Comparison of AURA/MLS tropospheric water vapor profiles with the new water vapor Raman lidar, and the radiosonde profiles from the JPL-Table Mountain Facility, CA (TMF)

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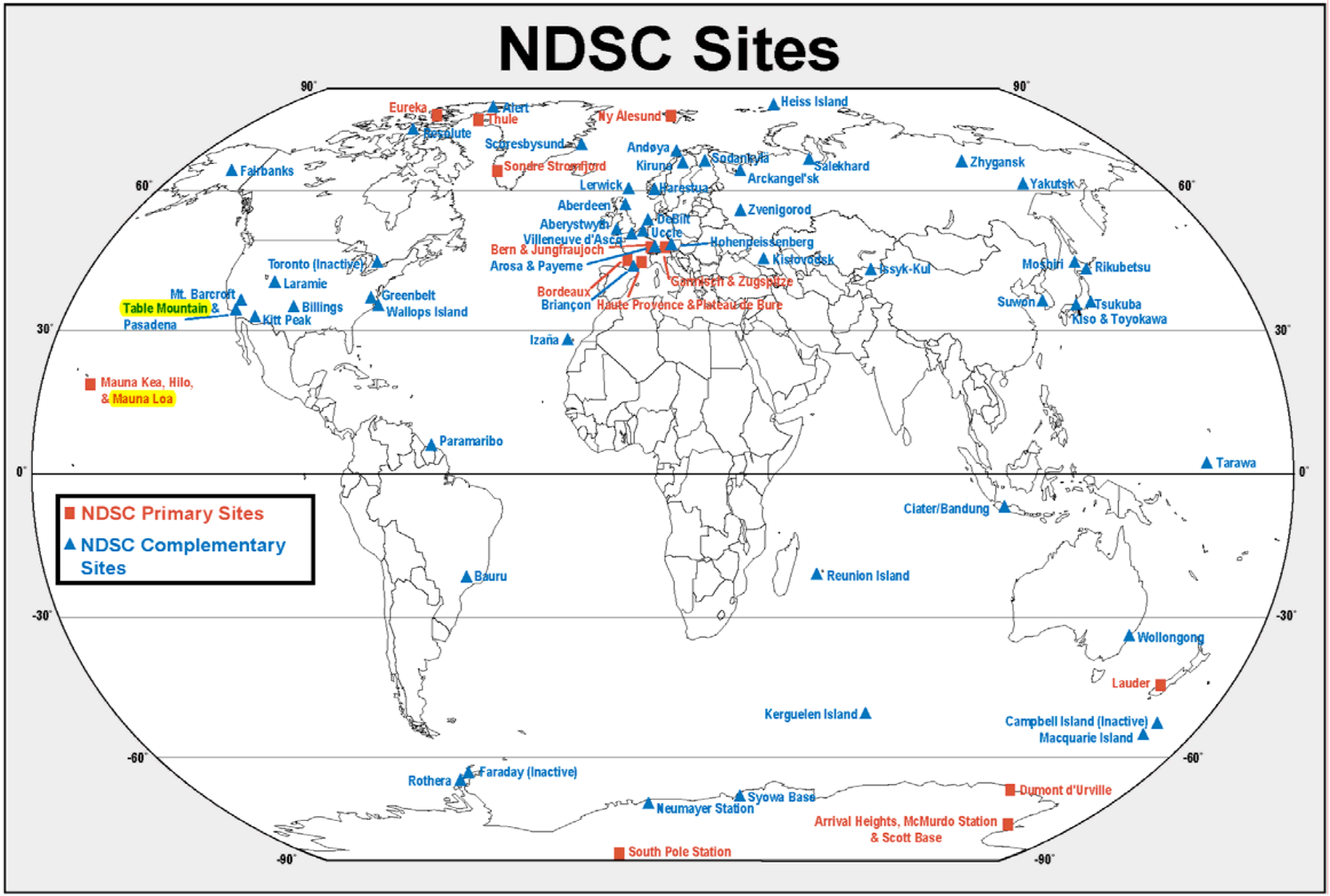
NDSC: Network for the Detection of Stratospheric Change



Water vapor Raman lidar, and PTU radiosondes at JPL/TMF

Lidar: Vibrational Raman technique. Emission at 355 nm. Reception at 387 nm (Raman N2) and 407.5 nm (H20). The ratio of the corrected lidar signals at these two wavelengths is proportional to water vapor mixing ratio.
Radisonde: PTU sondes with Vaisala Humicap RS-92 sensors

- **TMF:**
  - 50 miles NE of Los Angeles
  - Lat: 34.4ºN
  - Long: 117.7ºW
  - Alt: 2285 m (7500 ft)
  - > 340 clear nights/year

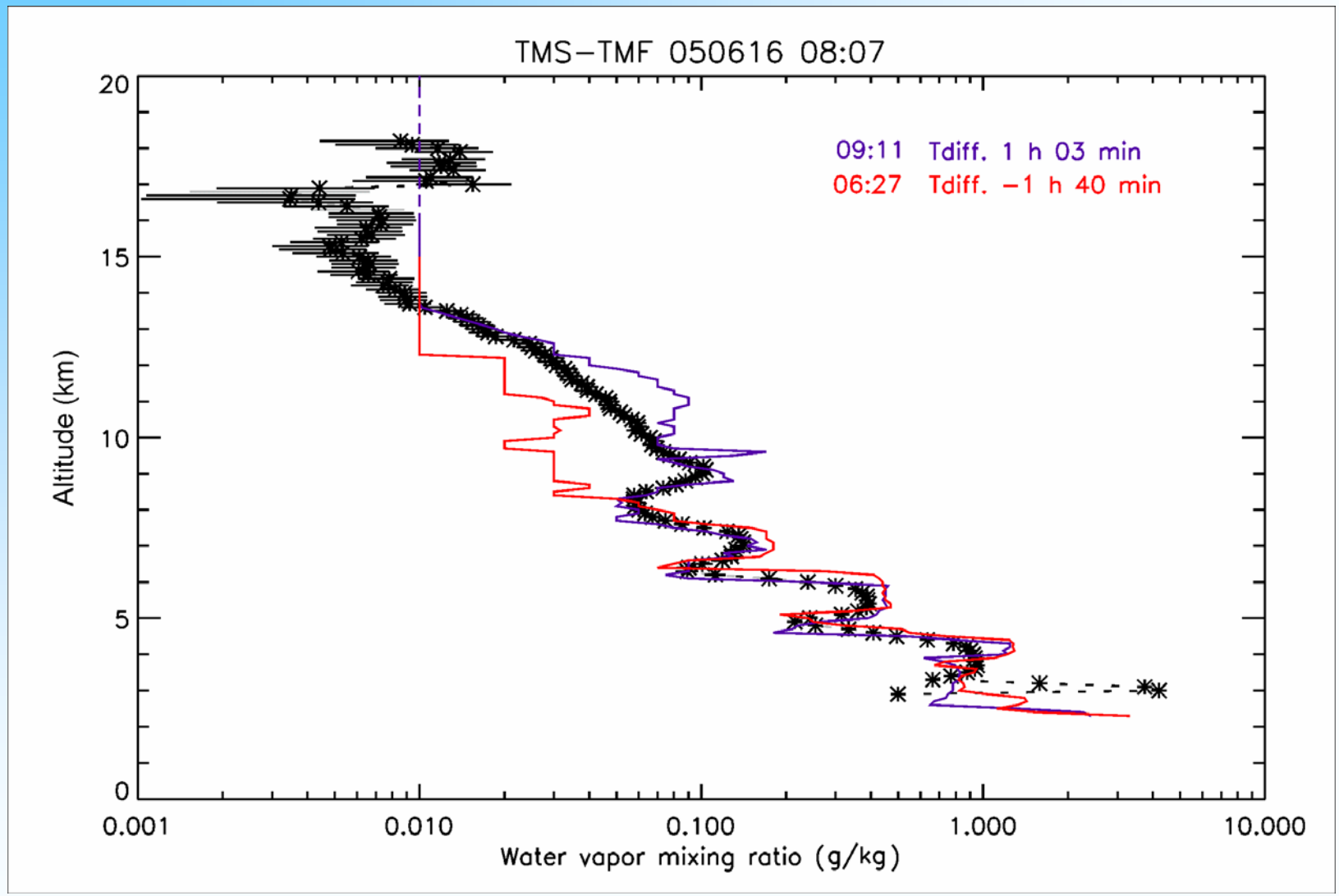
Dataset (TMF water vapor measurement program started in late 2004)

- **November 2004 – Present**:
  - Radiosonde P,T, (2.3-20 km), RH (2.3-15 km)

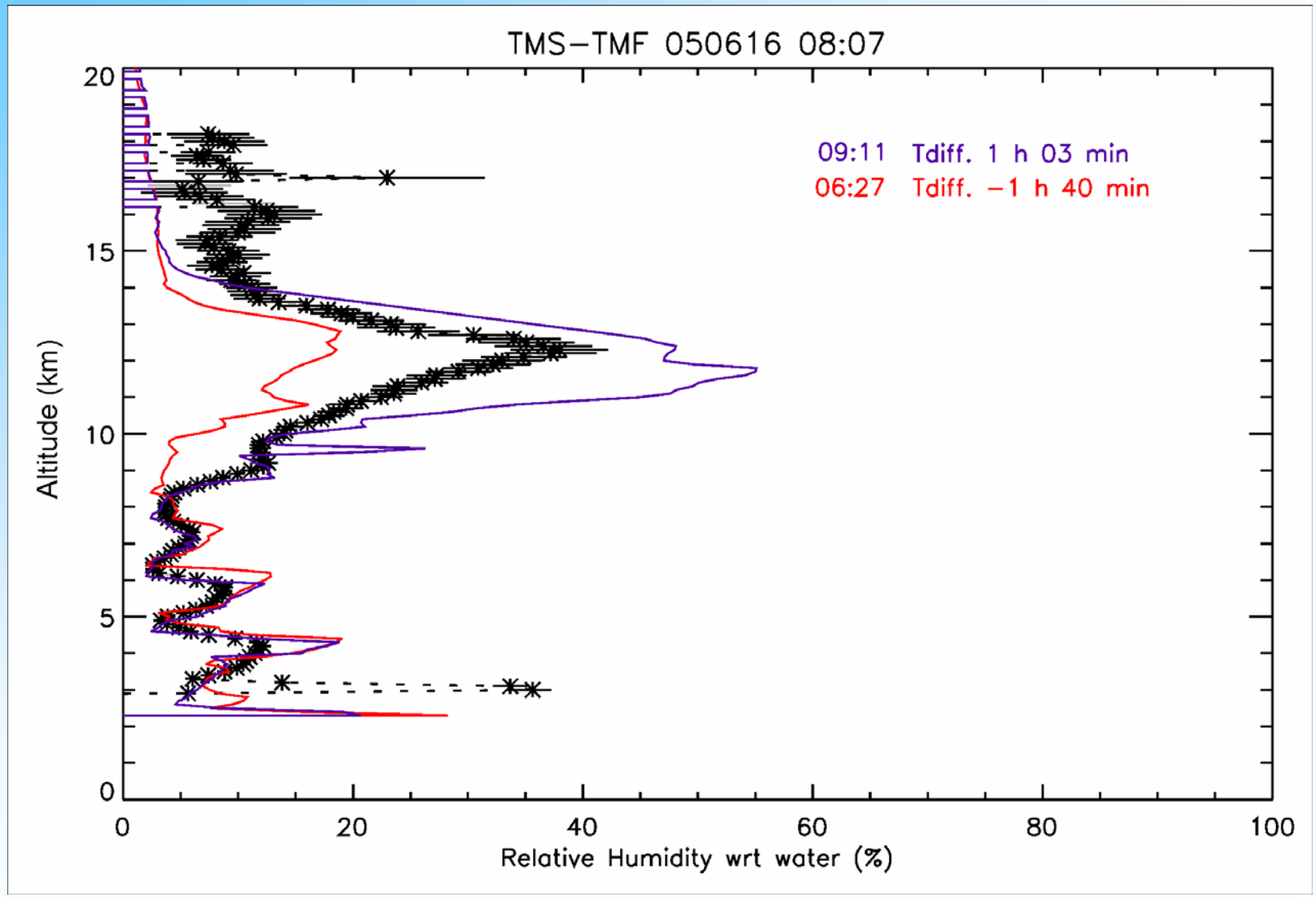
- **April 2005 – Present**:
  - Raman Lidar (4-19 km)

- **Lidar vertical resolution and accuracy**:
  - 75 m instrumental, 2-h routine integration (5-minutes minimum)
  - WV total error estimated to ~5 ppm at tropopause

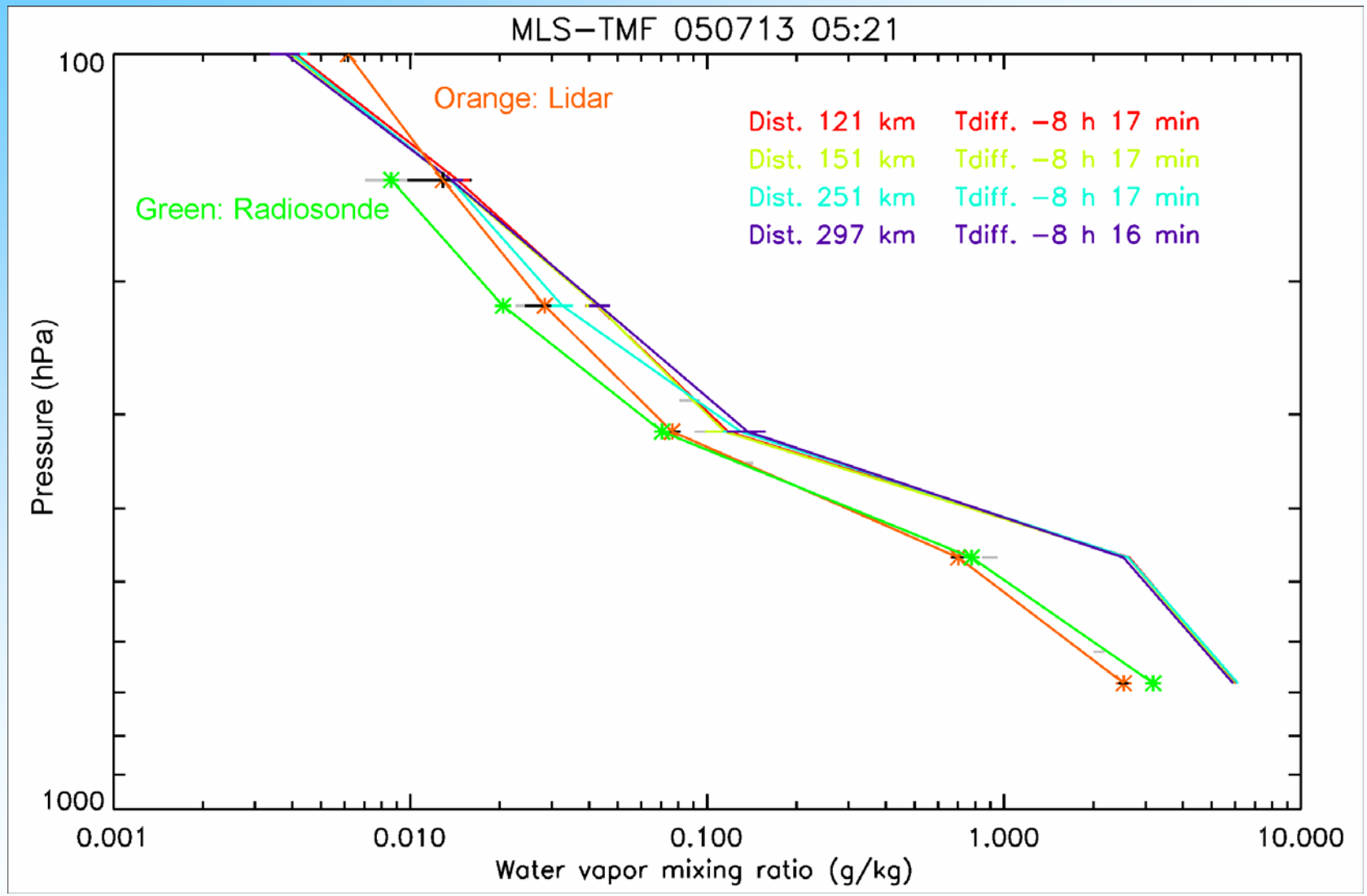
Comparisons Sonde-Lidar (1)



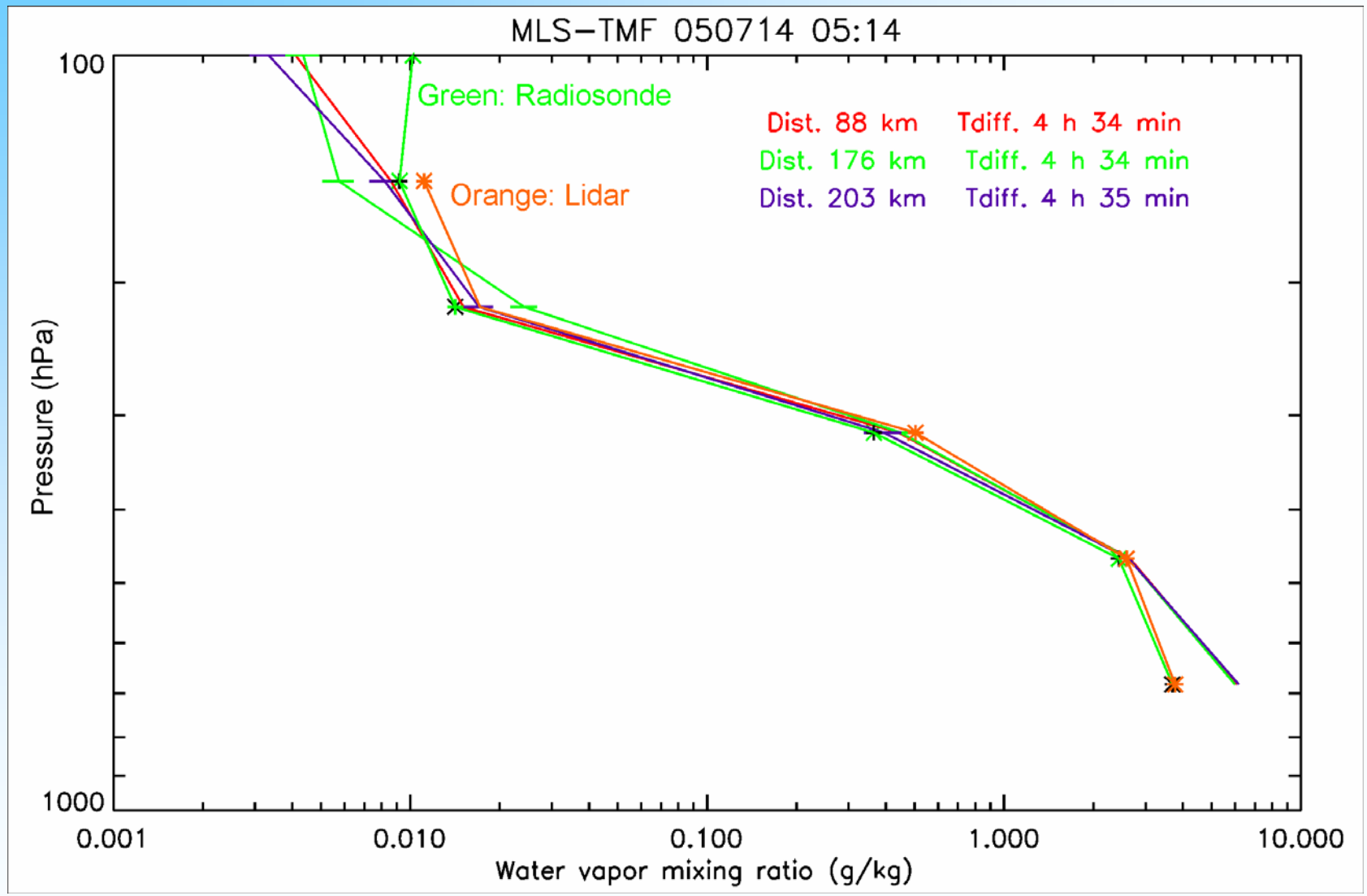
Comparisons Sonde-Lidar (2)



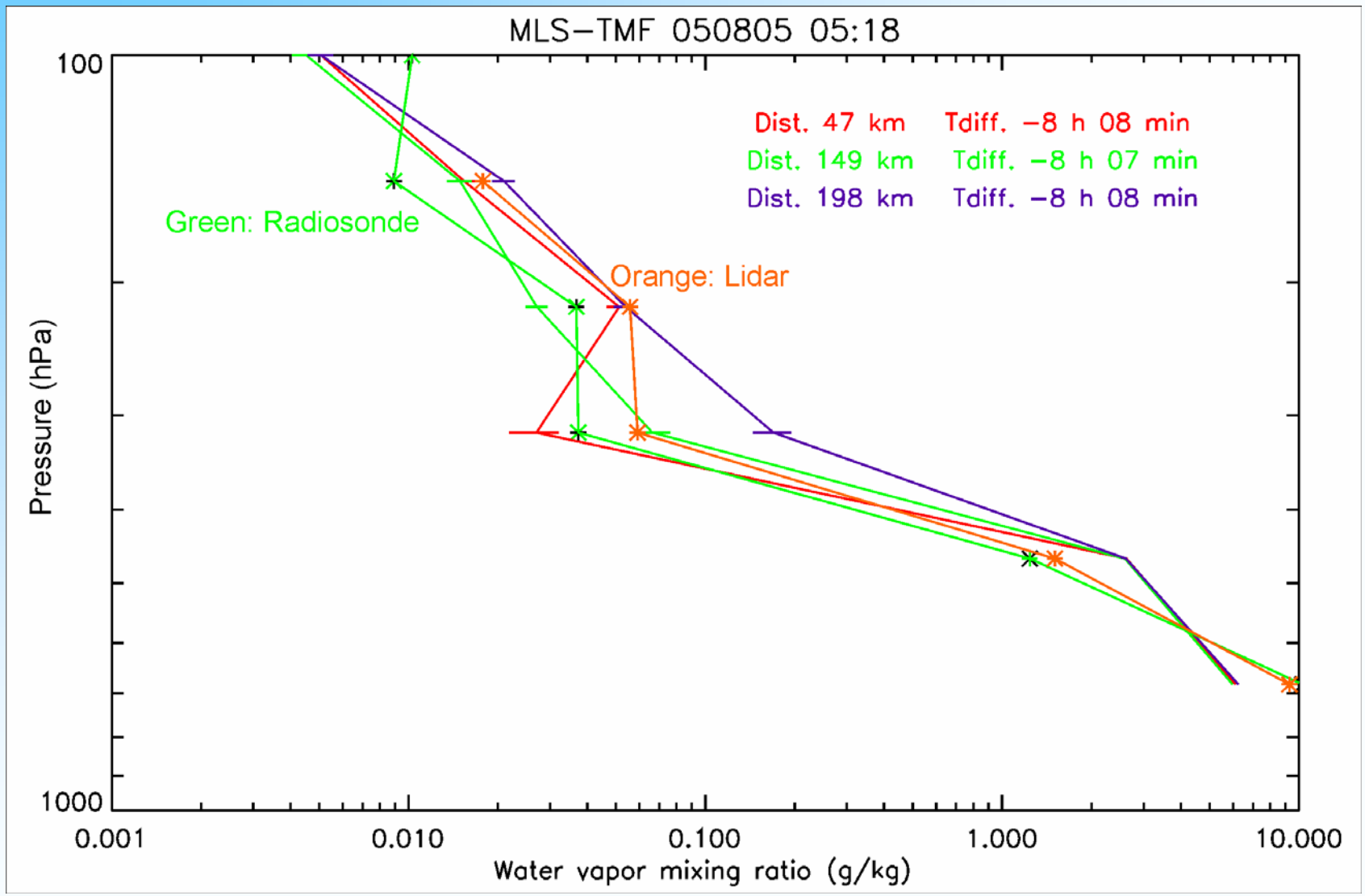
Comparisons MLS-Lidar and MLS-sonde (1)



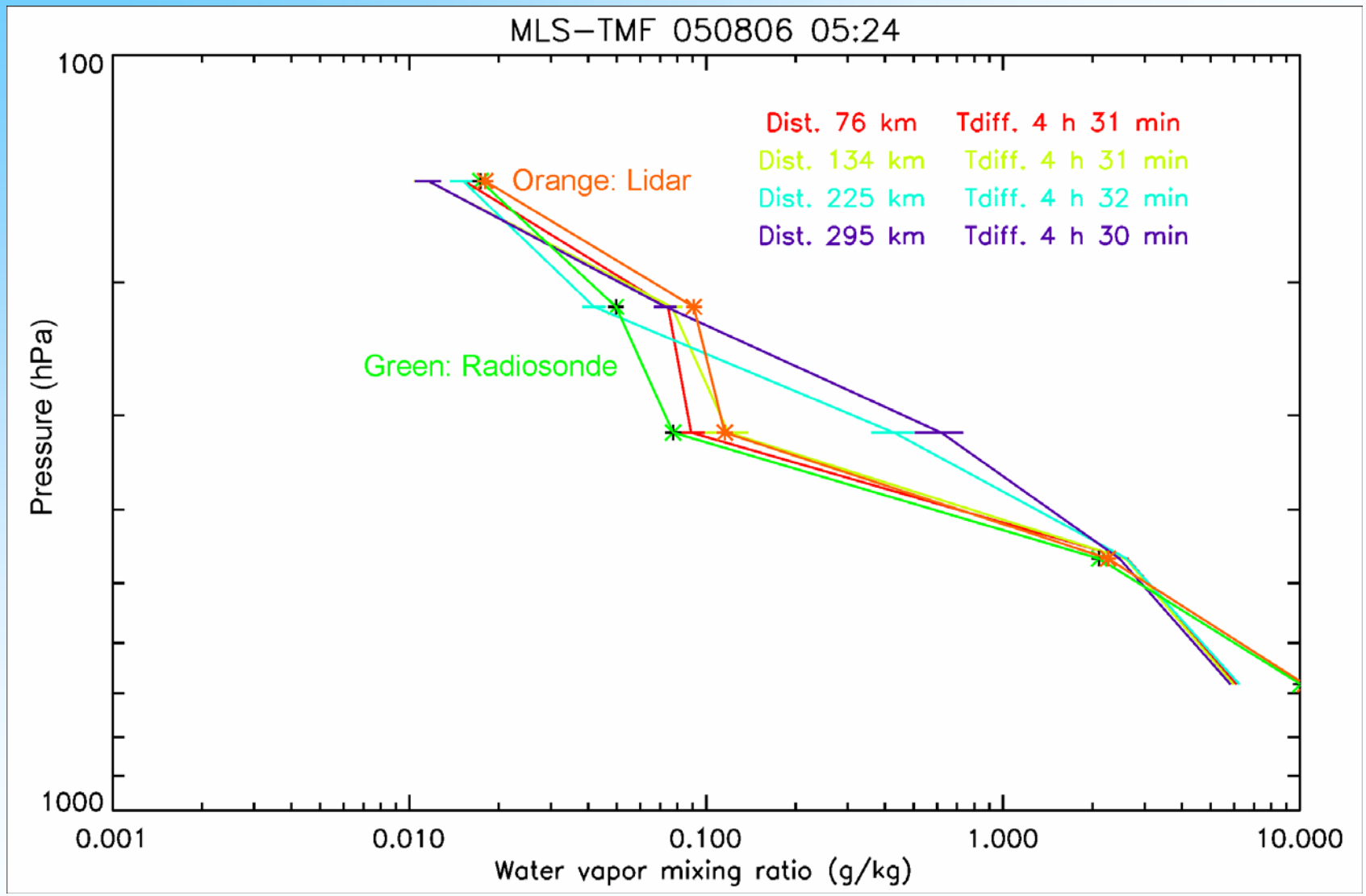
Comparisons MLS-Lidar and MLS-sonde (2)



Comparisons MLS-Lidar and MLS-sonde (3)



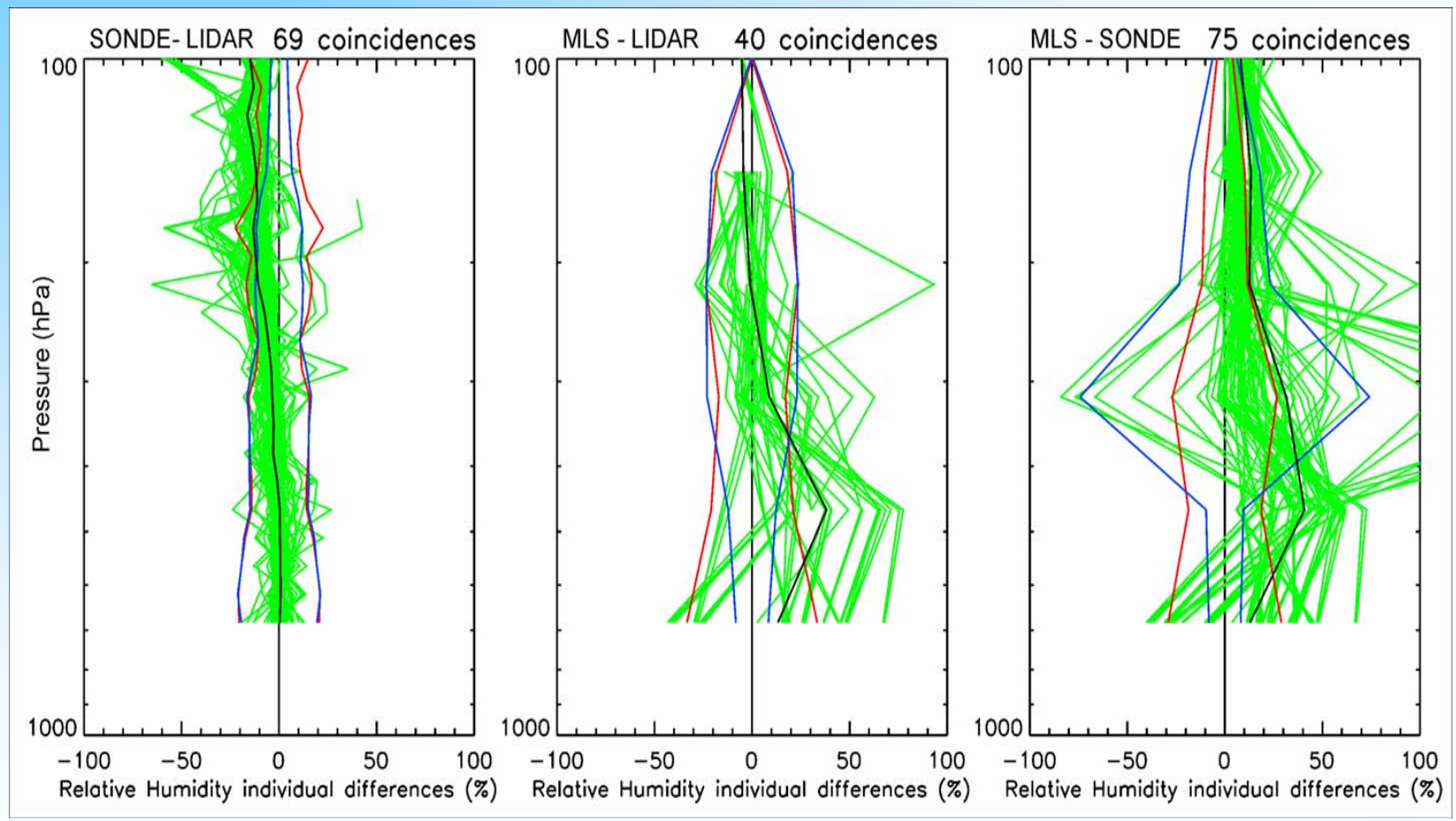
Comparisons MLS-Lidar and MLS-sonde (4)



Comparisons sonde – lidar, MLS – lidar, and MLS - sonde

Green: Differences (individual) Red and blue: Standard deviations Black: Differences (mean)

Left: blue=sonde, red=lidar Center: blue=MLS, red=lidar Right: blue=MLS, red=sonde



SUMMARY

- MLS H2O comparisons with TMF lidar and TMF radiosondes are still at a preliminary stage
- Spatial coincidence occasionally found to be good, but temporal coincidence has not been very good so far
- MLS overestimates H2O at all levels below 400 hPa
- MLS-lidar agreement found to be better than MLS-sonde agreement at levels above 300 hPa.
- Vaisala humicap sensors known to underestimate H2O above 300 hPa (cold and dry), which can partly explain MLS positive bias with sonde there.
- MLS positive bias is not present with lidar above 300 hPa.
- However: lidar has started routine measurements only recently (April 2005), and needs further validation using other measuring techniques capable of reaching the lower stratosphere (i.e., NOAA hygrometer).
- In particular, an alternate version of the lidar analysis produces a drier upper troposphere (wet bias with radiosonde reduced by a factor of two)
- Though H2O not a tracer, trajectory hunting technique over a few days should help multiply close coincidences in future comparison studies