Boundary layer heights in TexAQS / GOMACCS: Land and ship-based estimates

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with help from

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RHB sonde launchers

and many others

The Goal:

To describe the spatial and temporal distribution of BL heights over East Texas and the nearby Gulf and explain their importance to air pollution and climate

Today's more modest goal:

To describe what and when, with examples

- These are estimates, not commitments
- Most of these data belong to someone other than yr. obdt. svt.

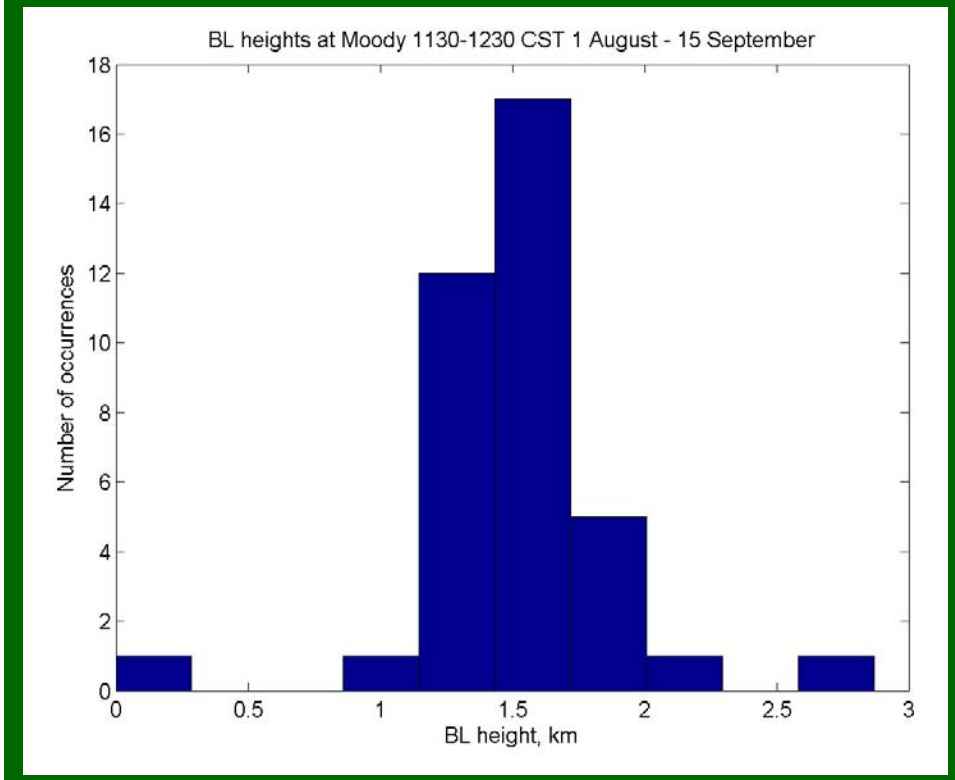
What BL height measurements do we have?

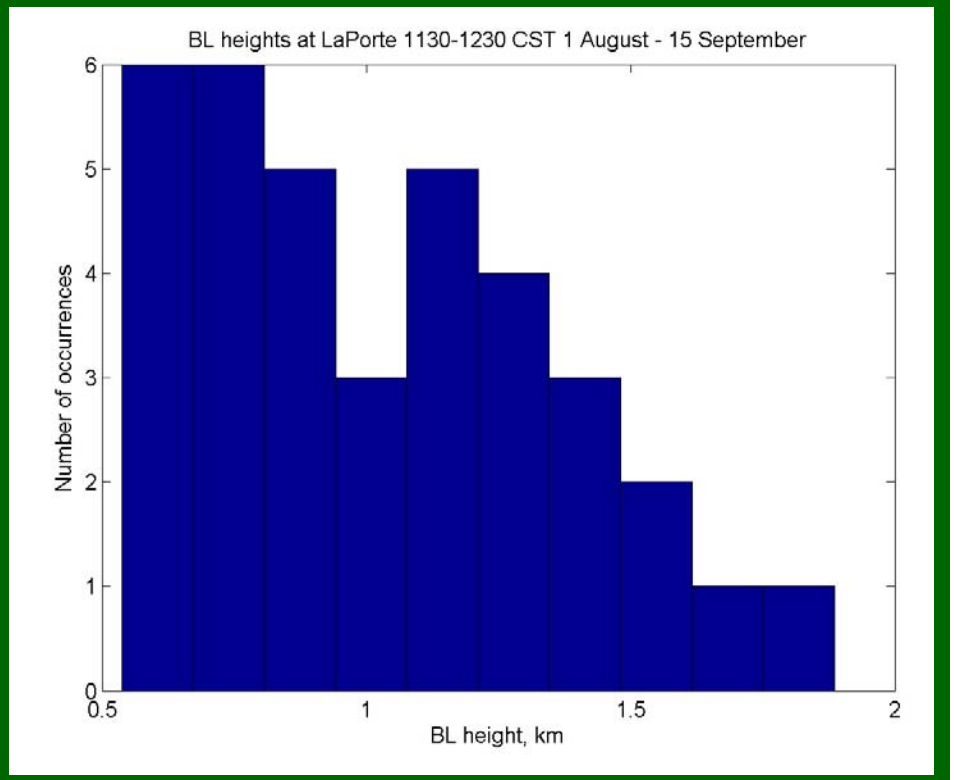
- Land-based wind profilers
- Ship-based lidar
- Ship-launched radiosondes
- Lidar aircraft
- In-situ aircraft soundings
- Land-based sondes
- Others....

Terminology (brief)

- Different instruments measure different physical quantities and are interpreted to produce various types of heights
- “BL height” is general but ambiguous – sometimes all definitions agree!
- “Mixing height” = the height to which some surface-emitted constituent is mixed on a time scale of ~1 hour
- “Aerosol layer height” = the height of a (surface-based) layer of stronger aerosol content
- “Residual layer” = a layer above the shallow nocturnal or marine boundary layer which was well-mixed nearby or recently

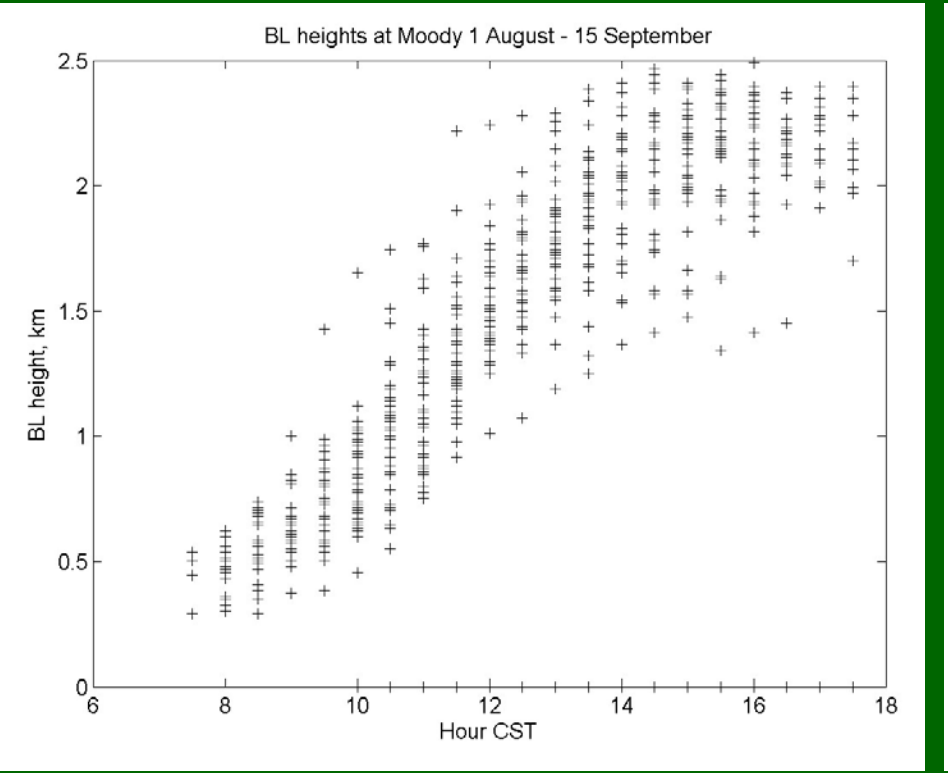
BL height distributions at midday from Moody and LaPorte profilers

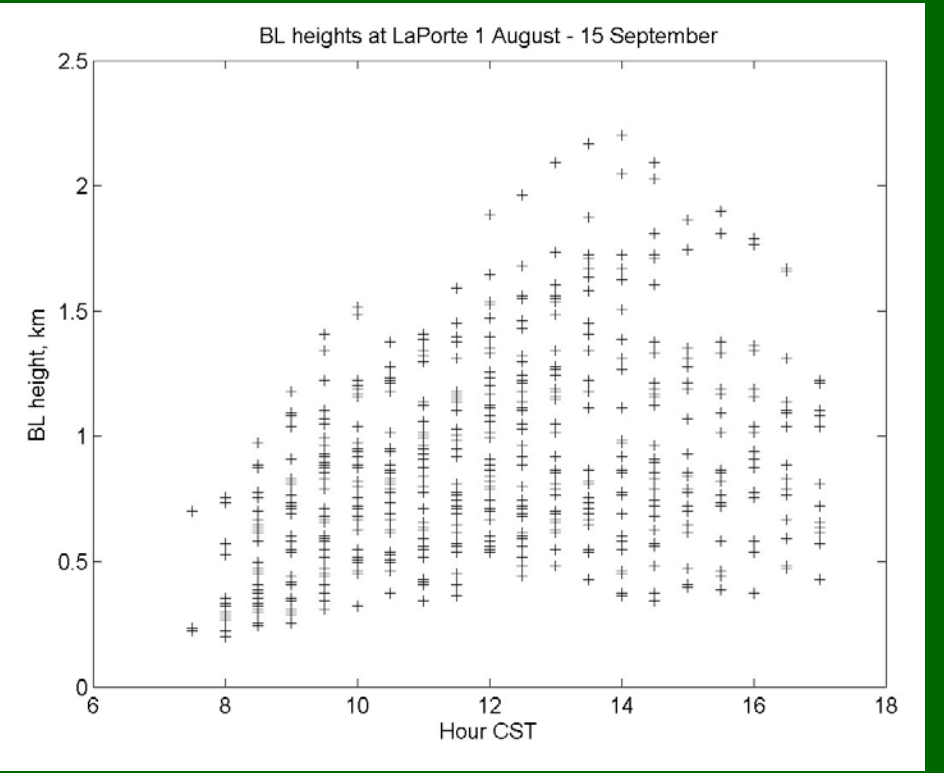




- Lower heights, broader distribution, and lower confidence at LaPorte

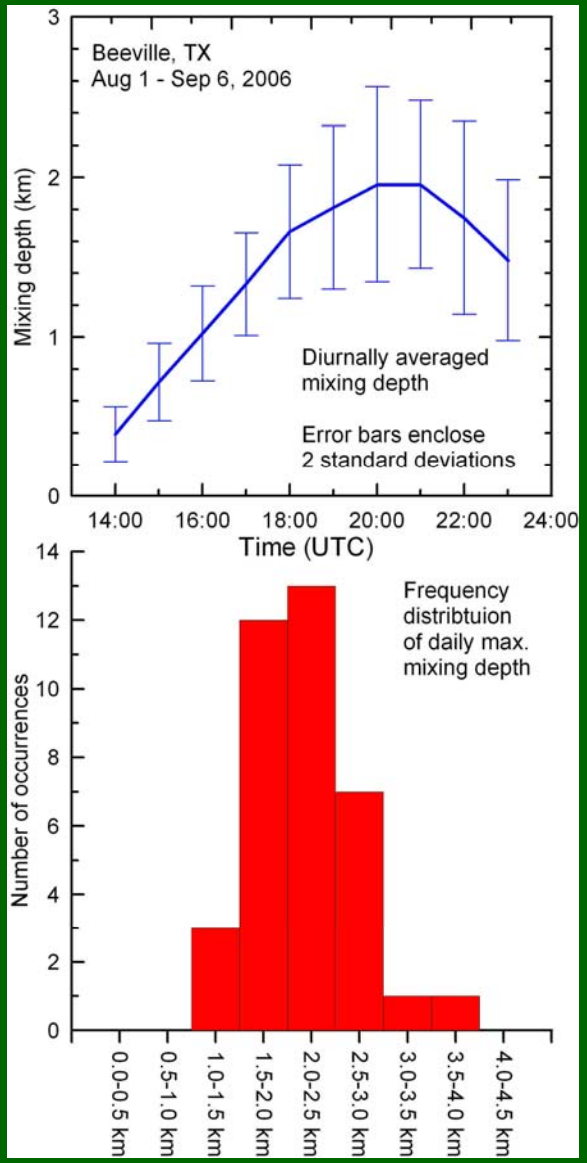
BL heights by time of day from Moody and LaPorte profilers

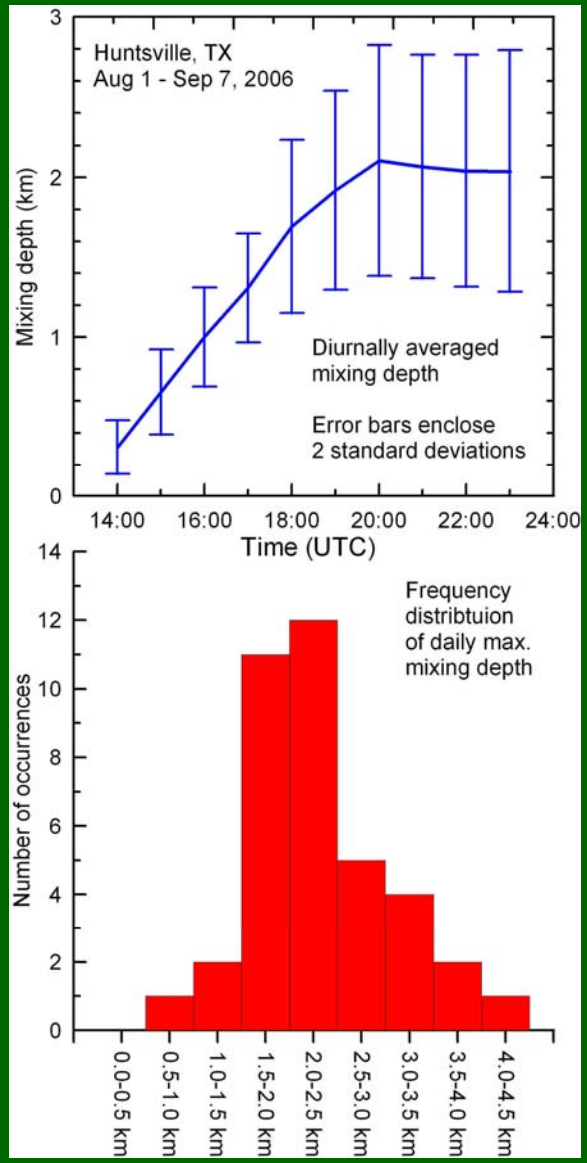




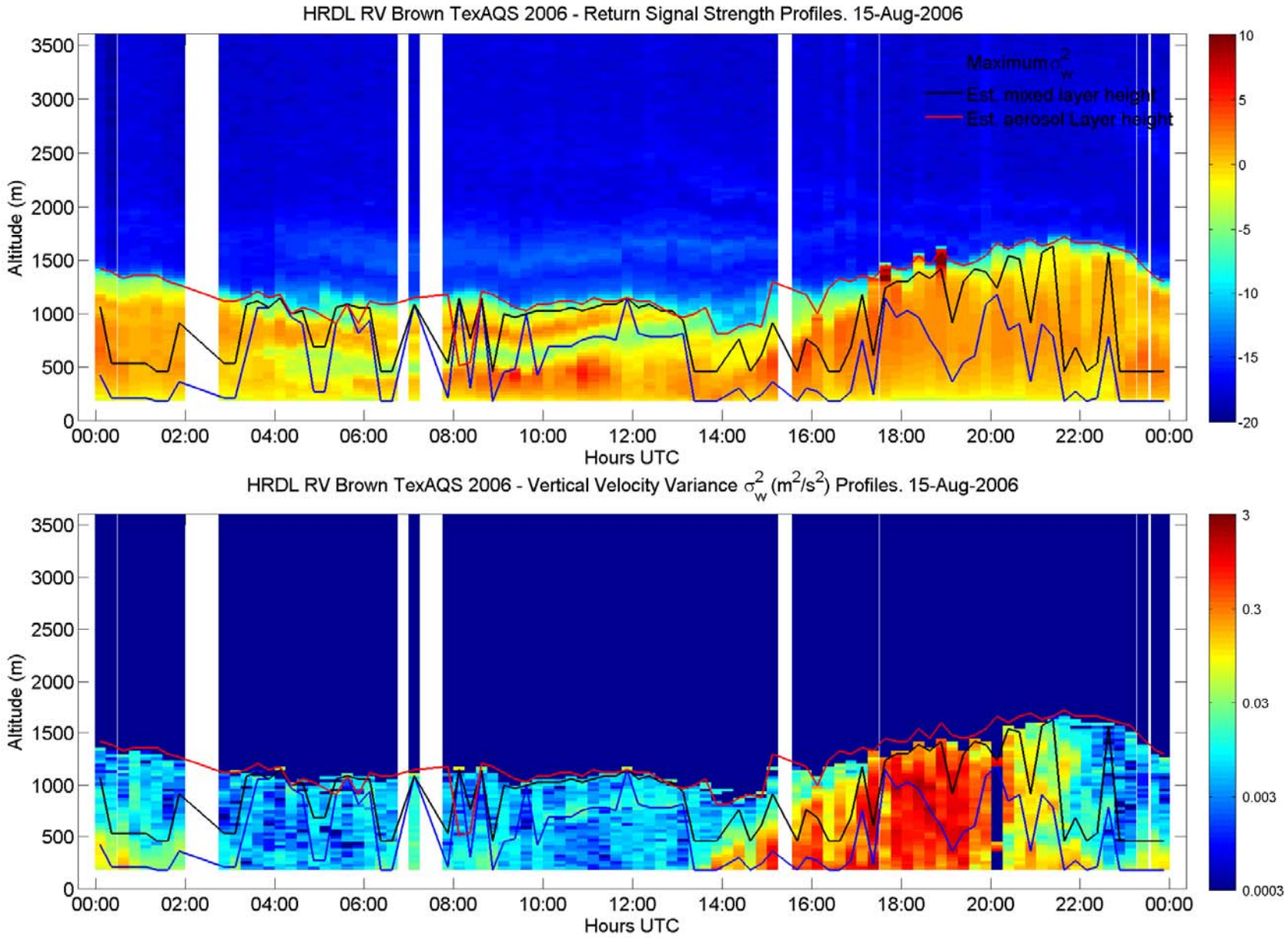
- LaPorte has clouds, sea breezes, and other phenomena that complicate analysis

BL heights from Beeville and Huntsville profilers



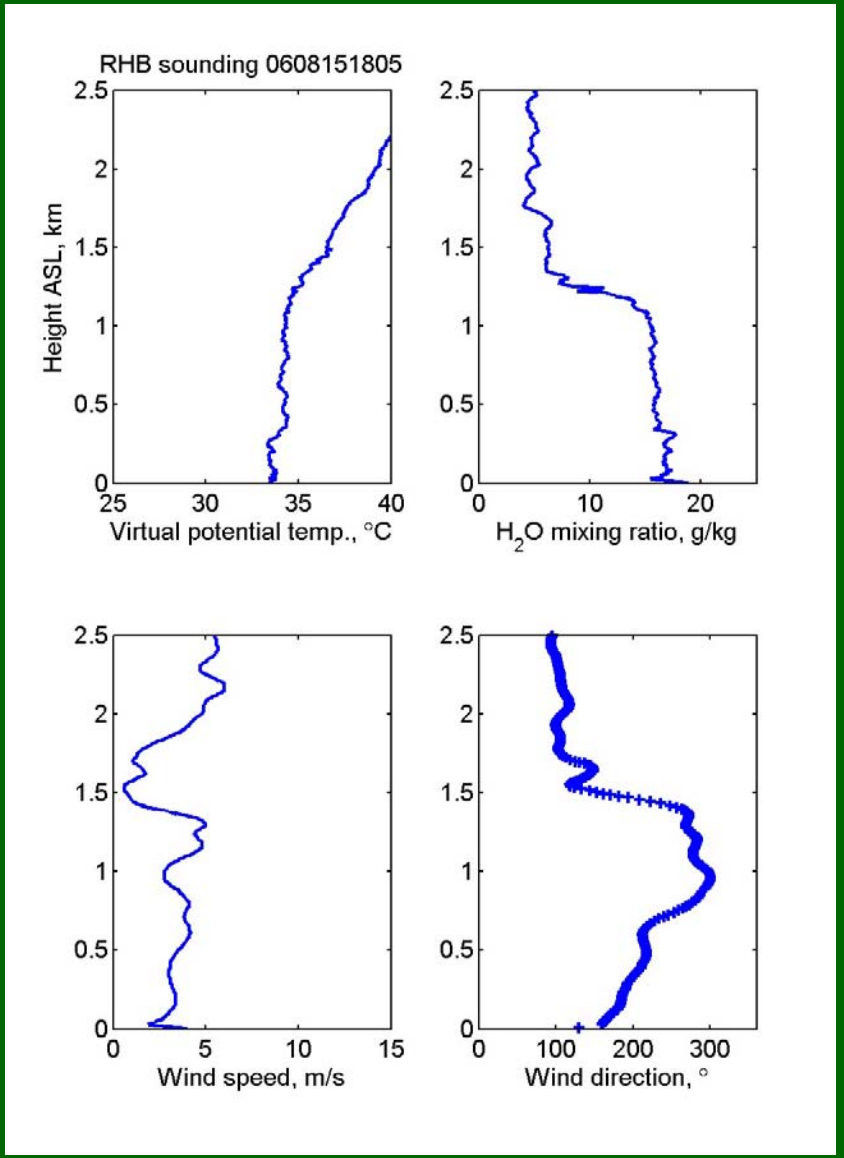


BL heights from ship-based lidar (HRDL)

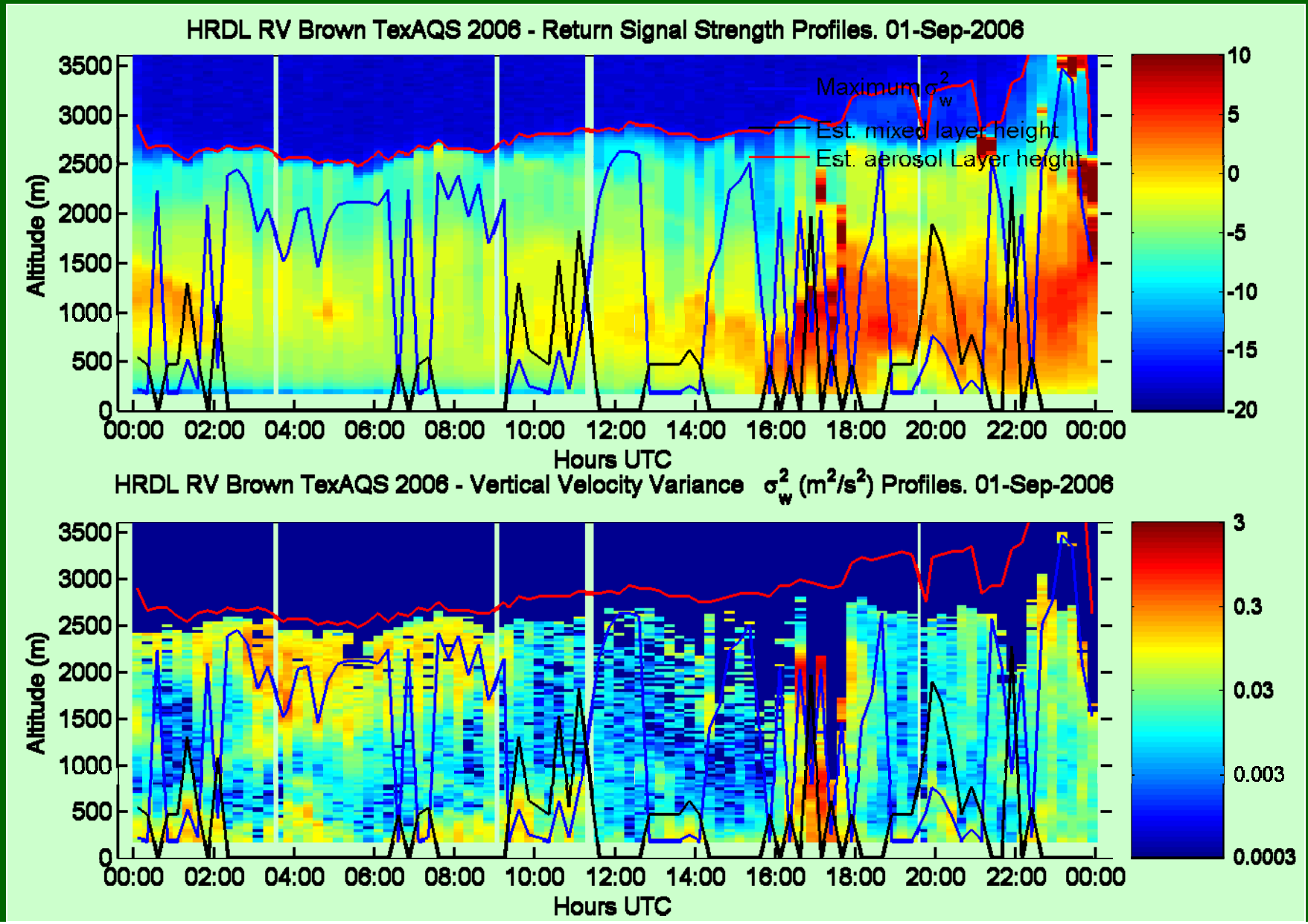


BL heights from ship-launched radiosondes

- 15 August 18Z at Barbour's Cut
- Note reasonably well-defined boundary layer top at 1200 m
- Some evidence of local effects below 300 m

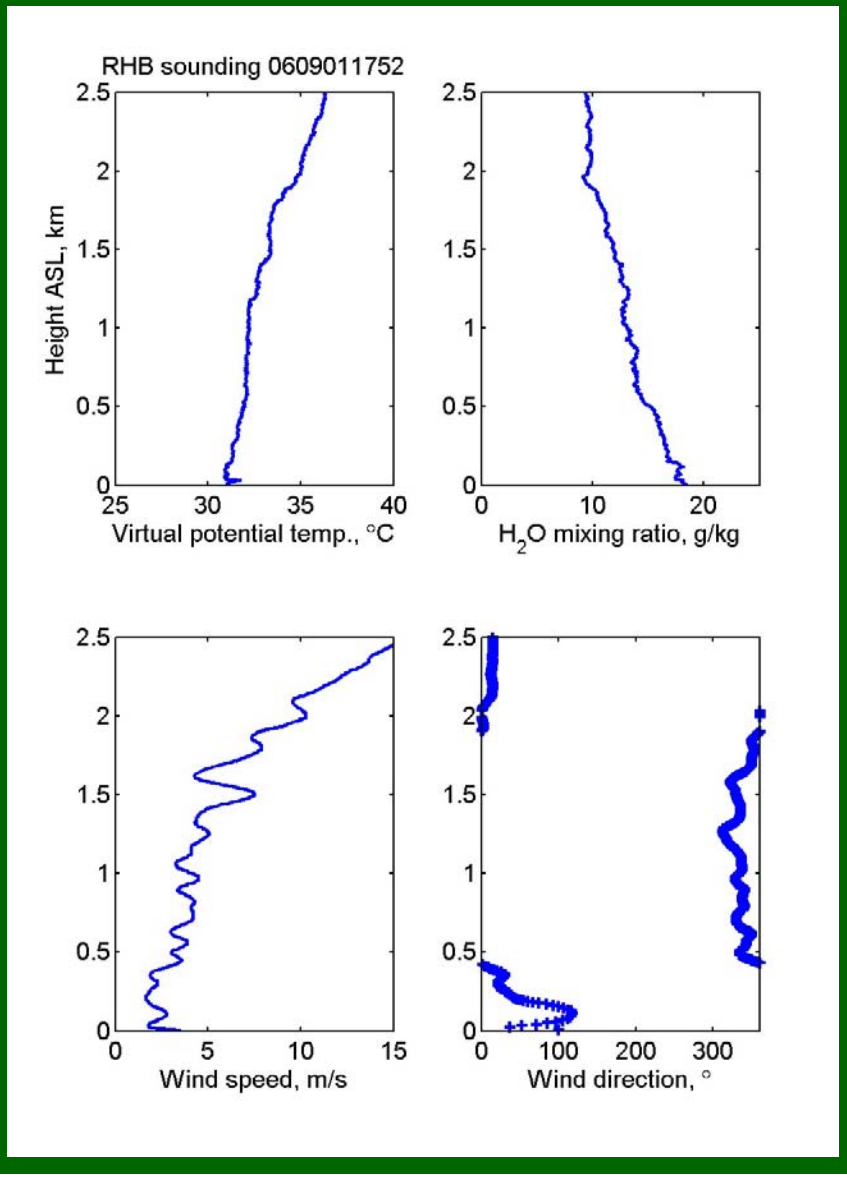


BL heights from ship-based lidar (HRDL)



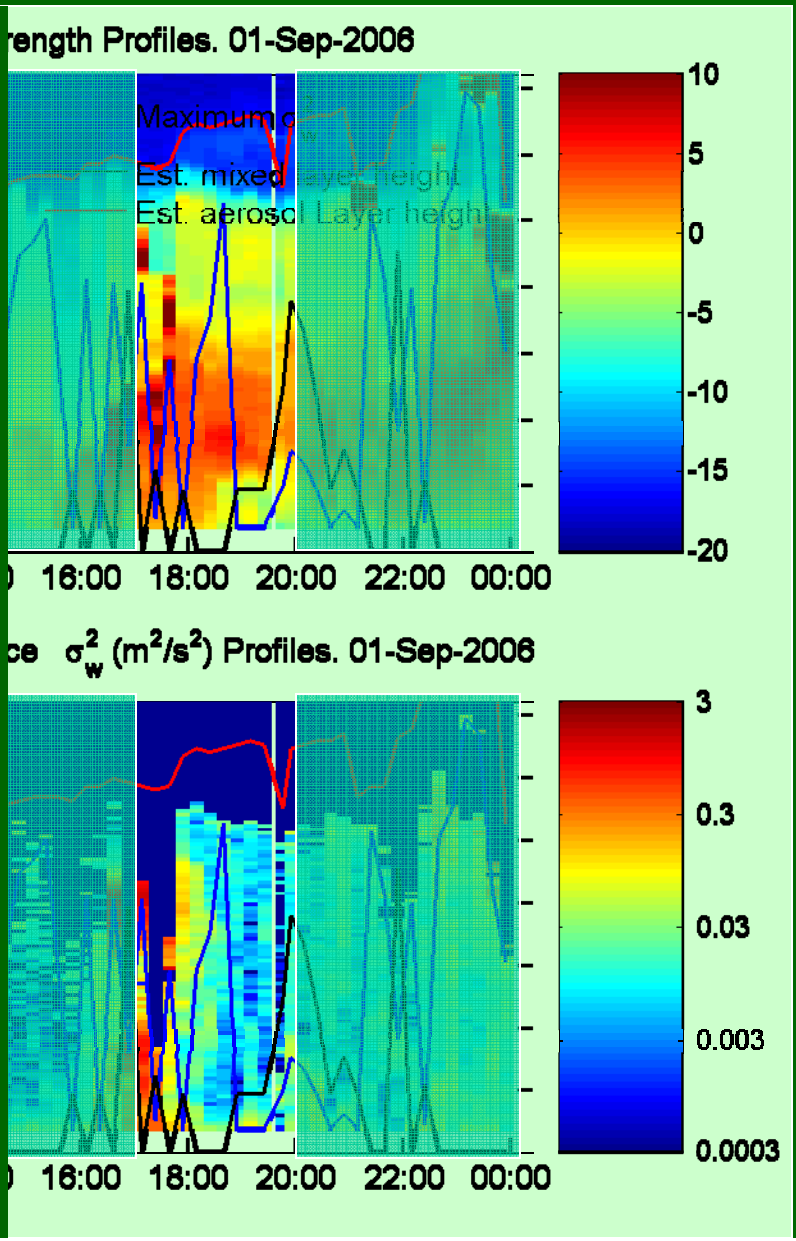
BL heights from ship-launched radiosondes

- 1 September 18Z at Barbour's Cut, near time and place of peak ozone observed at the ship for the entire campaign (>170 ppb)
- Note multiple layers with "tops" at 200, 1200, 1800 m



How do lidar data correspond to sonde data?

- Aerosol tops out ~2500 m
- Strong aerosol below 1500 m
- Lowest layer becomes cleaner as ship moves south
- Strong mixing below ~1000 m, gets weaker quickly as ship moves south
- Some small clouds present



What and when?

Today

- Moody profiler 1 Aug. – 15 Sept.
- LaPorte profiler 1 Aug. – 15 Sept.
- Sonde BL heights for a few cases
- HRDL BL heights for a few cases

What and when?

Preliminary report

- Moody profiler 1 Aug. – 15 Oct.
- LaPorte profiler 1 Aug. – 15 Oct.
- Sonde BL heights for some cases
- HRDL BL heights for some cases

What and when?

Final report

- Moody profiler 1 Aug. – 15 Oct.
- LaPorte profiler 1 Aug. – 15 Oct.
- Other profilers: Cleburne, Brenham, Huntsville, ???
- Sonde BL heights for several cases
- HRDL BL heights for several cases
- Some analysis and synthesis