OAWL: Full Atmospheric Doppler Wind lidar for Airborne and Space-based Applications

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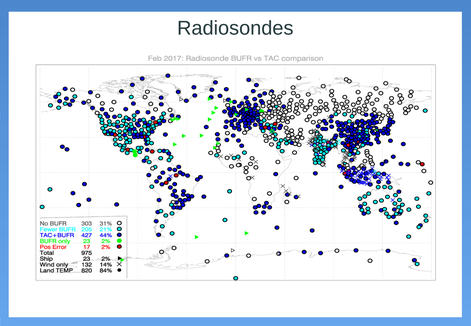
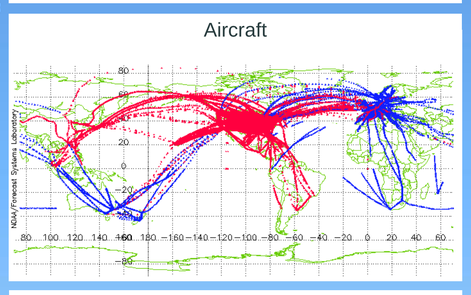
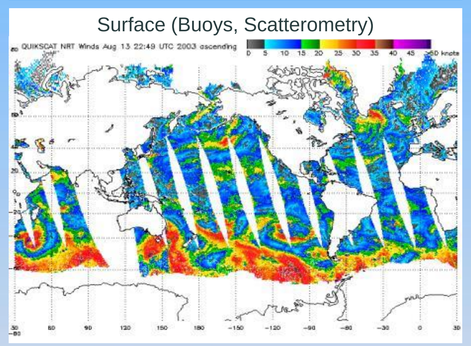
Existing Global Winds

In-situ: over land and flight level only

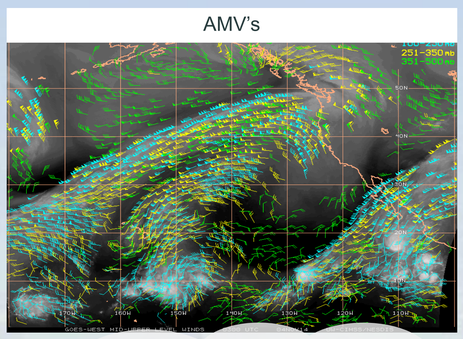




Ocean-surface



Feature layers

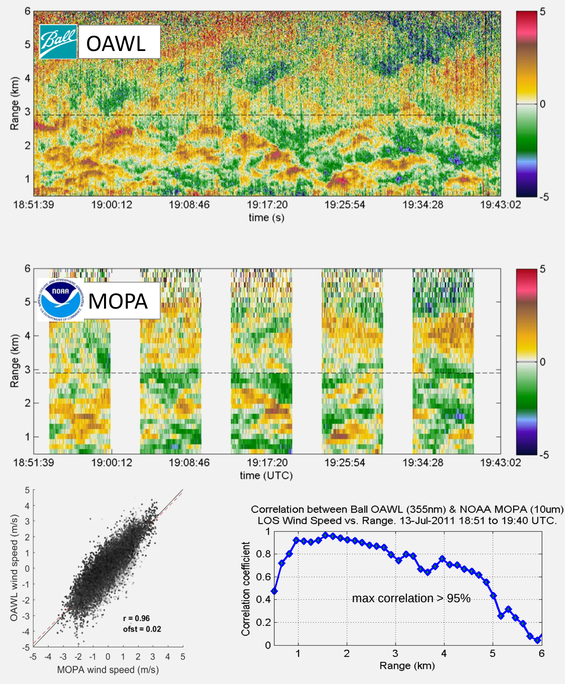


AMV's/Feature tracking: wide coverage, limited to feature layers; prone to height assignment errors

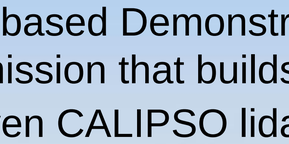
<u>Data GAP</u>: Upper level wind profiles over the oceans and Southern Hemisphere.

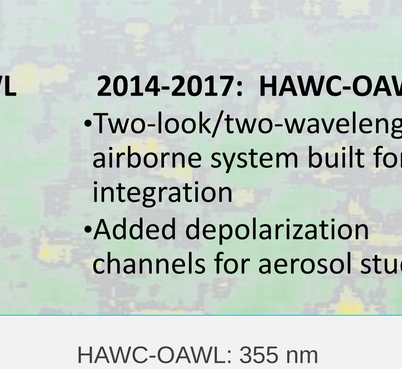
<u>Solution</u>: Space-based Doppler Wind Lidar (DWL)

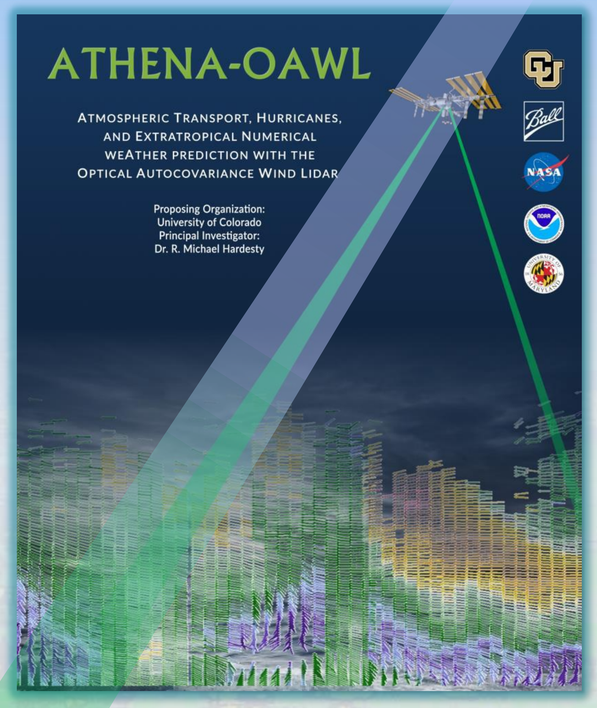
Optical Autocovariance Wind Lidar (OAWL) Evolution



2008-2012: OAWL IIP-07
- Breadboard system, Single look
- 355 nm only, 4x channels
- Ground validation with NOAA MOPA Coherent detection system
- Autonomous flight tests on NASA WB-57



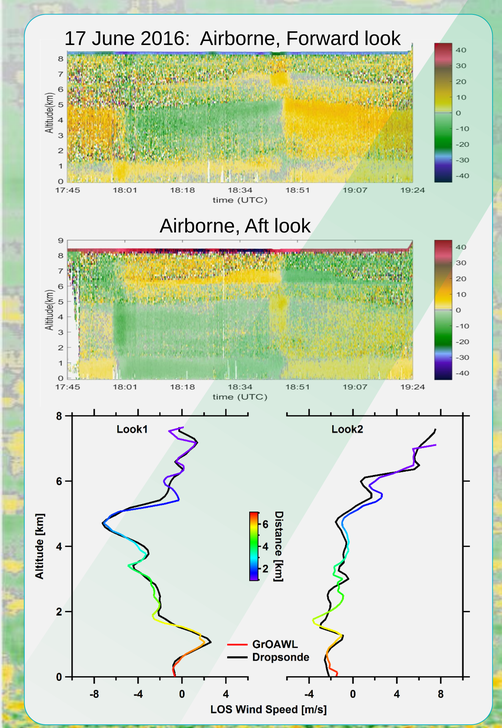


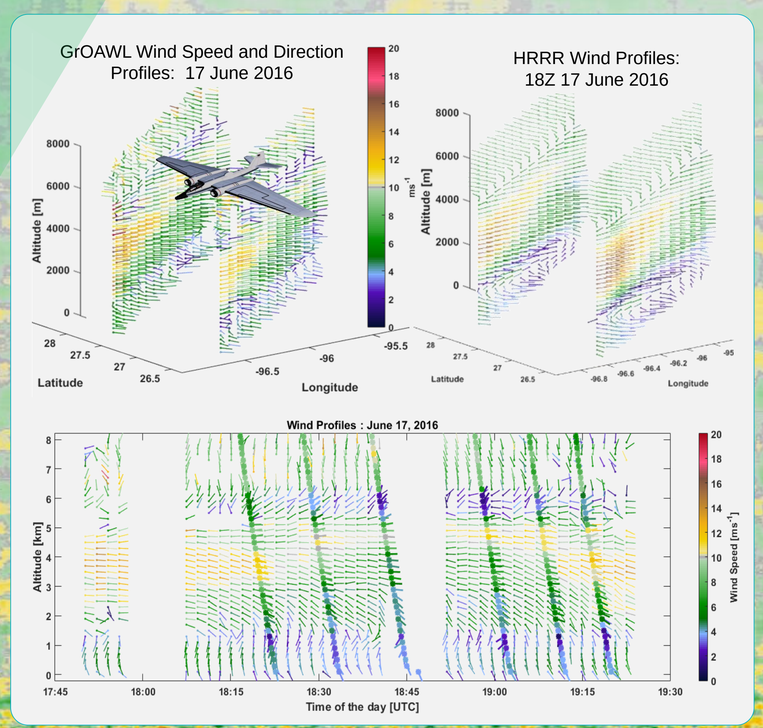


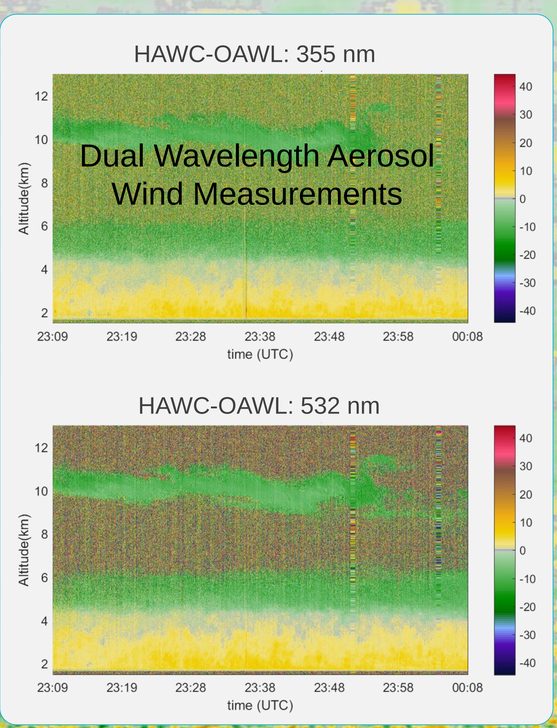
ATHENA-OAWL: Proposed Space-based Demonstration DWL mission that builds on:
- Proven CALIPSO lidar technologies: Laser (532 nm), Telescopes, optics, processing
- Demonstrated wind measurements from ground & airborne platforms
- ISS enabling technologies: Mass, Cooling system, TDRSS downlink

2015-2017: ATHENA-OAWL Venture-Tech: GrOAWL
- Airborne demonstrator System WB-57
- 2 looks: 2 lasers & 2 telescopes to demonstrate the 2-look geometry for space for wind speed & direction profiles.
- Real time wind speed processing

2014-2017: HAWC-OAWL IIP
- Two-look/two-wavelength airborne system built for DC-8 integration
- Added depolarization channels for aerosol studies







OAWL Based Solutions

OAWL path to *full* atmospheric wind profiles:

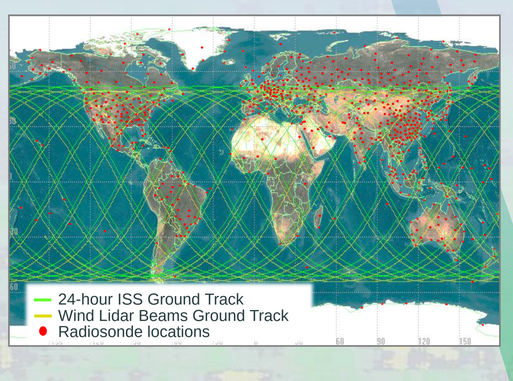
Two wavelengths and two "nested" receivers measure winds from both aerosols AND molecules

@ 532 nm – more precision using the ***aerosol returns***

@ 355 nm – more coverage using the ***molecular returns***

Applicable for airborne and Space-based configurations - but ideal for space

High altitudes have fewer aerosols & clouds, so UV wavelengths are used to measure winds using lidar returns from just molecules (e.g. ESA's Aeolus mission)



Aerosol-DWL's provide good returns in lower troposphere and where aerosol layers or thin clouds are present

Airborne & ground DWLs are ideal for boundary layer dynamics studies that can be smeared by space-based orbit speeds (~7.2 km/s)