

Dynamics and Thermodynamics of Convection

Deep continental convection

- ▶ Science questions
 - ▶ Complexities of real as opposed to idealized storms
 - ▶ Wind and thermodynamic patterns within storms
- ▶ Measurements needed
 - ▶ Thermodynamic environment (array of soundings etc.)
 - ▶ Measuring internal dynamic and thermodynamic fields in storms
 - ▶ Aerosol and cloud droplet/hydrometeor structure
 - ▶ Higher sampling frequency

Deep maritime convection

- ▶ Science questions
 - ▶ Environmental control of form and distribution of convection
 - ▶ Effect of convection on the environment
 - ▶ Effect of climate change on convection
- ▶ Measurements needed
 - ▶ Thermodynamic environment (array of soundings)
 - ▶ Mesoscale mass flux, divergence of moisture, MSE
 - ▶ Cloud-scale Updraft/downdraft structure
 - ▶ Aerosol and cloud droplet/hydrometeor structure
 - ▶ Surface fluxes and SST
 - ▶ Short and longwave radiation

Shallow convection

- ▶ Science questions
 - ▶ Explain morphology of convection
 - ▶ Understand transitions between different morphologies
 - ▶ Mixed phase clouds – aerosol budget
- ▶ Measurements needed
 - ▶ Thermodynamic environment (array of soundings)
 - ▶ Mesoscale spatial structure
 - ▶ Updraft/downdraft structure
 - ▶ Aerosol and cloud droplet/hydrometeor structure
 - ▶ Short and longwave radiation

Facilities

- ▶ Instruments
 - ▶ Fast scanning Doppler radar at multiple wavelengths and dual polarization (land, ship, **airborne: APAR**)
 - ▶ Vertically pointing W/**K**-band Doppler radar (**X-band?**) (land surface, **ship?**, airborne)
 - ▶ Dropsondes (**over land**)/radiosondes
 - ▶ Remote sensing of wind, temperature, humidity (Raman lidar, WV-DIAL **+ temperature, Doppler lidar**) (land surface, ship, **airborne, multiple sets for arrays**)
 - ▶ In situ aerosol/microphysics instrumentation
 - ▶ **In situ, in-cloud thermodynamics**
 - ▶ Long and shortwave radiation instrumentation
- ▶ Platforms
 - ▶ Aircraft, including high altitude, long range, heavy lifting, and **convective penetration: A-10**
 - ▶ Ships for radar, radiosondes, etc.