

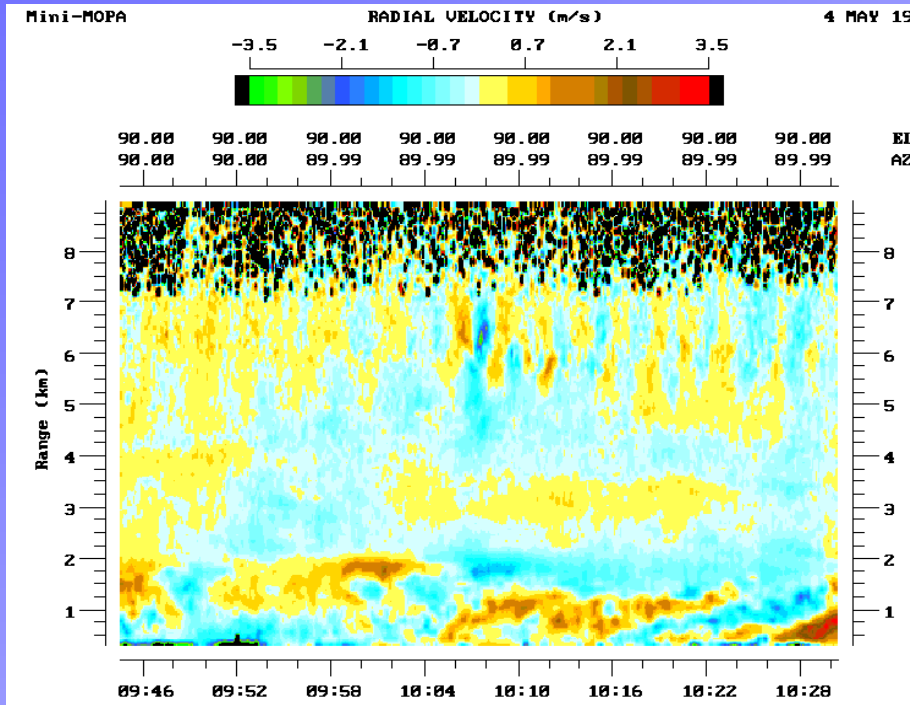
Potential NOAA Research Observing Systems for COPS

- Research Aircraft
- Meteorological radars
- Cloud radars
- Lidars
- Wind profilers
- Surface flux stations
- Airborne and surface microwave radiometers
- Mobile in situ sensors

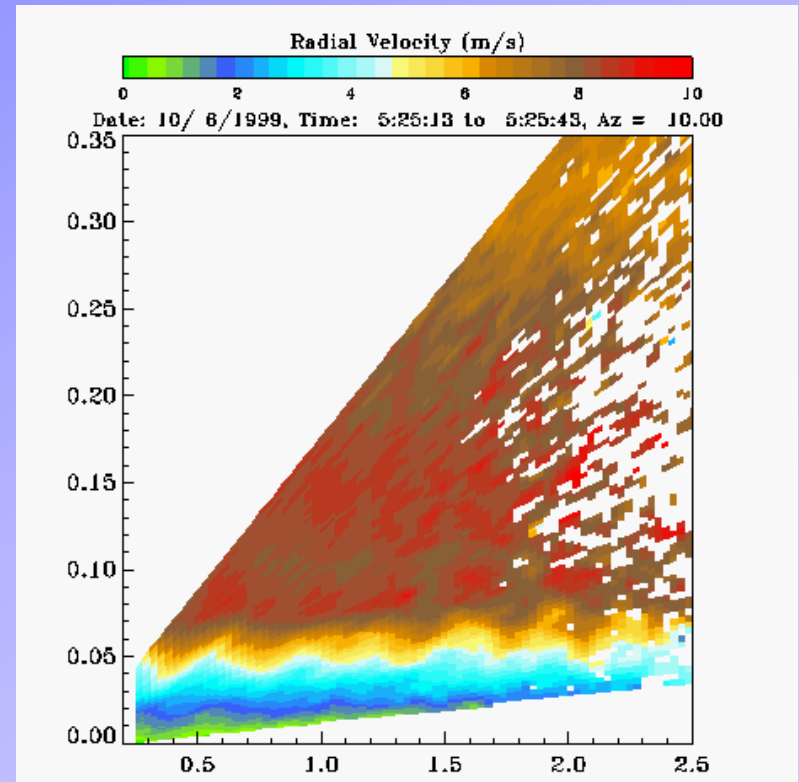
ETL Lidar Measurement Capabilities

- Doppler Lidar (3)
 - Winds
 - Turbulence
- Differential Absorption Lidar (DIAL)
 - Ozone (2)
 - Water vapor (1)
 - NH₃
- Cloud/Aerosol Lidar (1)
 - Aerosol 3-D distribution
 - Microphysical properties
 - Cloud morphology / climatology
- Marine Lidar (1)
 - Biomass
 - Species identification

Boundary Layer Dynamics

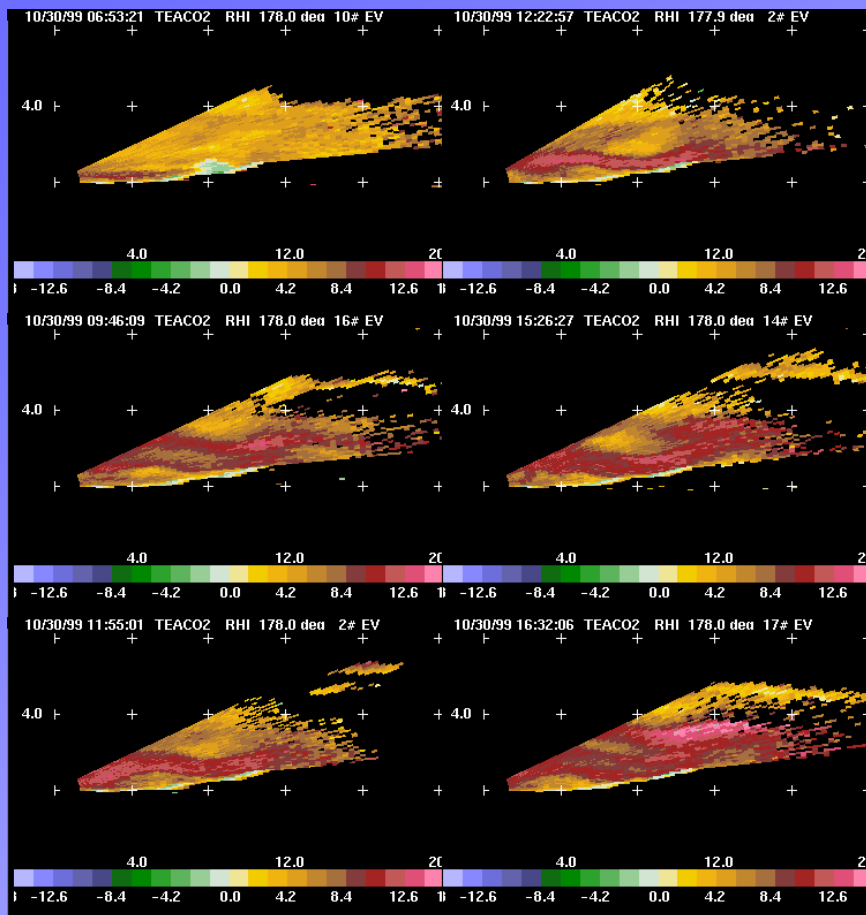


Vertical velocity

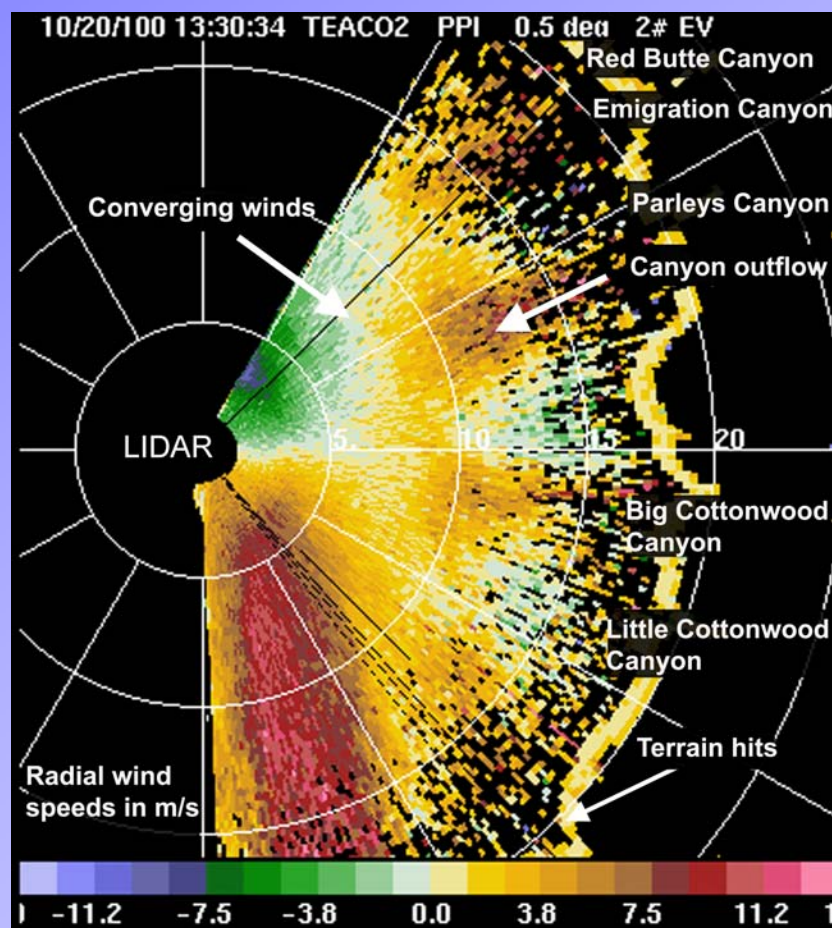


Nighttime shear instability

Flow in Complex Terrain



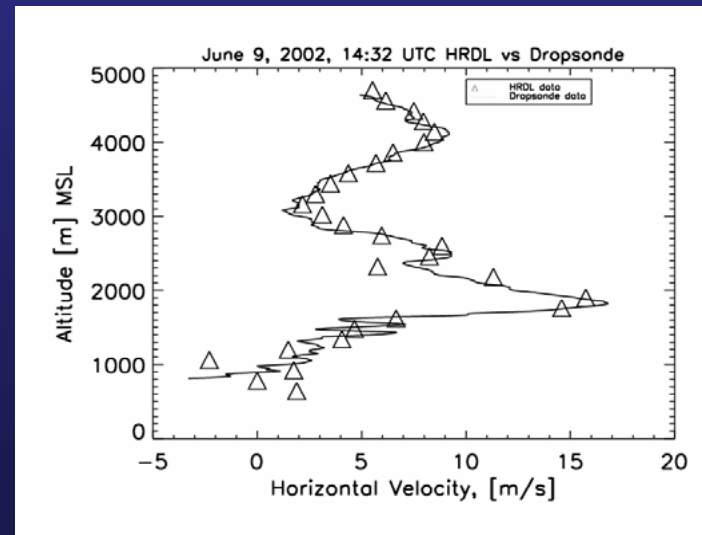
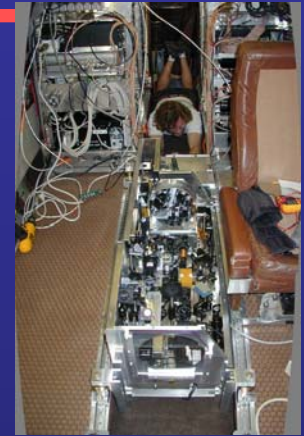
Downslope flows during MAP



Canyon outflows in Salt Lake City

IHOP: Regional Transport of Moisture

- Co-deployed a Water Vapor DIAL (DLR) and a Coherent Doppler Lidar (ETL) on the DLR Falcon
- Combined measurements to estimate vertical flux profiles and horizontal transport of moisture



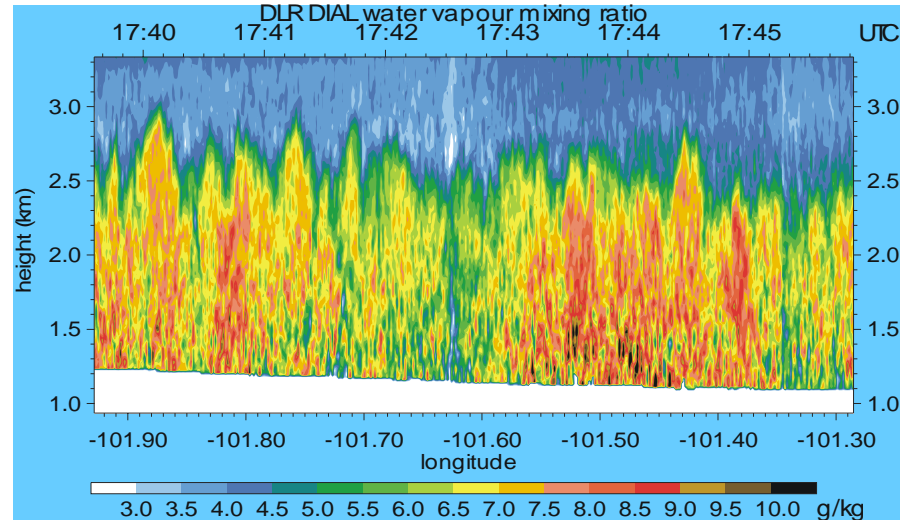
Combined Wind and Water Vapour Measurements

Spatial Averaging:

DLR-DIAL **➔**

$\Delta x = 200 \text{ m}$

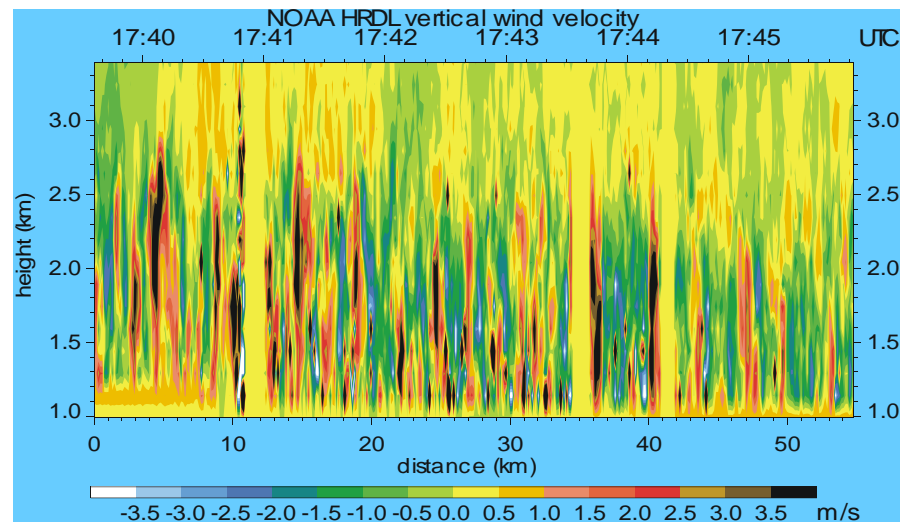
$\Delta y = 150 \text{ m}$



NOAA-HRDL **➔**

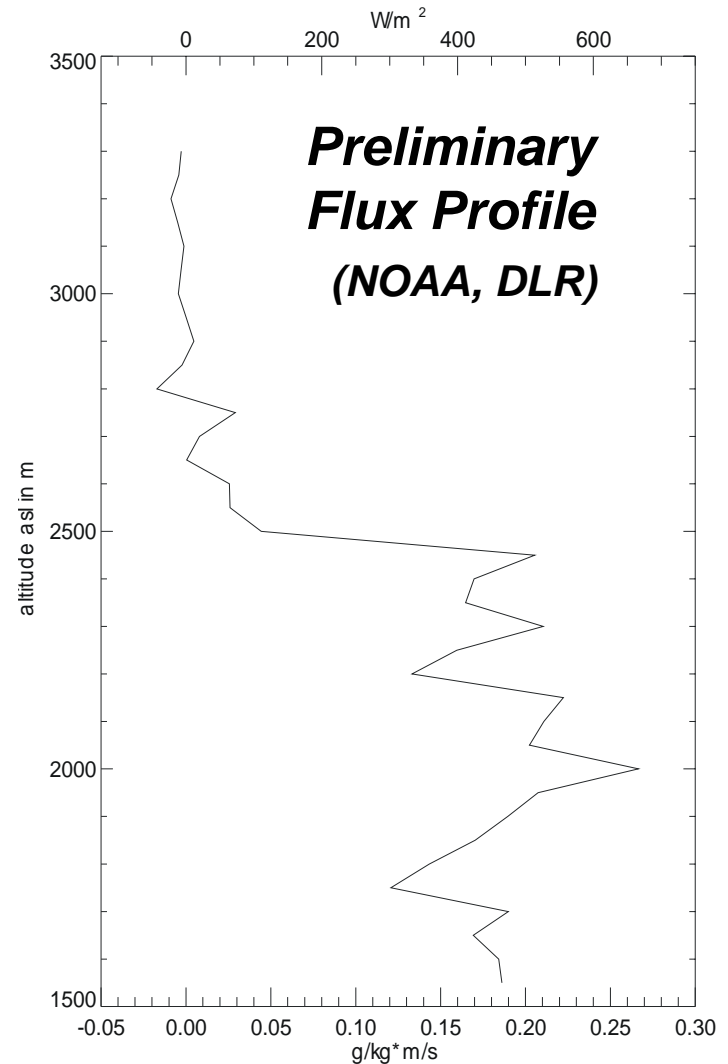
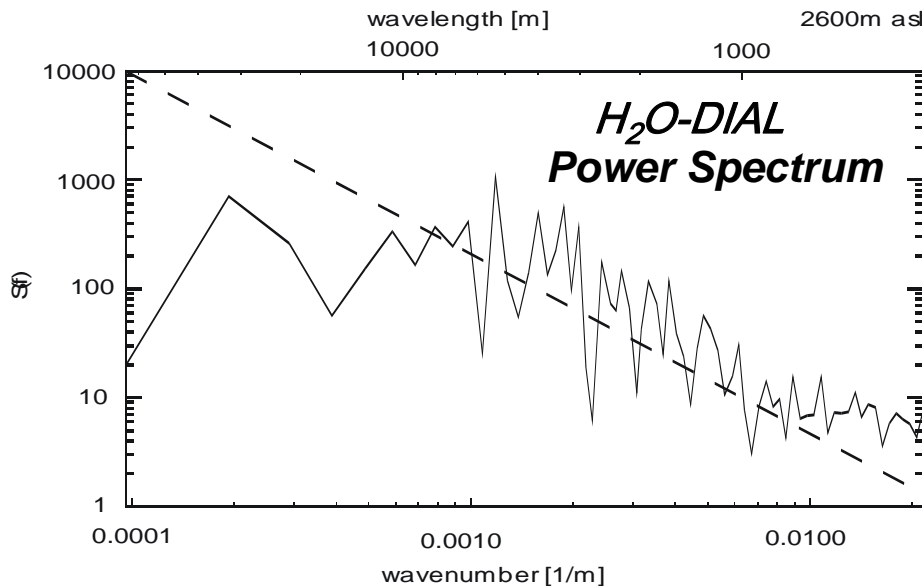
$\Delta x = 150 \text{ m}$

$\Delta y = 150 \text{ m}$

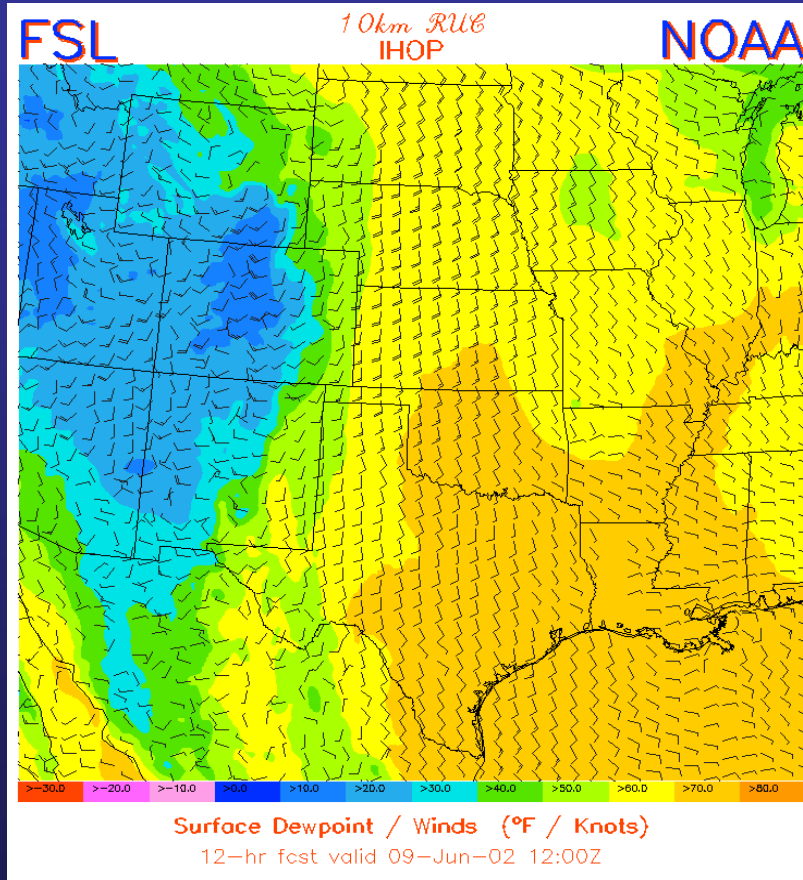


Flux Profile from Eddy-Correlation

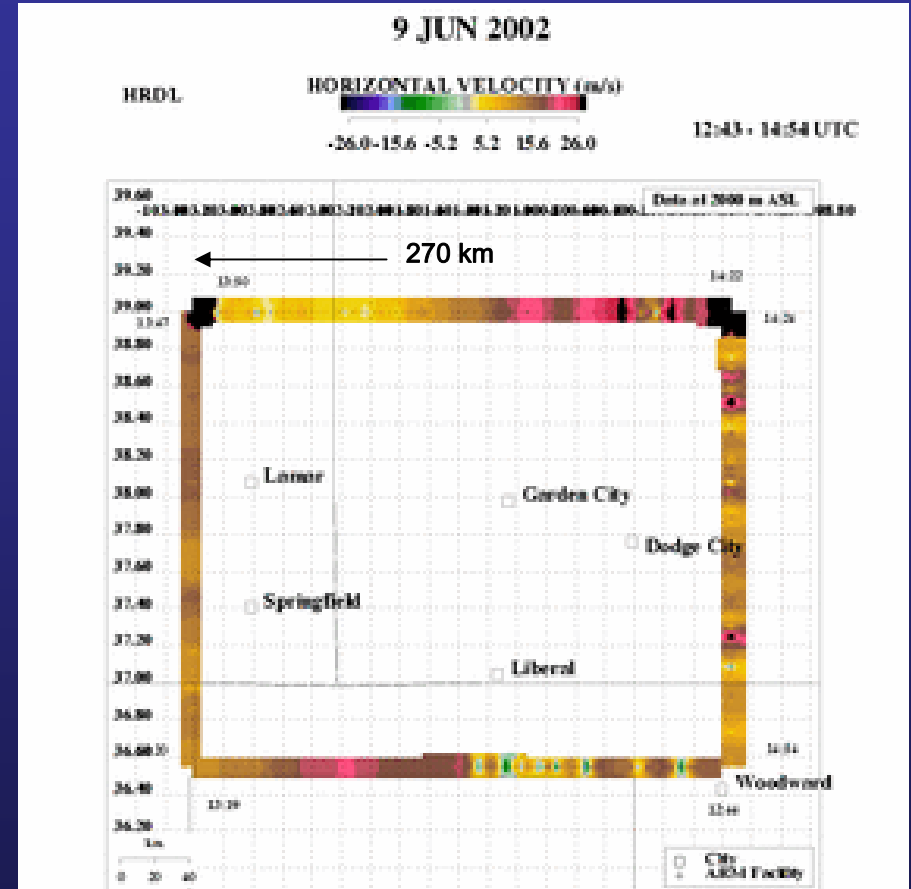
First Measurement of Latent Heat Flux Profile by co-located airborne water vapor DIAL and Doppler wind lidars



IHOP Horizontal Winds: 9 June

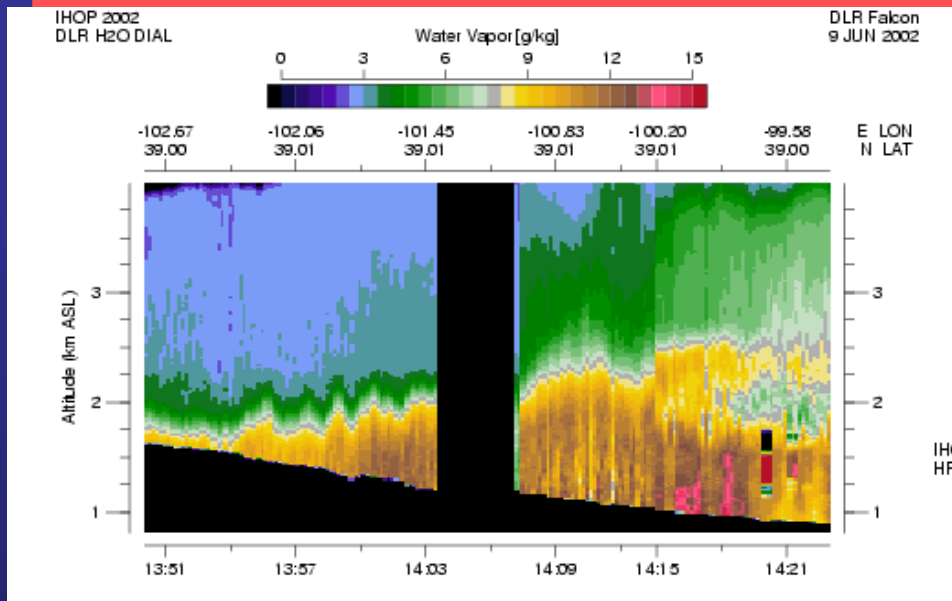


Forecast showed low
level jet



Flight track to measure jet

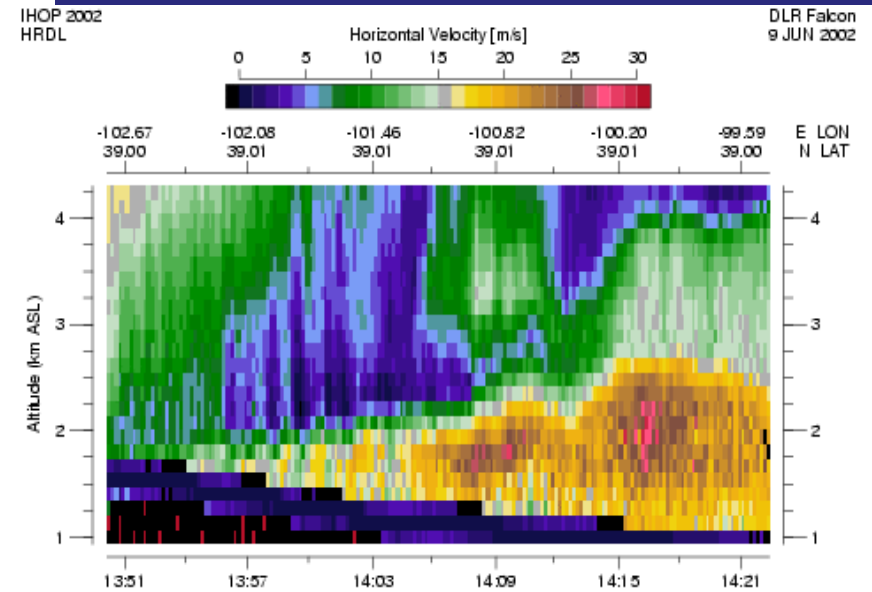
Northern leg wind and water vapor



Water vapor profiles

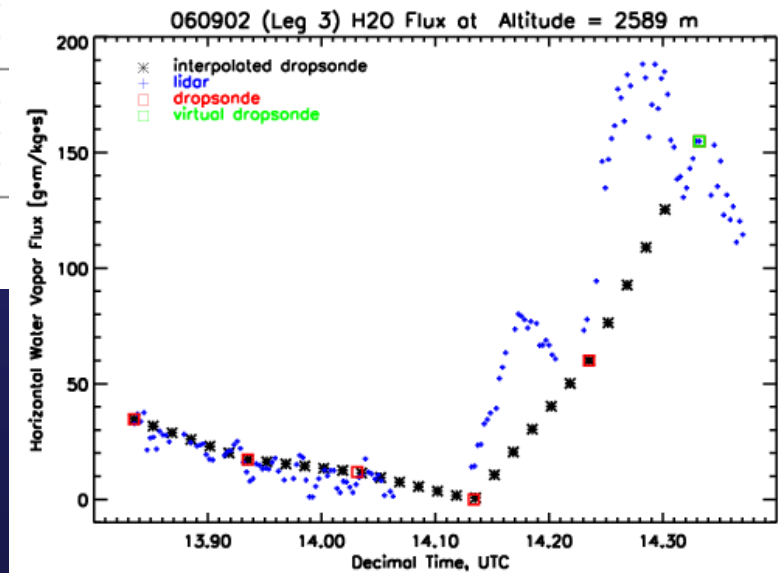
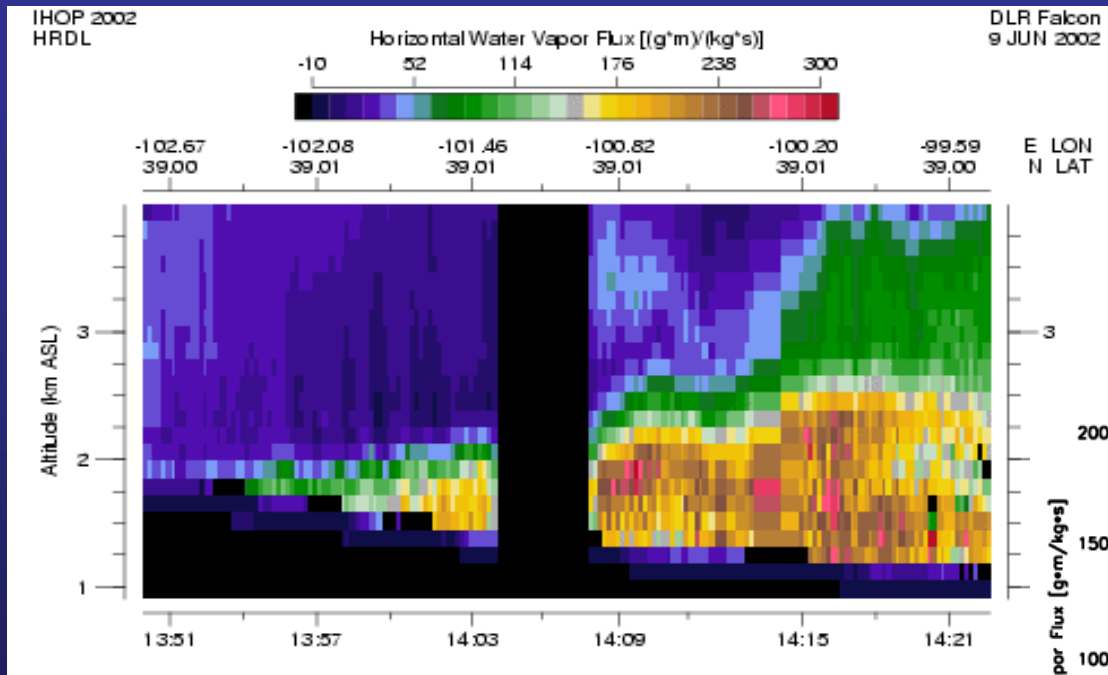
Wind Profiles

Resolution = 150 m (vertical)
= 1.5 km (horizontal)



Lidar and dropsonde flux comparison

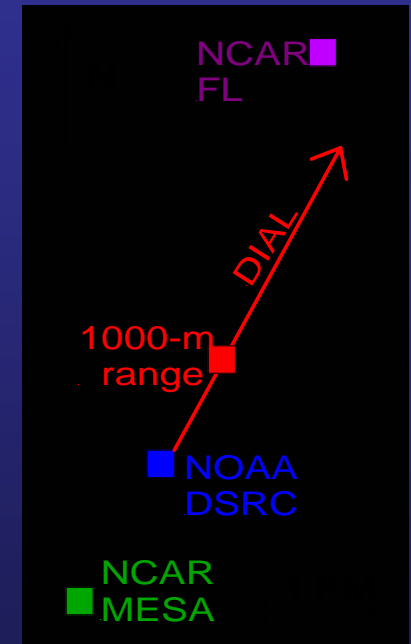
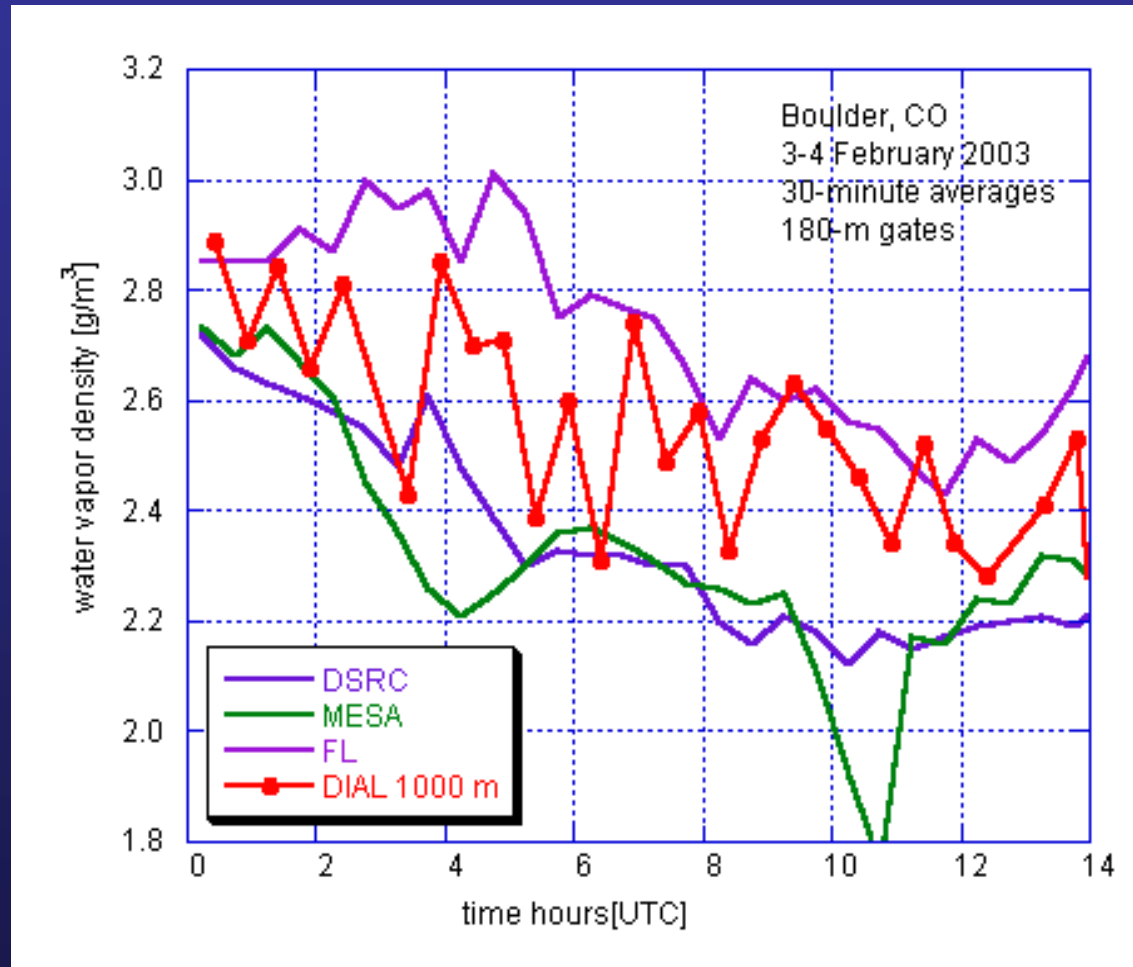
DIAL/Doppler lidar (1500 m spacing)



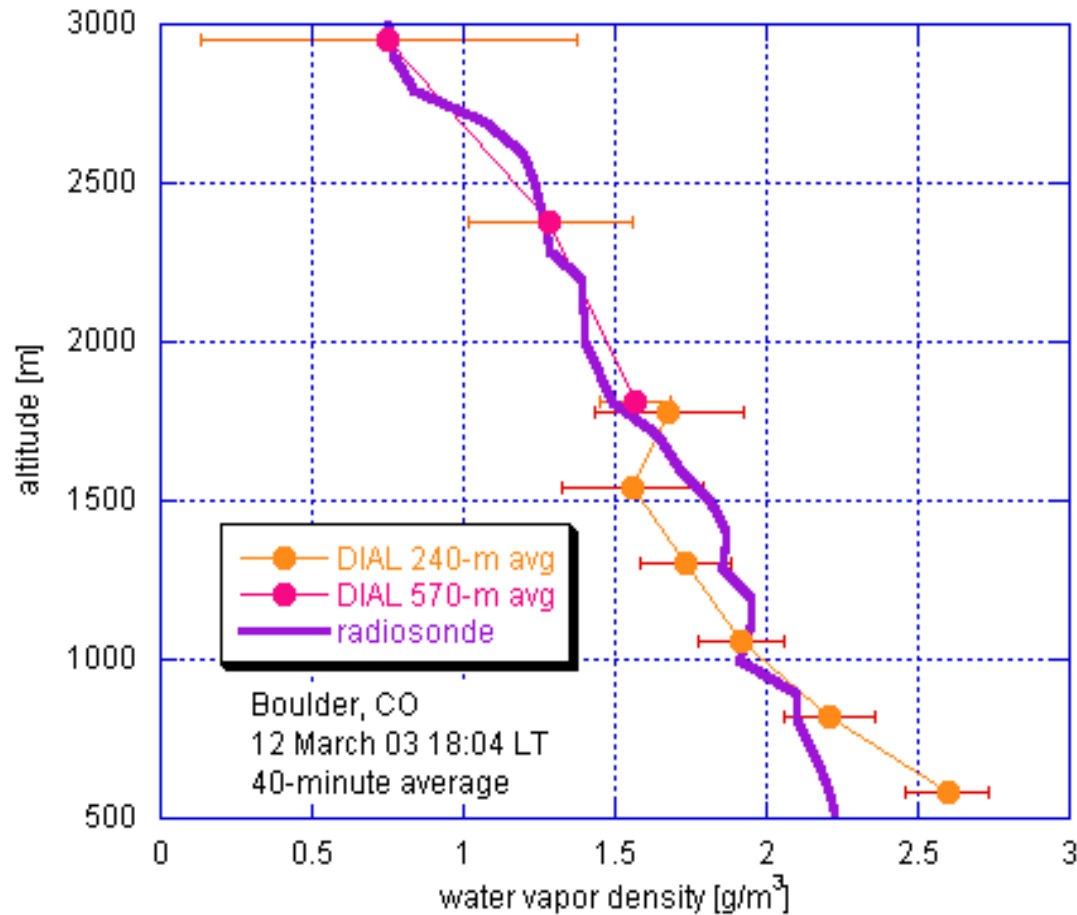
CODI



Comparison of horizontal DIAL at 1000 m with *in situ* Sensors



Comparison of vertical DIAL and radiosonde



Summary

- NOAA/ETL has many potential observing systems applicable to COPS
- ETL lidars could be deployed for measuring mesoscale flows, dual Doppler wind fields, moisture profiling, or from aircraft
- Significant NSF or NOAA forecasting component in COPS probably necessary for substantial ETL contribution