Remote Sensing of the Boundary Layer: The Ground-based Option

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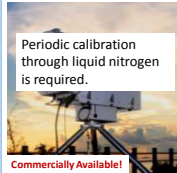

Key point:

Ground-based profilers are important component of profiling temperature and water vapor.


Three Boundary-Layer Profiling Instruments

AERI
Passive infrared interferometer Temperature and water vapor profiles.

Commercially Available!

Microwave Radiometer
Passive microwave radiometer Temperature and water vapor profiles.

Commercially Available!

NCAR WV DIAL
Active Differential lidar ONLY water vapor profiles.

Still research only.

Absolute calibration for any passive instrument is critical to instrument performance.

AERI
Automatic calibration of all channels.

Calibration occurs through two NIST traceable blackbodies.

Commercially Available!

Microwave Radiometer
Requires manual calibration.

Periodic calibration through liquid nitrogen is required.

Commercially Available!

NCAR WV DIAL
Automatic calibration

Calibration is automatically performed during instrument operations.

Still research only.

Retrieval algorithms can blend the strengths of each instrument.

1. The AERI has 2-4 times more information than microwave radiometers provide.
2. Microwave radiometers are the only instrument that can profile in-cloud.
3. Both the AERI and microwave radiometer have little information above 3 km AGL.
4. The NCAR WV DIAL can provide water vapor information above 3 km.
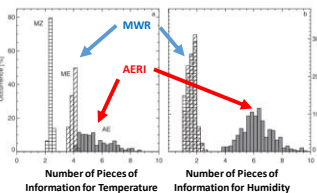
From Löhnert et al. 2009 (JAMC)

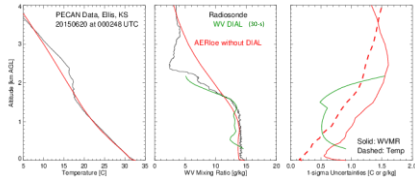## An Example Profile from PECAN

Daytime case (~2 hours before sunset)
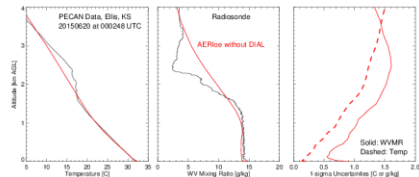
- Nominal AERIoe retrieval yields good agreement in both temperature and WV to sonde below 1.8 km (in this case)
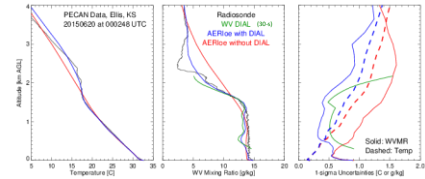
An Example Profile from PECAN
Daytime case (~2 hours before sunset)

- DIAL captures the rapid decrease in WV above top of BL well
- DIAL data limited in maximum range due to clean atmosphere

An Example Profile from PECAN
Daytime case (~2 hours before sunset)

- *AERIoe* retrieval that uses both AERI and DIAL data as input
  - Matches WV profile better aloft (even above maximum height of the DIAL data)
  - Provides better temperature retrieval, capturing elevated inversion
  - Smaller 1-sigma uncertainties in both WV and temperature

Ground-based instruments should be a part of any future boundary-layer profiling network.

1. AERIs and microwave radiometers are commercially available **now** for deployment in a ground-based networks.
2. OU/NSSL has developed mobile profiling trailers called CLAMPS systems. These trailers are prototypes for future profiling sites and are currently being used for field projects (e.g. VORTEX-SE, PECAN).
3. The New York Mesonet has plans to deploy a network of ground-based microwave radiometers.

OU/NSSL CLAMPS Trailer