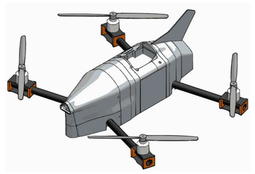
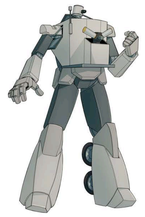




Boundary layer observations in extreme environments

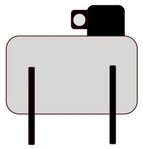
SCAN ME

BLISS
BOUNDARY-LAYER INTEGRATED SENSING & SIMULATION

What is BLISS?

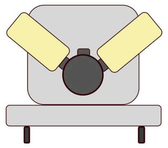
The Boundary Layer Integrated Sensing and Simulation (BLISS) group acts as an umbrella under which all those in the National Weather Center community with an interest in boundary layer studies can come together and collaborate. BLISS welcomes the participation of independent functioning research groups or centers (in part or in entirety), individual researchers of any affiliation, faculty members, and students from any background with an interest in boundary layer studies from theory to observations to NWP applications.

Instrumentation



Scanning Doppler Wind Lidar

Directly measures radial velocity. Can retrieve horizontal wind and turbulent quantities from the radial velocity measurements

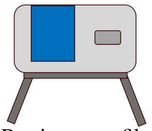


Infrared Spectrometer (AERI/ASSIST)

Retrieves profiles of temperature, moisture, and cloud properties from infrared spectra

CopterSonde WxUAS

Collects in situ measurements of temperature and humidity up to 1.5 km AGL. Also can retrieve winds from UAS tilt



Microwave Radiometer

Retrieves profiles of temperature, moisture, and liquid water path from microwave brightness temperatures

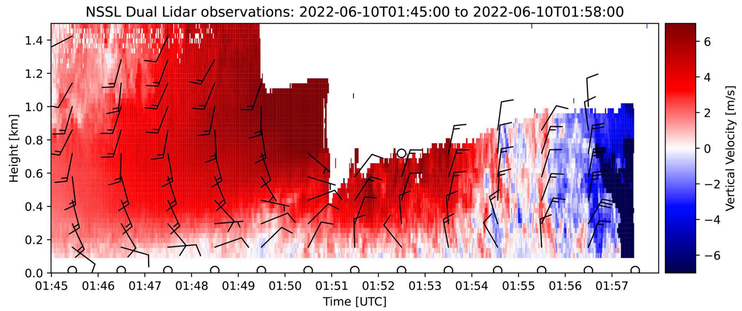
Deployment Platforms

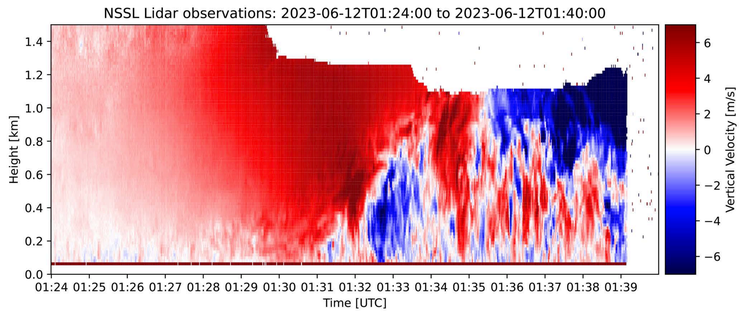
Mobile

Nimble

Deployments typically fall into one of two types: mobile and nimble. **Mobile deployments** involve taking instruments to a location and leaving them there for a time, typically for weeks to months. The Collaborative Lower Atmospheric Profiling System (CLAMPS; left) is well suited for this. However, some deployments require rapid repositioning in response to the environment. These **nimble deployments** are carried out by vehicle-based platforms like the NSSL Doppler lidar truck (right)

Near-storm Observations

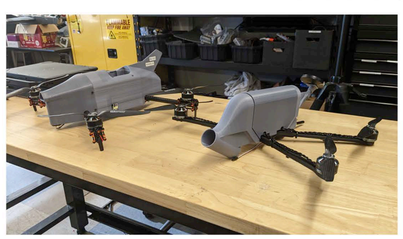




A common application for nimble deployments is observations of the near storm environment. In particular, the NSSL Doppler lidar truck has been used to sample the inflow into supercells, the conditions leading up to QLCS passage, and outflow boundaries produced by storms.

Above are two examples of the vertical velocity from supercell outflow boundary passages. Observations of these outflows generally follow the same pattern: steady rising motion ahead of the density current, a sharp increase in vertical velocity when the leading edge arrives, and very turbulent motions following the leading edge. Understanding these outflows should increase understanding of storm behavior.

WxUAS



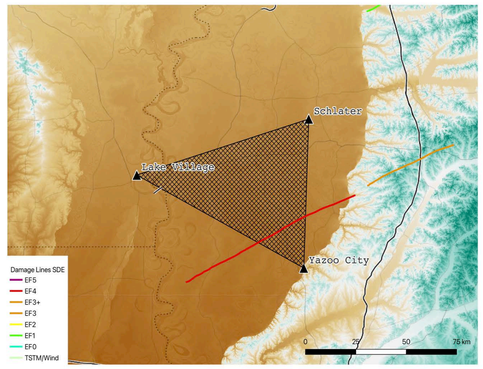
Development

The BLISS group continues to innovate on unique, custom WxUAS to meet new needs, whether that is operational boundary layer profiling systems or high-performance WxUAS for severe weather research

Training

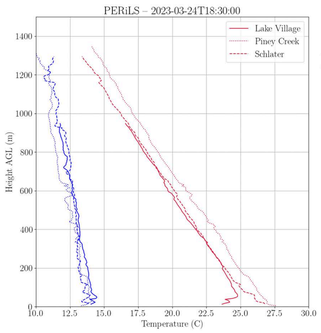
Developing robust and accessible training for UAS has become vital as UAS become more ubiquitous in the physical sciences. The BLISS group has developed online and in-person training for current platforms that allows broad participation from students, scientists, and even National Weather Service forecasters in field deployments of the CopterSonde. This allows these groups to be properly exposed to the rapidly advancing field of UAS.

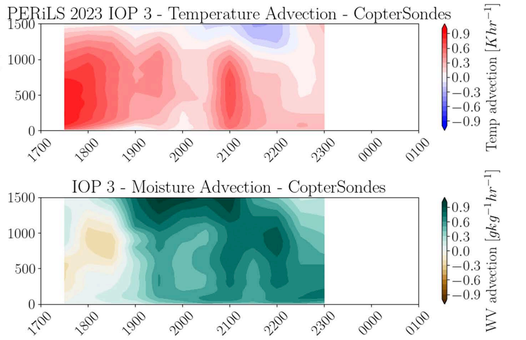
Network Observations



BLISS works to collect longer term, fixed observations using mobile instrumentation while supplementing with additional instrumentation during nimble deployments. This creates high resolution networks of boundary layer observations that can be used to develop value added products which could be applied to future boundary layer profiling networks.

Case Studies





Case studies from networks of boundary layer profilers are useful for finding synergy between instrument types and ways to combine information from different instruments. BLISS members have developed optimal estimation approaches to combining both thermodynamic instrumentation and kinematic instrumentation (TROPoe and WINDoe, respectively). This allows calculation of value-added products like advection and vorticity over an area from mixed-instrument networks. An example of this is shown above from PERiLS.

Long Term Observations

Longer term observations from mobile deployments also allow for composites to be created for both quiescent periods and phenomena of interest. During PERiLS, significant differences in vertical velocity and storm-relative helicity (right) are noted between locations in the Mississippi River Delta, likely due to the sharp terrain gradient on the eastern side of the Delta.