

Update for NextGen BL Moisture Breakout

Status of the WVSSII Program

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NOAA/NWS/OST
March 23, 2010

Project Background:

What is the Benefit?

Observing Weather and Climate
FROM THE GROUND UP
A Nationwide Network of Networks

Committee on Developing Mesoscale Meteorological Observational Capabilities to
Meet Multiple National Needs

Board on Atmospheric Sciences and Climate

Division on Earth and Life Studies

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

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Washington, D.C.
www.nap.edu

Infrastructure Needs: Mesoscale observations above and below the atmosphere's lowest ten meters are particularly inadequate.

The highest priority observations needed to address current inadequacies are:

- Height of the planetary boundary layer
- Soil moisture and temperature profiles
- High resolution vertical profiles of humidity
- Measurements of air quality and related chemical composition above the surface layer

Second tier national observing gaps:

- Direct and diffuse solar radiation
- Vertical profiles of wind
- Sub-surface temperature profiles (e.g., under pavement)
- Icing near the surface
- Vertical profiles of temperature
- Surface turbulence parameters

“Ground Up” Report Link:

http://www.nap.edu/catalog.php?record_id=12540

Recommendation: Collect atmospheric profiles nationally at approximately 400 sites (~125 km resolution) to continually monitor lower tropospheric conditions.

2008 Sensor Re-Design

- **Improve the laser head seal.**
 - Eliminated moisture intrusion into the laser head cavity (wet bias).
 - Improved the sensor stability over time (long term sensor stability).
- **Modified the signal processing circuit to improve the thermal insensitivity.**
 - Improved the observed dry bias by component and circuit upgrades.
 - Improved the performance over changing temperature by temperature measurement upgrades.
- **Improved the laser thermal control loop.**
 - Improved the laser wavelength stability by an improved thermal control loop.
- **Upgrades to the processor from the petrochemical board experiences.**
 - Improvements to noise levels and thermal insensitivity.
- **Upgrade the thermal management of the system.**
 - Isolate the SEB from the fuselage structure to improve the thermal environment for the electronics and laser head.
 - Isolate the laser head from the sample cell to improve the thermal environment for the laser head.
 - Upgrade the gas temperature monitor and gas temperature management to assure that the gas temperature is correct in the concentration computation.
 - Increased thermal heating of the gas heating system.
- **Added a test connector to the exterior of the SEB**
 - Allows SSI to perform the final functional and calibration testing after the SEB is completely assembled and enclosed.
 - Provides for a post installation functional test to assure that the units are working after installation. SSI recommends a breakout box for this testing.

Recent Assessments

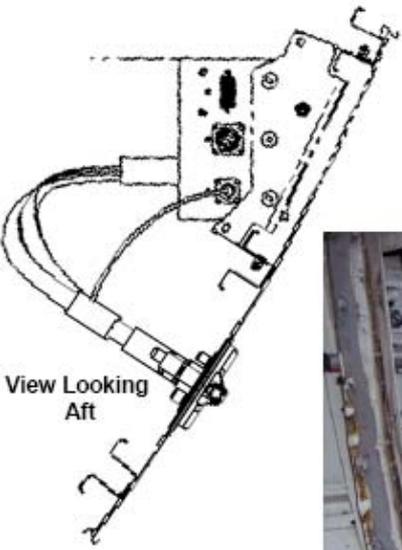
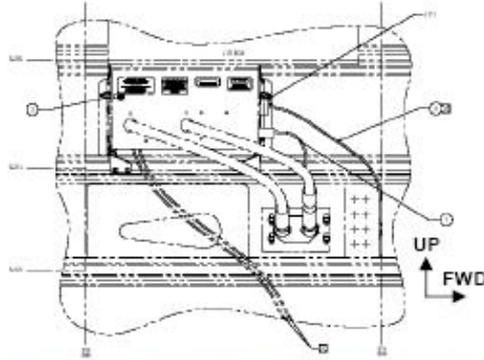
- **Chamber Tests:**
 - Sterling Field Support Center, October 2009 – “WVSS-II sensor performed well under most of the test conditions” B. Tauveltz
 - Deutscher Wetterdienst, September 2009 – “The sensitivity of the WVSS-II touches the upper Troposphere or lower Stratosphere; A. Hoff
- **Radiosonde:** Rockford, IL AERIBAGO RS92 Tests, November 3-11, 2009 – Full CIMSS report pending
 - **ASOS:** Louisville ASOS/WVSSII Surface/Lowest Level Sounding Inter-comparisons - When the temperature error components are removed, the moisture errors account for an RH error of <4%, a value which exceeds the accuracy of most rawinsonde sensors and all WMO requirements; R. Petersen and R. Baker
- **GPS-Met/WVSSII IPW Inter-Comparison Assessment:** “After removing outlier points, slope of fit linear line is 1.0, with a 3% negative bias for WVSSII-v3 as compared with GPS-Met IPW. Much of the WVSSII-v3’s negative bias is an artifact of “incomplete” moisture soundings where the aircraft leveled off before capturing the full extent of atmospheric moisture. Much of the variance between the WVSSII-v3 and GPS-Met is explained by the sampling difference of an in situ sensor (WVSSII) and a volumetric sensor (GPS-Met)”; S. Gutman
- **Model Analysis Inter-Comparisons:**
 - “WVSSII data are now performing well enough to be accepted for assimilation into the GSD Rapid Refresh Development Model”; B.Moninger
 - “Model bias and RMSE were good through 300 hPa, but diverged from model guess at lower pressures; outlier units were diagnosed to be problems with blocked intake hoses; D.Helms

WVSS Aircraft Update

- 24 of 25 WVSSII units operational on UPS Boeing 757-200 Aircraft
 - Randy Baker, Chief Meteorologist for UPS has been using the data since 2006 and has provided strong recommended improvements
 - Fundamental technology has been thoroughly tested
- 2 of 31 WVSSII units operational on Southwest Boeing 737-300
- WVSSII FAA Certification
 - Completed for Boeing 757-200 and 737-300
 - Amendment started for Airbus A319
 - Amendment started for B737-700

WVSSII Installations: 31+25 by June 2009 Generating ~800 Soundings/Day

Southwest Airlines B-737 Schematics for WVSSII Installation



United Parcel Service B-757 WVSSII Installation

“Cargo-Door” View WVSSII
WVSSII Located on Forward-Port Side of UPS B-757

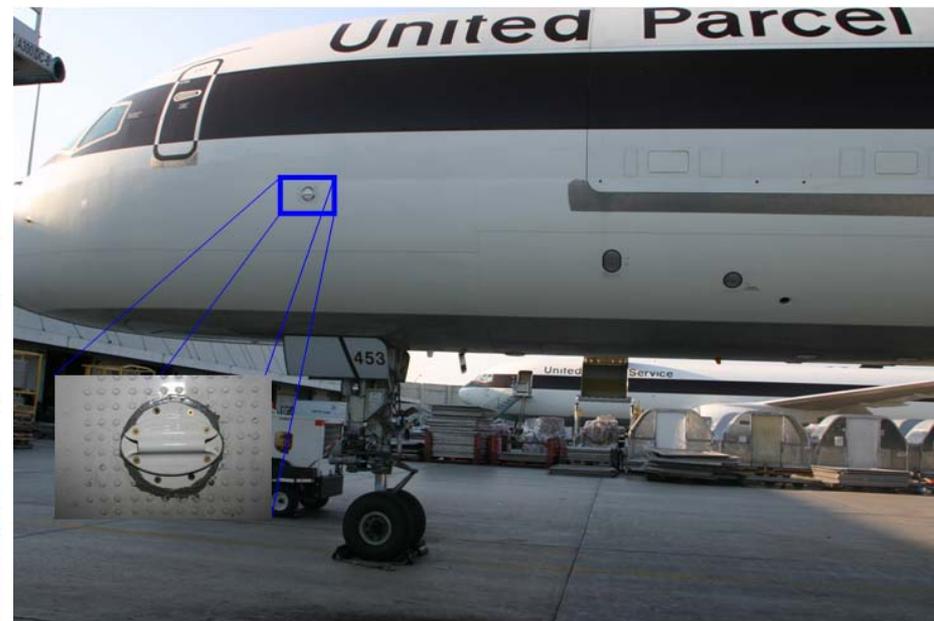
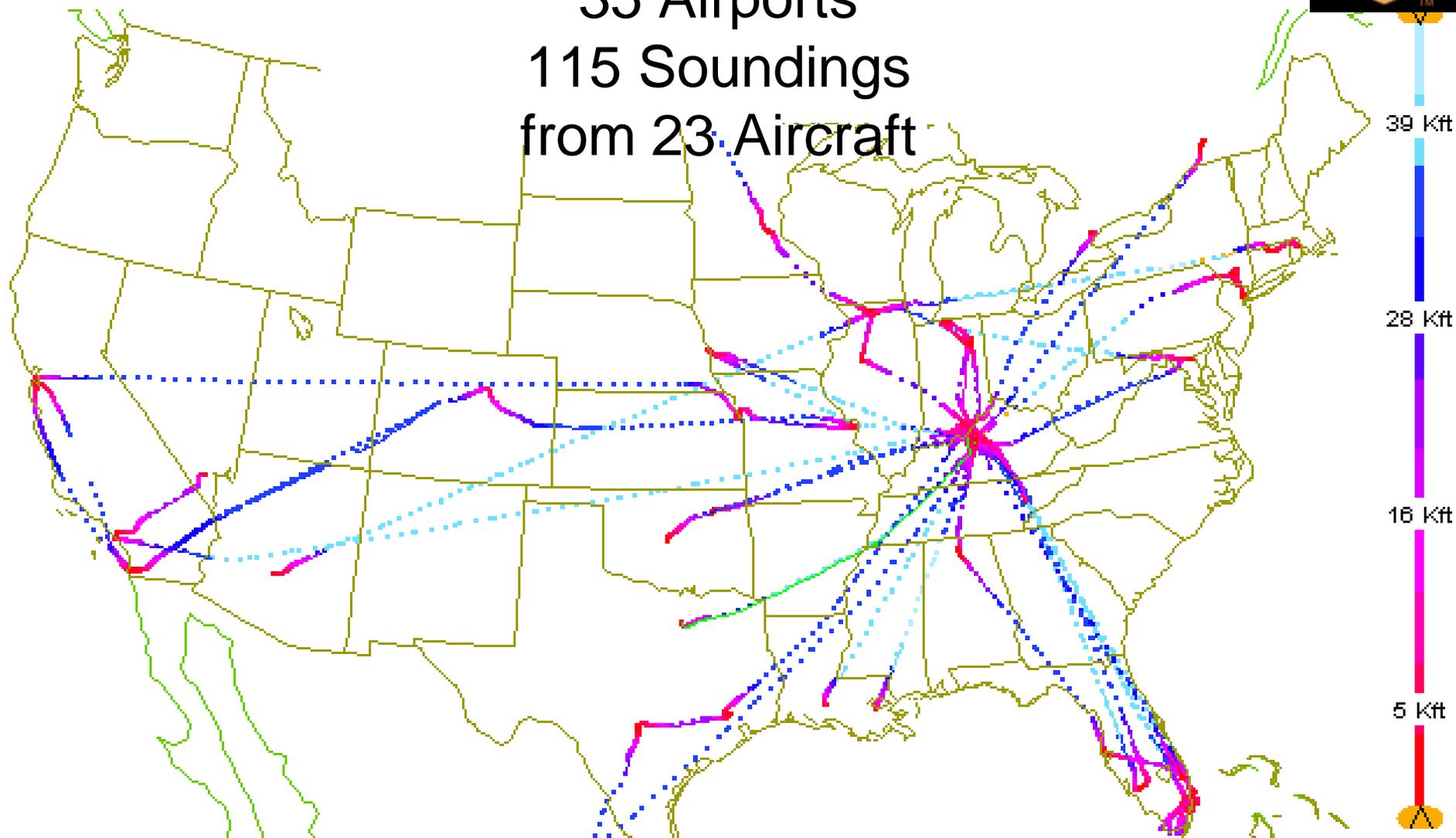


Photo Credit: UPS Dispatch
Contact for Usage: Randy Baker/UPS; Email:
air1rtb@ups.com



24 hours of WVSSII March 23, 2010 35 Airports 115 Soundings from 23 Aircraft



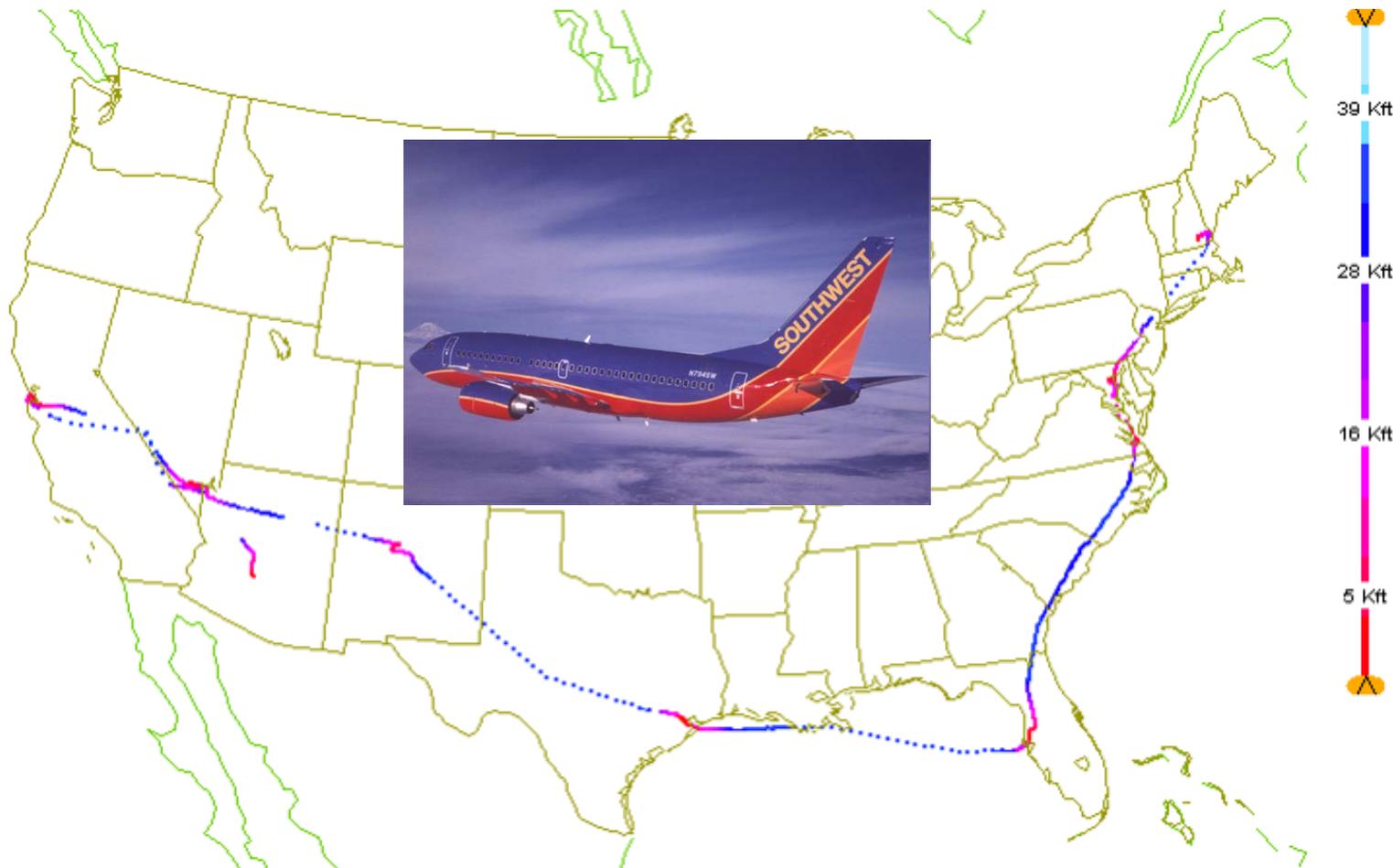
22-Mar-2010 13:00:00 -- 23-Mar-2010 13:49:28 (290413 obs loaded, 5172 in range, 2386 shown)



A Day in the Life of Southwest N644

March 18, 2010

From New Hampshire to Arizona;
10 Stops – 18 Soundings

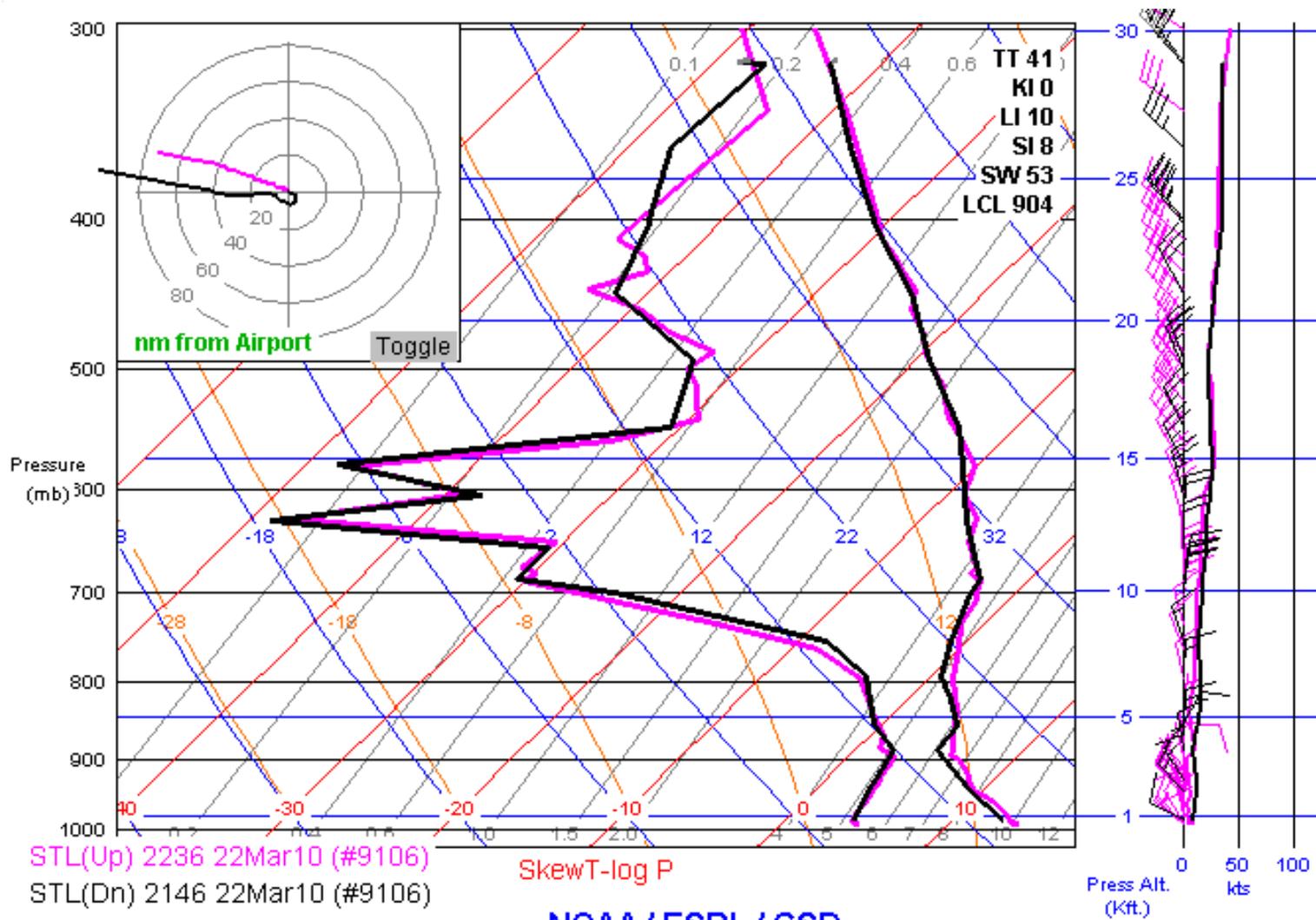


17-Mar-2010 07:30:00 -- 18-Mar-2010 07:29:49 (127746 obs, 717 in range, 504 Data points shown)

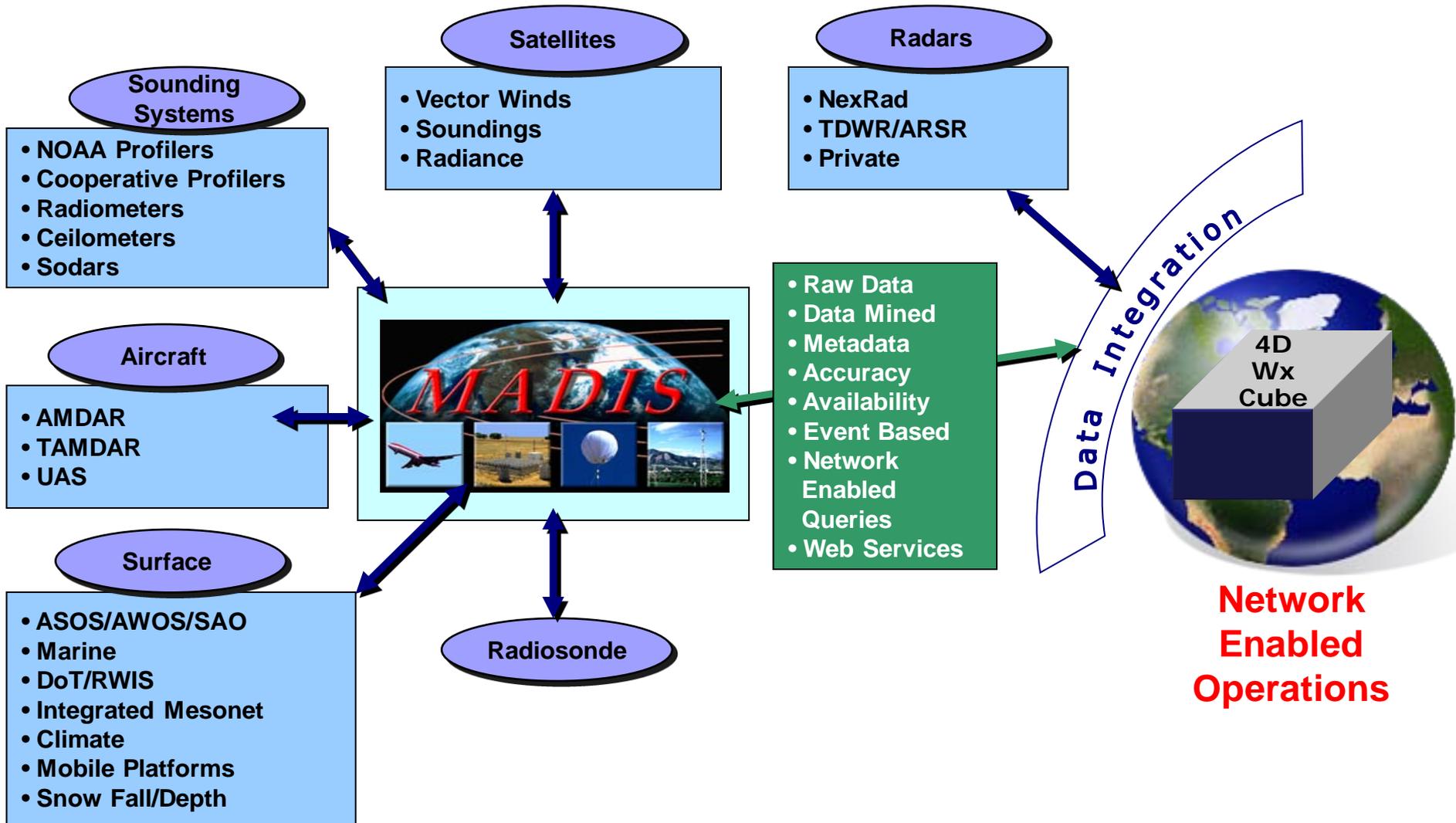
NOAA / ESRL / GSD Model: RR1h Vapor Alt: UNLIMITED



Southwest GSD9106 Ascent/Descent St Louis, MO - March 22, 2010



WVSSII Data Dissemination



Questions?

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