head/bent back front. Image courtesy of Michael Folmer Satellite Liaison at NOAA/NWS WPC/OPC/TAFB and NOAA/NESDIS SAB

Future Work

- Adjust product according to forecaster feedback after the winter demonstration at the National Centers
- Elaborate on forecaster training to include a short module
- Make the products available in AWIPS-II
- Expand the ozone products to Suomi National Polar-Orbiting Partnership (NPP) instruments such as the Cross-Track Infrared Sounder (CrIS) and Ozone Mapping Profiler Suite (OMPS)

Questions?

Contact:

emily.b.berndt@nasa.gov

More information and on SPoRT AIRS products and real-time access at:

<http://weather.msfc.nasa.gov/sport/airs/>

Training materials at:

<http://weather.msfc.nasa.gov/sport/training/>



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