Lidar observed subcloud and cloud base latent heat fluxes

Neil P. Lareau

Department of Physics, University of Nevada, Reno

nlareau@unr.edu

University of Nevada, Reno

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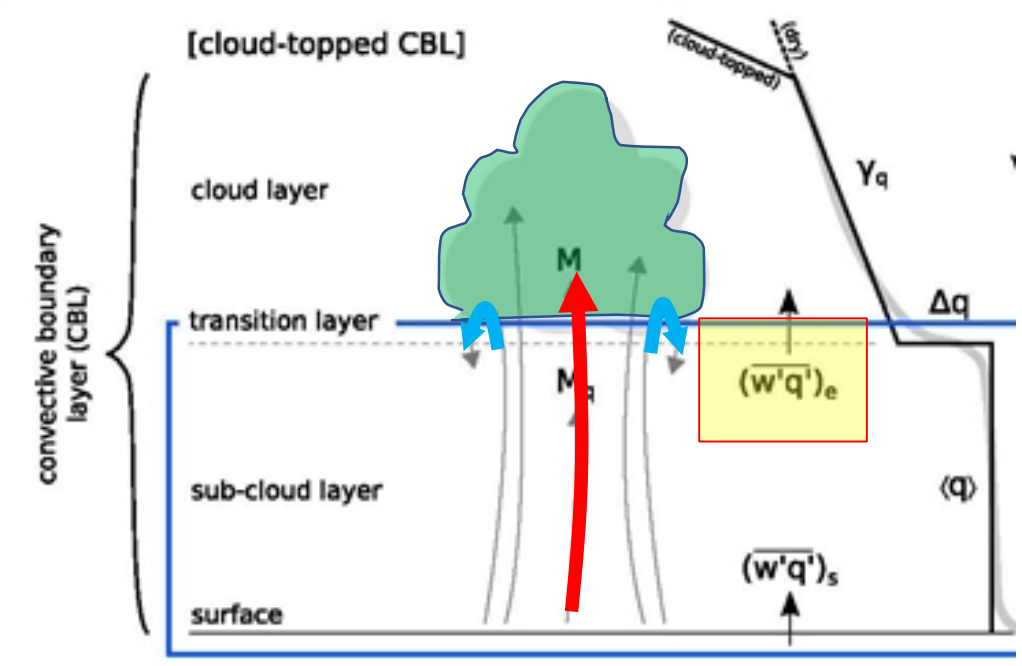
Observing latent heat fluxes:

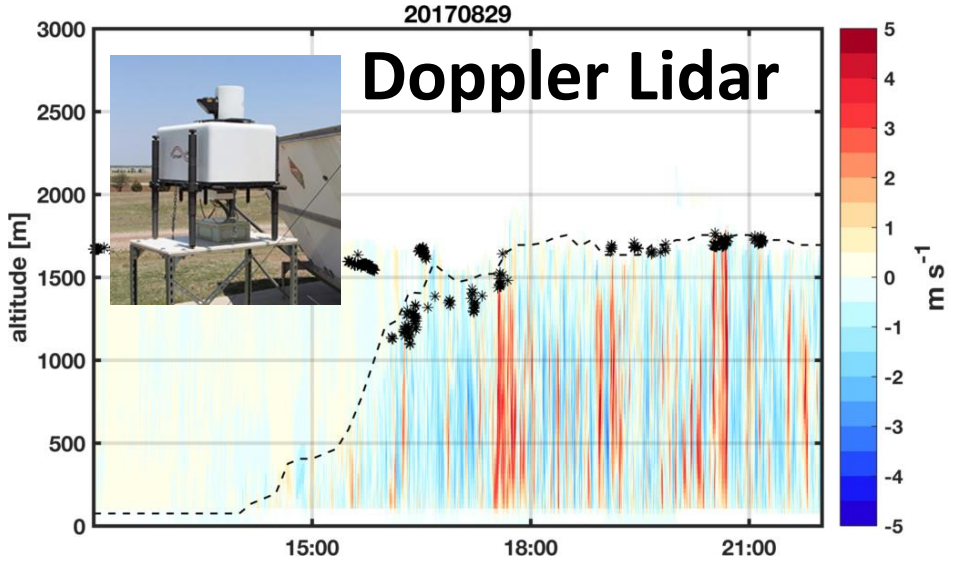


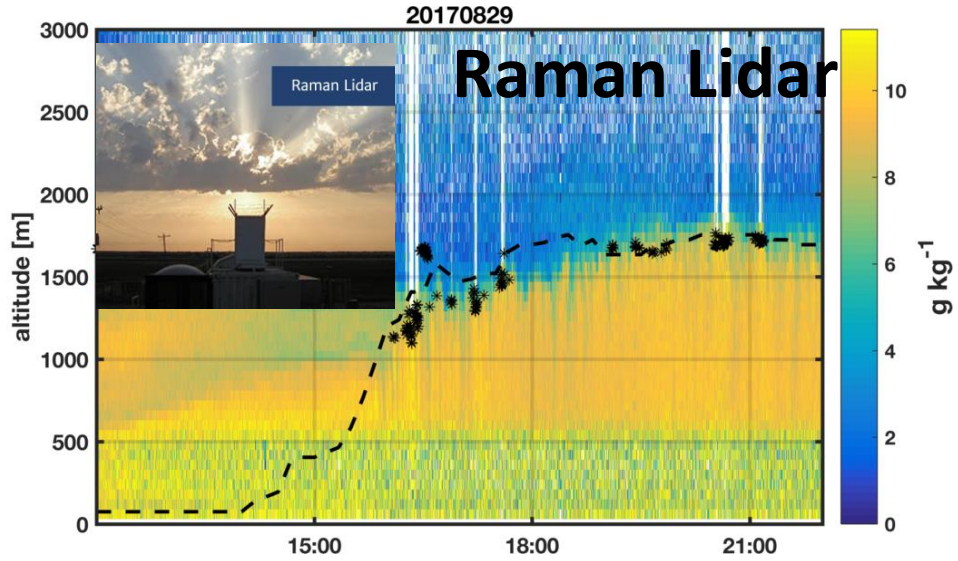
Van Stratum et al. 2014, JAS

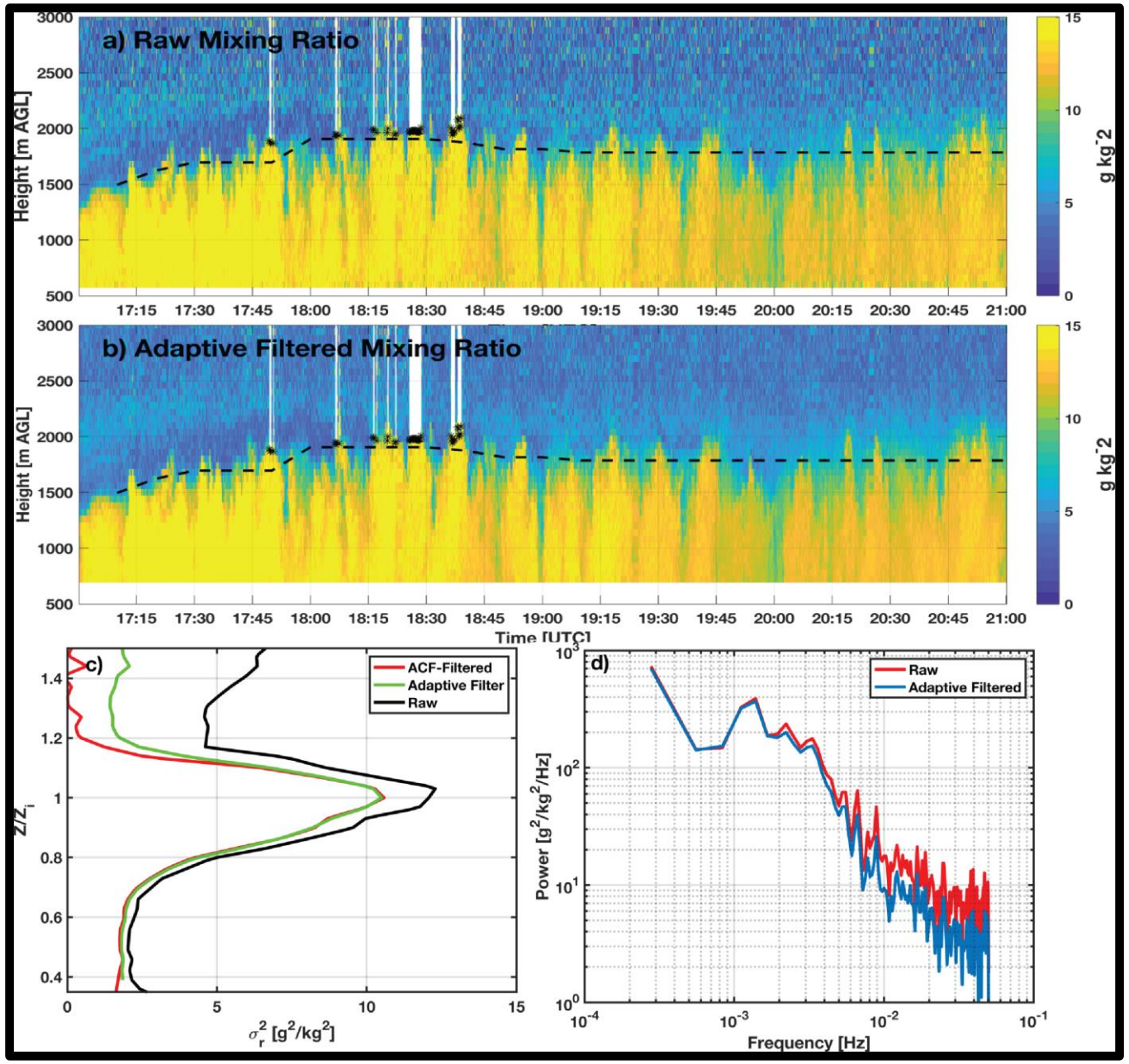
Subcloud and cloud bases fluxes of mass ($\rho w'$) and moisture ($w'q'$) can be observed by combining Doppler and Raman lidar

These fluxes are important:
Act as a moisture valve resulting in CBL drying
Drive cloud layer processes:

- lower boundary condition for cloud development





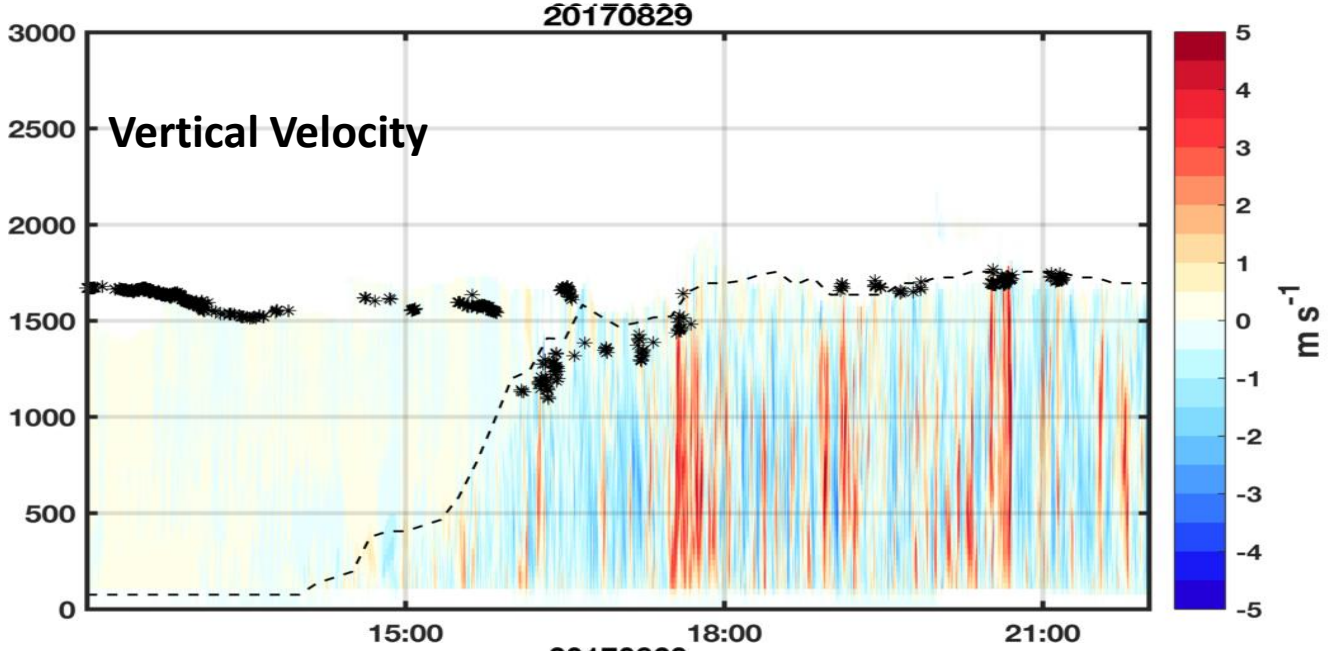


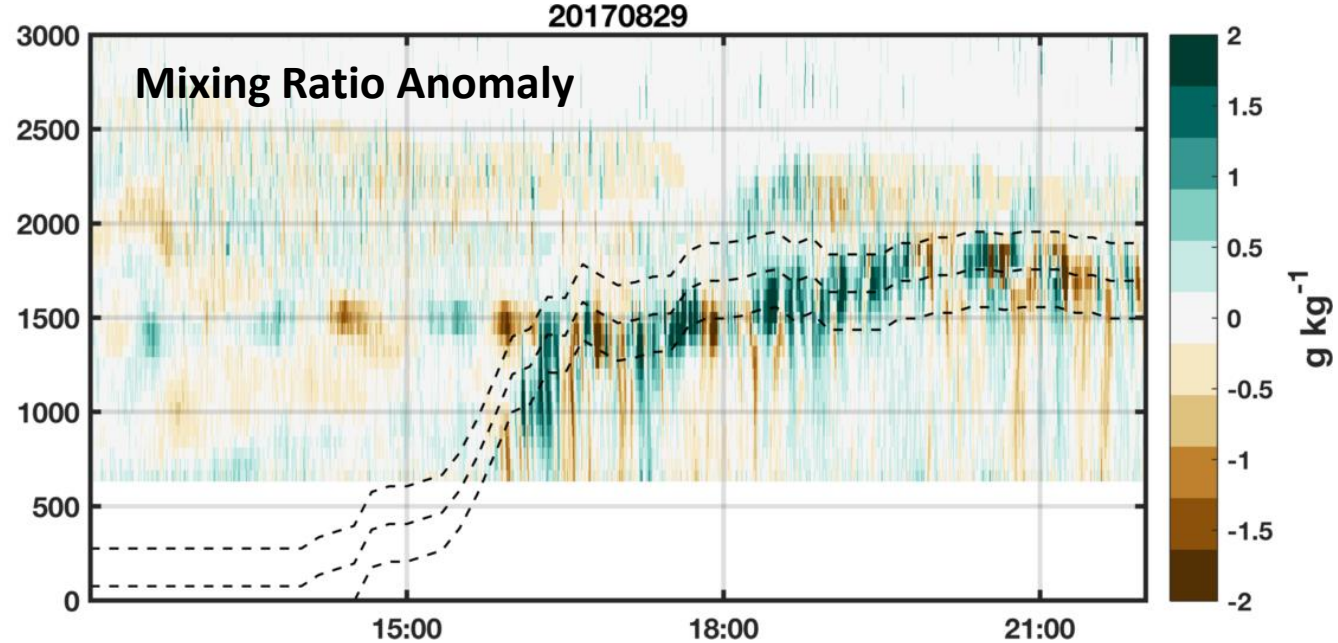
Data Filtering

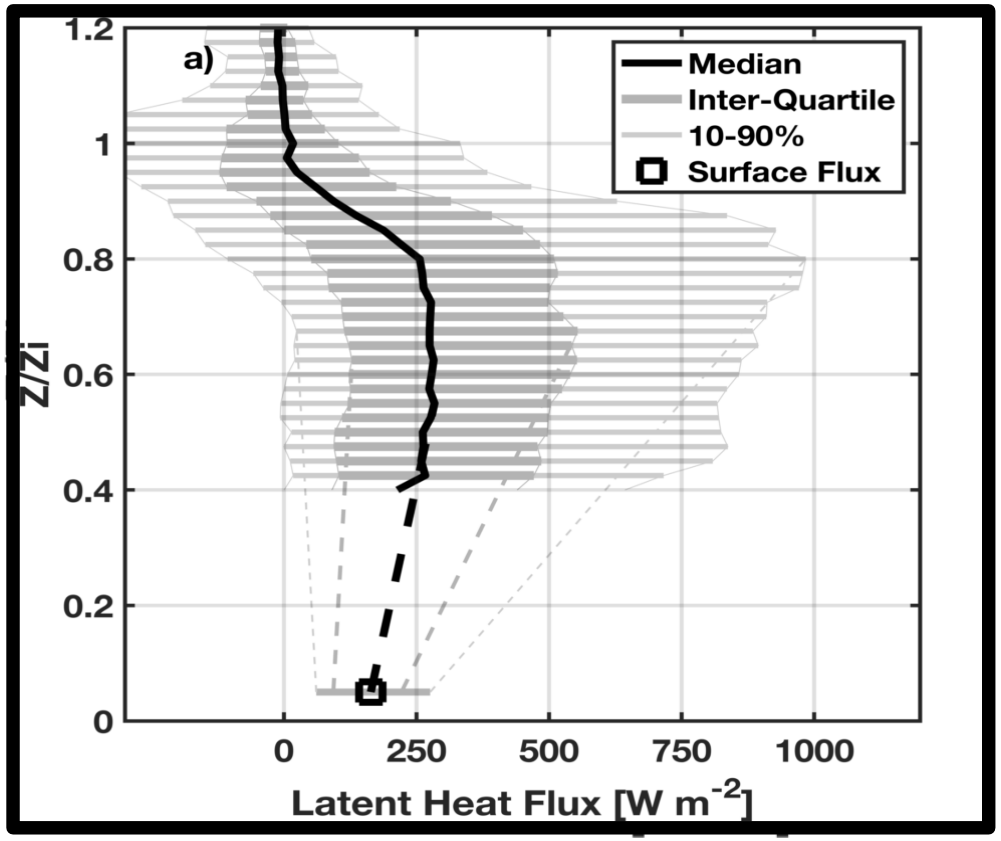
- Adaptive image filtering informed by the autocovariance noise estimate
- Preserves the process level details while removing the random, uncorrelated noise

Figure shows the qualitative and quantitative aspects of the data filtering.

What is the profile of water vapor flux in the subcloud layer?



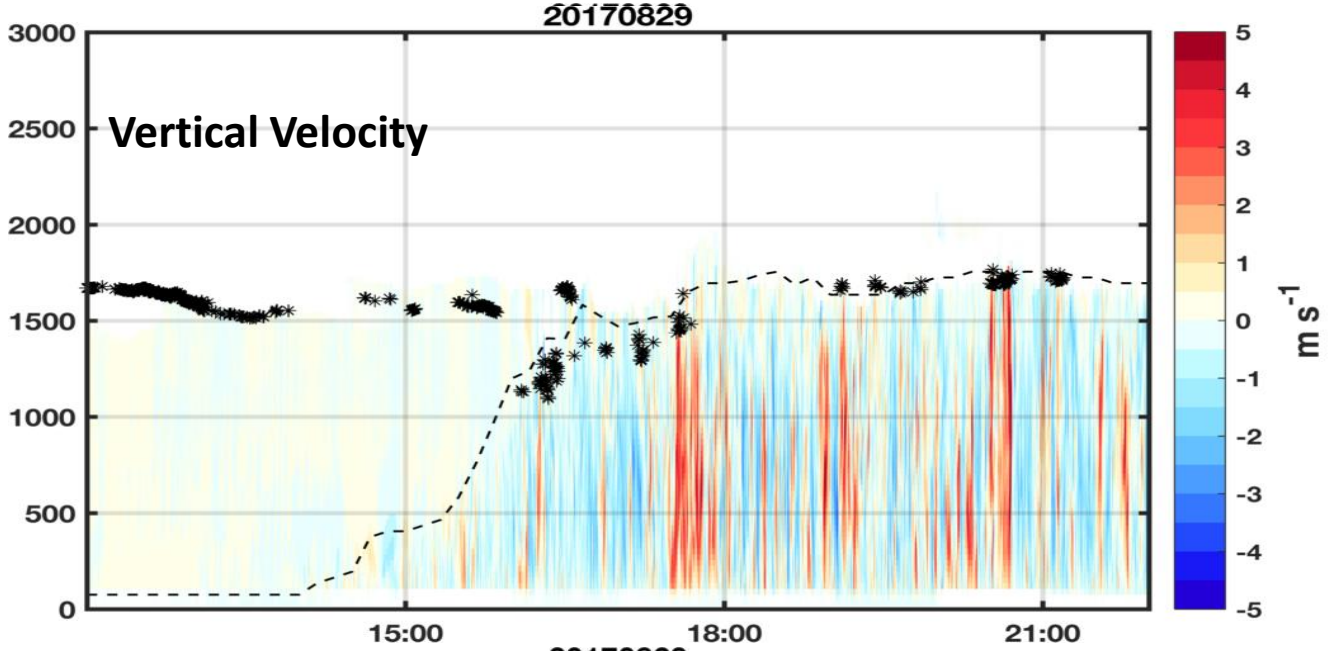


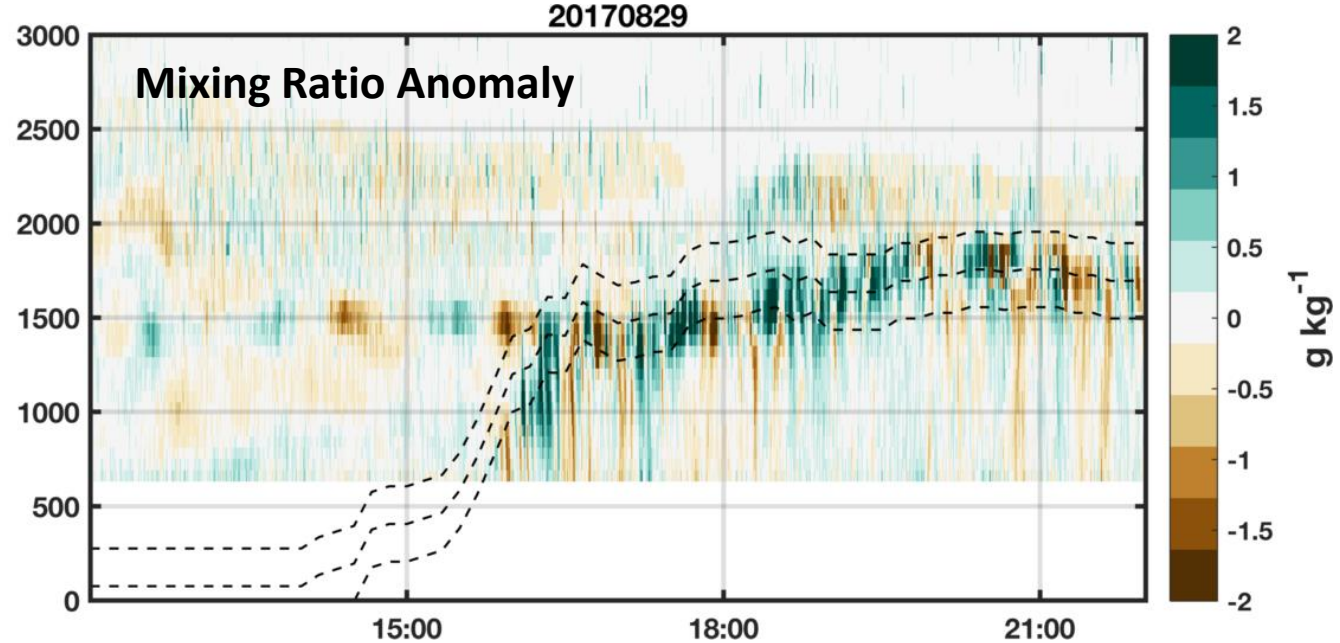


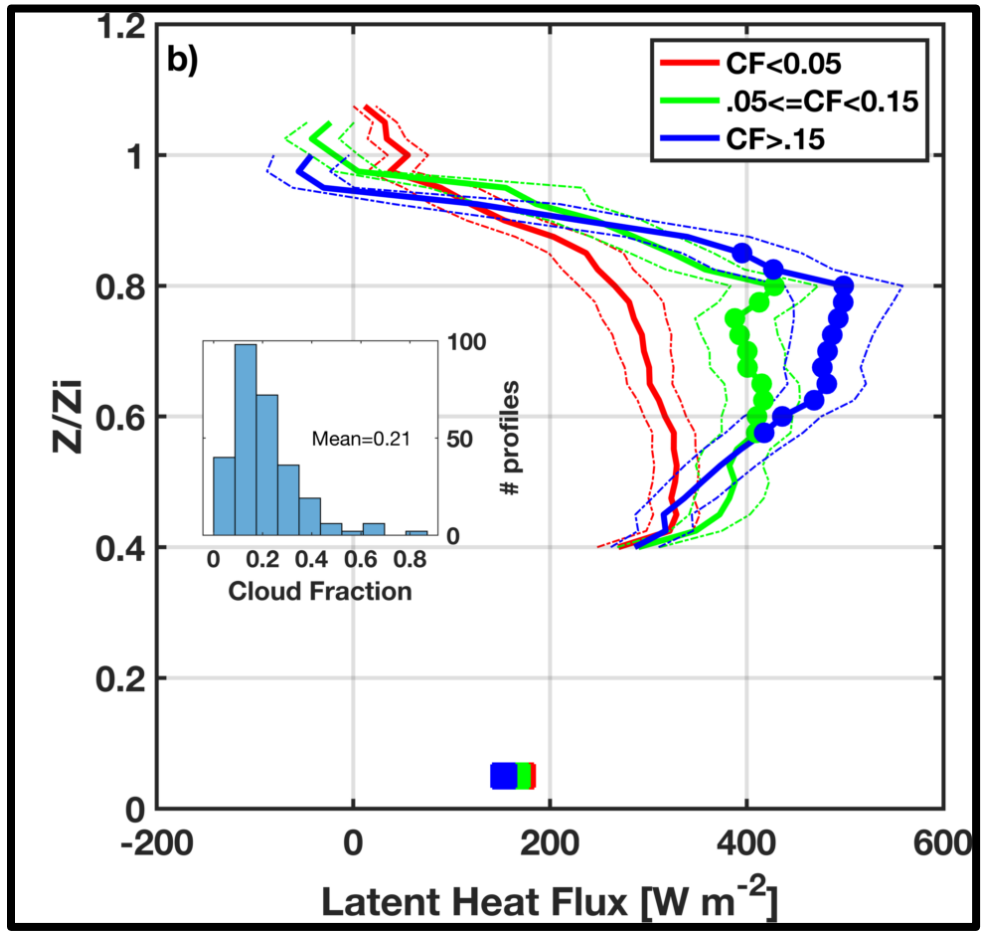
Height-normalized water vapor flux profile in the subcloud layer:

- **Quasi-linear increase with height**
- **Varying degree of drying (flux divergence)**

How does the flux profile vary with cloud fraction?

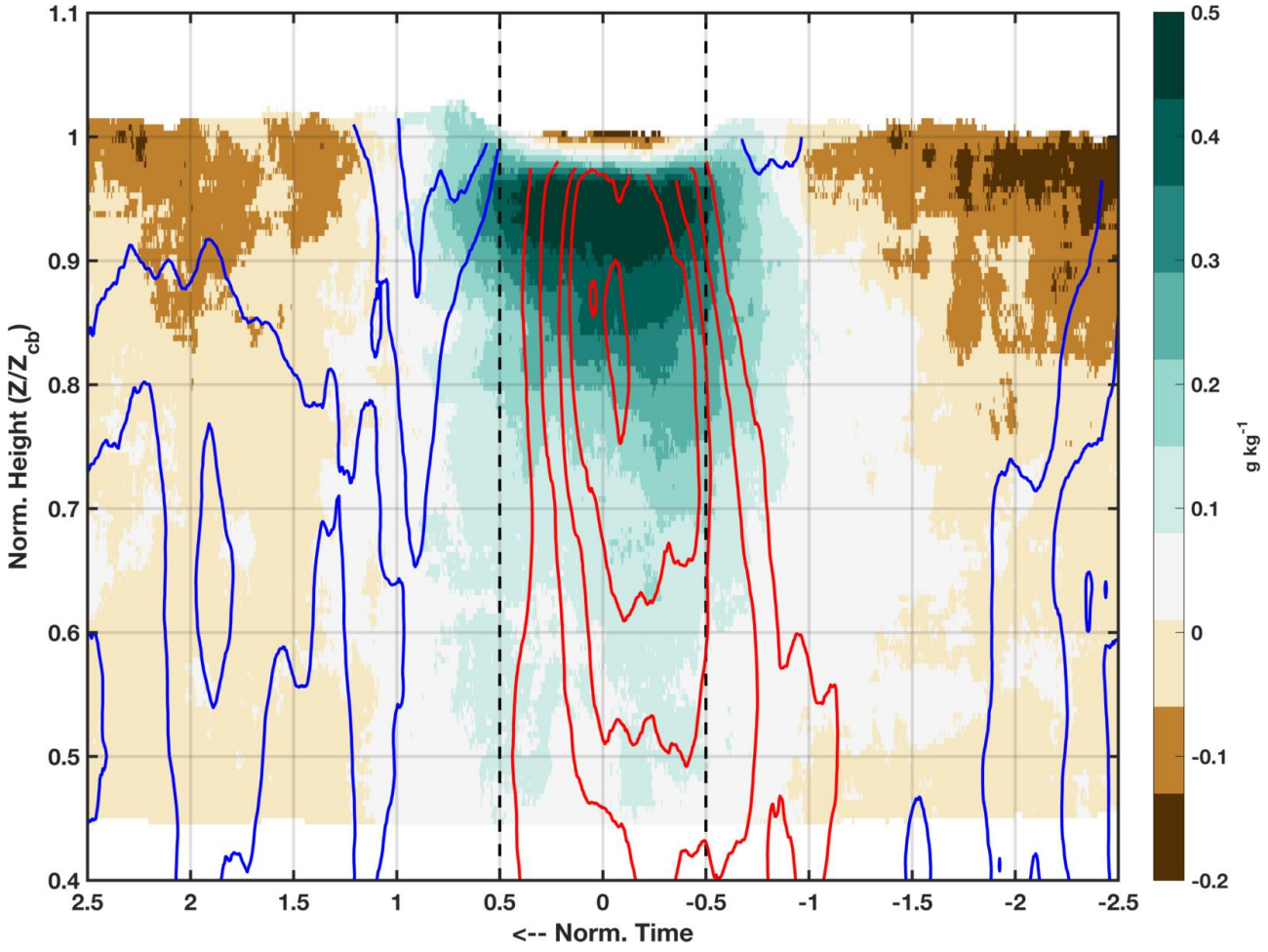


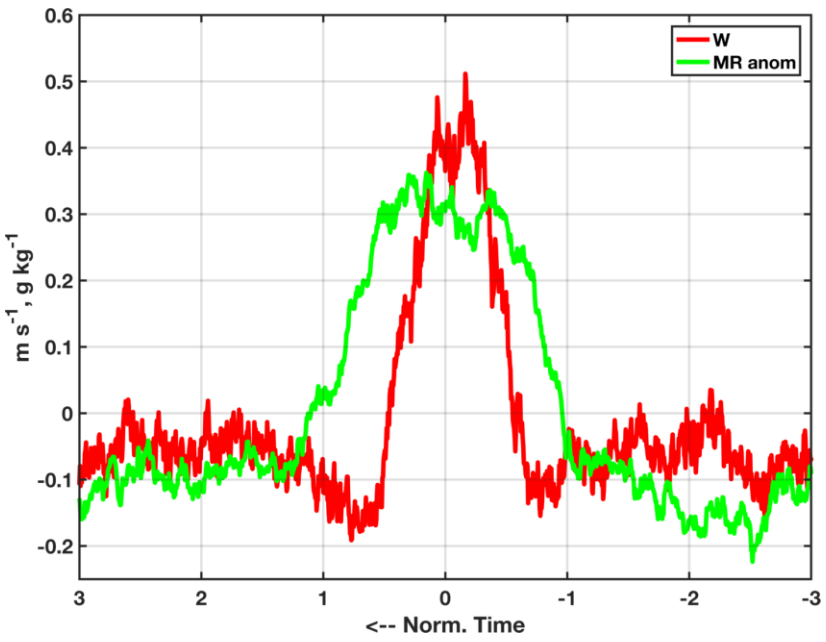




Fluxes are substantively larger during periods of active cumulus convection (CF>.05)

How does the subcloud circulation overlap with the subcloud water vapor anomaly?





- The water vapor anomaly is systematically wider than the updraft.
- Mechanically forced downdrafts have high mixing ratio air