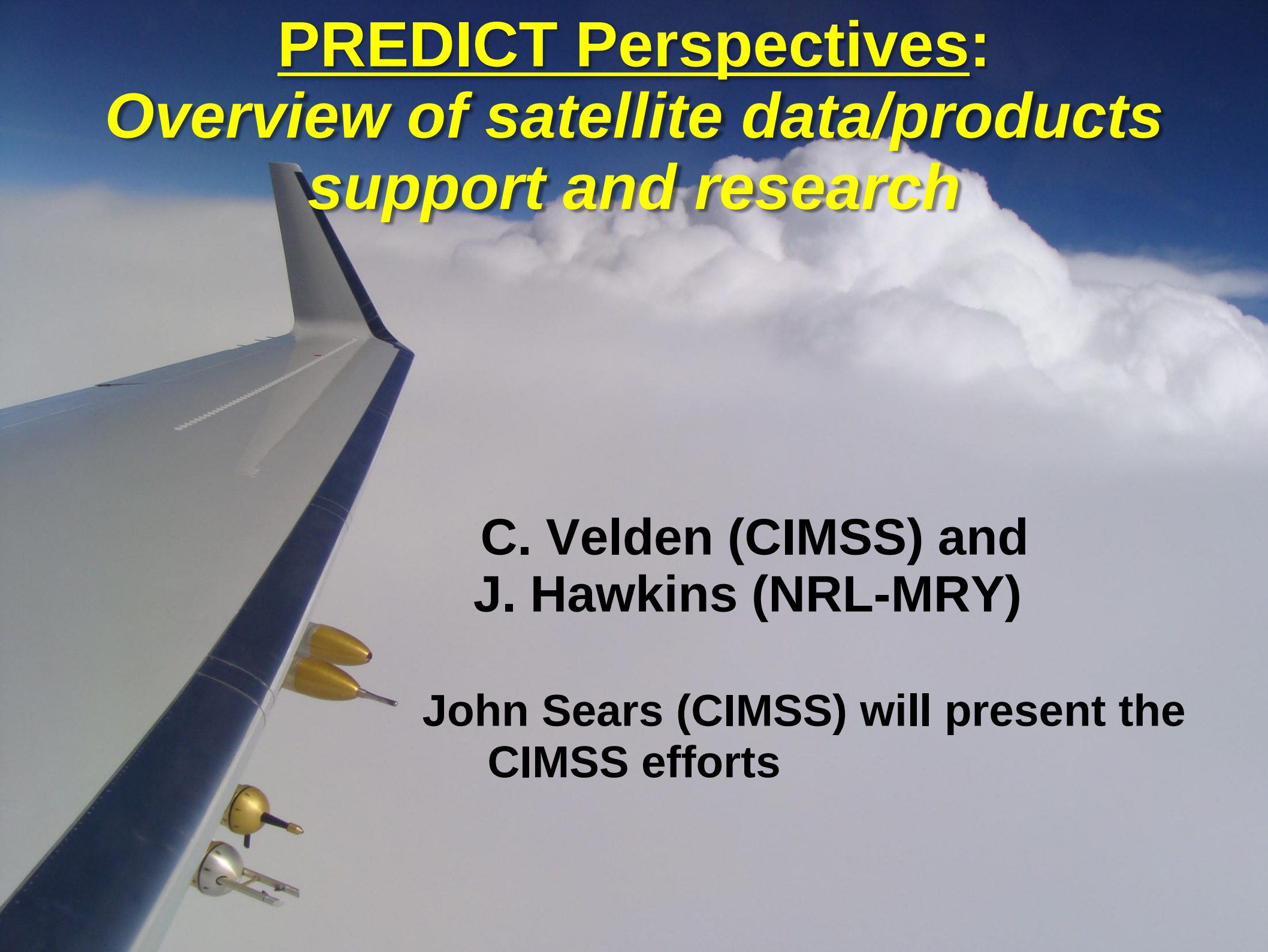
PREDICT Perspectives:
Overview of satellite data/products support and research

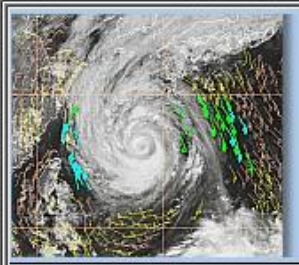


C. Velden (CIMSS) and
J. Hawkins (NRL-MRY)

John Sears (CIMSS) will present the CIMSS efforts

WEBSITE

http://tropic.ssec.wisc.edu/predict



Cooperative Institute for Meteorological Satellite Studies
Space Science and Engineering Center / University of Wisconsin-Madison

PREDICT *CIMSS Support Page*

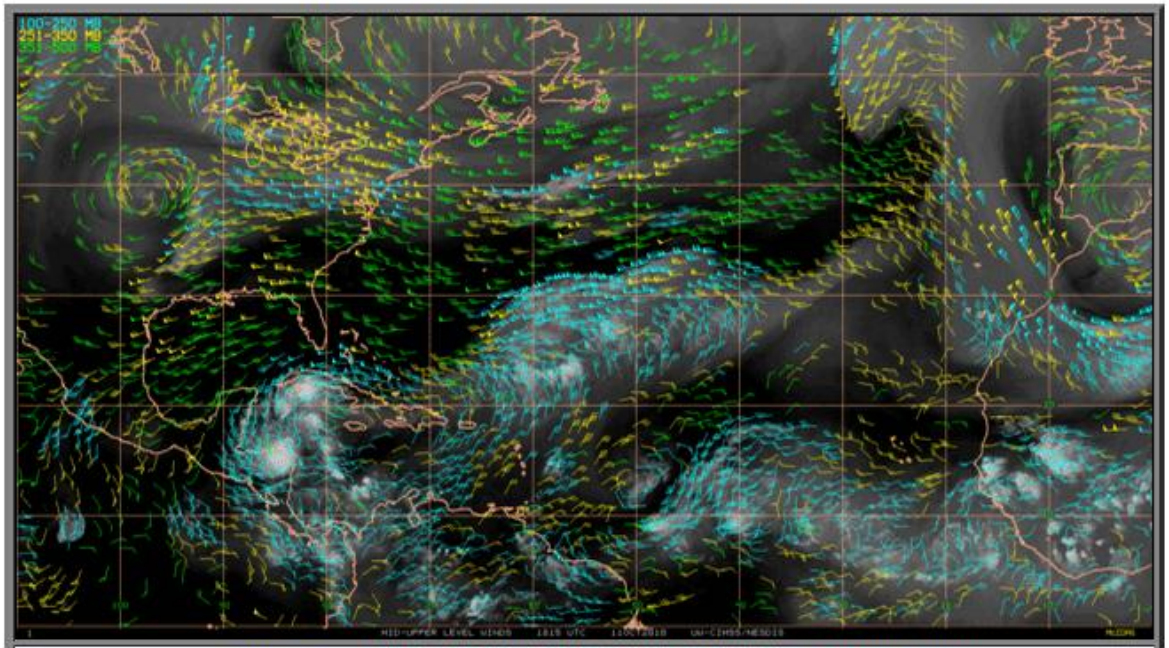
DATA STATUS *(as of 05 Oct 2010 / 20:01UTC) : All products currently available.*

Archive Blog Contact Us

Current Time : 08 June 2011 / 17:08:31UTC

Real-Time Products with Storm Coverage

Mouse over image for all hourly real-time products;



CIMSS TC ADT AMSU SATCON MIMIC-TC MIMIC-TPW
"Quick Links" Overshooting Tops SAL TPW-Invest Diagnosltics

Invest Products

WEBSITE

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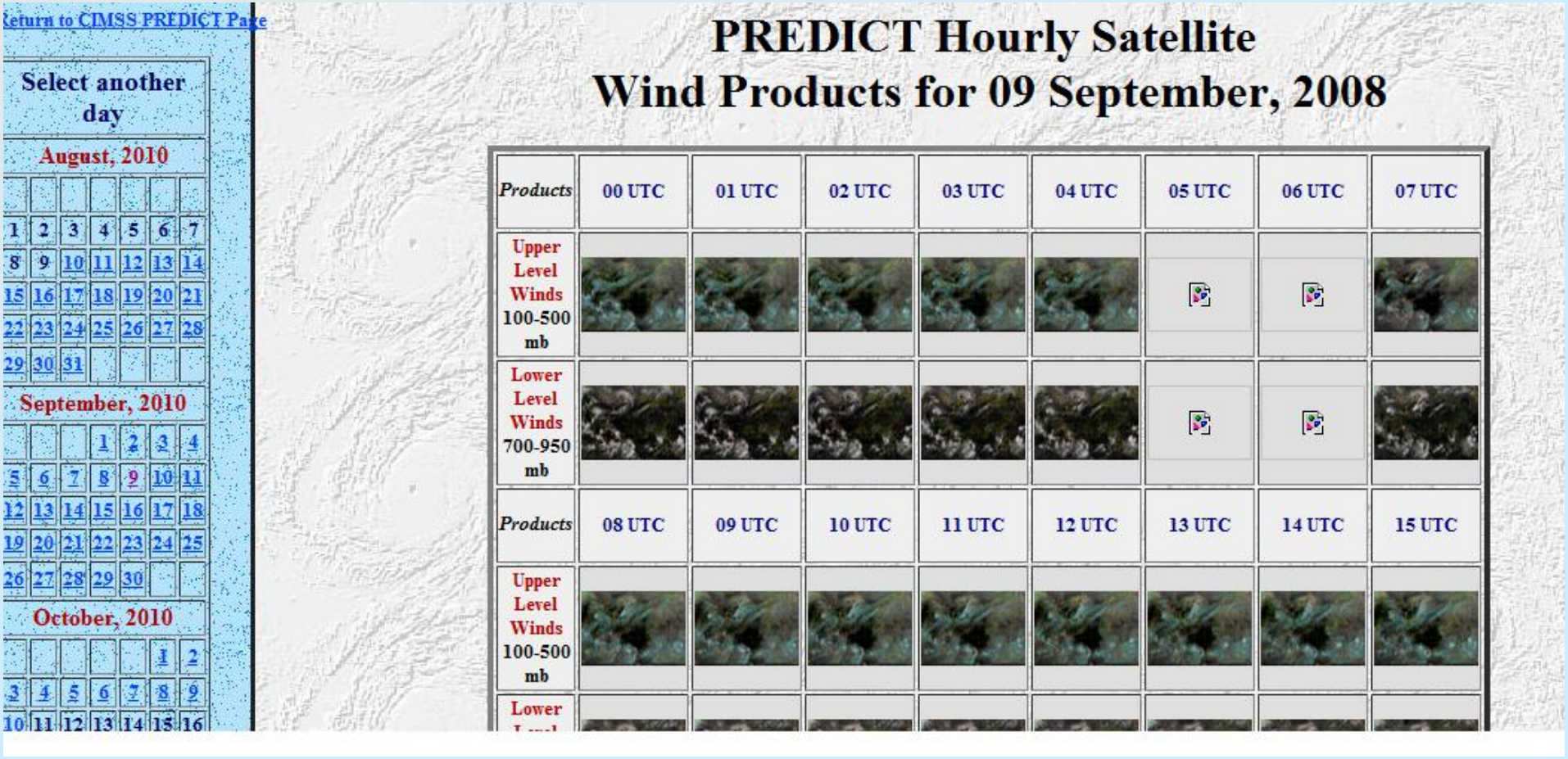

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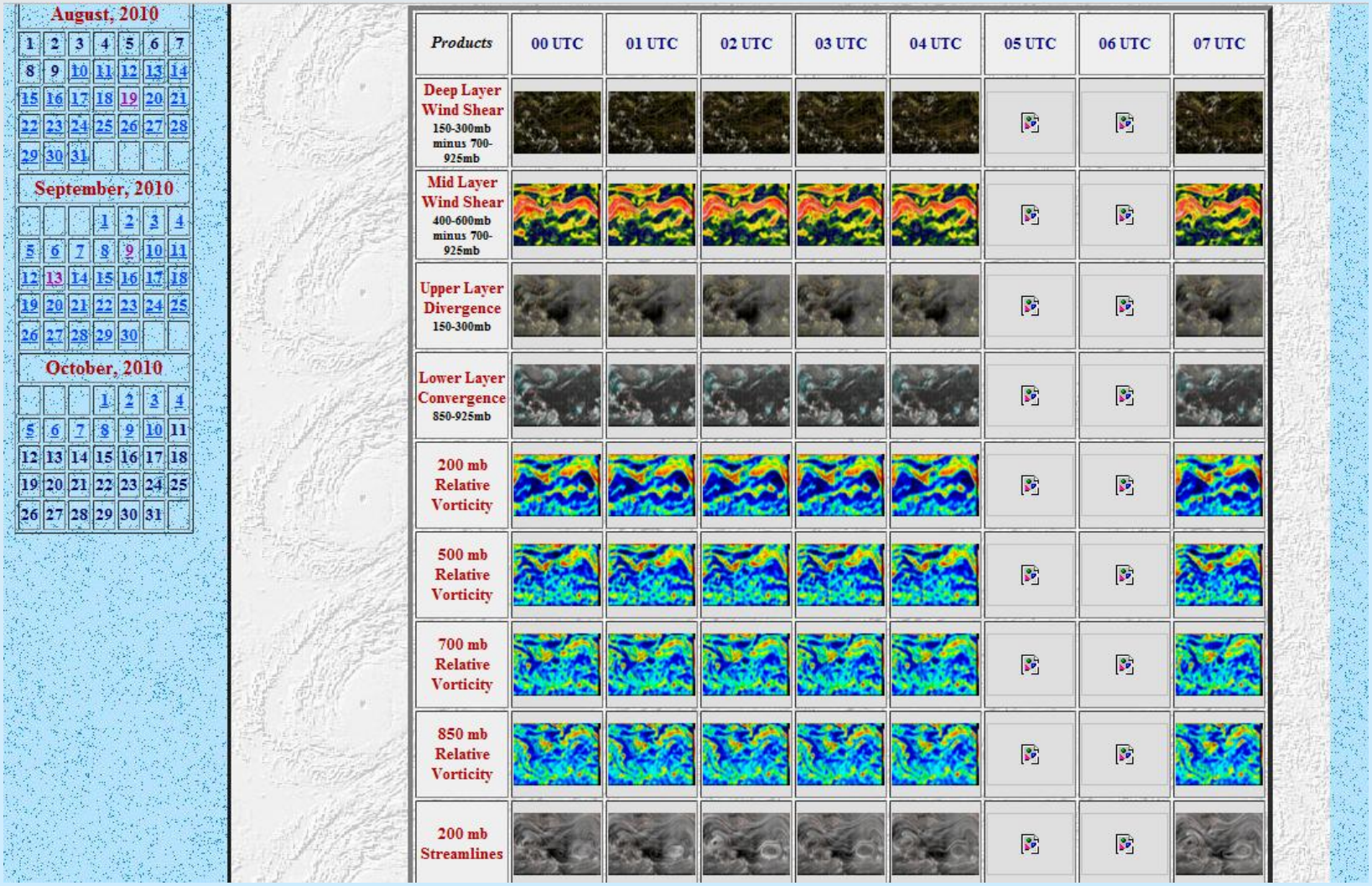
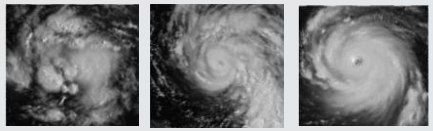




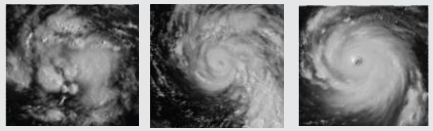
Objective Tropical Overshooting Top (TOT) Detection Algorithm

Developers: Sarah Monette and Chris Velden (CIMSS)
Collaborators: Kyle Griffin, Kris Bedka, Chris Rozoff

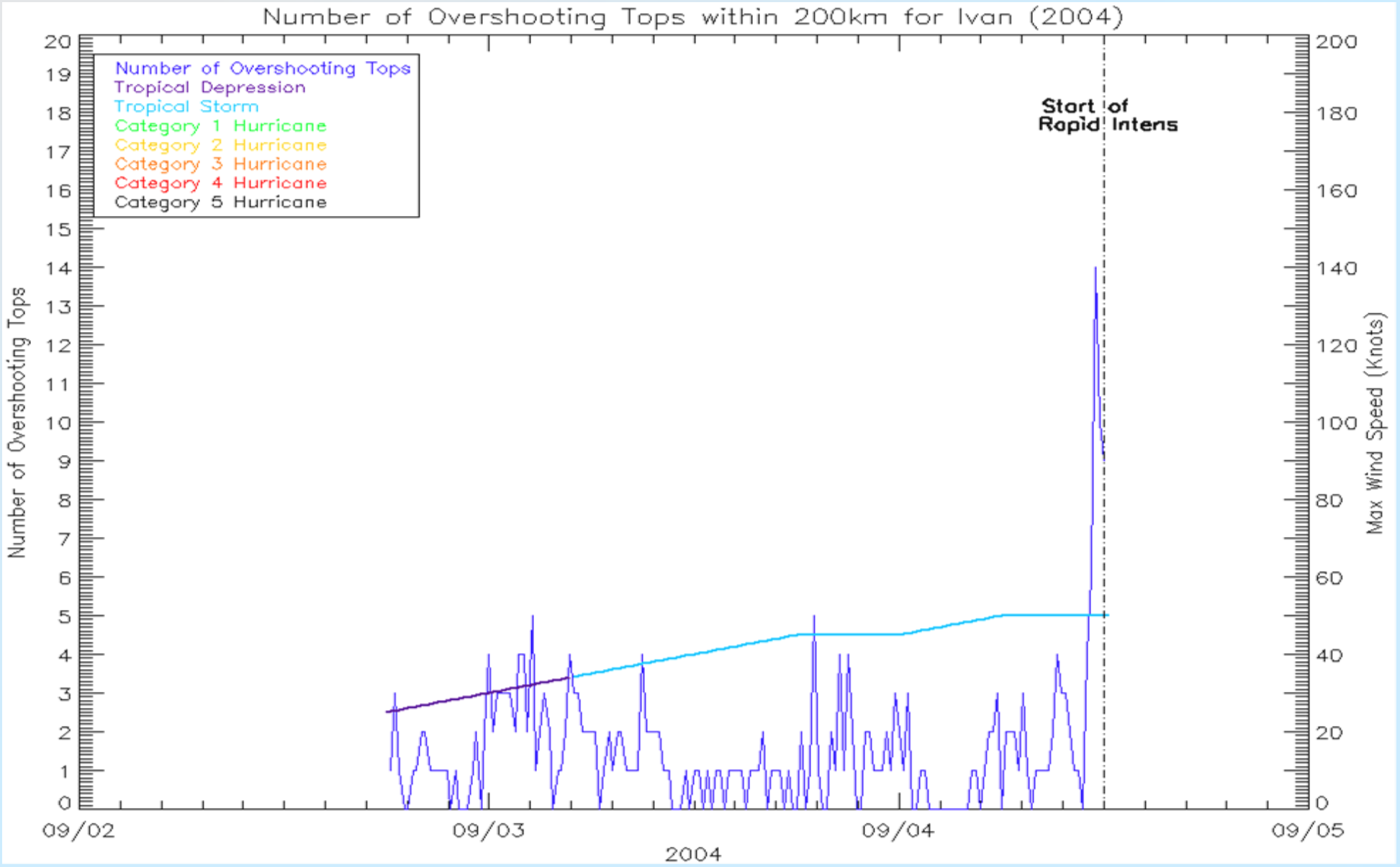
Motivation: Location and timing of hurricane genesis and rapid intensification (RI) are two problematic areas for NHC forecasters.

Concept: The OTs are associated with vigorous tropical convection, and may be employed as a proxy for identifying “vortical hot towers”, hypothesized to be important for hurricane genesis and intensity change.

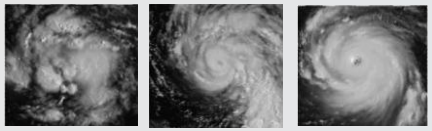
Application: Trends in OTs associated with pre or existing hurricanes can be related to favorable environmental factors for genesis or RI, respectively.



Objective Tropical Overshooting Top (TOT) Detection Algorithm



TOT trends can be monitored: Note the spike in the TOTs prior to the RI of Ivan.



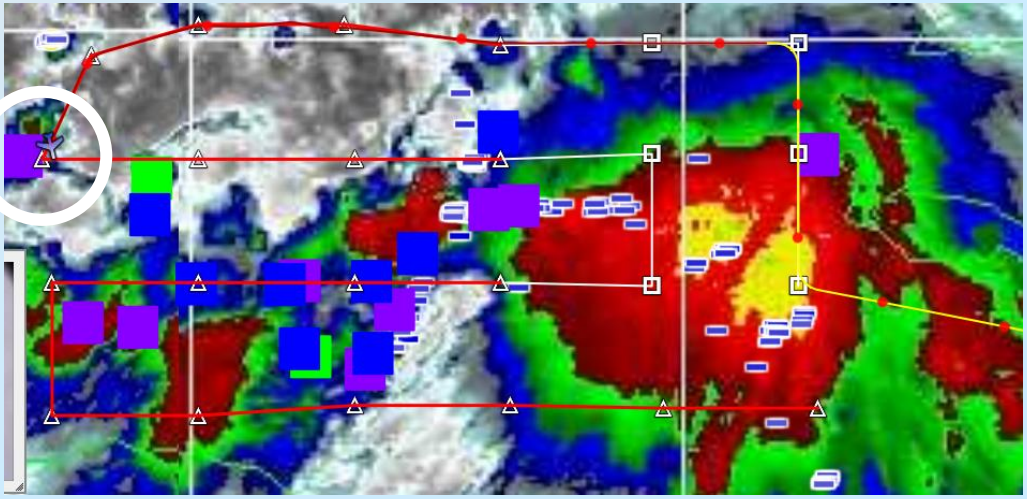
Objective Tropical Overshooting Top (TOT) Detection Algorithm

TOT research/applications (Details in Sarah Monette's presentation tomorrow):

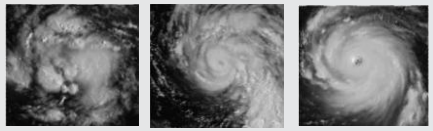
Analysis of TOTs with respect to hurricane genesis began in 2009, and continued in 2010 using data and cases from the Atlantic Ocean PREDICT/GRIP experiments. Preliminary results are promising, however more data are needed to confirm results.

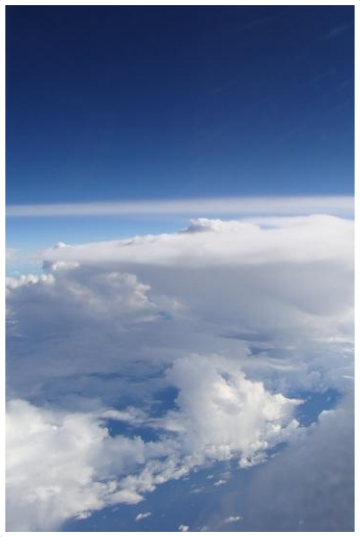
TOTs have also been shown to be a promising predictor of RI. Initial testing using an objective logistic regression scheme for RI prediction has shown a modest increase in forecast skill. Further tuning is needed.

Another potential application of TOTs: oceanic aviation and hazard avoidance. TOTs were used to help guide aircraft during PREDICT. On the right, the G-V plane track (red line) deviates to avoid a TOT in the vicinity (purple square, circled).



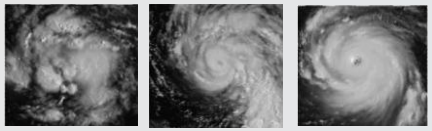
As part of the GOES-R 2011 Proving Ground activities, CIMSS will produce TOT products in real time during the Atlantic hurricane season to be evaluated by NHC forecasters. The TOT products will use SEVERI imagery from MSG as proxy GOES-R demonstration data.





Investigating the Role of the Upper-Levels in Tropical Cyclone Genesis

John Sears and Chris Velden

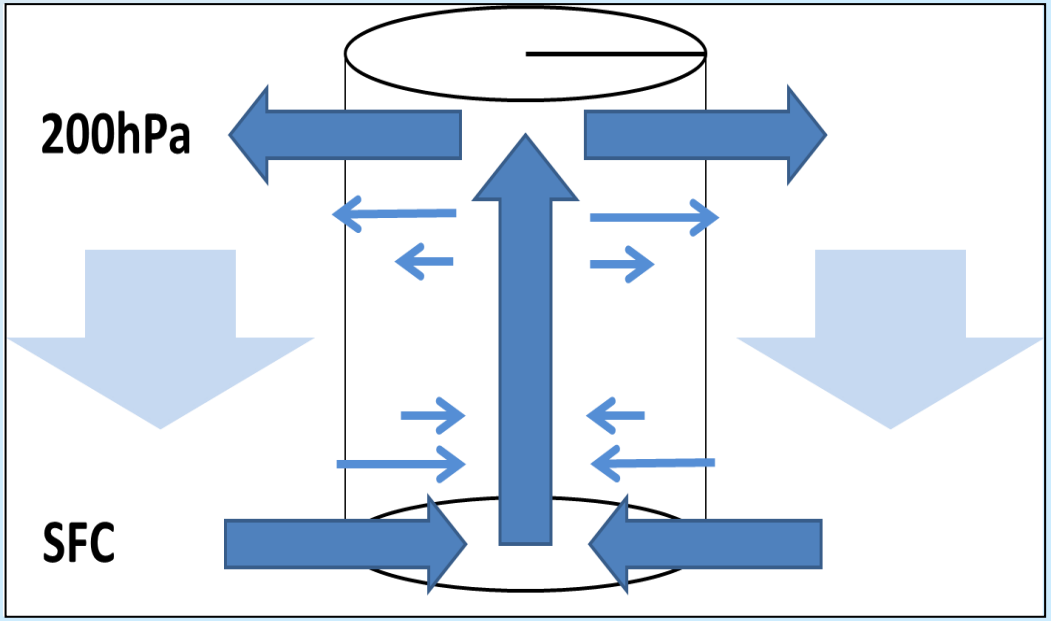


Our Hypothesis

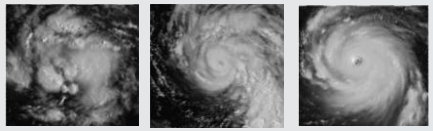
Only 10-20% of pouches actually develop into tropical depressions or storms of greater intensity. Therefore, while the pouch theory might supply a ***necessary*** condition, it is obviously not ***sufficient***.

It has been shown in previous research that near-storm environmental conditions in the *upper-levels* can play a significant role in the intensification of mature storms, such as low-shear, weak inertial instability, and mass ventilation ducts (outflow channels).

We hypothesize that weak Inertial stability aloft concentrated in outflow vents can provide the ventilation and horizontal mass transport necessary to sustain the VHT processes leading to TCG. In this regard, the upper-level conditions may in some cases facilitate or regulate the ability of the pouch dynamics to lead to TCG.

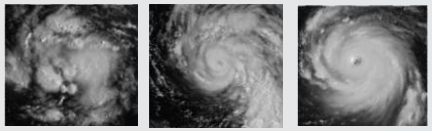


Radial Wind



Datasets

- 1-hourly gridded (1-deg. res.) wind analyses and derived diagnostic fields at standard pressure levels produced by CIMSS employing a 3D recursive filter analysis during the 2010 Atlantic hurricane season (including PREDICT period), using enhanced high-resolution cloud/water vapor drift winds with GFS background fields -- 502 total analyses with 21x21 storm-centered grid boxes used for composite analyses.
- 6-hourly isentropic analyses (1-deg. res.) of Inertial Available Kinetic Energy (IAKE) and Ertel's Potential Vorticity (PV) from the GFS model during the PREDICT period.
  - PREDICT pouch center fixes derived from linear interpolation of model consensus pouch tracks (courtesy, Mark Boothe).
- Analyzed aircraft dropsonde data and CIMSS satellite winds (0.5 deg. res.) for selected PREDICT cases using a 3D variational analysis, provided by New Mexico Tech University (NMTU).



PGI-44 (Pre-Karl) 9/13

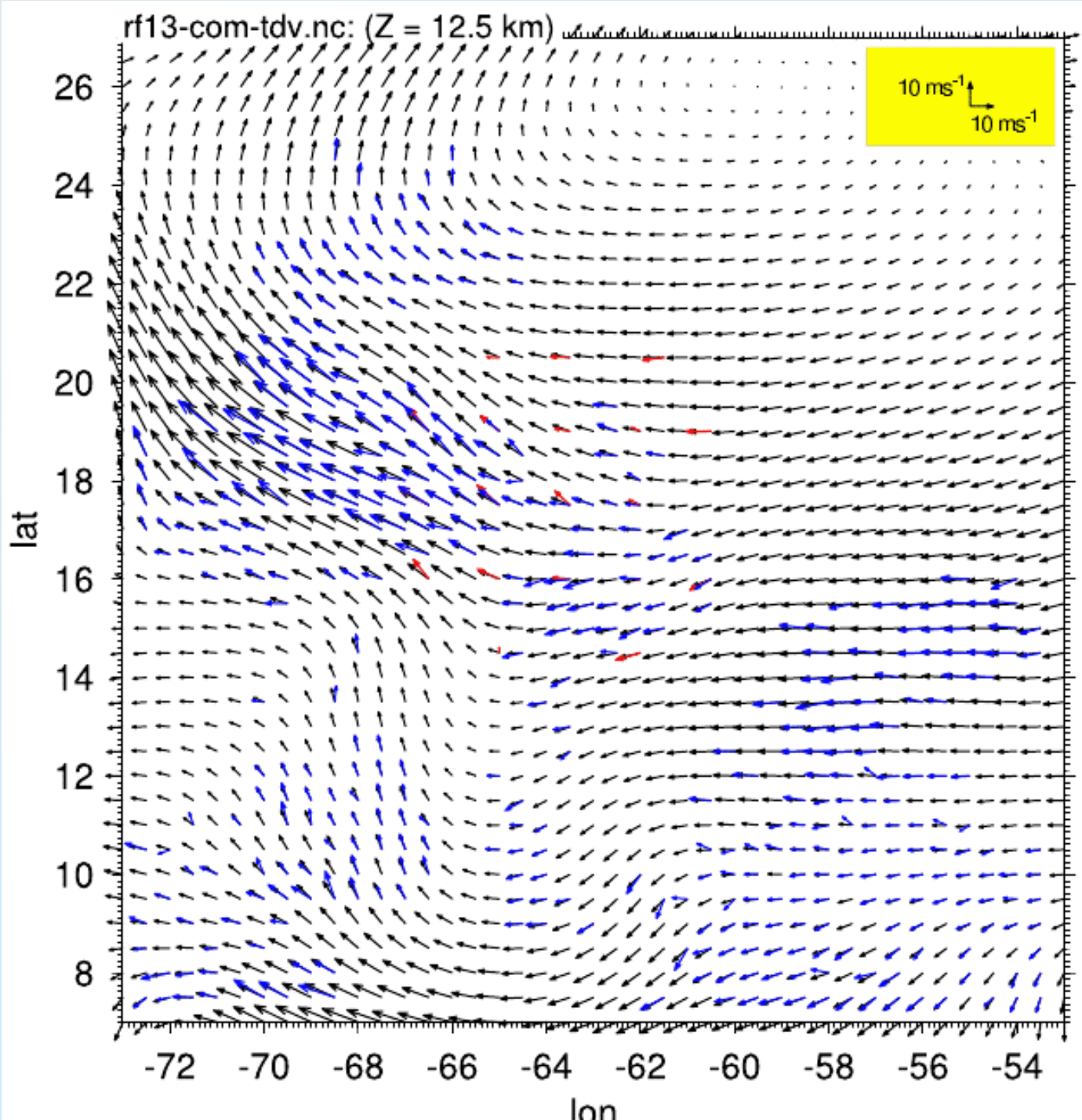
NMTU wind analysis at 12.5km height

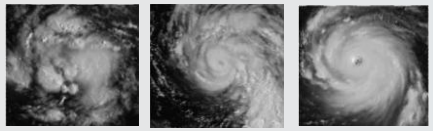
Analysis is centered on the pouch

Black -- Analysis

Red – Drops

Blue – CIMSS Satwinds

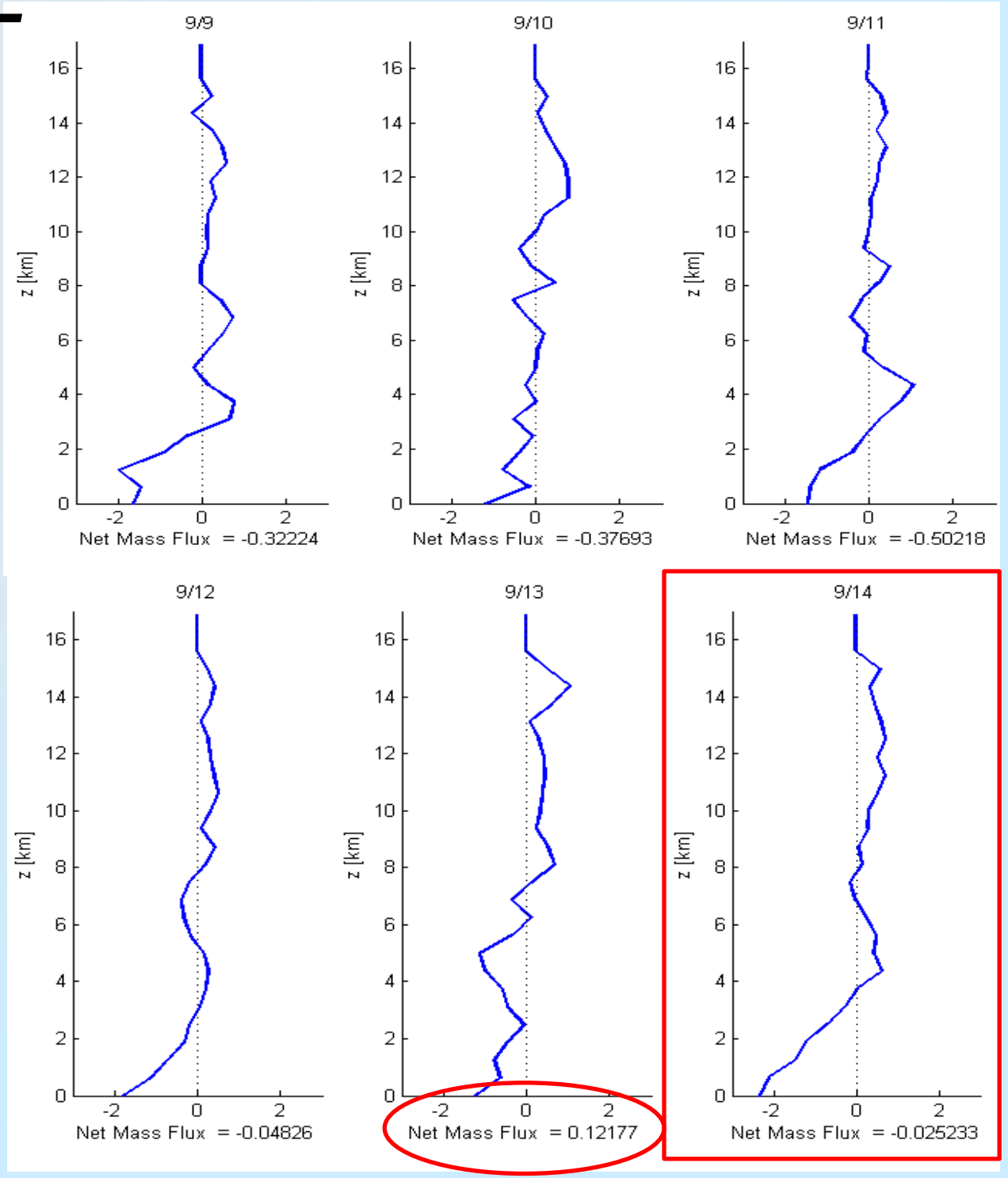


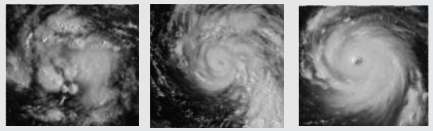


PGI 44L - Karl

- Vertical Profiles of Horizontal Mass Flux [kg/m^{2}s]
  - NMTU analyses (0.5 deg. resolution)
  - Azimuthal averages at 3 deg. radius from pouch center
  - 24 hrs between plots

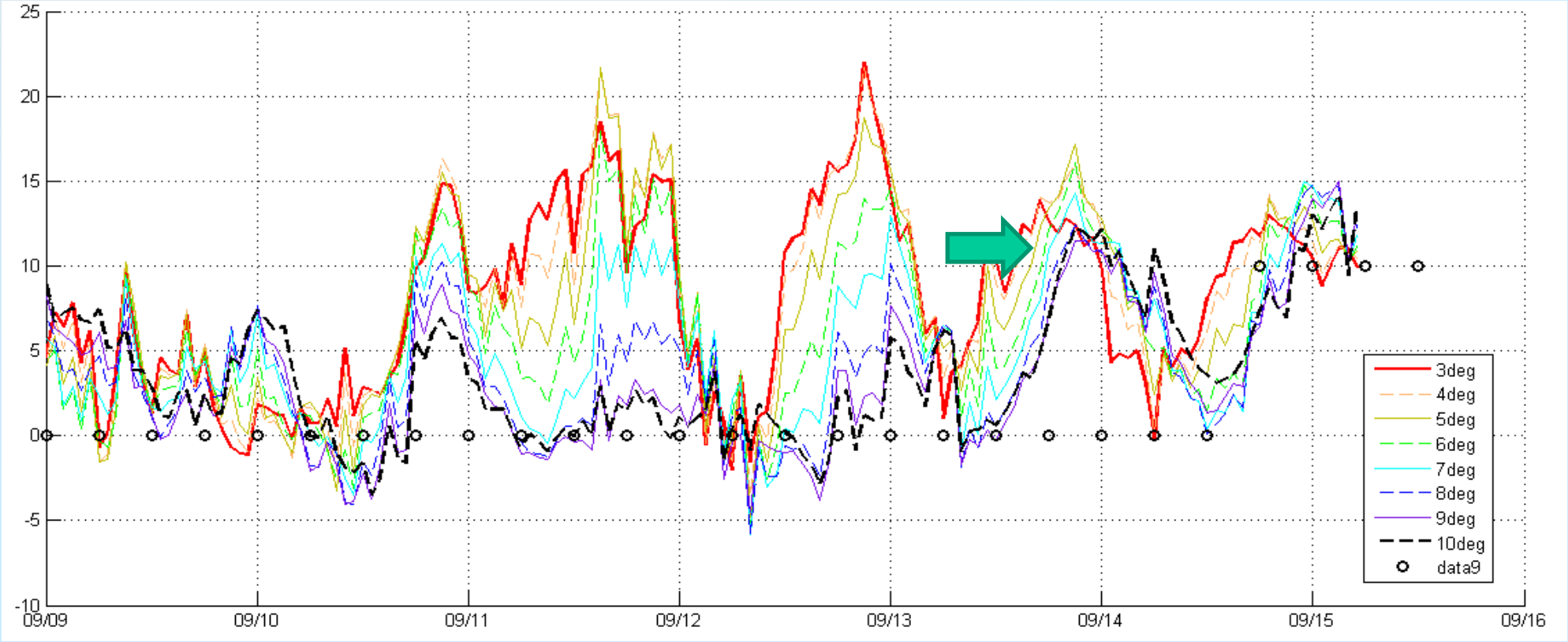
- Genesis at 9/14 (red box)
- Net vertically-integrated horiz. mass flux becomes positive 24 hrs before genesis (red circle) -- Only instance of positive integrated mass flux .

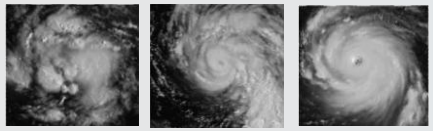




PGI 44L - KARL

- Time evolution of 200hPa Horizontal Mass Flux [kg/m^{2}s] evaluated at 8 different radii
  - Axisymmetric means
  - Using CIMSS hourly analyses
  - Outward Mass Flux peak shifts to include outer radii (arrow) just prior to TCG on the 14th (suggesting good ventilation conditions)





Future Work

Further study of composite and NMTU dropsonde-enhanced cases study analyses

-- EFC, PV, IAKE

-- Diagnostics by storm quadrant

Additional case study (GASTON)

-- Karl developed, but Gaston did not despite strong pouch characteristics.

Examine other PREDICT cases

Investigate and associate environmental flow features, systems, etc. associated with positive diagnostic signals (IAKE, PV, etc).


More this evening at the student session
Questions?