

Comparison of airborne sunphotometer and satellite sensor retrievals of aerosol optical depth during MILAGRO/INTEX-B

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<http://geo.arc.nasa.gov/sgg/INTEX-B/index.html>

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Jetstream 31 in MILAGRO/INTEX-B: Instrument Locations



RSP	Total & linearly polarized reflectance	412-2250 nm, 9 λ
SSFR	Upwelling & downwelling spectral hemispheric irradiance	300-2200 nm, many λ ~8-12 nm resolution
CAR	Spectral & angular distribution of scattered light from clouds, aerosols, land and water surfaces; imagery of clouds & surface	340-2130 nm





NASA Ames Airborne Tracking Sunphotometer: AATS-14

1. Measures direct solar beam transmission:

353.5	380.0	449.0	499.4	525.0
605.7	675.1	778.4	864.5	939.7
1019.1	1241.3	1557.8	2139.0	nm

2. Yields:

aerosol optical depth + aerosol extinction when A/C flies profiles

columnar water vapor (ozone) + water vapor (ozone) concentration when A/C flies profiles

3. Size:

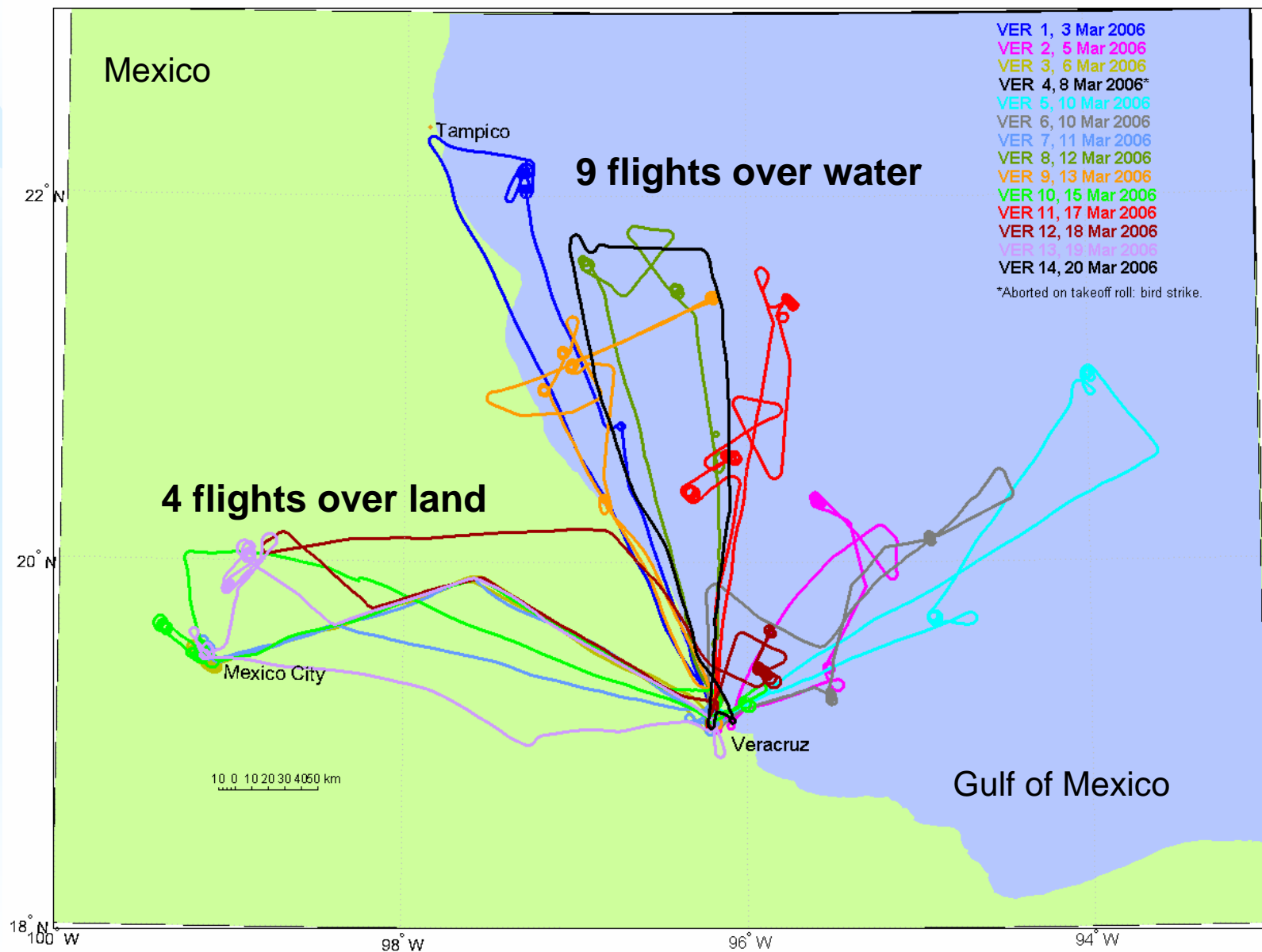
Telescope dome 8" OD (hemisphere) atop 5" H pedestal. (Total H: 9" above A/C skin), Inside A/C: 12" D x 18" H cylinder.

4. Weight:

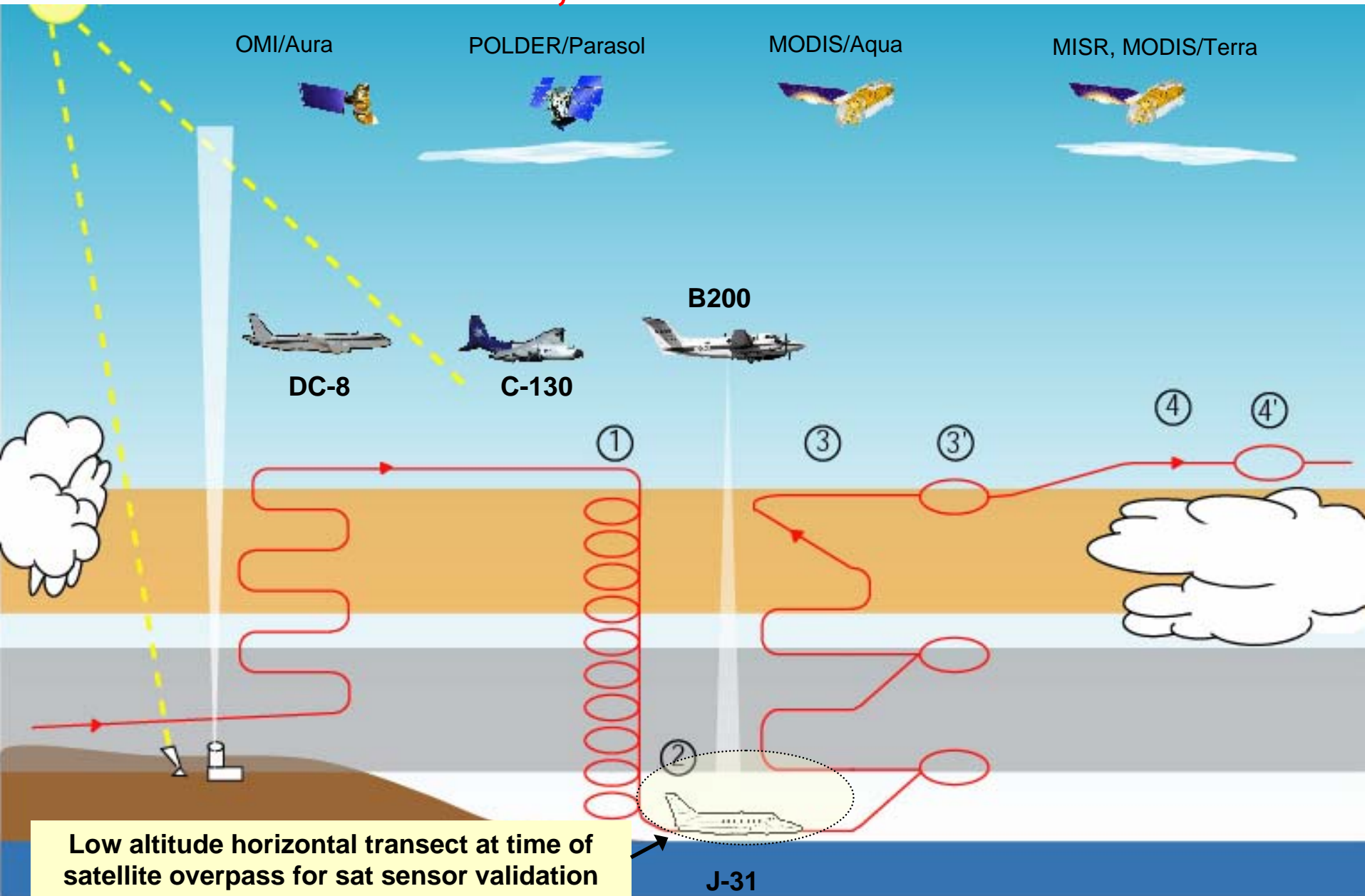
131.6 lbs



J31 flight tracks: 13 flights out of Veracruz, Mexico



J31 flight patterns: Coordinated satellite, in-situ and radiative missions



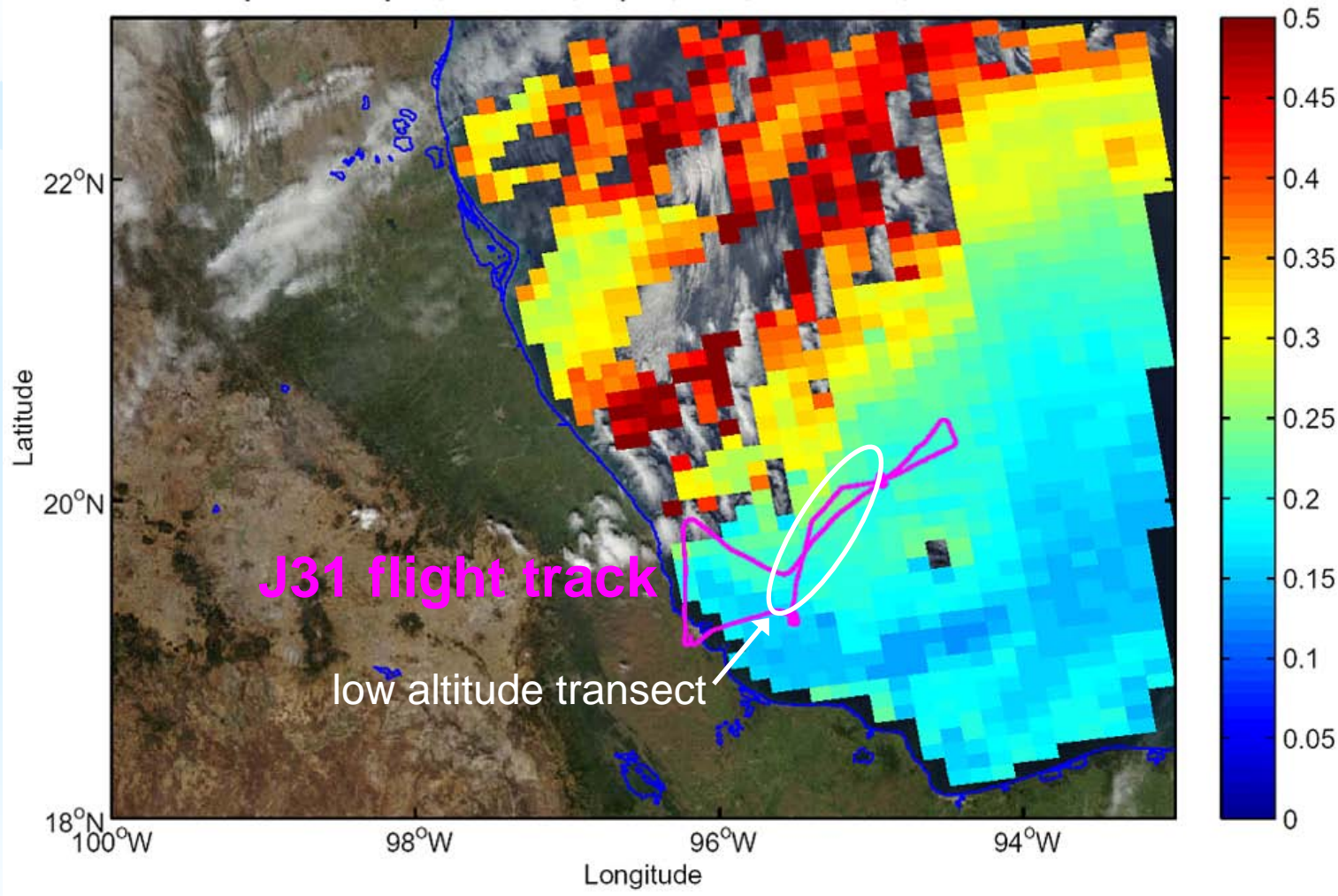
Outline

- Jetstream 31 (J31) instrument payload and flight overview
- Airborne, satellite, and ground-based AOD comparisons
- **AATS-14 (Ames Airborne Tracking Sunphotometer) & MODIS AOD spectra over water (Gulf of Mexico) for all coincidences during MILAGRO**
- AATS-14, OMI (UV and MW retrievals), & MODIS over water (2 cases)
 - 10 March (Aqua, Aura)
 - 17 March (Aqua, Aura)
- AATS-14, OMI, & AERONET over Mexico City (1 case)
 - 19 March (Aura)
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 - 10 March (Terra)
- Summary/Conclusions



J-31 Research Flight 06, 10 March 2006

Aerosol optical depth, MODIS, Aqua, 069, 03/10/06, UT: 19:55--20:00

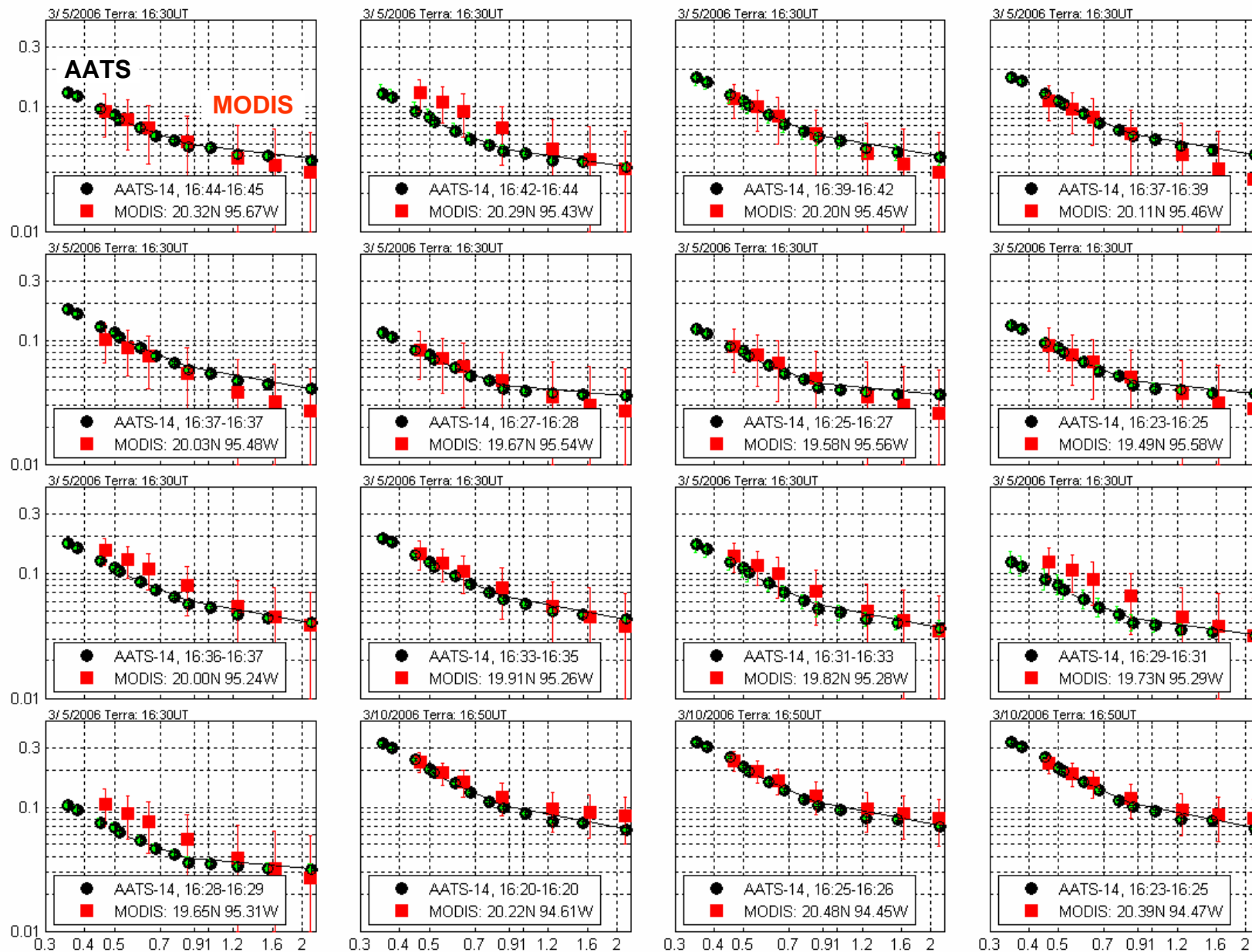


Note: MODIS RGB images, with MODIS AOD maps overlaid for every J-31 flight available at:
<http://geo.arc.nasa.gov/sgg/INTEX-B/> Acknowledgements appreciated.



Full spectrum AOD measurements: AATS vs. MODIS-Terra in MILAGRO

Aerosol Optical Depth



Wavelength (μm)

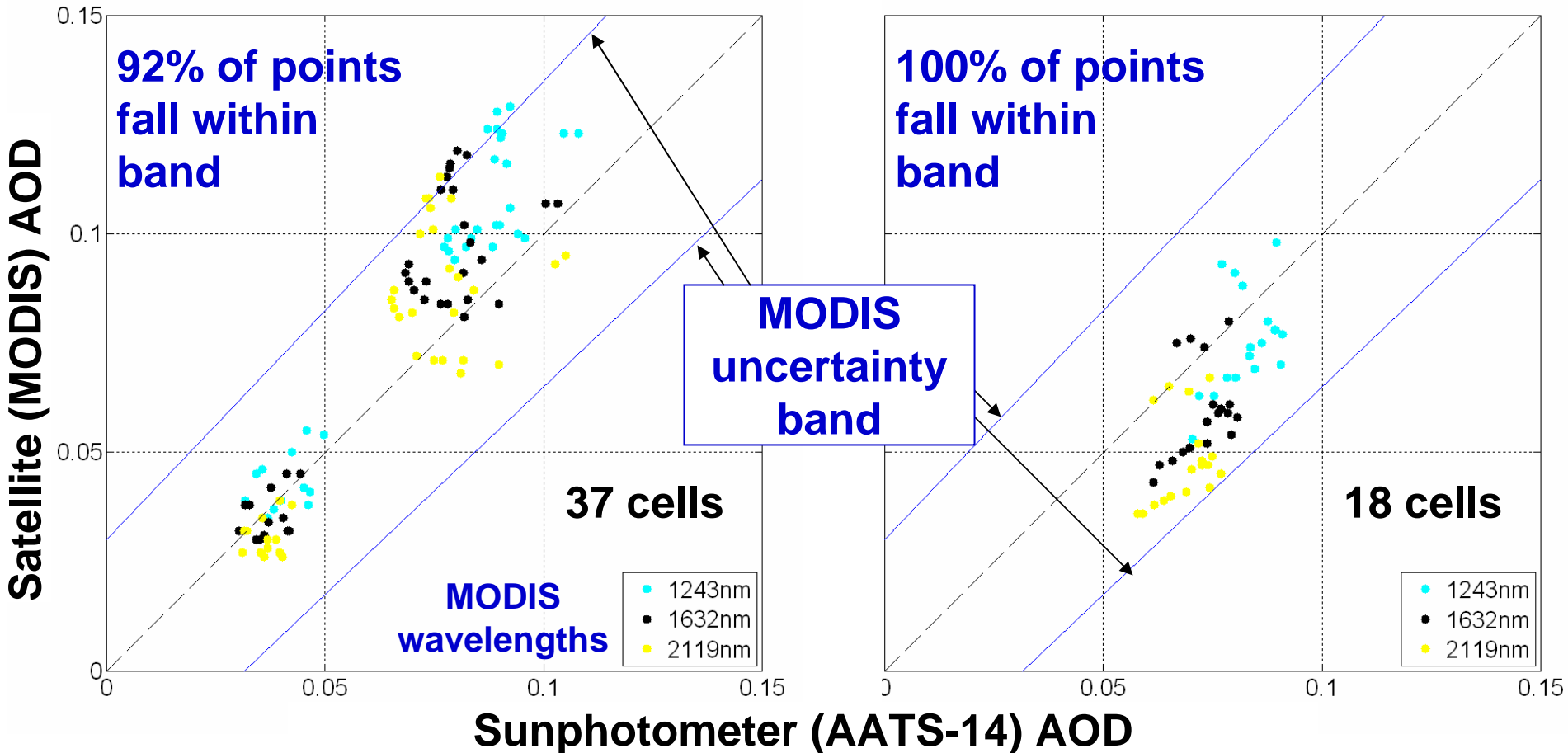


AOD Comparisons, MODIS vs AATS

Gulf of Mexico, INTEX-B/MILAGRO, 2006

MODIS-Terra (March 5, 10, 12)

MODIS-Aqua (March 10, 17)



Agreement at MODIS SWIR wavelengths is better than expected, because the number of points falling within the uncertainty band exceeds 66%, which is the expected fraction if the MODIS uncertainty ($\pm 0.03 \pm 0.05$ AOD) is $\pm 1\sigma$.

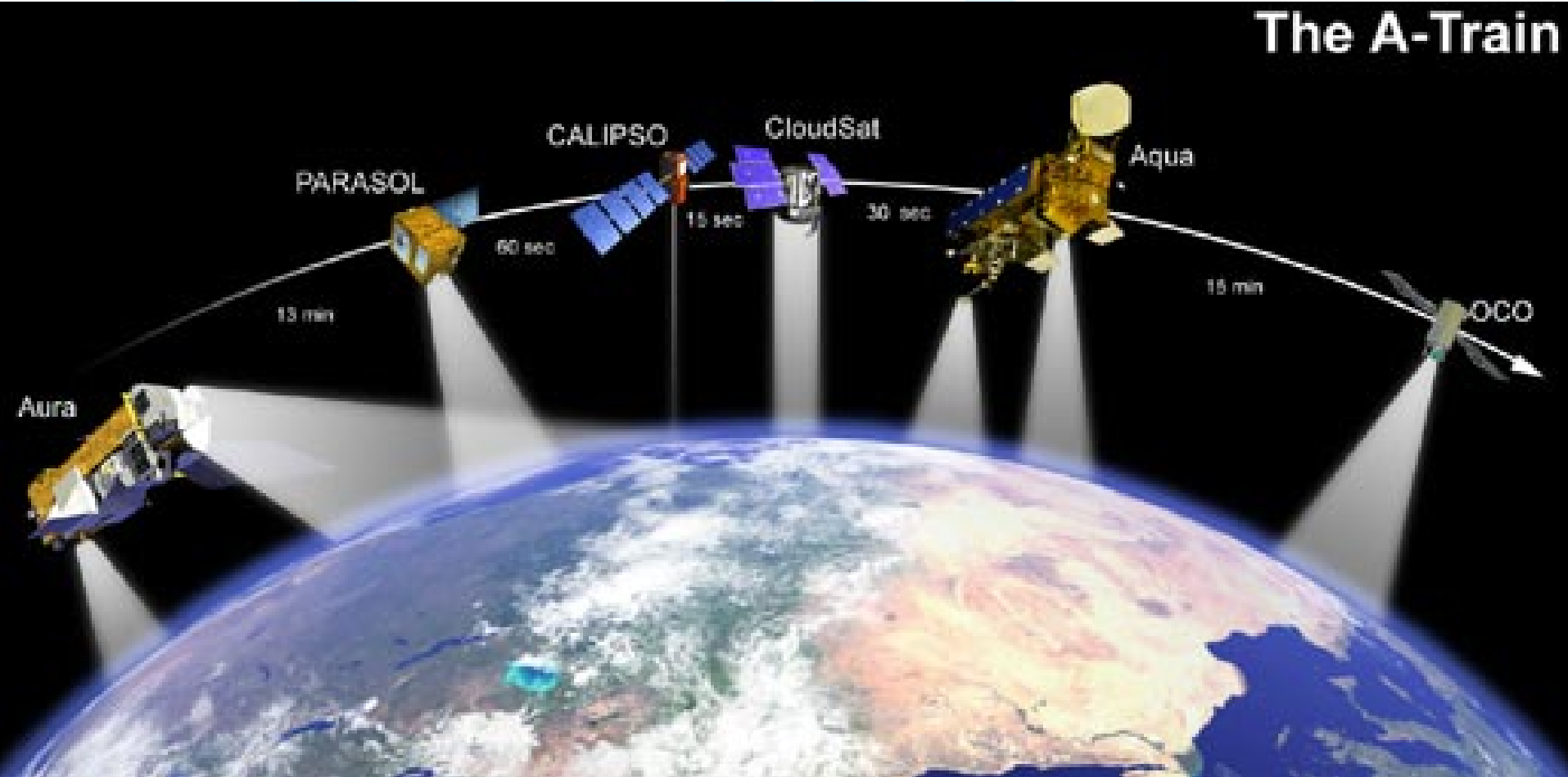


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The A-Train is a set of satellites that fly in sequence

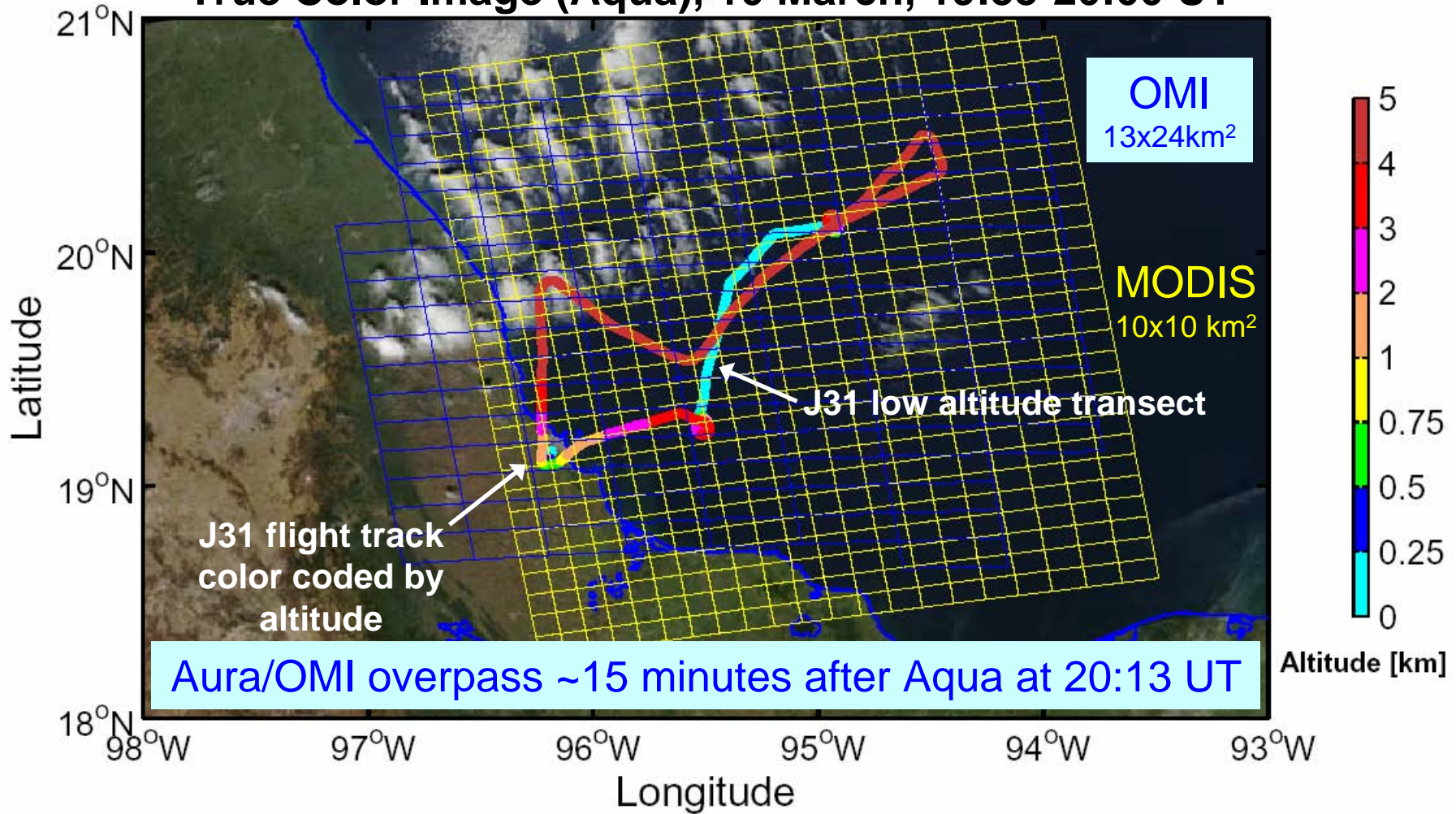


Many J31 flights included legs or profiles under the A-Train or other satellites

AOD Comparisons, OMI - MODIS - AATS

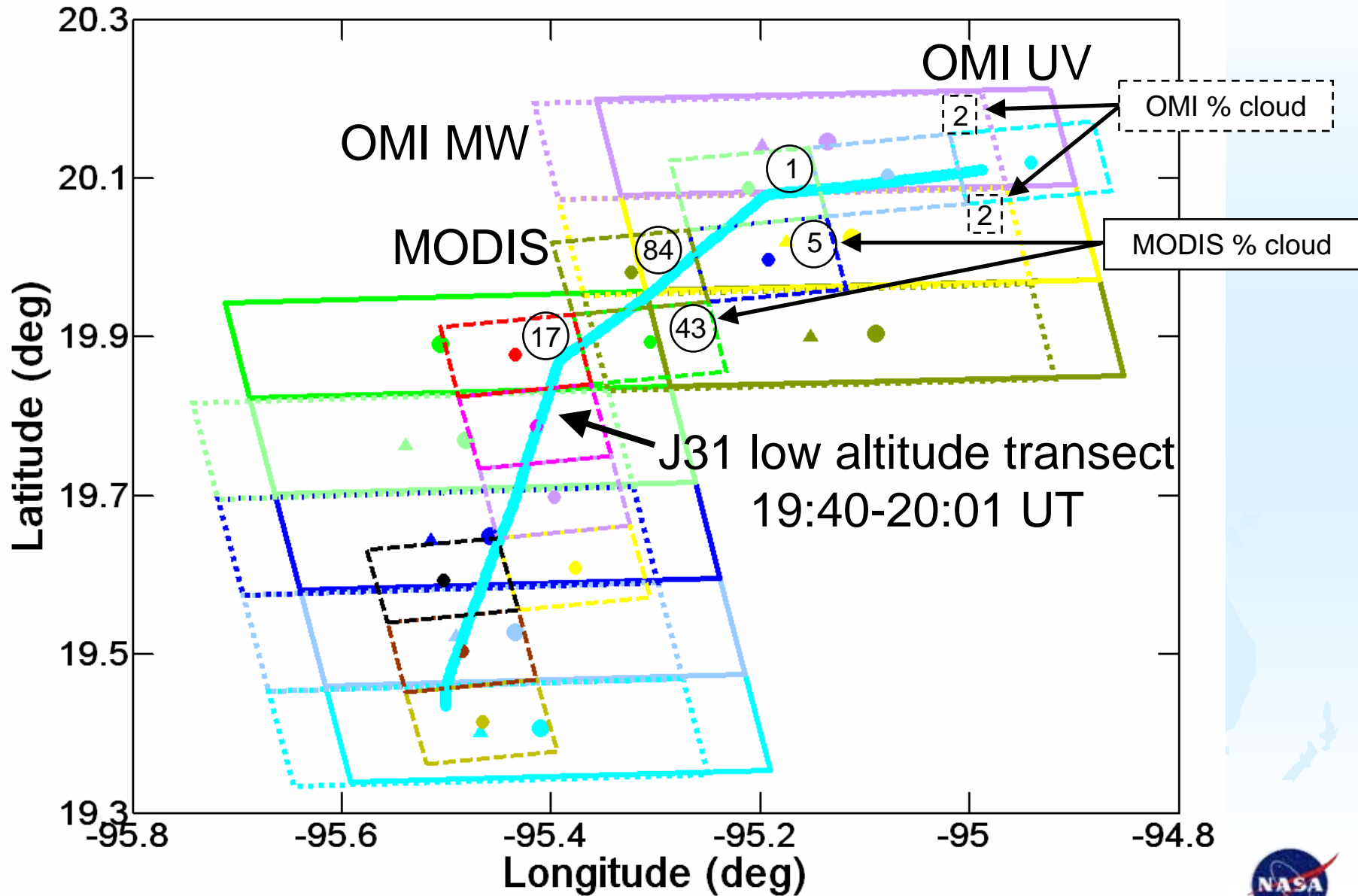
INTEX-B/MILAGRO, 2006

True Color Image (Aqua), 10 March, 19:55-20:00 UT

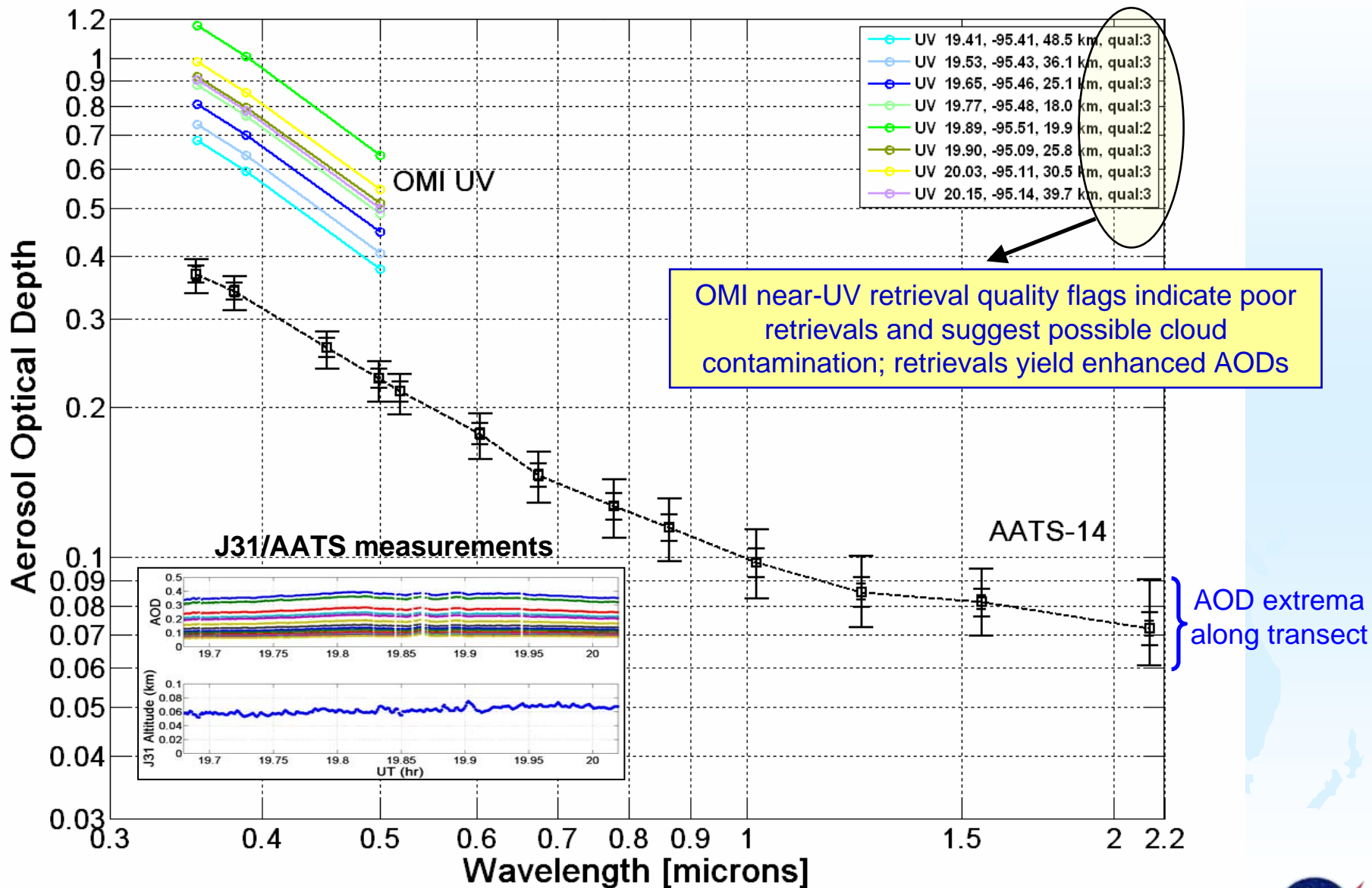


AOD Comparisons, OMI - MODIS - AATS

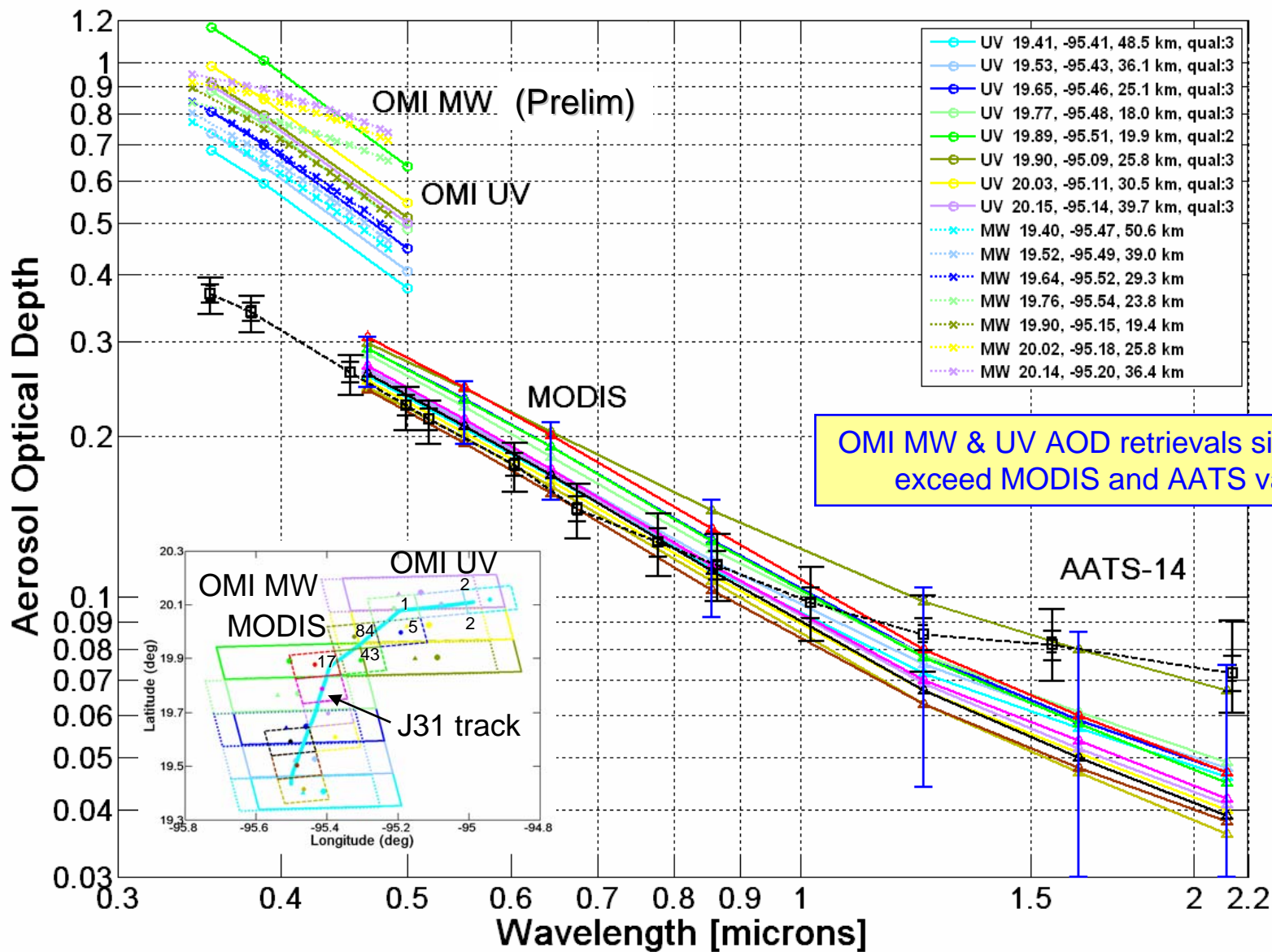
INTEX-B/MILAGRO, 10 March 2006



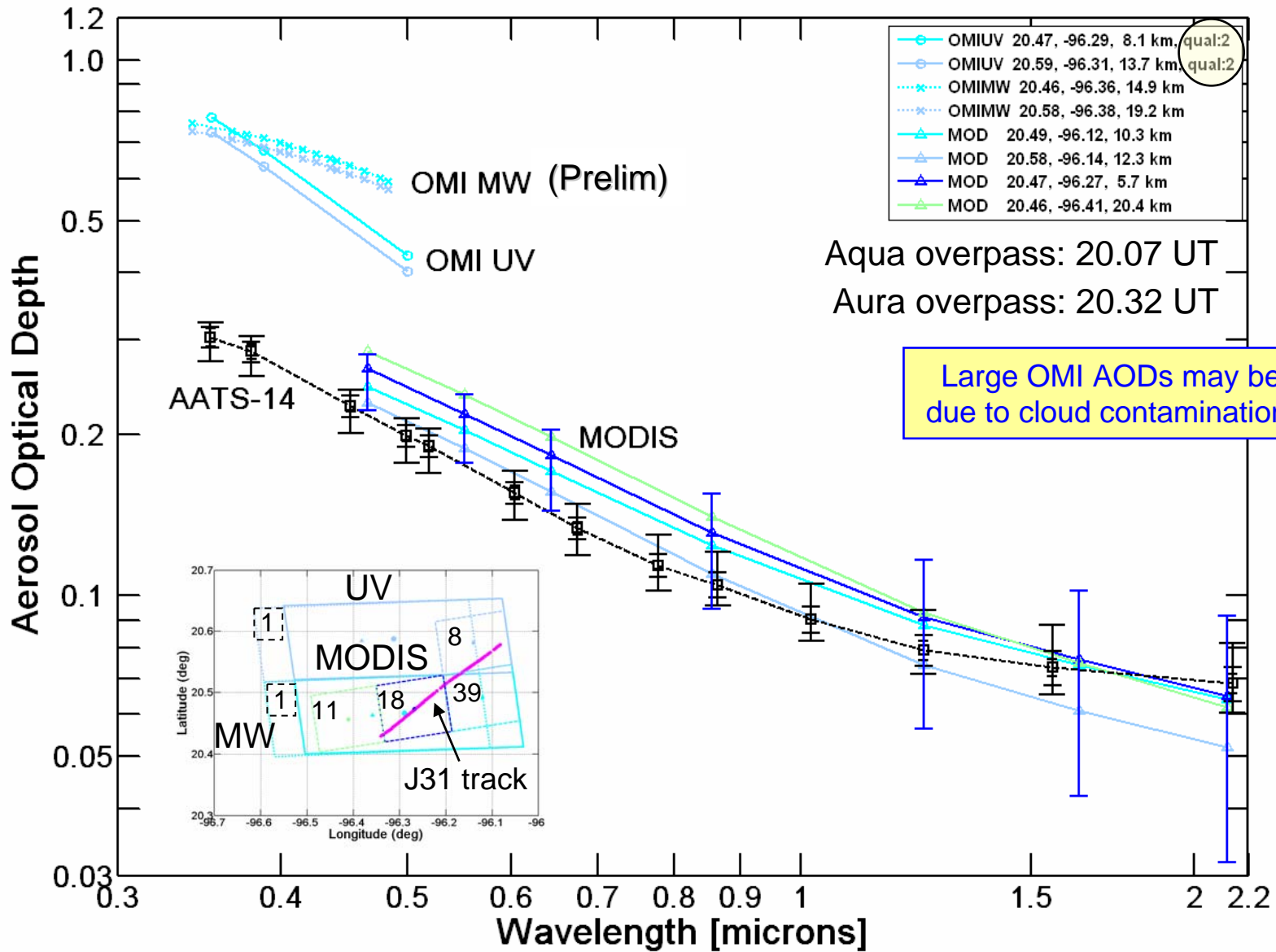
J31 low altitude transect: 19.680-20.020 UT zkm: 0.06+-0.00 km



J31 low altitude transect: 19.680-20.020 UT zkm: 0.06+-0.00 km



J31 low altitude transect: 19.420-19.526 UT z: 0.06±0.01 km



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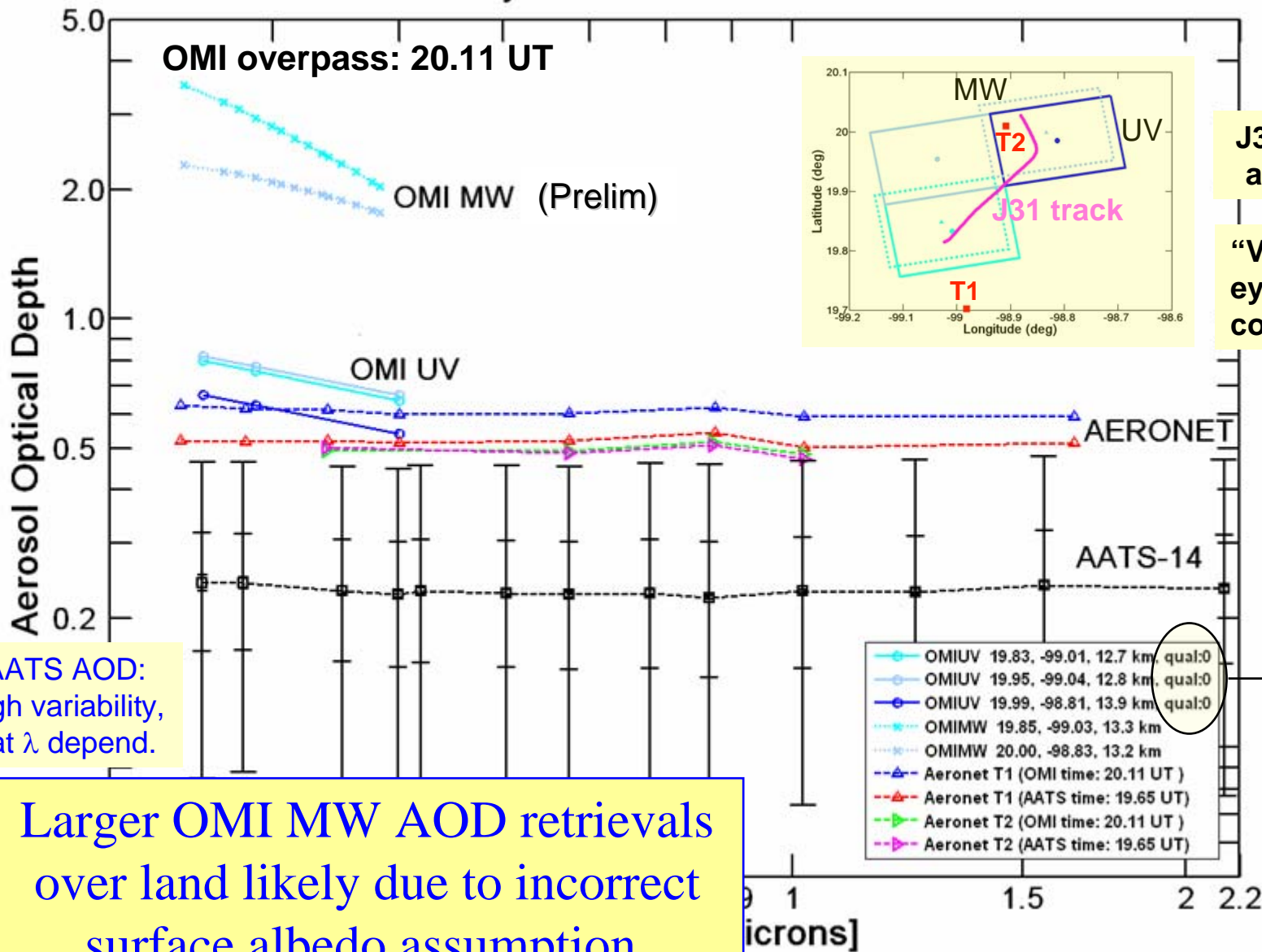
Photo from DC-8 over Mexico City, 19 Mar 2006

Courtesy of Cam McNaughton (Univ. of Hawaii)



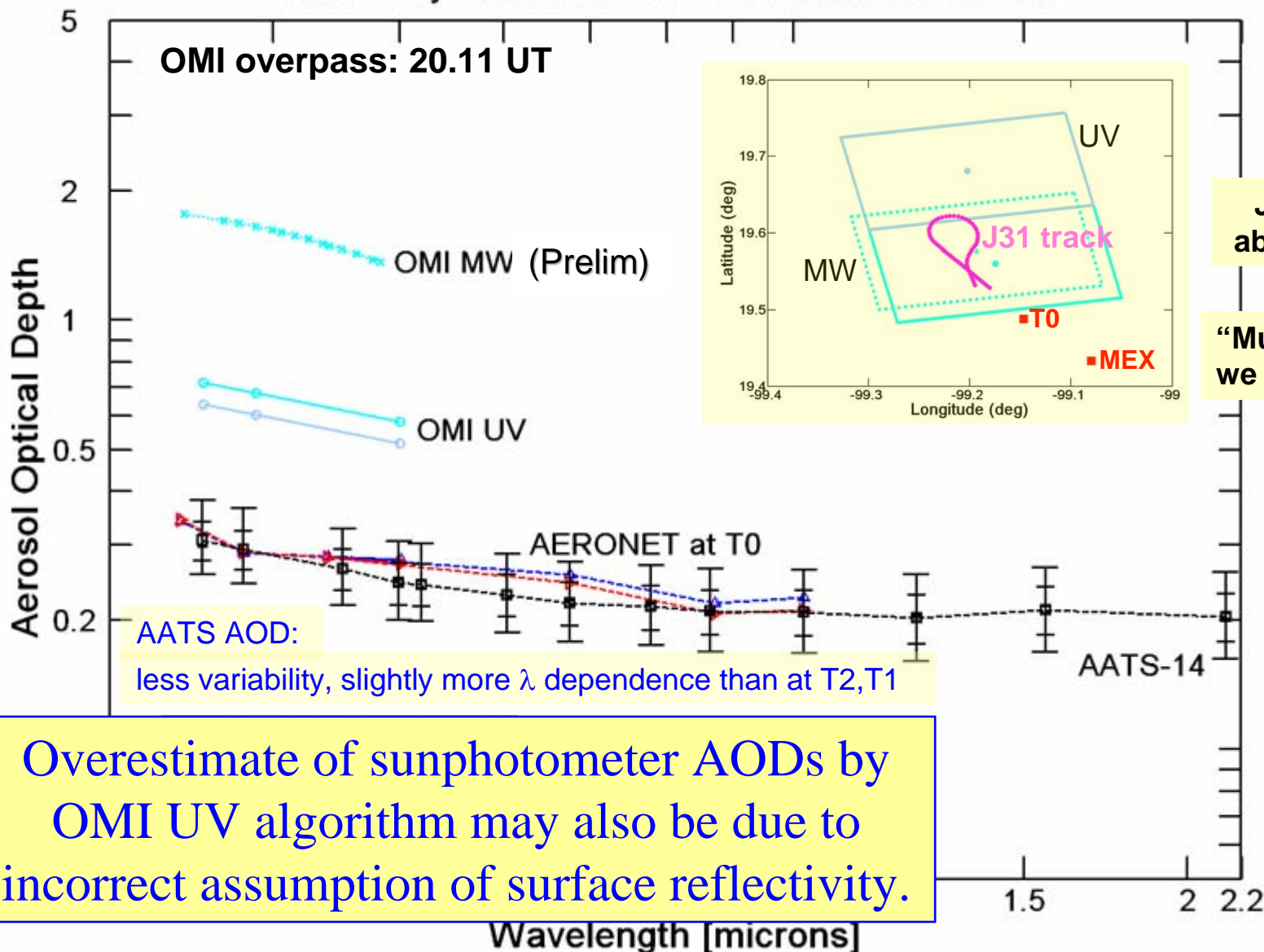
19 March 2006 (over land)

North of Mexico City 19.60-19.70 UT J31 altitude: 2.96±0.03 km



19 March 2006 (over land)

Mexico City 20.41-20.48 UT J31 altitude: 2.79±0.02 km

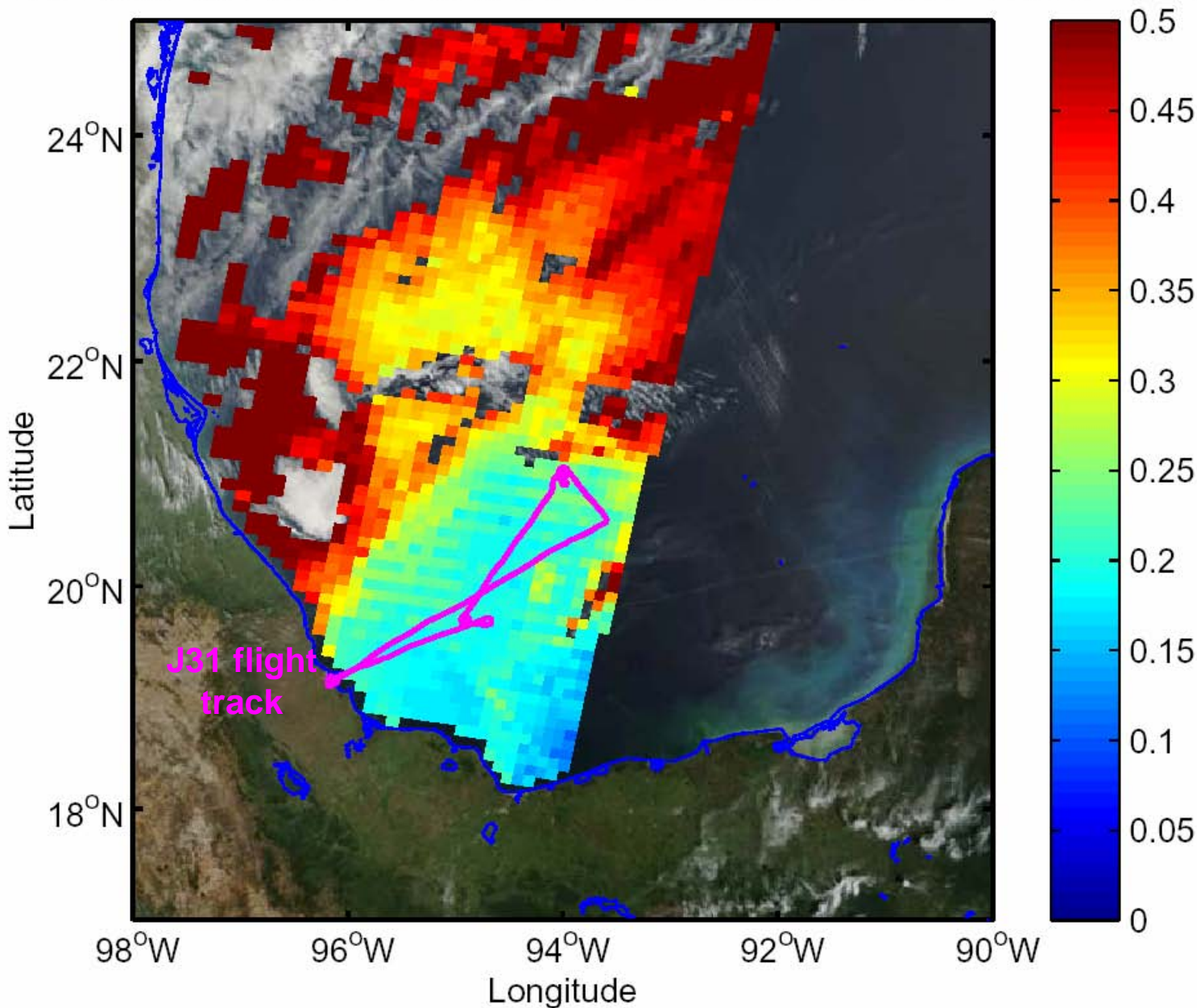


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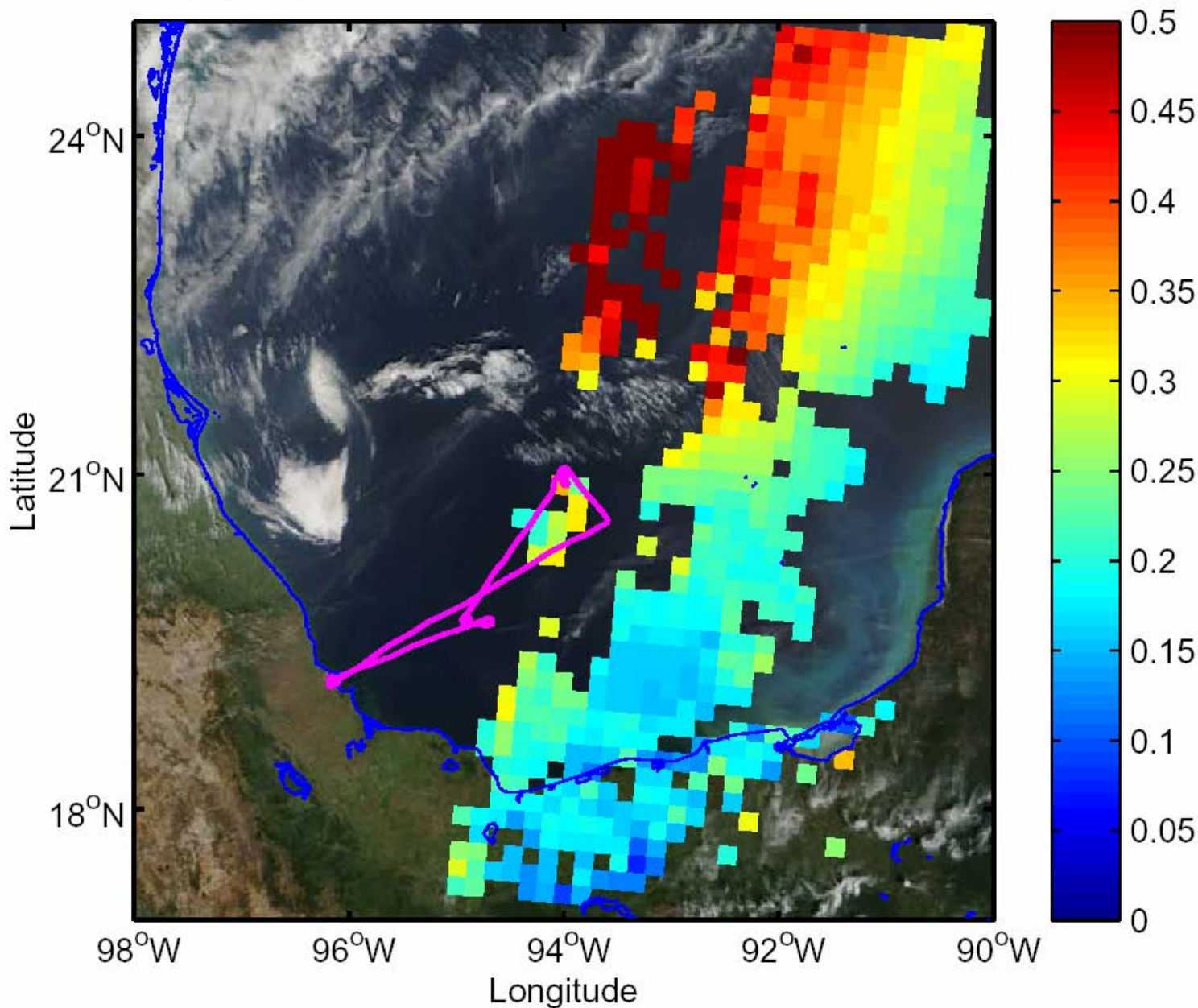
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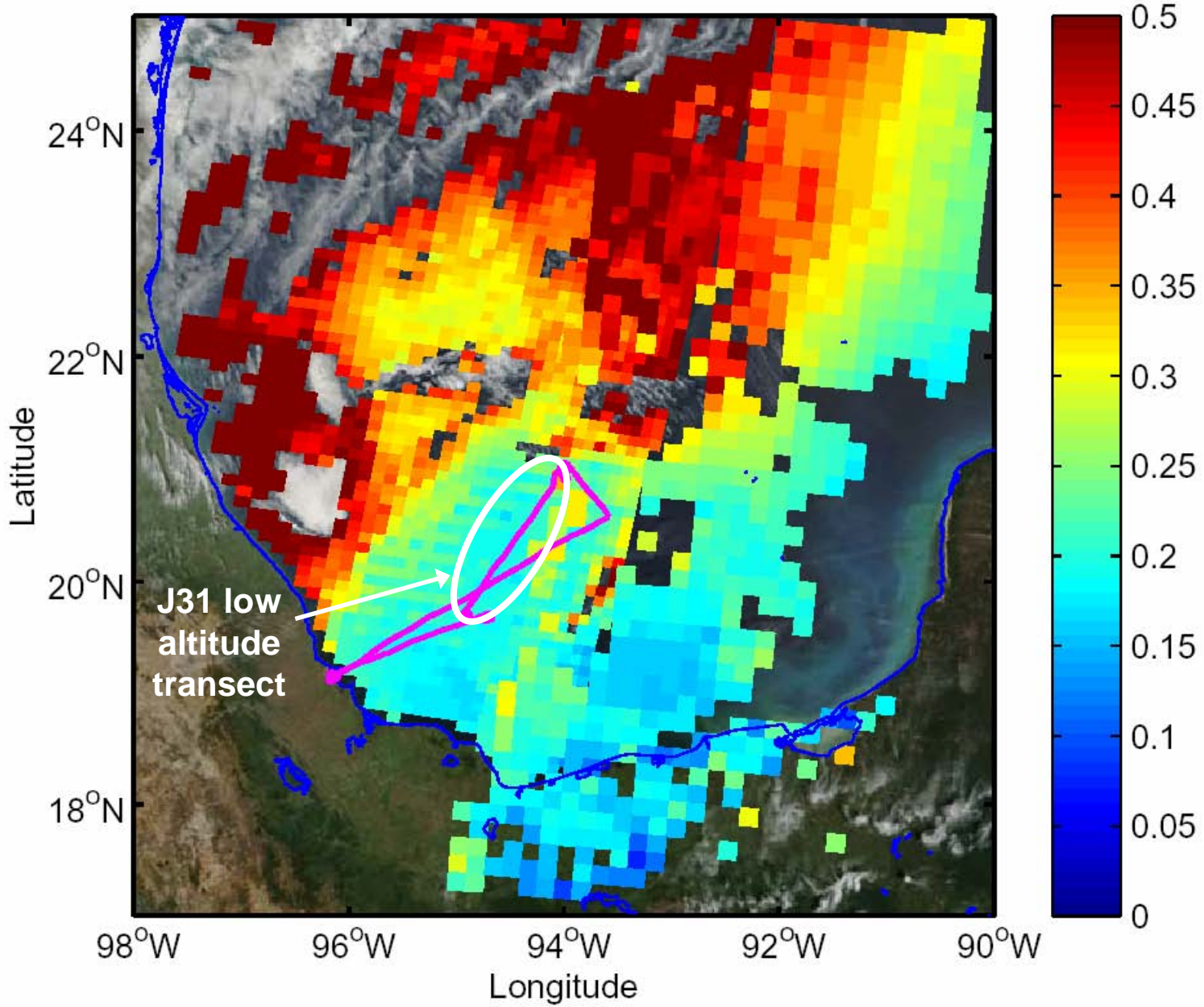
AOD 550nm, MODIS, Terra, 069, 03/10/2006, UT: 16:50–16:55



AOD 558nm, MISR, Terra, 069, 03/10/2006, UT: 16:50–16:55



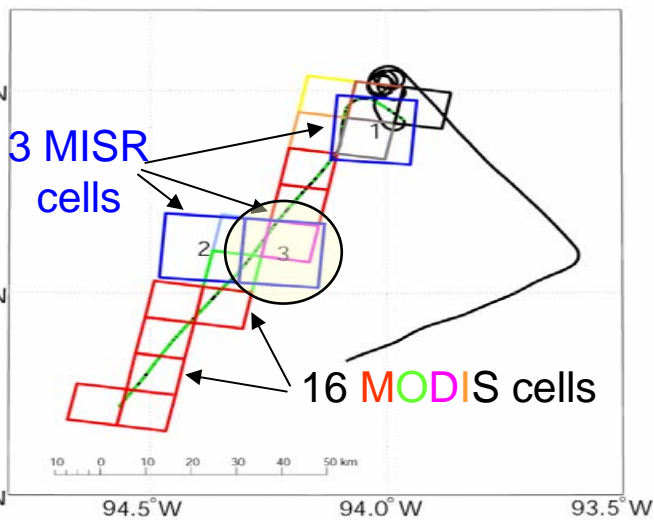
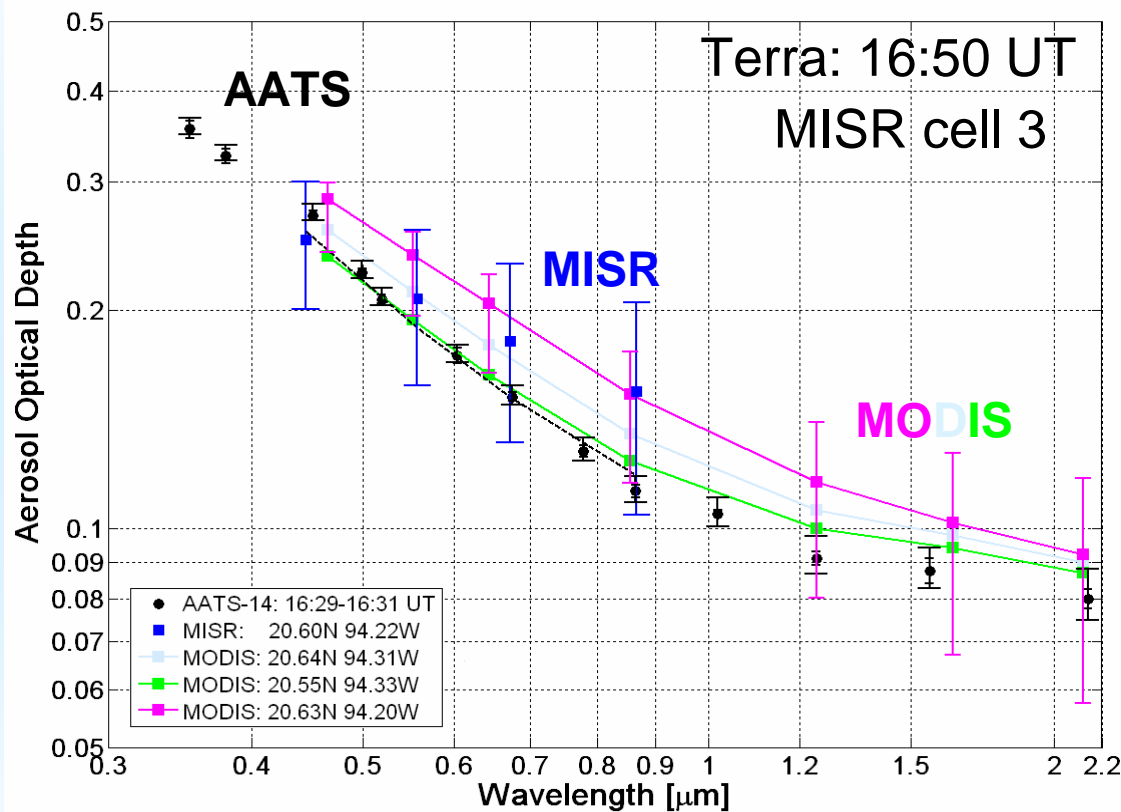
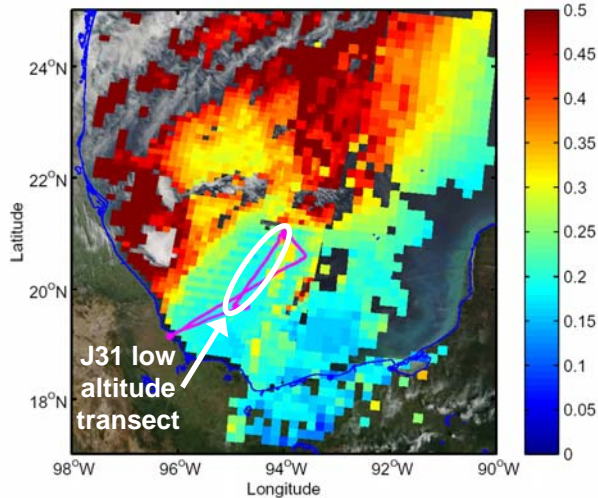
AOD 558/550nm, MISR/MODIS, Terra, 069, 03/10/2006, UT:16:50-16:55



AOD Comparisons, MISR - MODIS - AATS

Gulf of Mexico, INTEX-B/MILAGRO, 10 March 2006

MODIS/MISR composite AOD



Summary/Conclusions

- 1) AATS-14 MILAGRO/INTEX-B data set is **very mature** and the latest version is **archived**; future changes will likely affect only singular data points at high altitude; would require fine-combing by hand.
- 2) **Validation of MODIS (-Terra & -Aqua) AOD well underway: major finding is exceptionally good agreement** with AATS and **appreciable AOD at SWIR**.
- 3) For AATS/OMI coincidences, archived OMI near-UV AODs and preliminary **OMI MW AODs exceed AATS AODs**, but these cases need to be examined in more detail. Differences may be due to **cloud contamination over water** or to the **surface albedo assumed by the OMI retrieval algorithms over land**. *Analysis of coincident measurements by other J31 sensors (SSFR, RSP, and CAR) should provide additional information on surface spectral albedo and BRDF.* **Still to be investigated: effect of MILAGRO-measured wavelength-dependent SSA in UV.**
- 4) **AATS, MODIS, and MISR** over-water AOD spectra have been compared for a Terra overpass: **near-IR AODs agree** within uncertainties **in all 3 MISR grid cells**; in the **visible**, MISR AODs agree with AATS and MODIS values in **2 of 3** co-located MISR cells.
- 5) **Collaboration between AATS and other J-31 sensors is in its initial phase.**



End of Presentation

Remaining Slides are Backup



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