The Tropical Warm Pool International Cloud Experiment

TWP-ICE
Darwin, Jan/Feb 2006

Jim Mather, PNNL

Acknowledgements

TWP-ICE Coordination: Peter May, Christian Jakob

Aircraft Coordination: Jay Mace and Greg McFarquhar

TWP-ICE Participants: ARM, BOM, CSIRO, NASA, and many Universities

ACTIVE Coordination: Geraint Vaughan and Keith Bower

Our hosts: Northern Territory Regional Forecast Centre
Charles Darwin University
Darwin RAAF Base

Logistics coordination: Andrew Hollis

Operations web site: Tim Hume

Forecast team: Lori Chappel and Mick Pope

Ground site maintenance: Brad Atkinson and Anthony Noonan

Plus many, many others

TWP-ICE/ACTIVE Observation Network

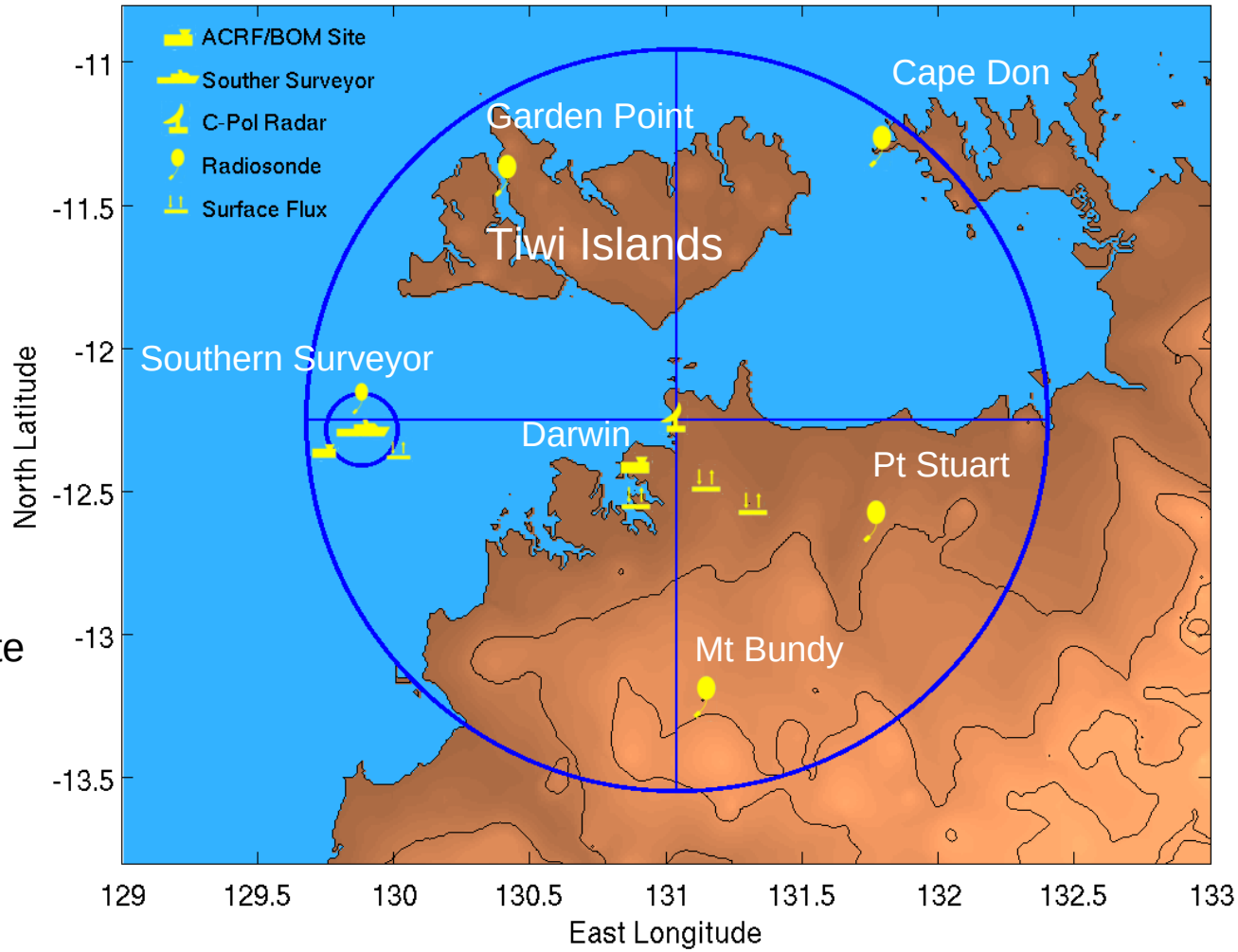
In situ microphysics

Twin Otter

Radar/Lidar

Chemistry/Aerosol/Atm state

Fluxes/Atmospheric state



Science Goals/Observational Tools

Microphysical properties of cirrus cloud as function of altitude/temperature, strength of convective source, age

In situ microphysics in cirrus associated with marine and coastal convection, fresh anvil and aged cirrus

Relation between environment and convection

CPol scanning radar, radiosonde network, surface fluxes, flux/state flights
S-Band profiler, lightning network, chemical tracers (ACTIVE)

Interaction between cirrus and the environment

In situ microphysics, state parameters (radiosondes and aircraft)

Cloud Modeling

Forcing dataset, spatial data from CPol, satellite plus cloud properties

Impact of aerosol on convection and cirrus properties

ACTIVE aerosol/microphysics observations on Egrett and Dornier

TWP-ICE Datasets

Proteus: CAPS, CSI, CIN, CPI, water vapor, lidar, radiation

Twin Otter: 94 GHz Radar, 532 nm lidar

Dimona: Fluxes, atmospheric state

Southern Surveyor: Radiation, meteorology, radar, lidar, ceilometer, MWR
M-AERI, fluxes, oceanographic profiles

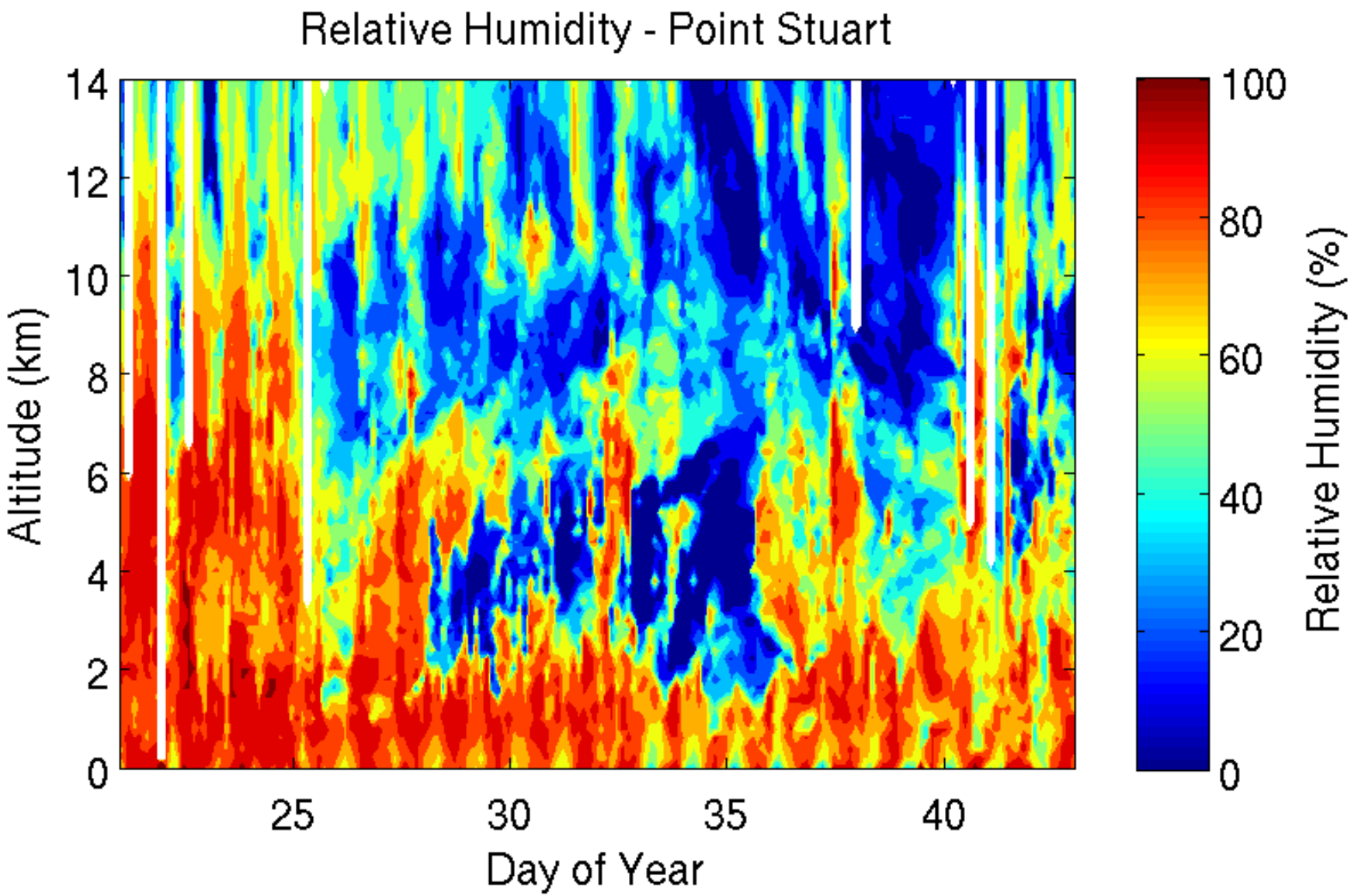
3-hourly RS-92 radiosondes at 5 sites on experiment domain perimeter
6-hourly RS-92 radiosondes at Darwin

Surface fluxes from 4 sites from harbor to Savannah

Radiative fluxes from boundary sites

NOAA S-band profiler, Adelaide 50 MHz profiler, microwave profiler

Lightning Network


Relative Humidity - Point Stuart
Altitude (km)
0
2
4
6
8
10
12
14
25
30
35
40
Day of Year
0
20
40
60
80
100
Relative Humidity (%)

Comparison of humidity from RS92
And Cryogenic Frostpoint Hygrometer.

From H. Vomel et al., submitted to
J. Atm. Ocean Tech.

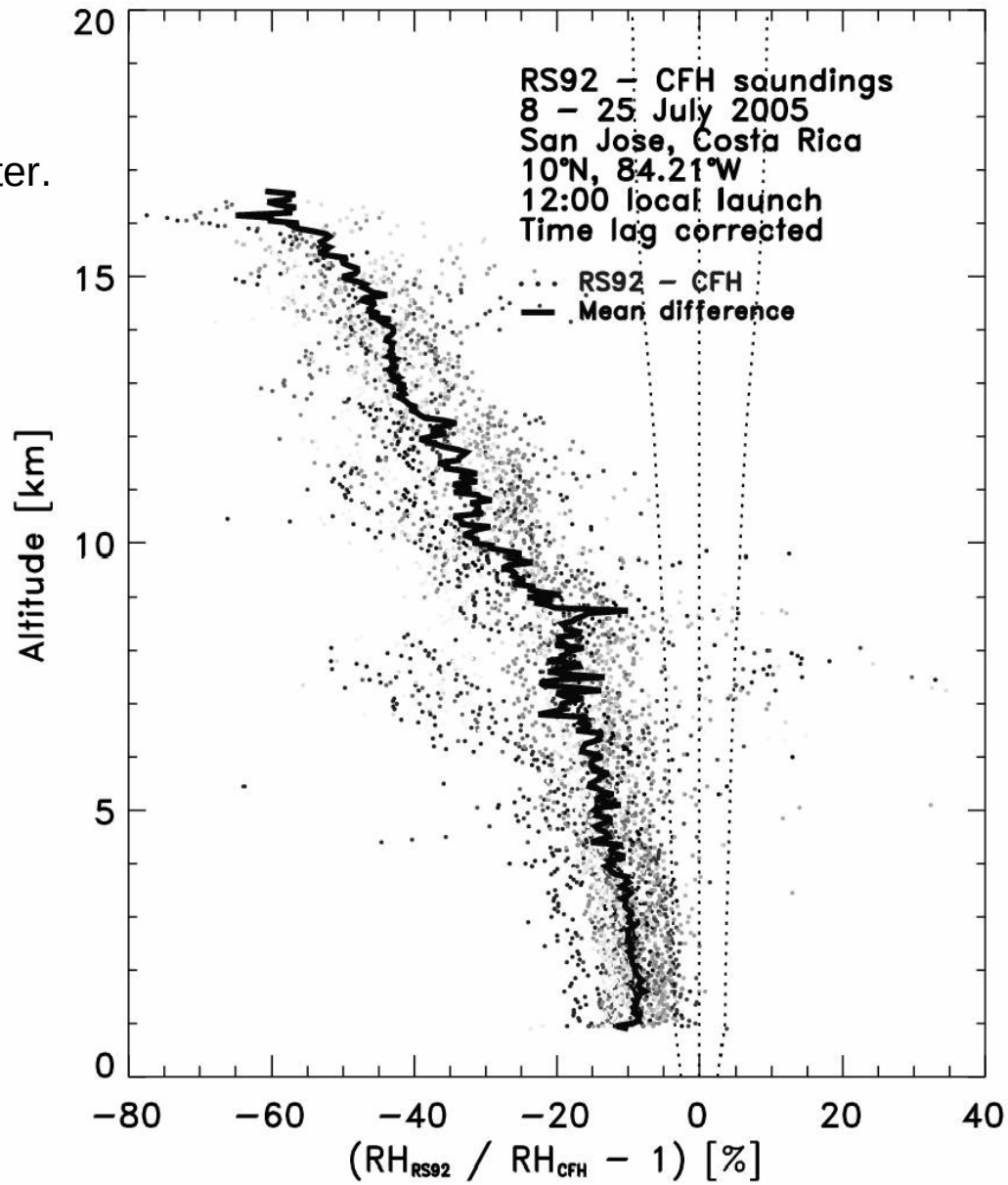
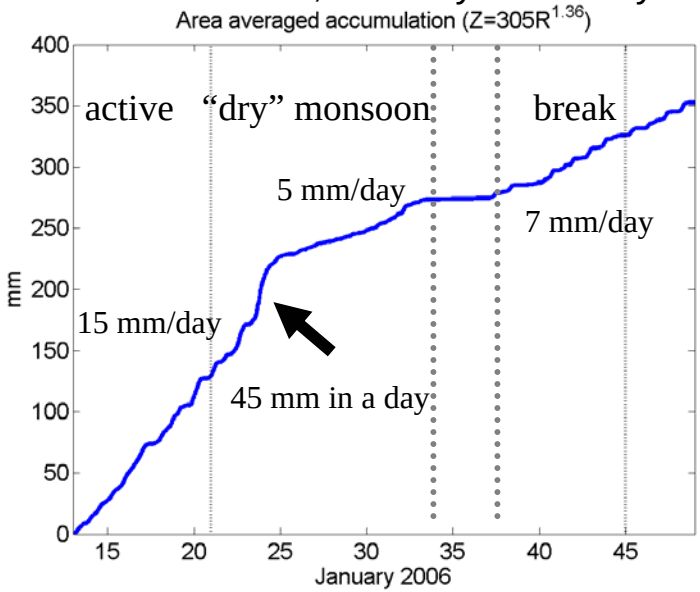


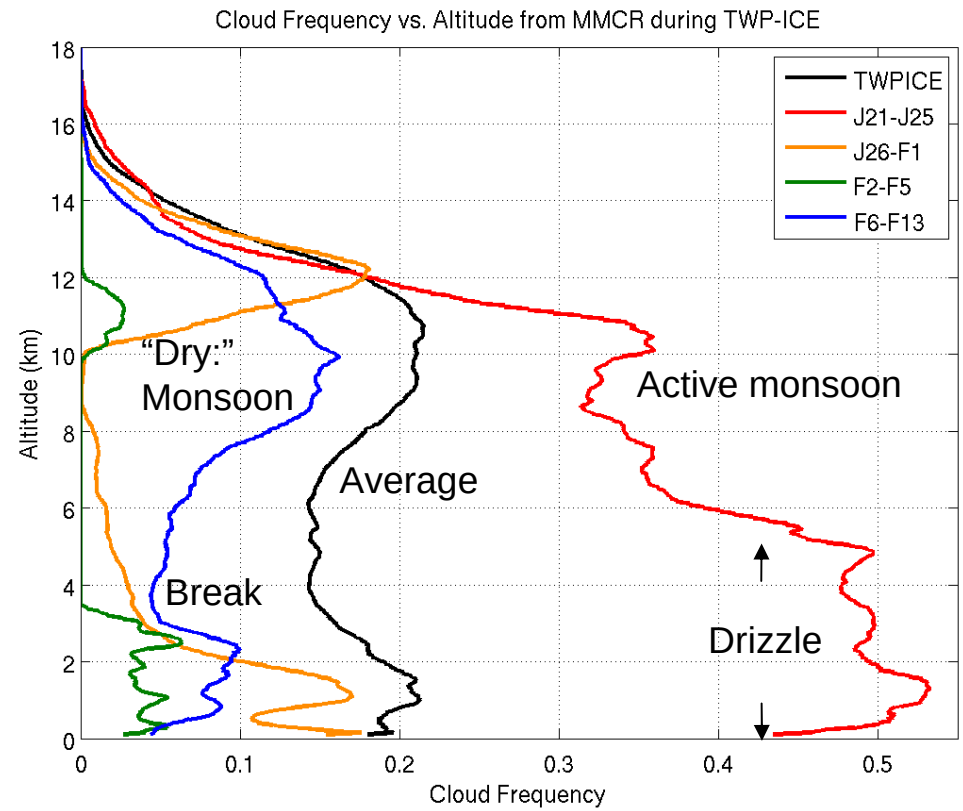
Figure 6: Relative difference between the Vaisala RS92 and CFH daytime RH.

TWP-ICE Meteorological Regimes

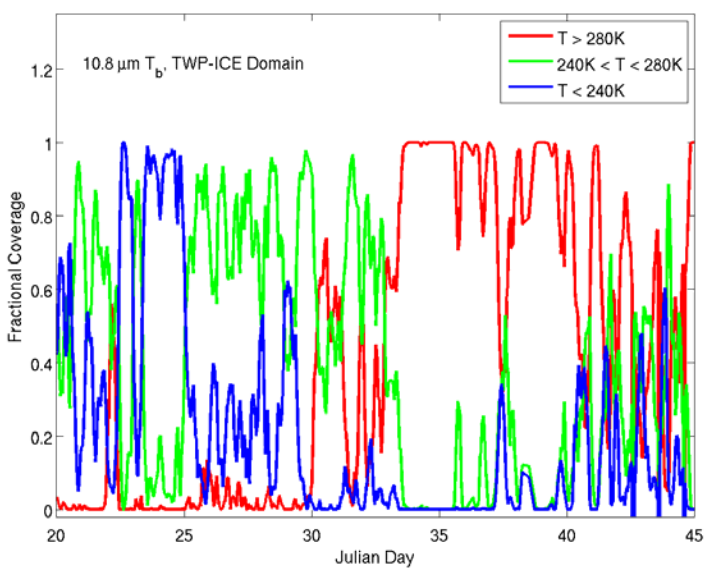
CPOL Rain, courtesy Peter May



Cloud Frequency from MMCR

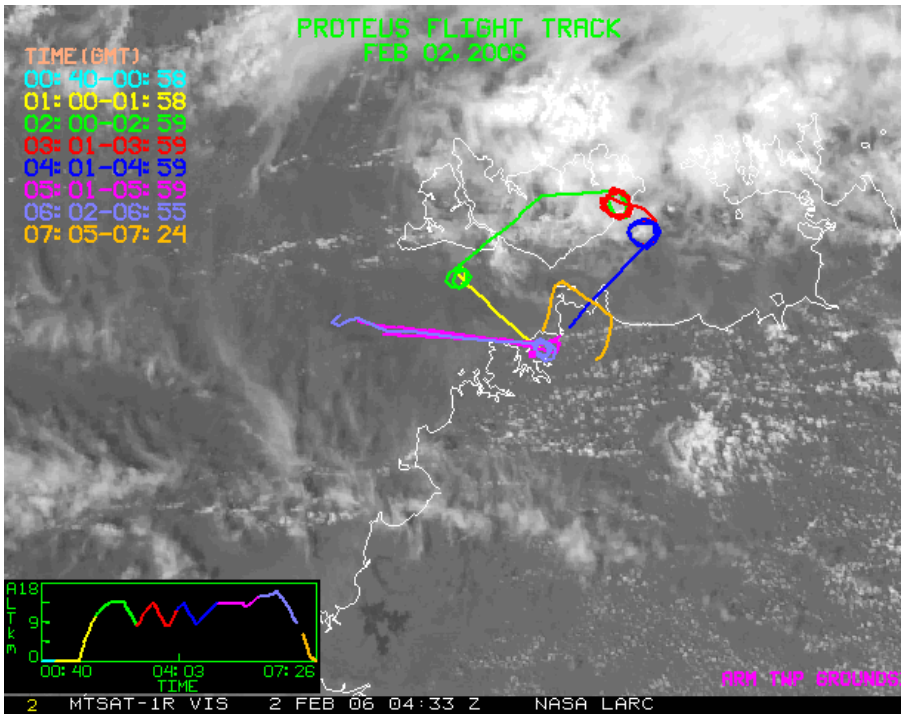


Cloud Fraction from MT-SAT

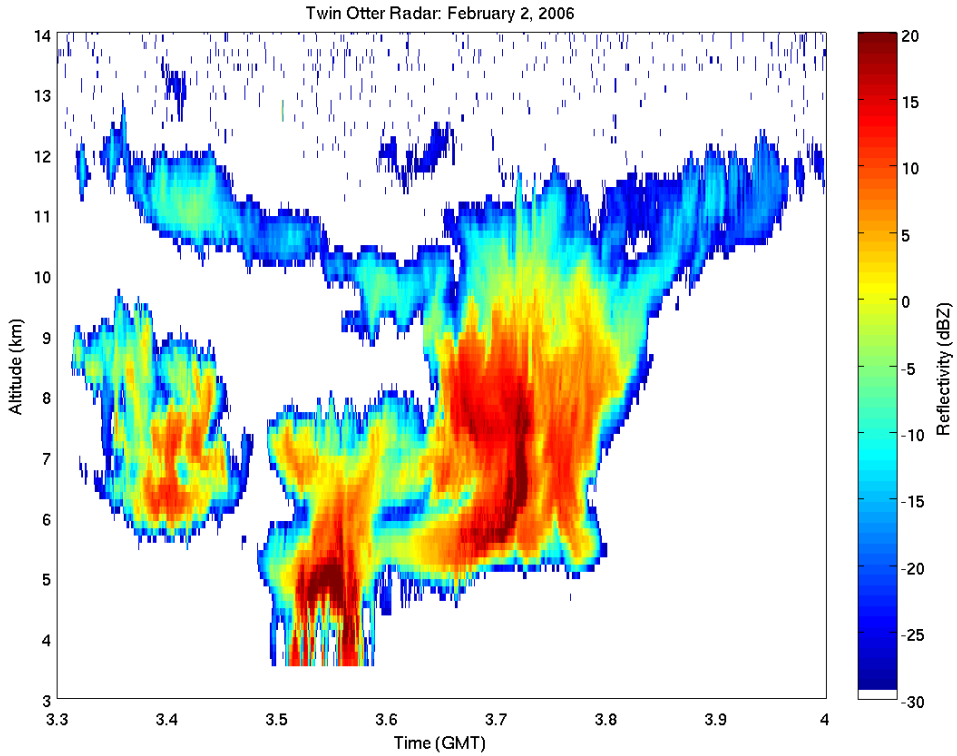


Aircraft Missions

Proteus/Twin Otter: January 25, 27, 29, February 2, 6, 10, 12
Egrett/Twin Otter: January 22, 23, 25, 27, 29 February 6, 8, 10, 12



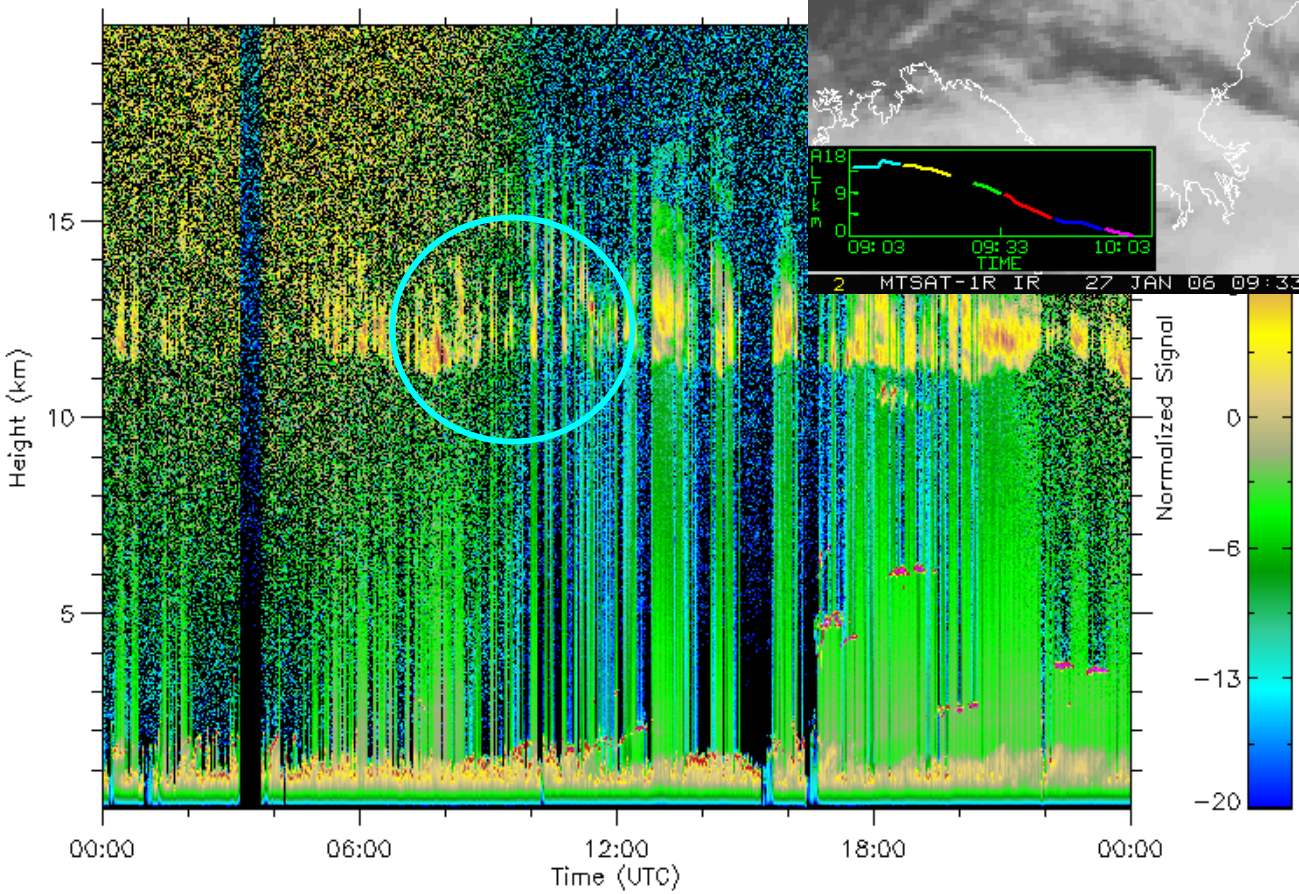
MT Sat Visible Image with Proteus flight track overlay for February 2, courtesy, Minnis et al.

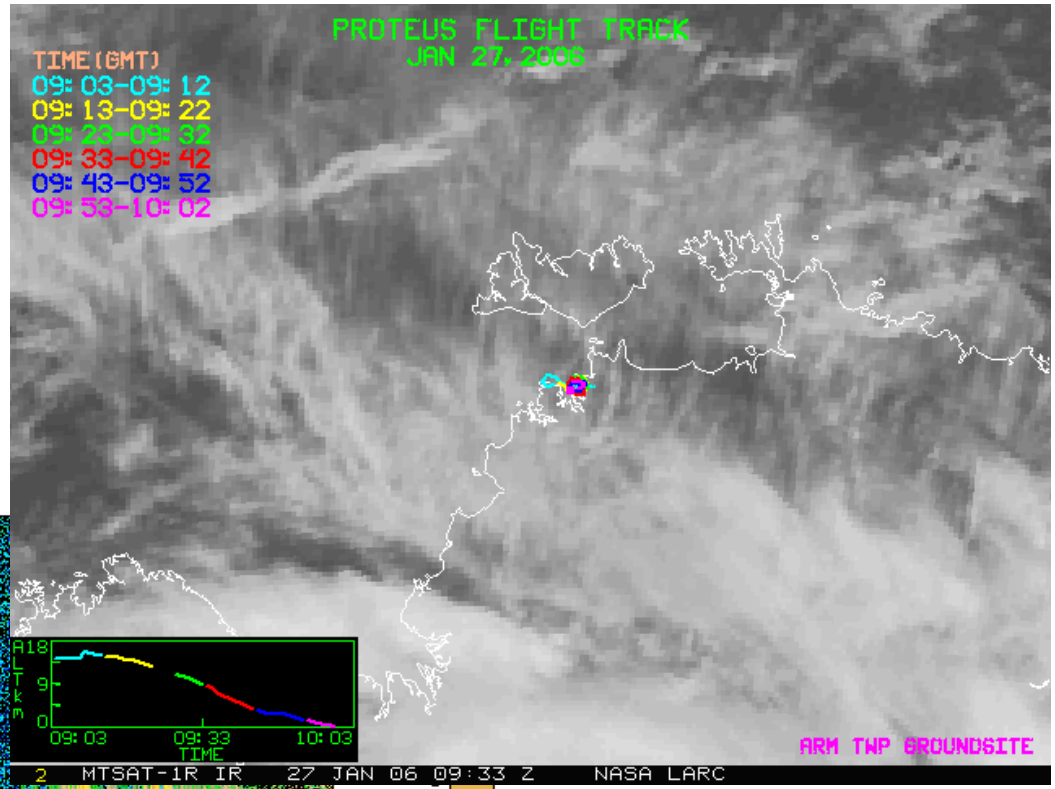


Profiles from Twin Otter Radar (Austin and Dinardo)

January 27, aged cirrus case

MPL Backscatter at Darwin ARM site



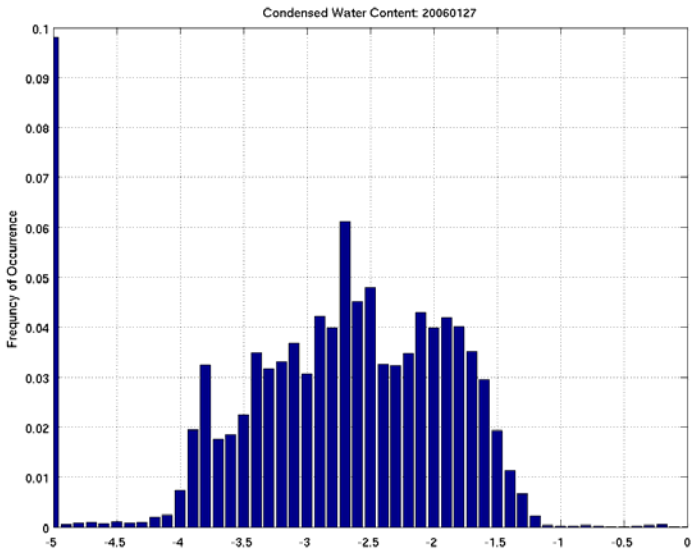


MTSAT-1R, 09:33Z
IR window channel
(Pat Minnis)

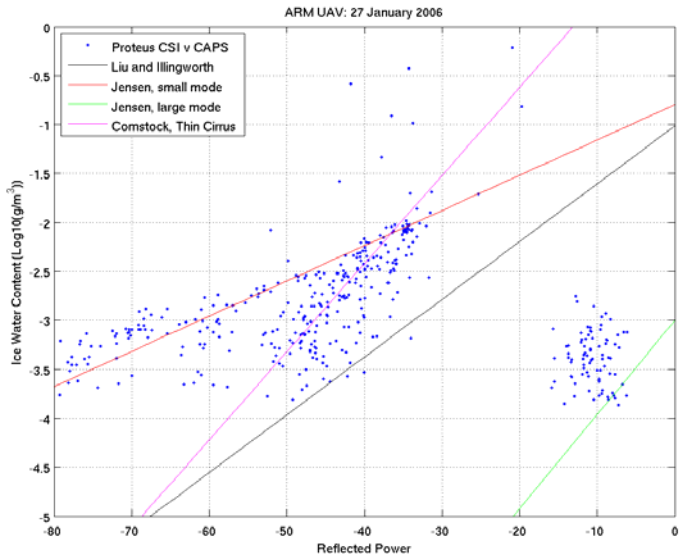
Observations from the microphysics probes

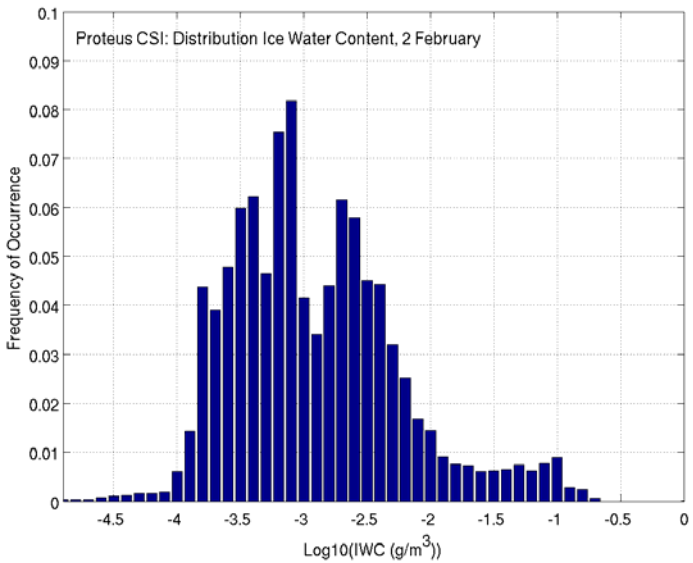
Ice Water Content from CSI

IWC vs. Simulated Radar Reflectivity

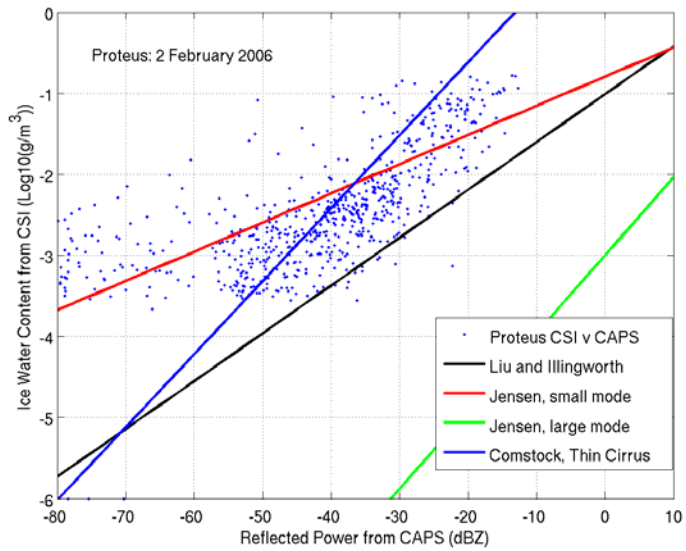


Jan 27
Aged Cirrus

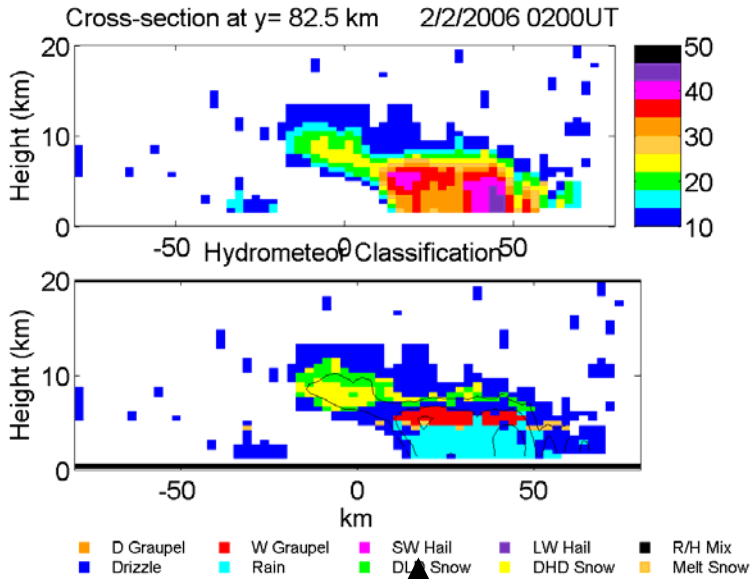


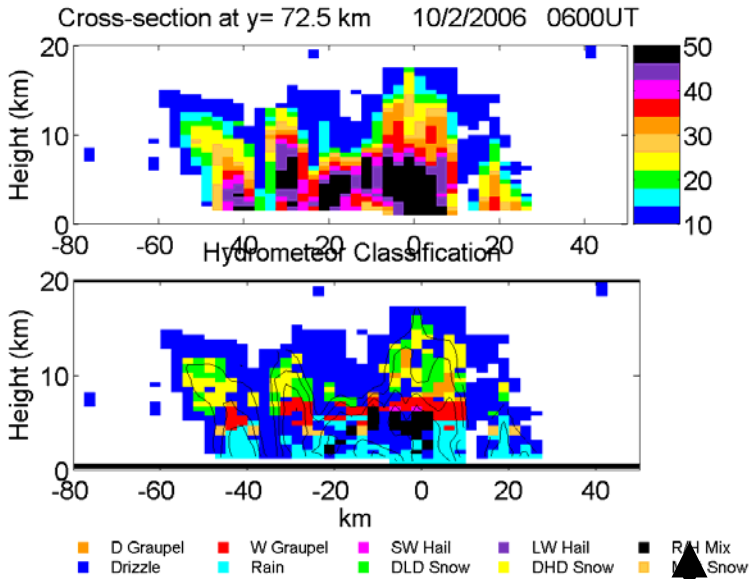


Feb 2
Fresh Anvil



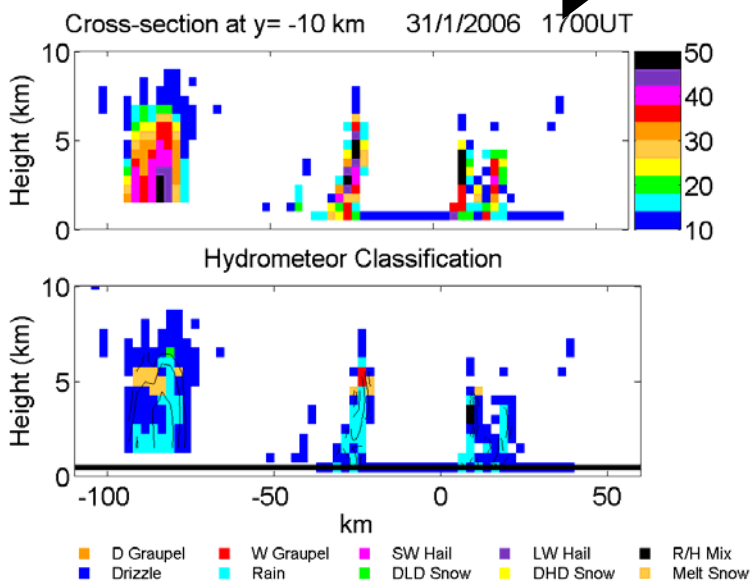
Cross Sections from C-Pol Radar in Different Convective Regimes (Peter May)

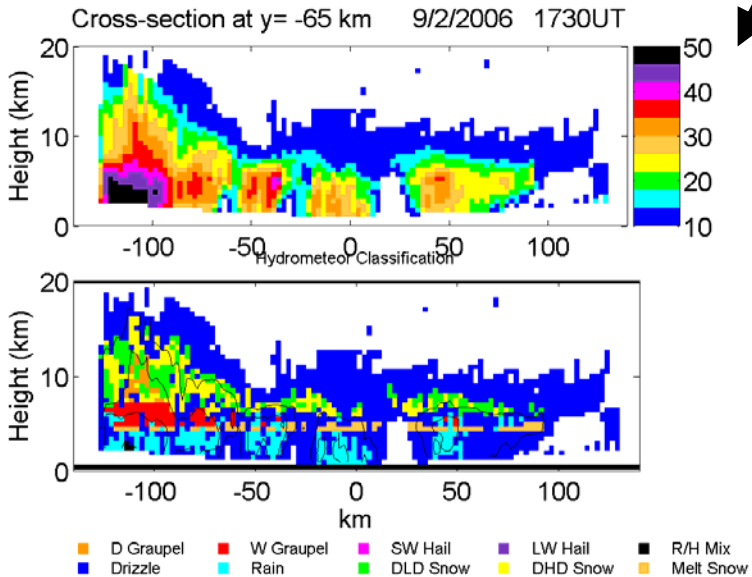




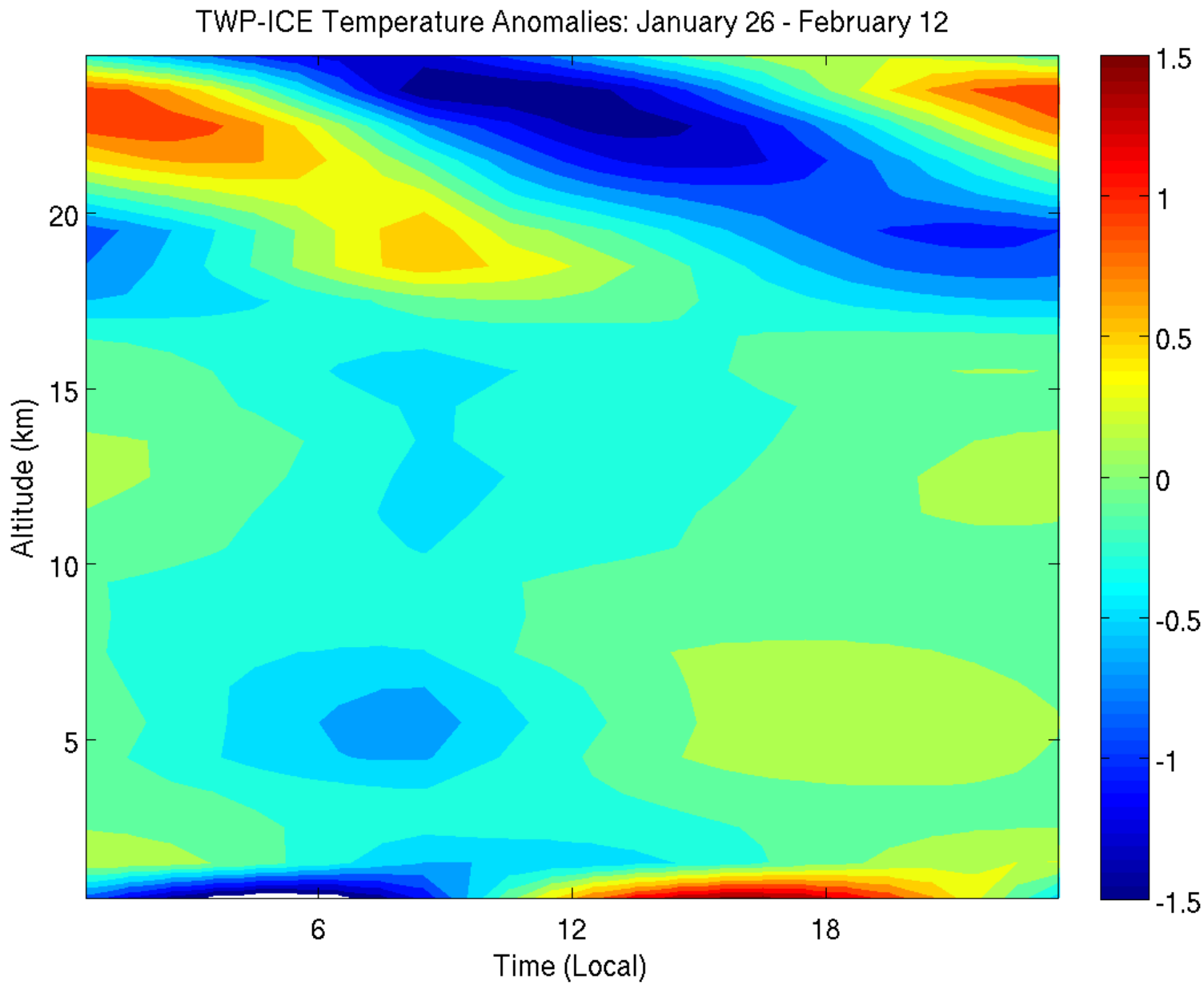
Monsoon deep "shallow"

Continental type - Hector Squall





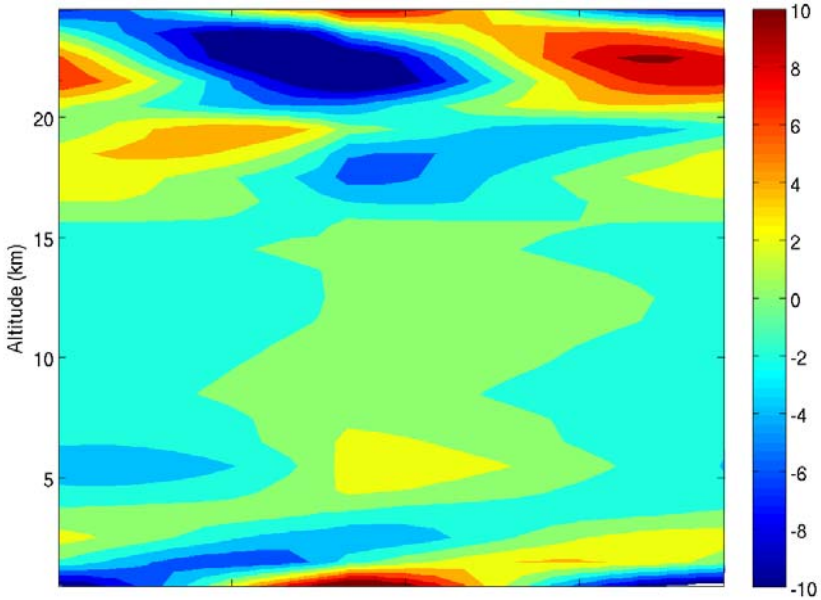
Temperature Anomalies: Diurnal Composite, Point Stuart

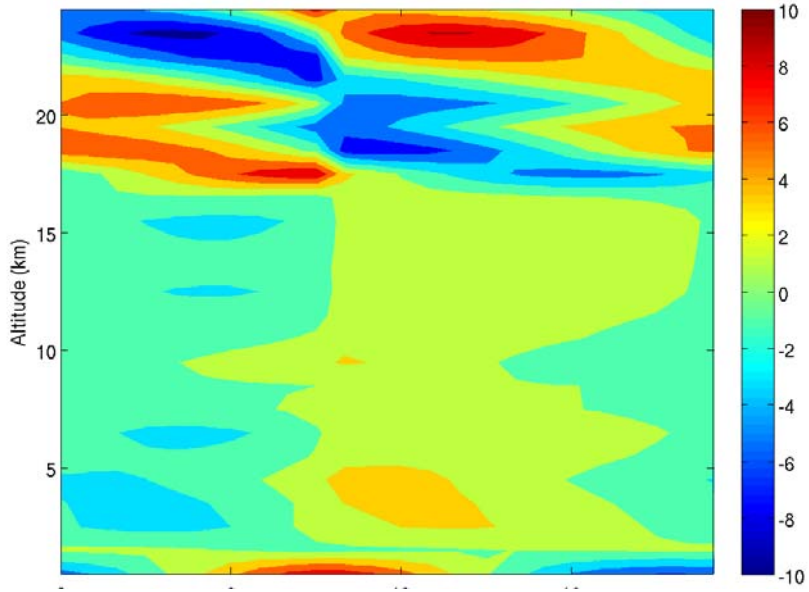


Feb 1 - 5

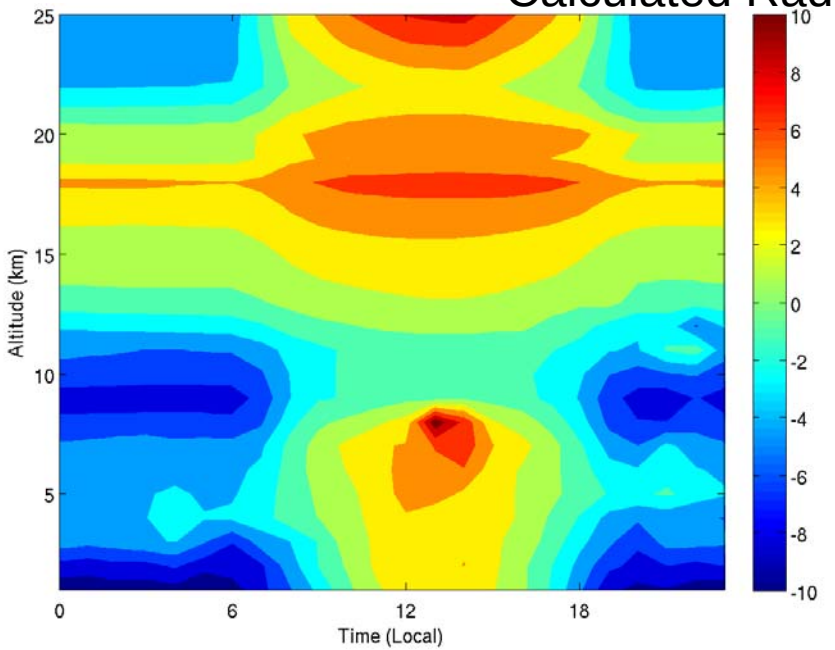
Apparent Heating from Radiosondes (K/day)

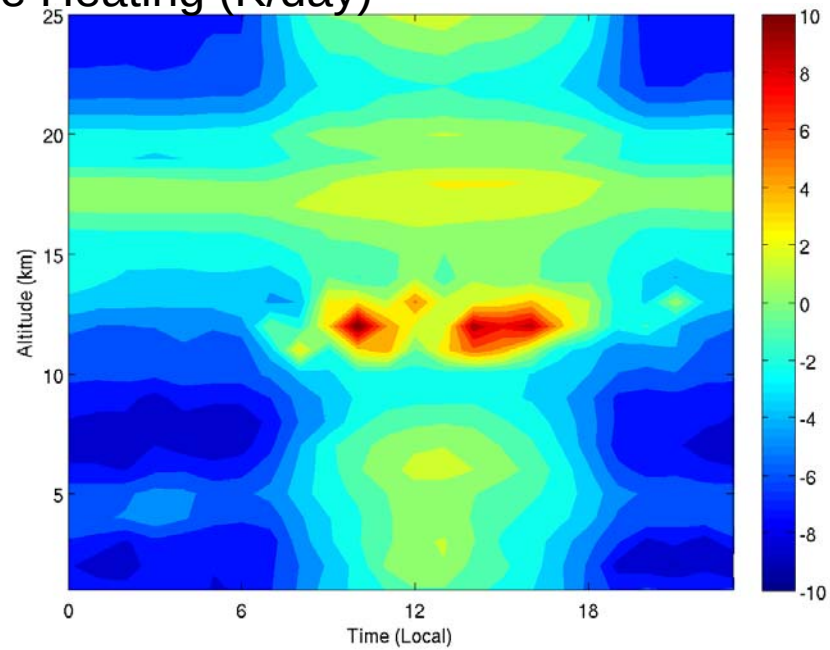
Jan 26-31



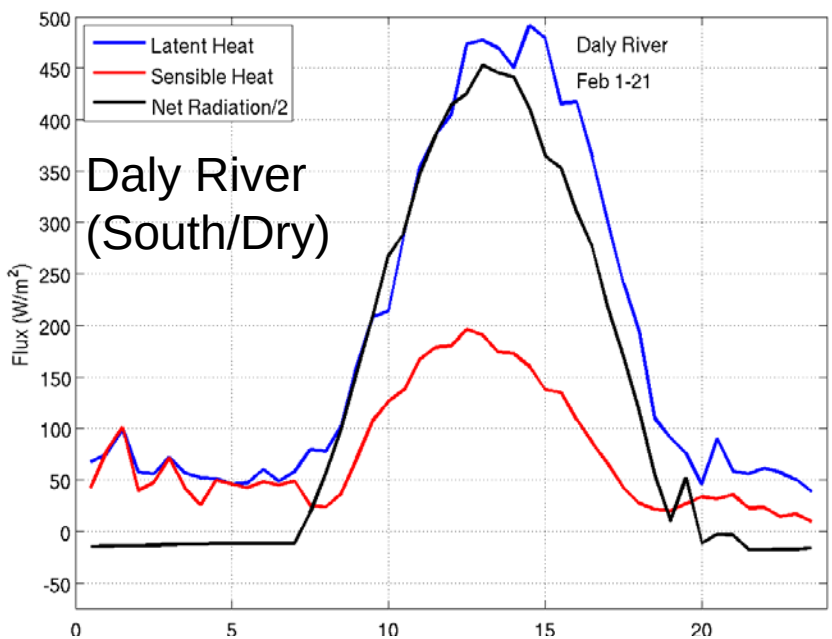


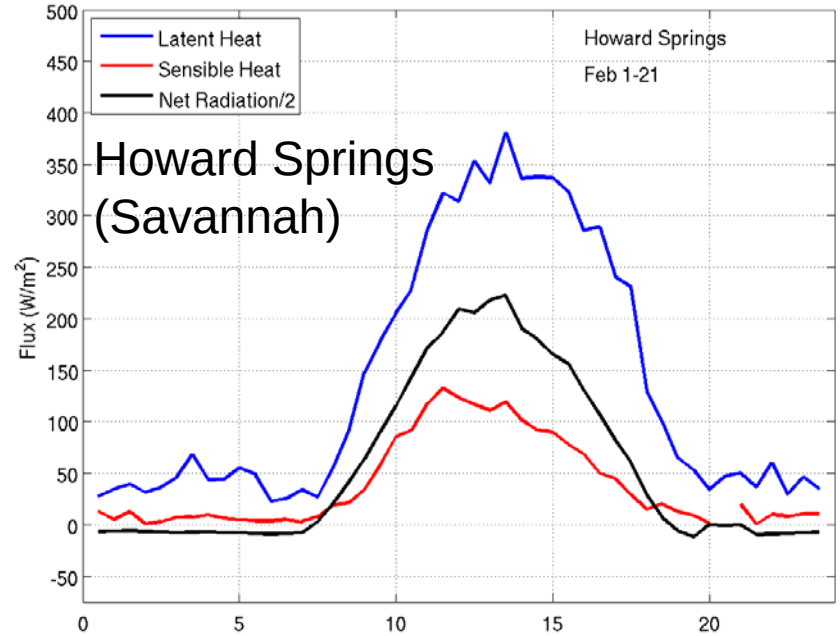
Calculated Radiative Heating (K/day)

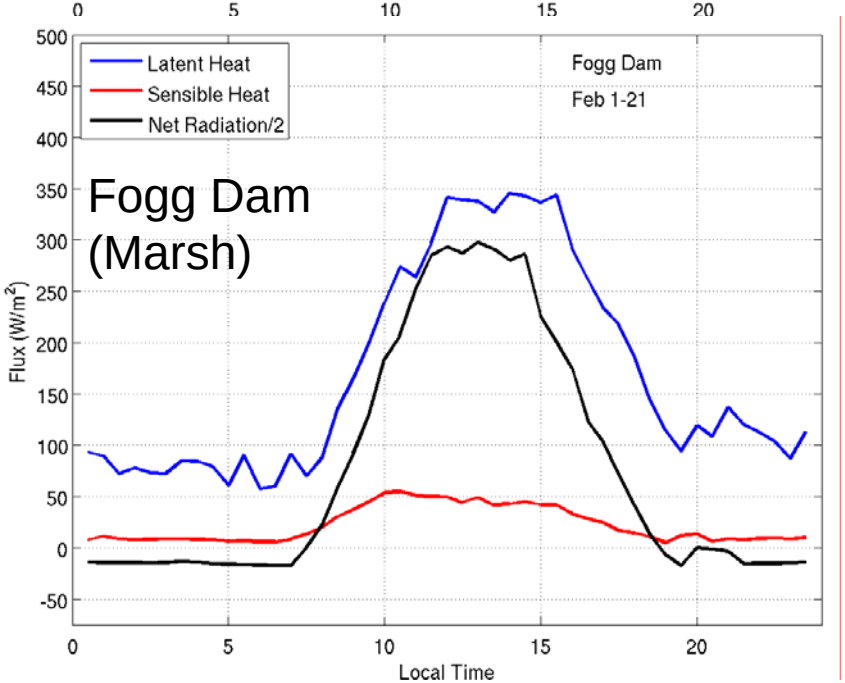


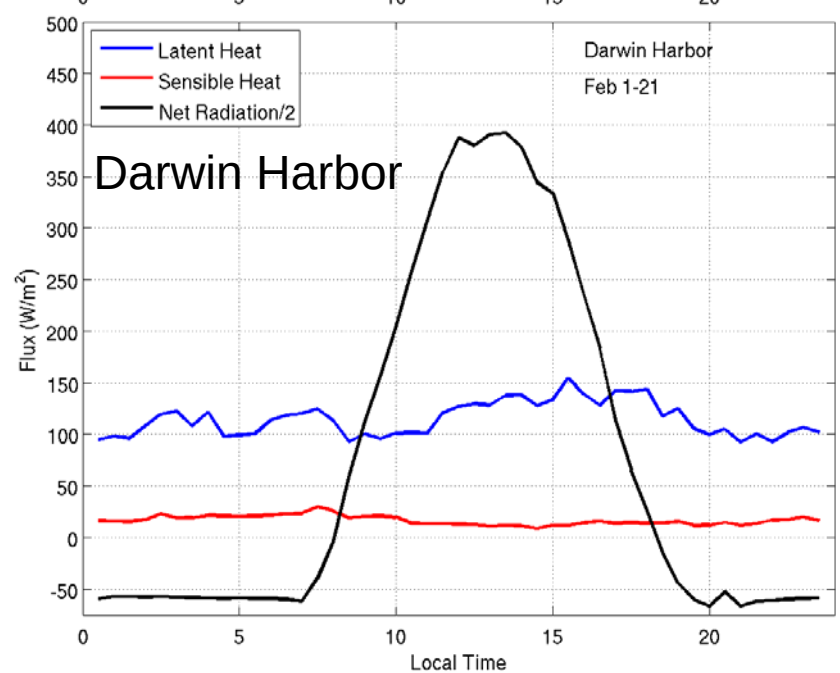


Surface Fluxes from Monash University (Tapper)









TWP-ICE Partners

ACTIVE (Aerosol and Chemical Transport in Tropical Convection) and

http://www.atm.ch.cam.ac.uk/active/

SCOUT-O3 (Stratospheric-Climate Links with Emphasis on the Upper troposphere and Lower Stratosphere)

http://www.ozone-sec.ch.cam.ac.uk/scout_o3

Summary

Varied meteorological regimes: wet monsoon, dry monsoon, suppressed, break

Sampled microphysics in fresh anvil and aged cirrus

Data submitted to archive includes radiosonde, surface fluxes, and cloud observations from Proteus and Twin Otter

Data issues include reduced sensitivity of radars and daytime dry bias in RS-92s

Multiple radars (MMCR, BOM C-Pol, NOAA S-Band, Adelaide 50 MHz) provide different views of cloud and precipitation profiles

Using radiosonde temperature data to study the diurnal cycle

Surface flux sites plus low level aircraft and radiosondes provide detailed description of convective boundary layer

Developing collaborations with ACTIVE and SCOUT-O3

Meeting next week in New York