UAS Laser Hygrometer (ULH)

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ATTREX Science Team Meeting

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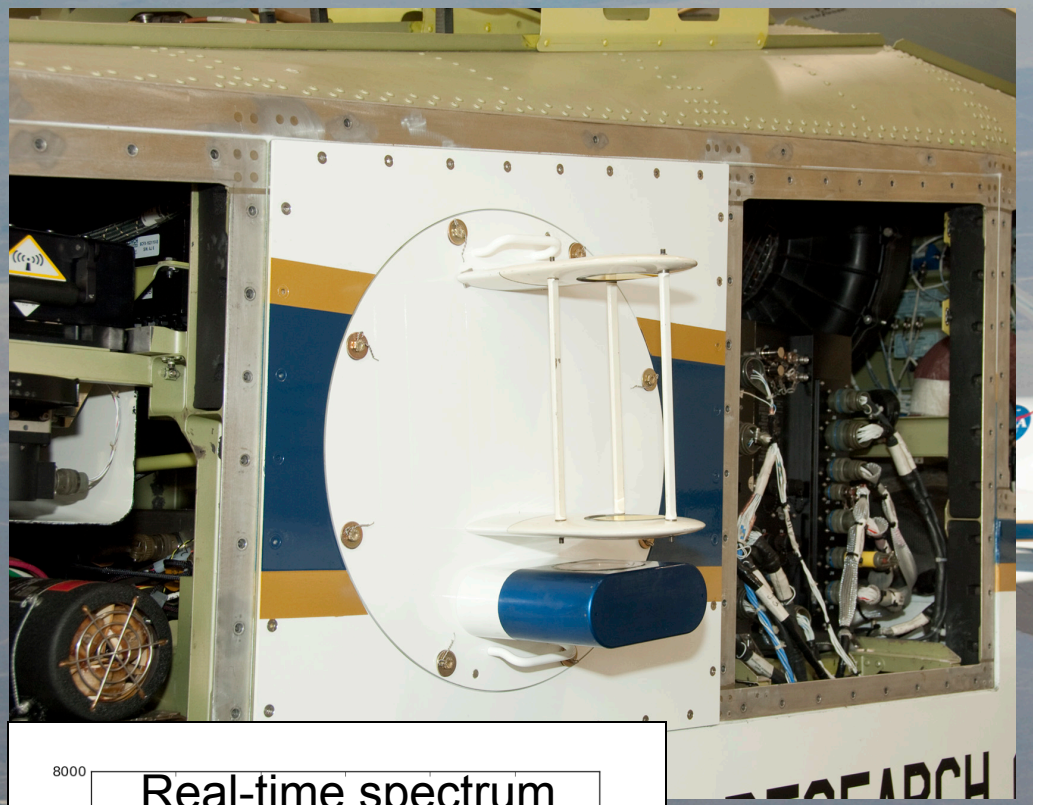
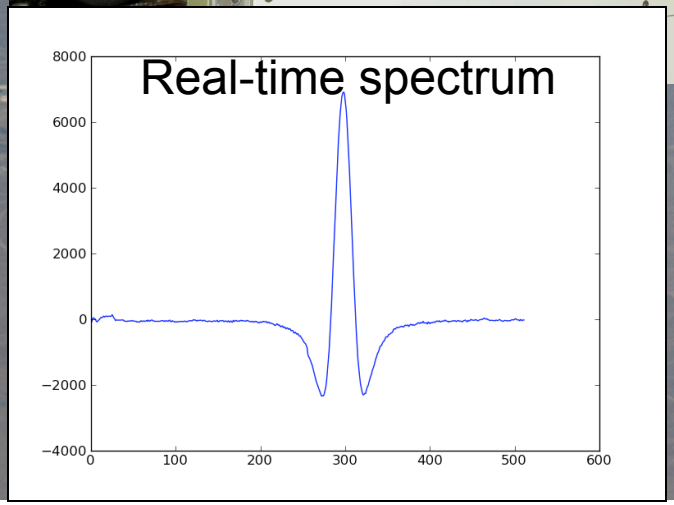


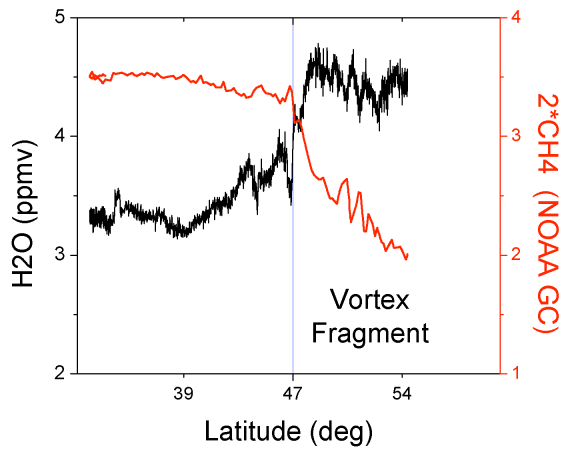


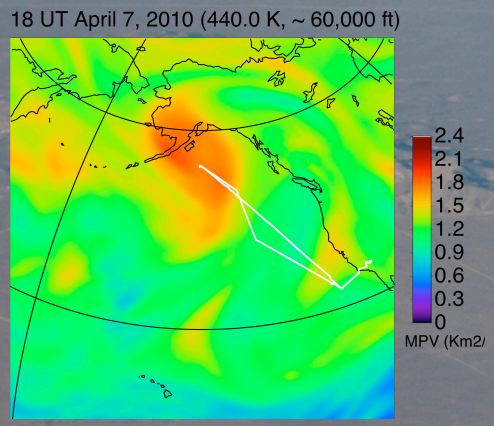
- Infrared laser absorption by water in a multipass optical cell.
- Accurate water vapor is critical for climate studies.
- Latest generation of JPL Laser Hygrometer, flying on the ER-2, WB-57, and DC-8 since 1997.
- Total number of flights: 221.
- Sampling rate: 1-40 Hz
- Precision: greater of 0.05 ppmv or 1% (goal for 2013).
- Accuracy: 10%
- What's new: Linux OS, ethernet, real-time data, command and control from the ground with a custom gui.

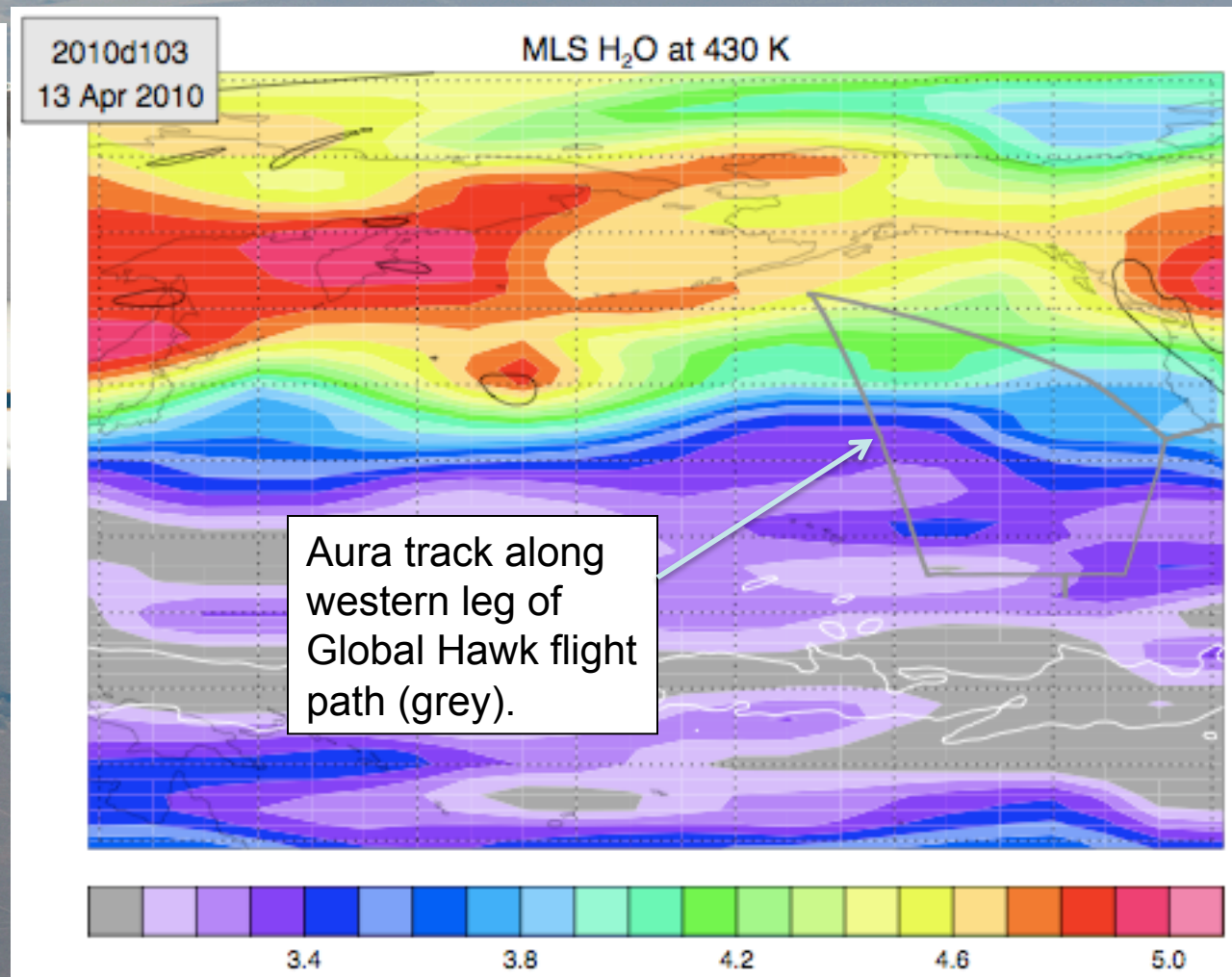
Some ULH results from GloPac

April 7th
Polar vortex fragment

April 13th
Aura validation from Arctic to tropics (52 - 15 N)



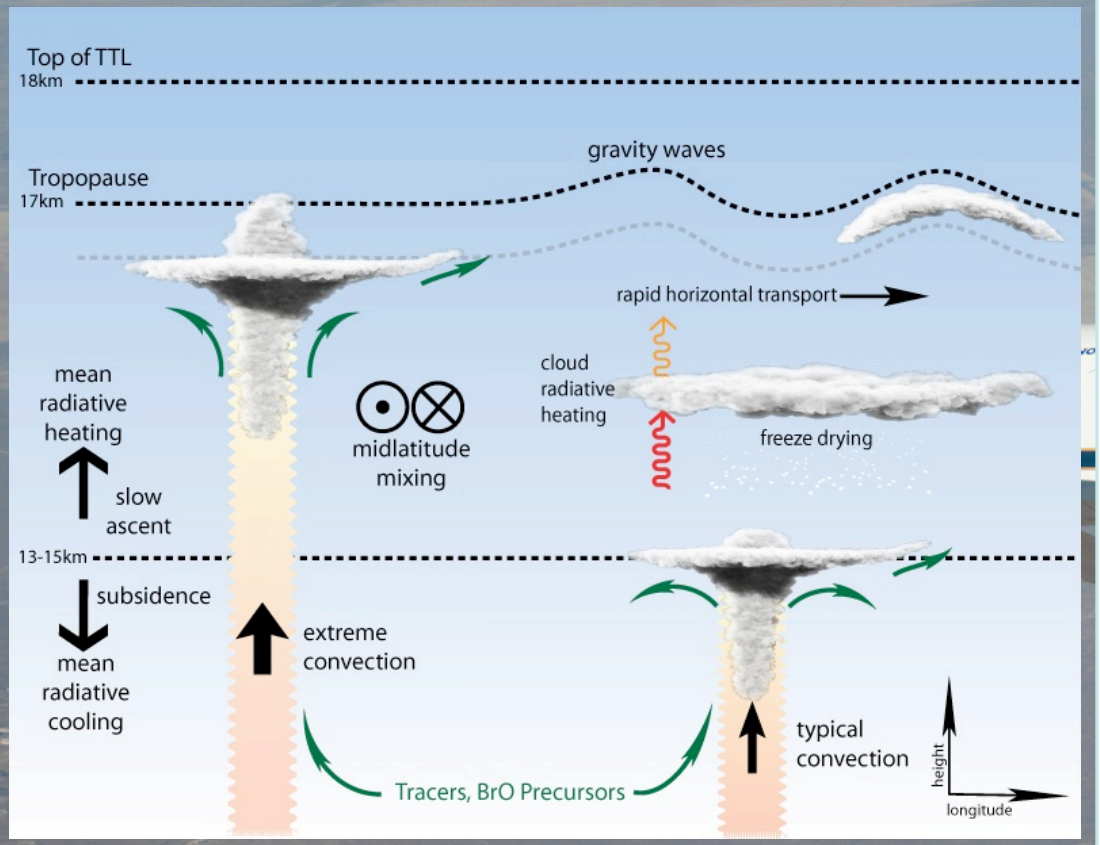




MLS water courtesy of Gloria Manney (JPL)

ULH Role on ATTREX:
Accurate In-situ Water Vapor

ATTREX Goal: How does the TTL control the composition of the stratosphere, especially H_2O?



Schematic of the Tropical Tropopause Layer (TTL) from ~13-18 km. T-structure controls H_2O flow.

- In-situ water vapor will be measured by the JPL UAS Laser Hygrometer (ULH).
- TTL water has disproportionate impact on climate (e.g. Solomon et al., Science, 2010).
- The NASA Global Hawk will carry out flights in different seasons to the region of interest, the Western Pacific TTL.
- The target is very dry air < 3 ppmv H_2O (perhaps < 1 ppmv).
- Our approach: improve signal, optical stability, consider stronger absorption line.

ULH Role on ATTREX

How dry is the TTL?

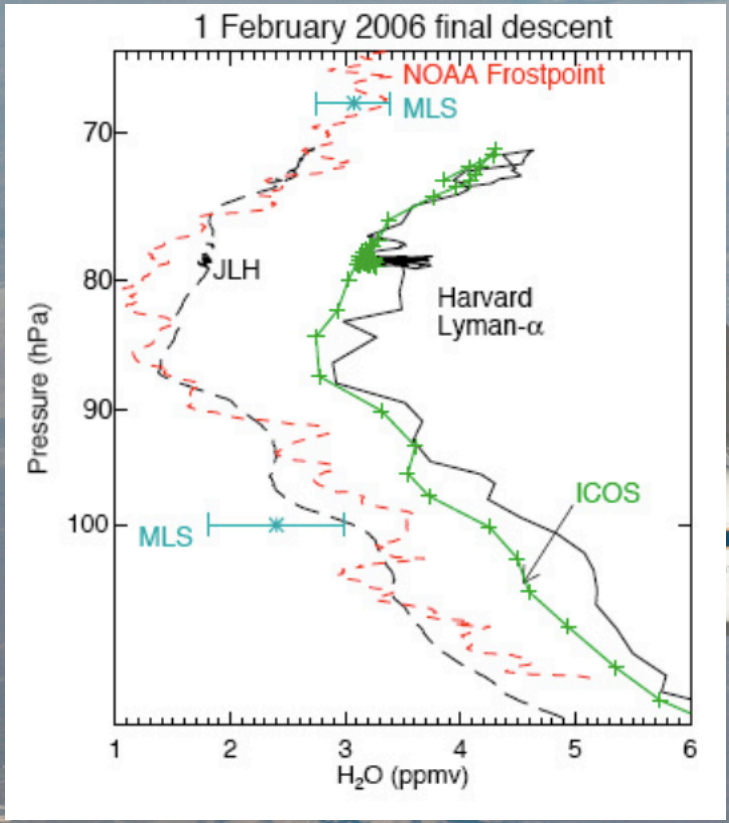


Figure courtesy of Eric Jensen

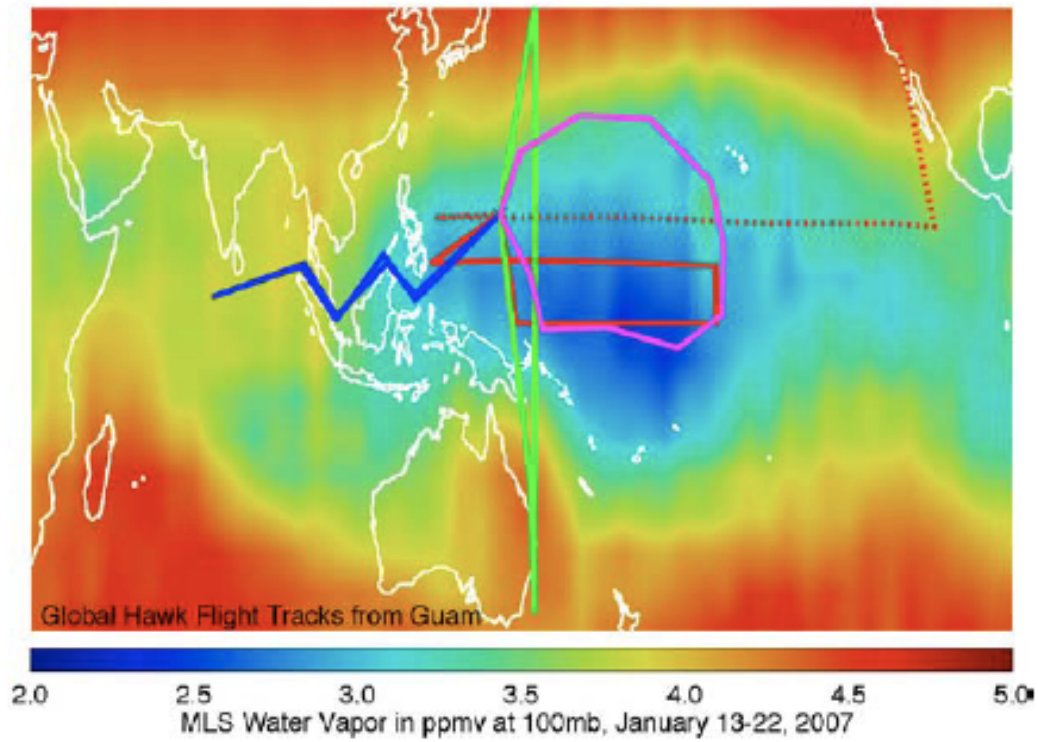


Figure 2-2. As in Figure 2-1b, except with 100mb MLS [Read, et al, 2007] water vapor (time as indicated) as background.

Left: Water vapor minimum value in the TTL is debated, but the in-situ instruments have improved since 2006 (previous encounter of < 3 ppm water). **Right:** Similar water vapor profiles are expected in the Western Pacific TTL during ATTREX.