Convective Boundary Layer Turbulent Structure from Raman Lidar Water Vapor Measurements

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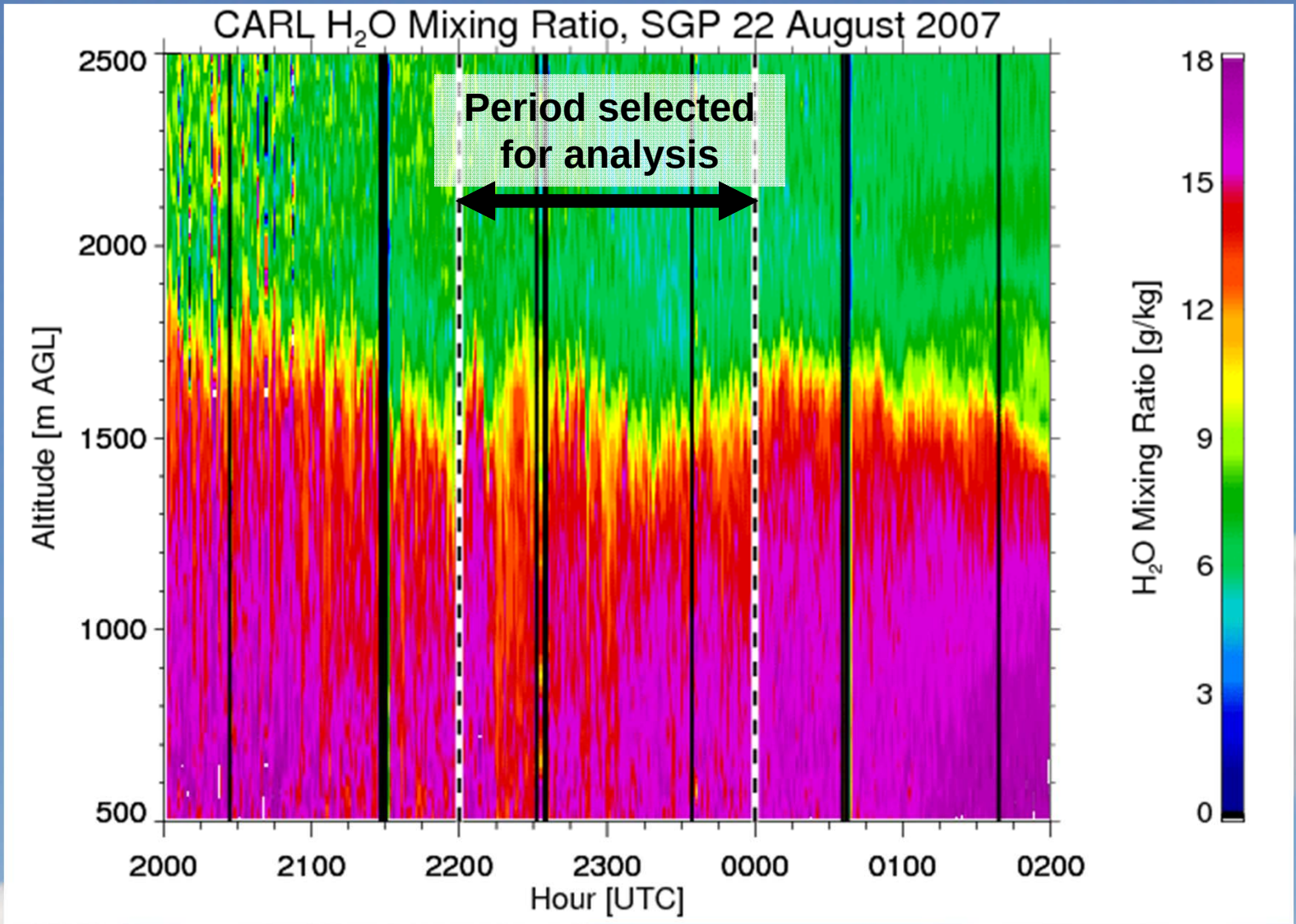
Entraining Dry Clean Air into BL and Moist Aerosol-laden Air into Free Troposphere

- Entrainment of moisture into middle atmosphere was highlighted as one of the two processes that exhibits the most sensitivity to GCM simulations (Sanderson et al. 2008)
  - Moisture in mid-trop also hypothesized to be extremely important for development of deep convection
- This entrainment important for venting aerosols out of BL
- Dry, clean air impacts BL cloudiness

- Requires high vertical and temporal resolution to study this
- Raman lidar (SGP, Darwin) makes the needed observations
  - Clear skies and beneath clouds
  - Need to account for instrument noise
- Passive ground-based WV profilers (e.g., AERI, MWRP) “run out of information” at top of BL, thus vertical resolution suffers
  - Still able to get useful information out of these instruments?
  - Does combining with satellite sounders (e.g., IASI) help?

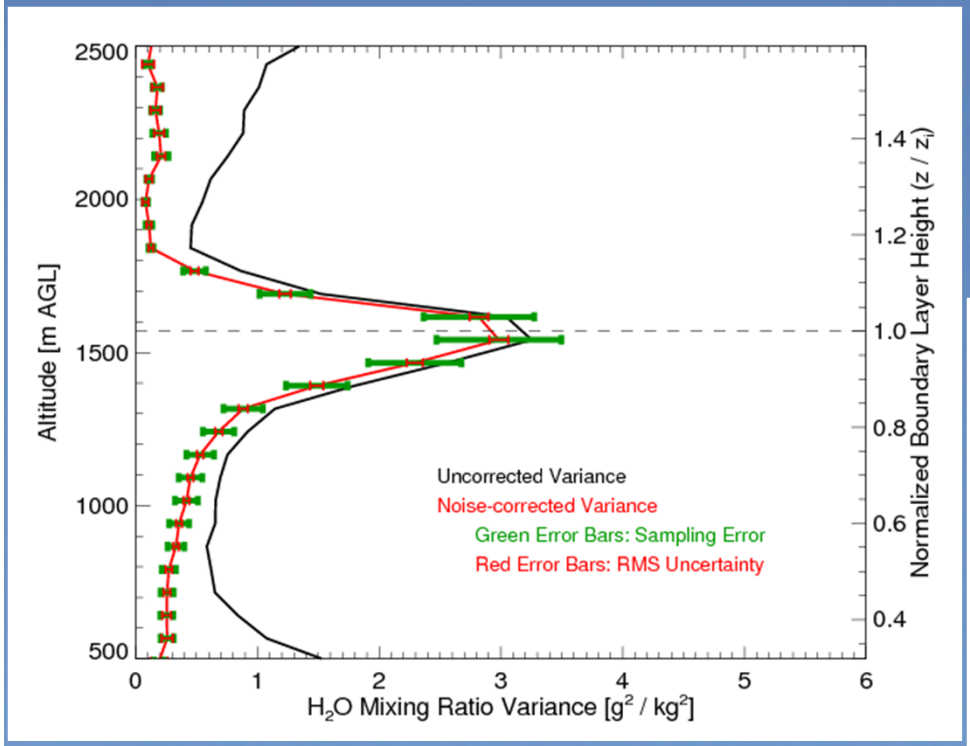
Example Time-Height Cross-Section

10-s, 75-m resolution (zoomed view)

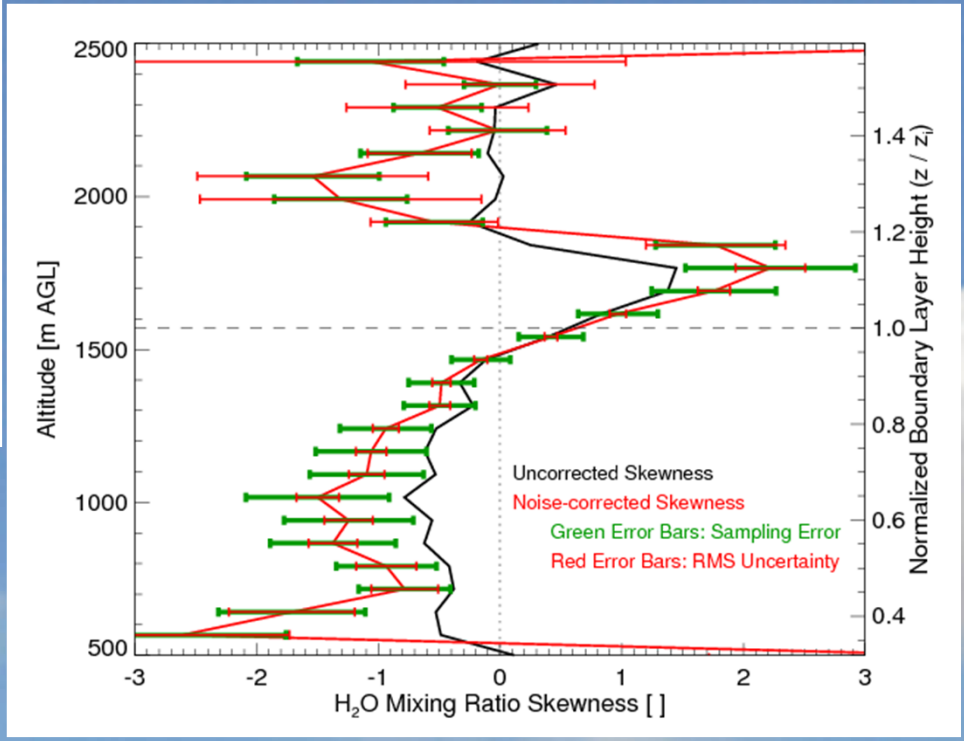


Atmospheric H_2O Variance and Skewness Profile

22 Aug 2007 from 2200-2400 UTC

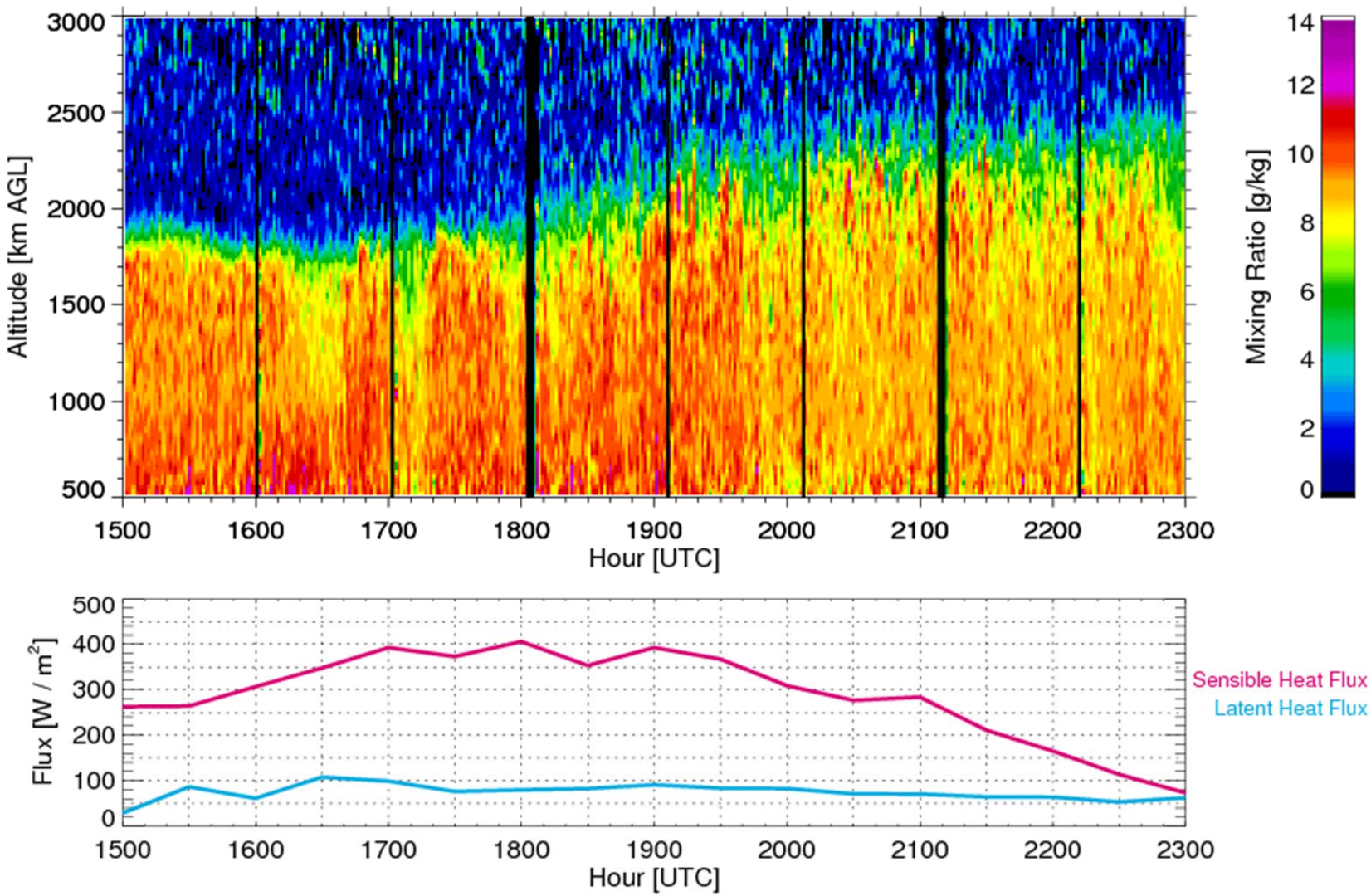


- Requires stationary boundary layer for ~2 hrs
- Method accounts for instrument noise
- Provides estimate of sampling error



Evolution of the BL Turbulence

3 September 2007



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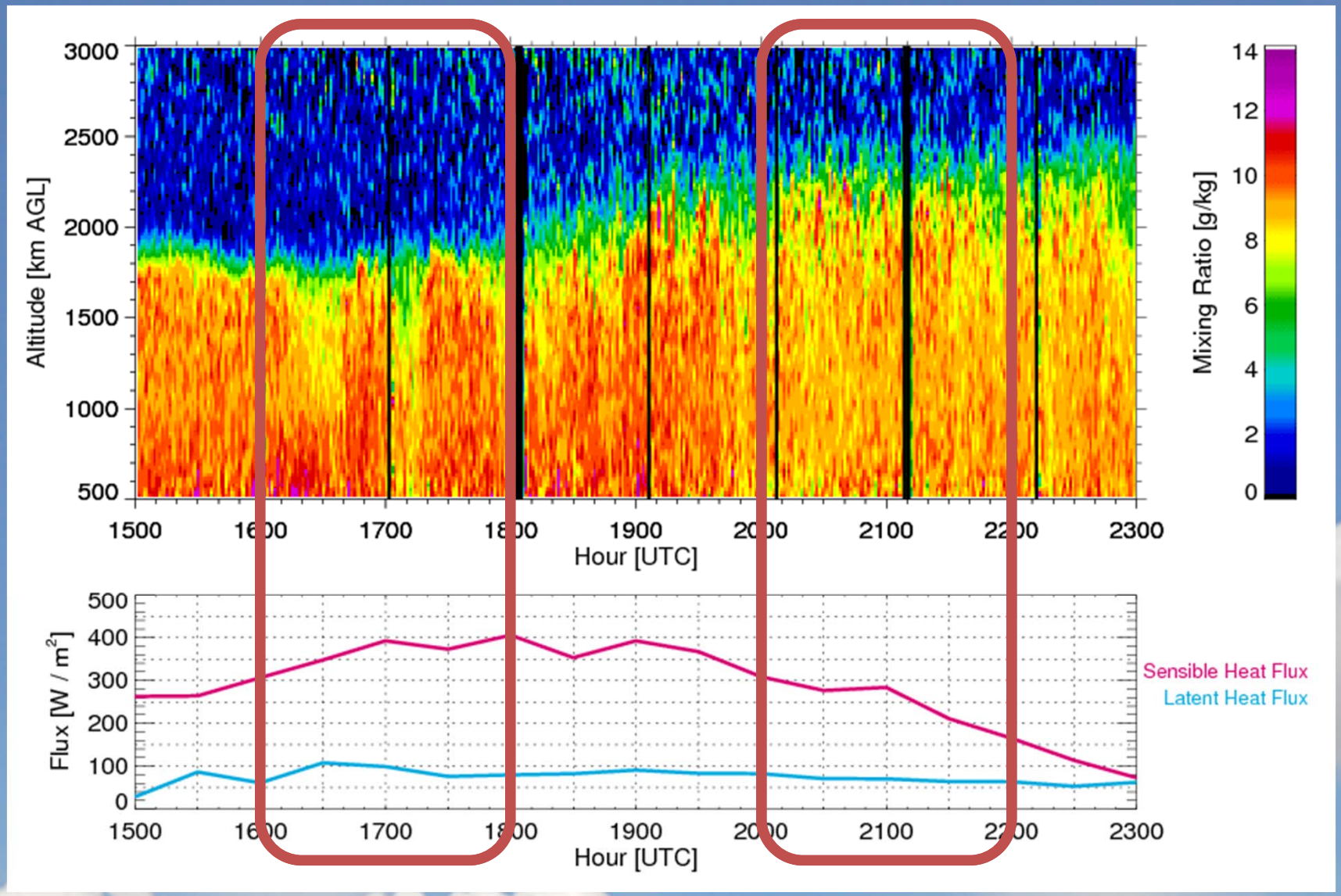
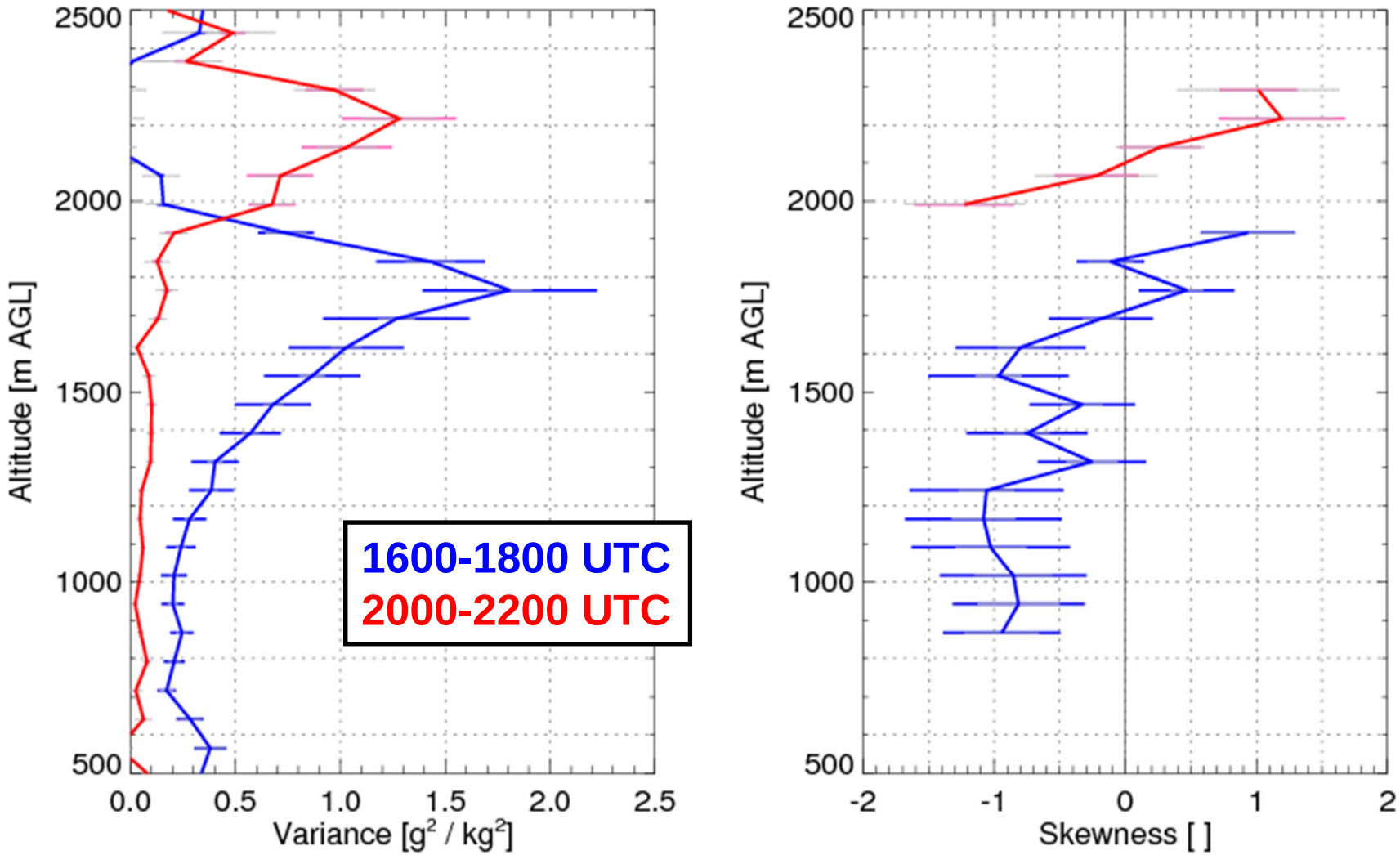


Variance and Skewness Profiles

3 September 2007: 1600-1800 and 2000-2200 UTC



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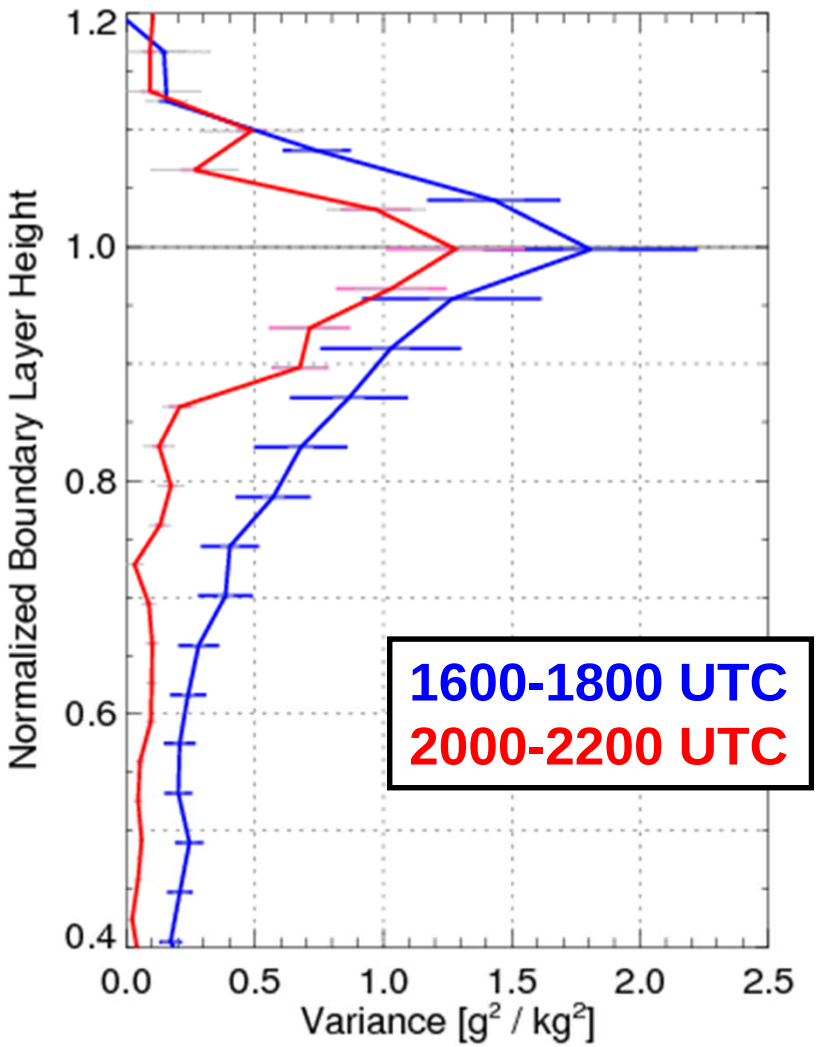

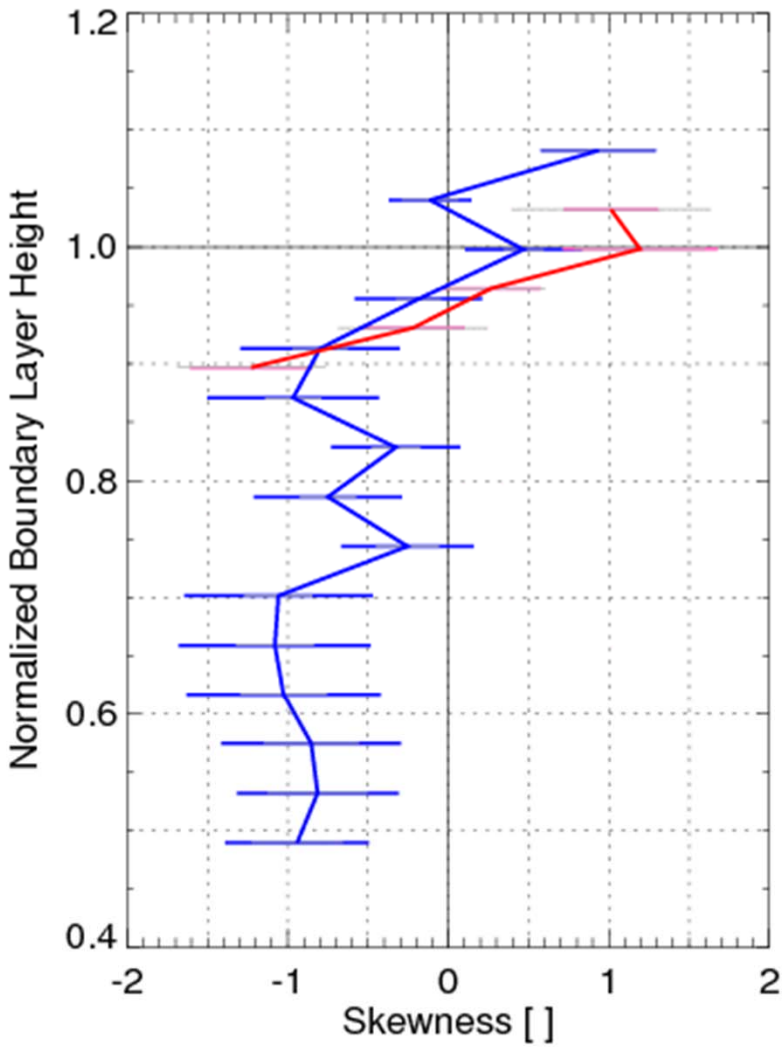

Doppler Wind Lidar

- Profiles of vertical velocity and w’
- Combined with RL water vapor to get water vapor fluxes
  - Need to consider horizontal separation (~300 m) of RL and DWL at SGP
- Only able to provide wind profiles in regions with aerosol (BL)
- How good will be the S/N at top of the BL?