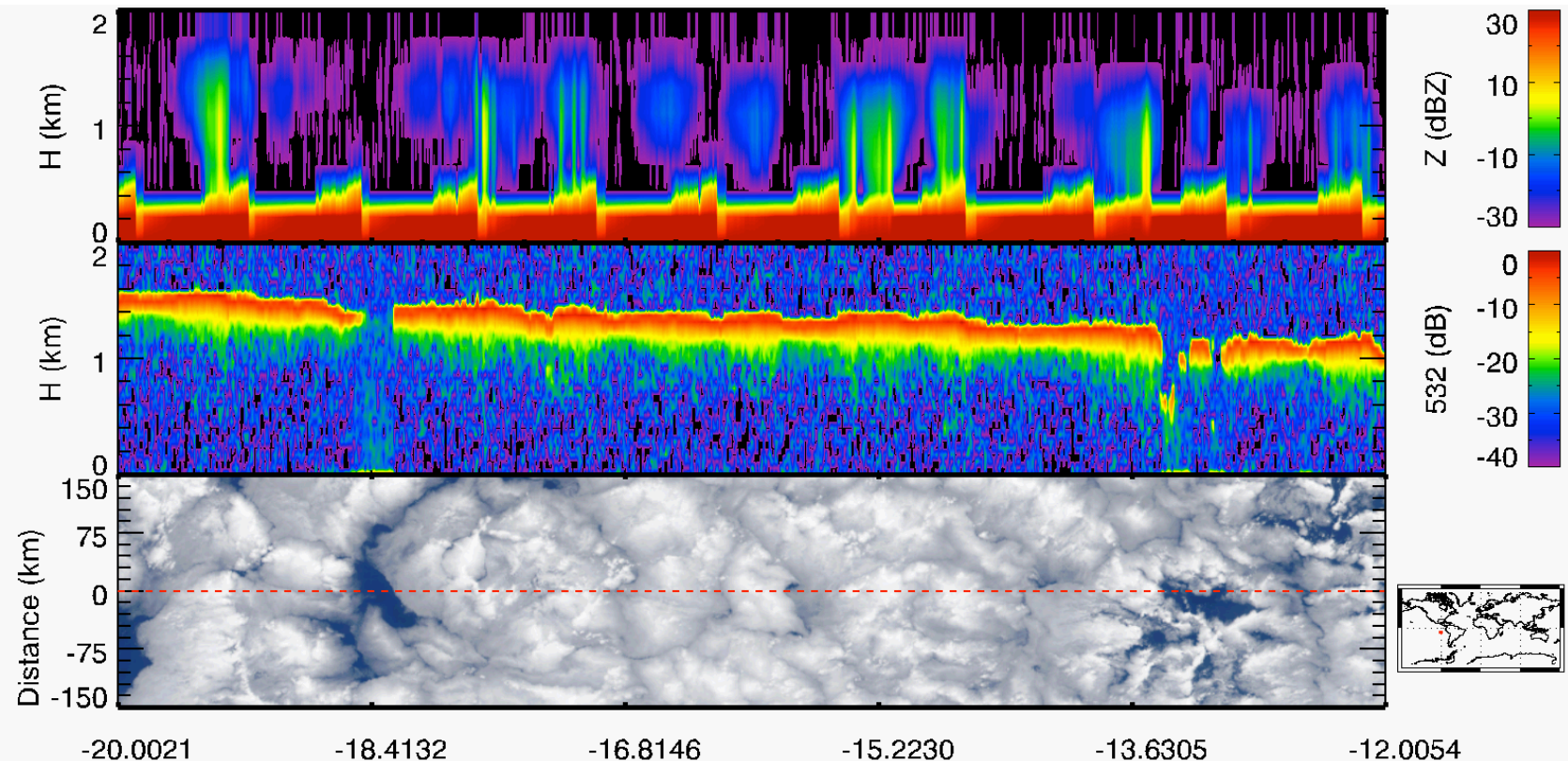


# Multi-sensor retrievals of cloud droplet concentration and drizzle properties

Zhien Wang and Jeff Snider

University of Wyoming

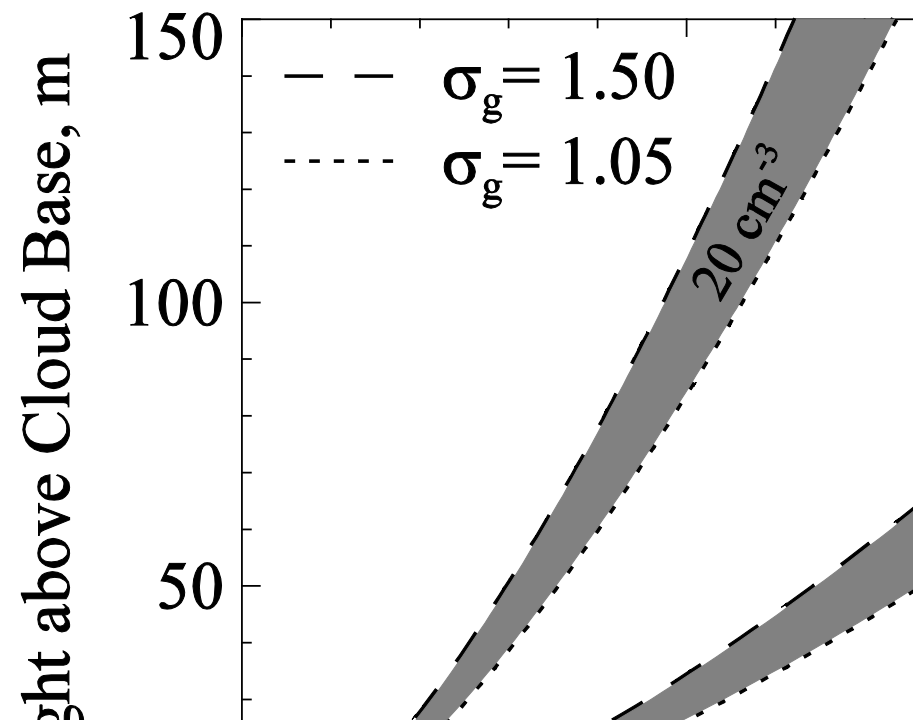


# MMCR+MWR+ MPL (lidar) (3M) for Precipitating Stratiform Clouds

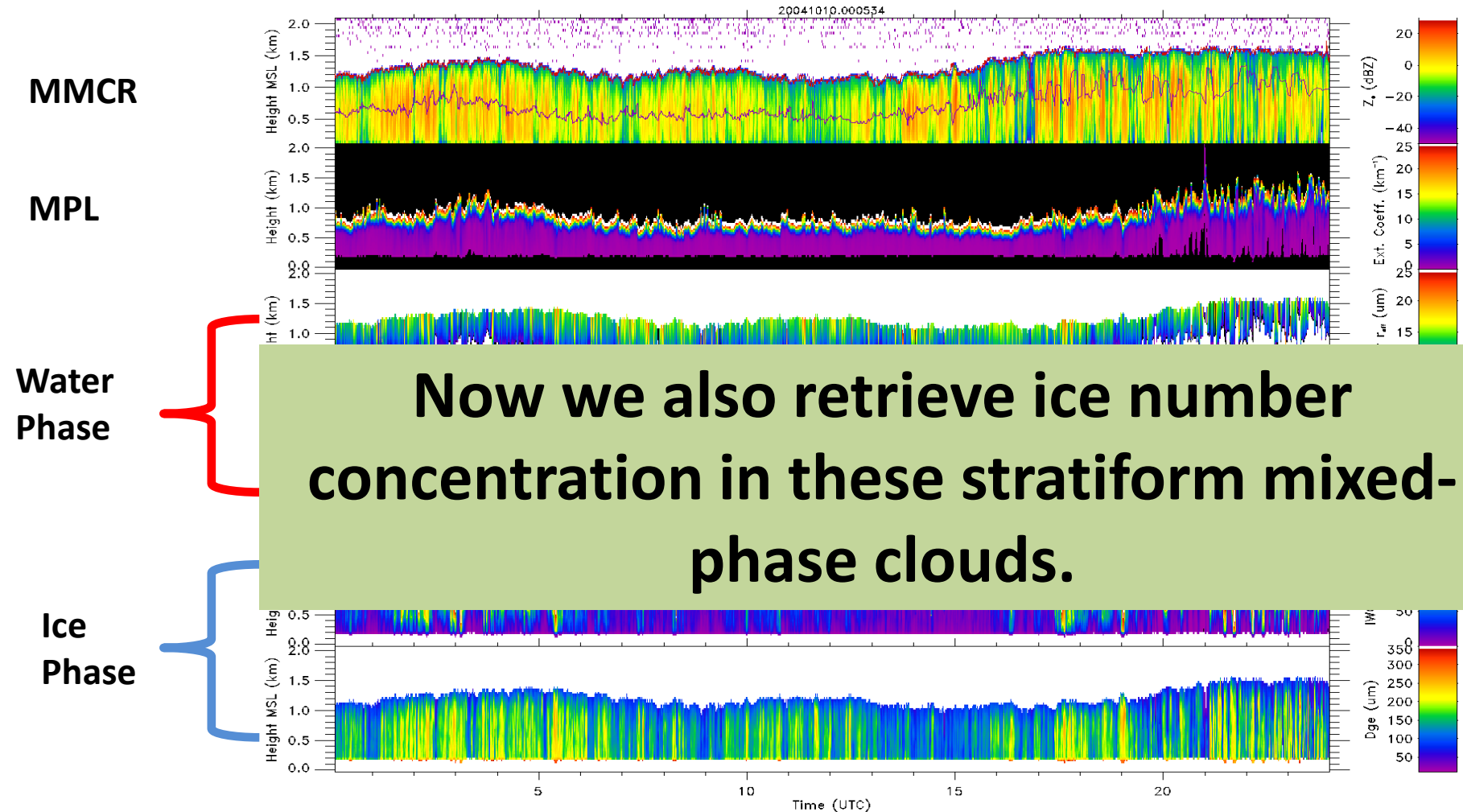
- MWR + Lidar: LWP+ droplet concentration + effective radius
- MMCR + lidar: Precipitating particle properties

## Droplet Concentration Retrieval

1. Liquid extinction profile: Lidar power + depolarization ratio at high vertical resolution.
2. Depolarization ratio to correct multiple scattering effect.
3. Extinction + adiabatic liquid water content to provide number concentration.

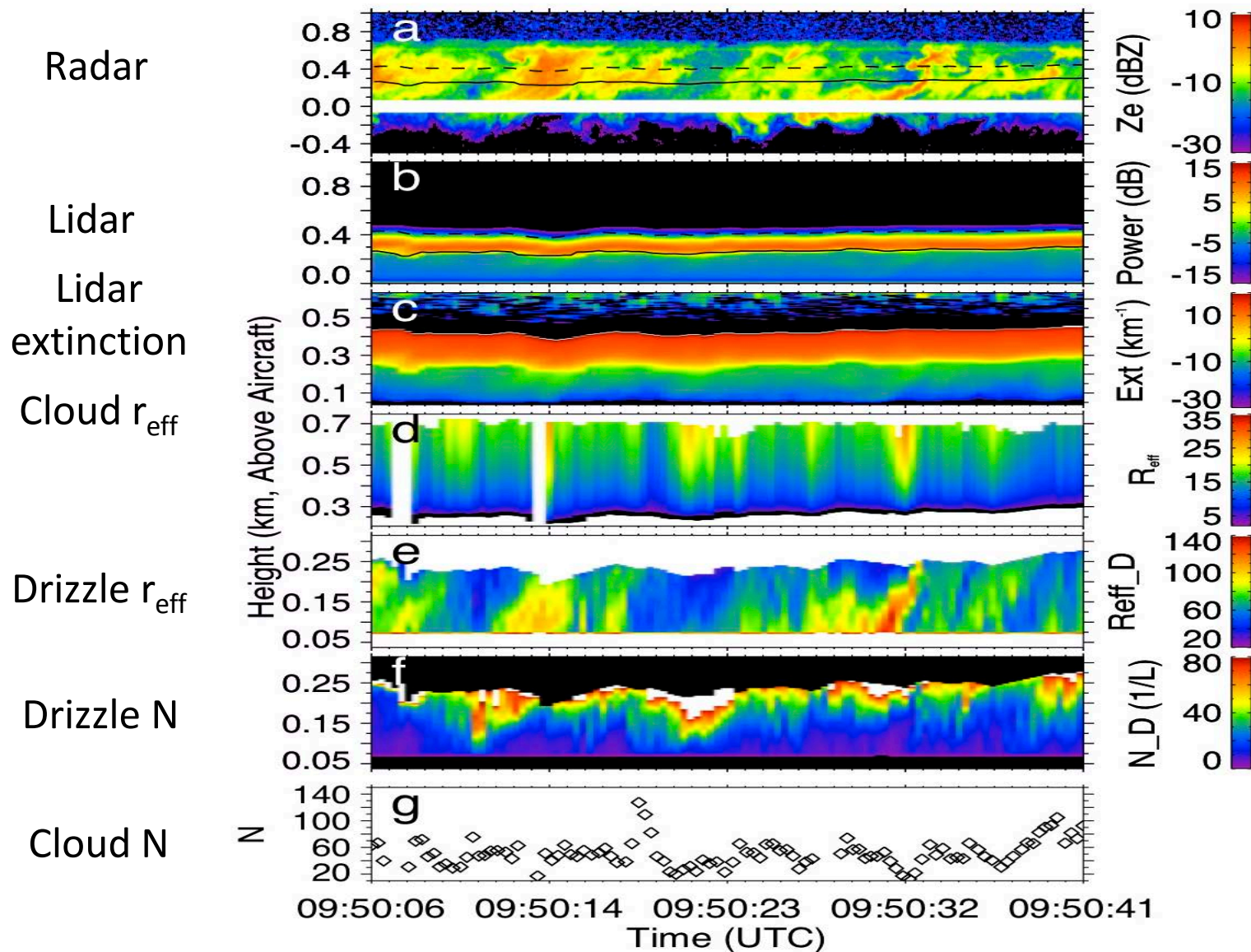


# A Mixed-phase Retrieval Example



Mixed-phase clouds observed at the Barrow site on 10 October 2004 by combining MMCR, MPL, MWR, and radiosonde data. Cloud top temperature  $\sim -13.3^\circ \text{C}$ . - Wang and Zhao, 2007

# Drizzling Stratocumulus Retrieval Example

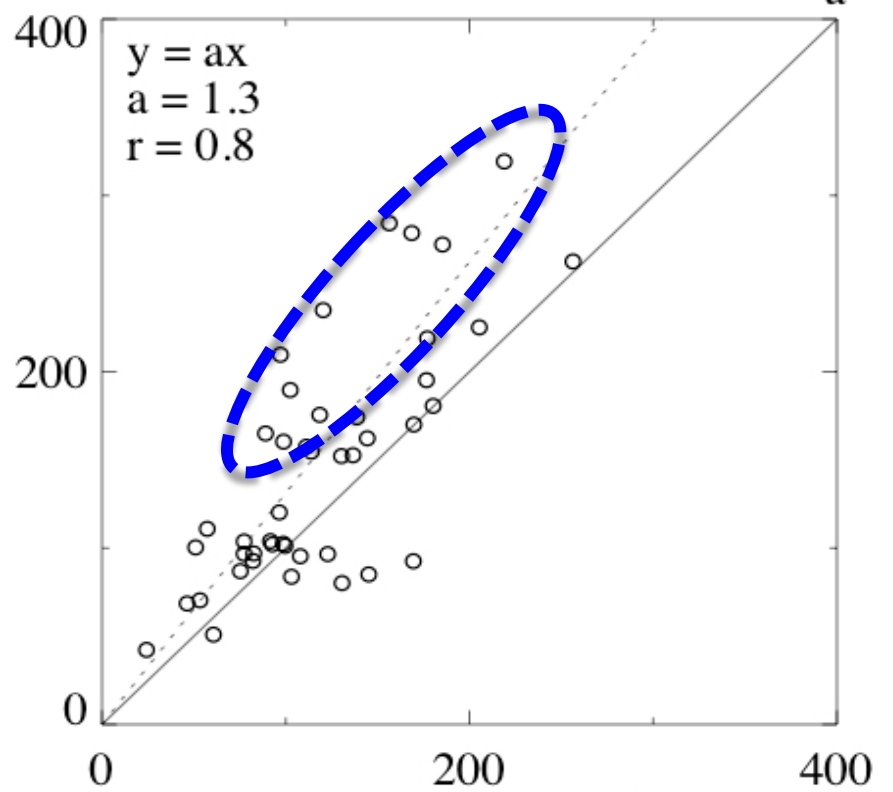


**A**  
**VOCALS**  
**case**

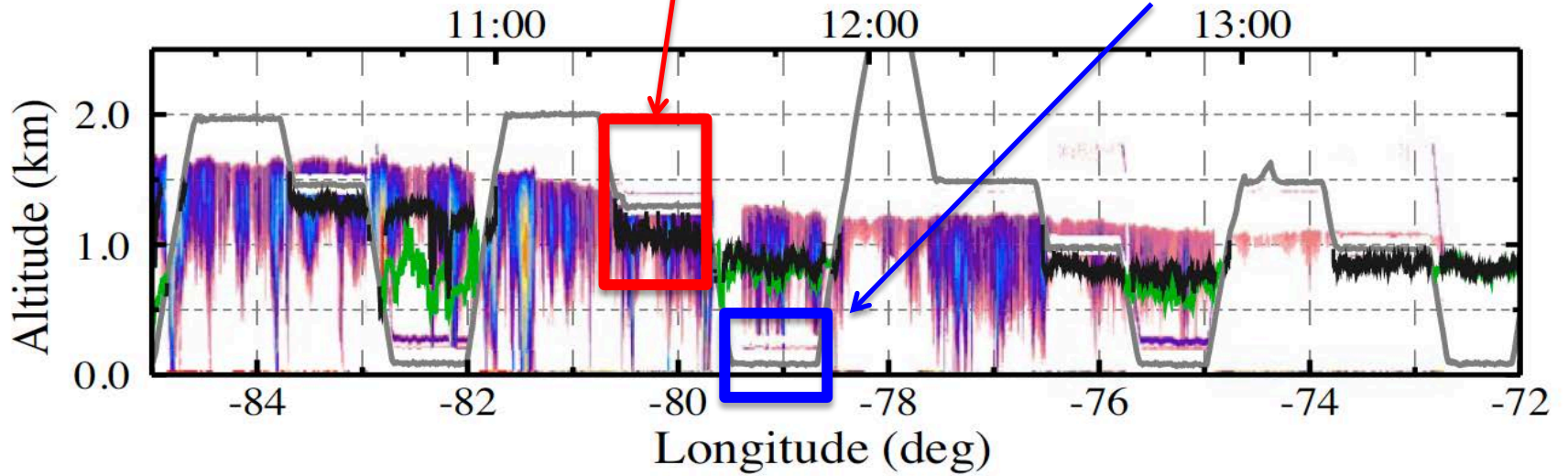
# Water droplet concentration Comparison

**In-situ**

N-observed, cm<sup>-3</sup>



**Remote Sensing**



# New capabilities to facilitate aerosol-cloud interaction study with *Surface-based* and *Airborne* observations

- Aerosol properties
- Vertical velocity
- Cloud properties

## Issues to implement the algorithm to ARM data stream

- The signal saturation of new MPL in water layer!