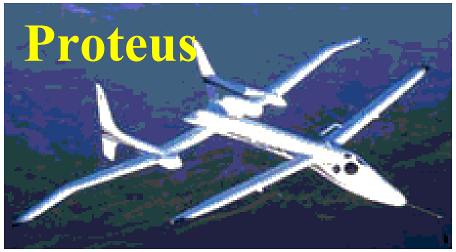
# TWP-ICE/ACTIVE Observation Network



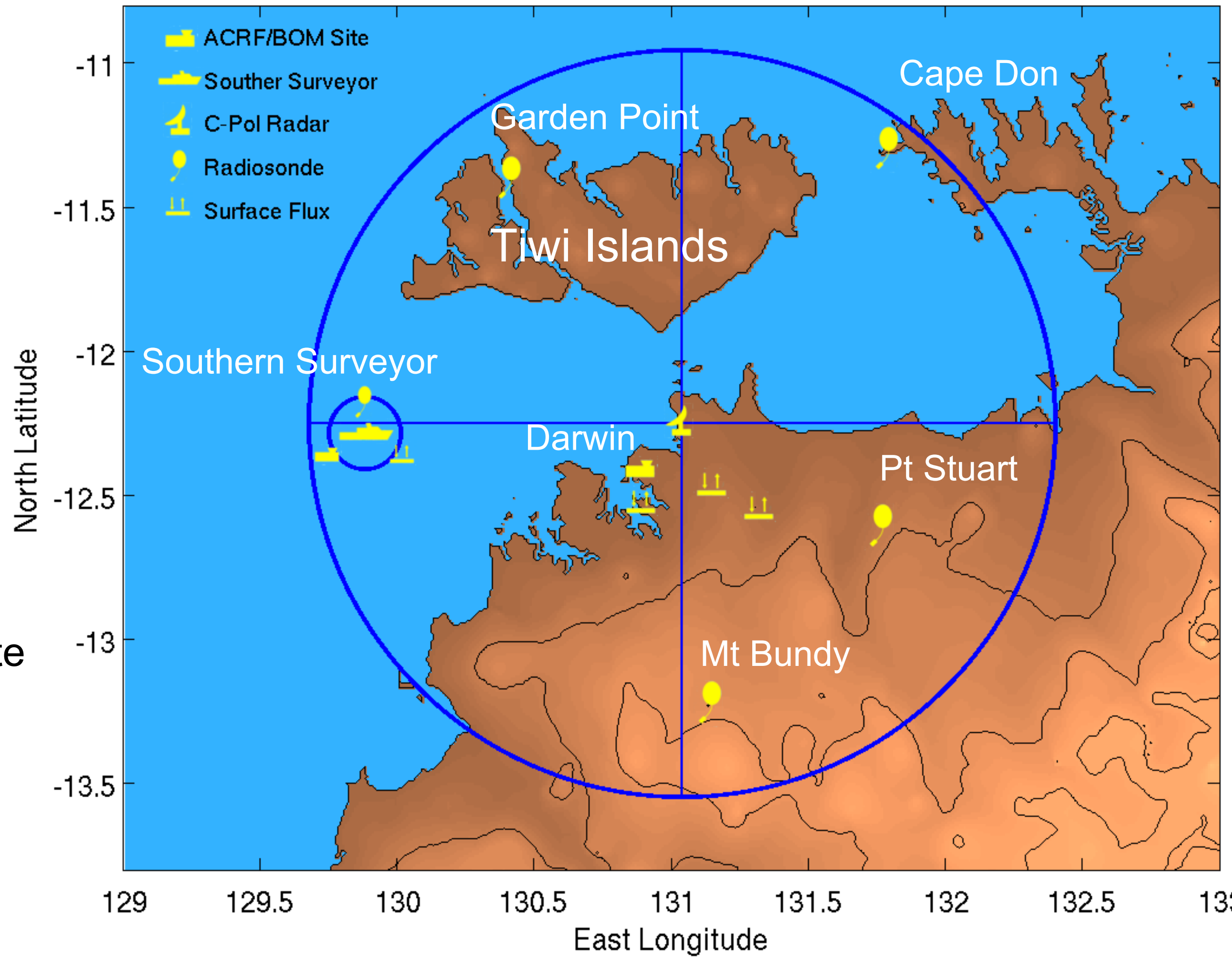

In situ microphysics


Twin Otter

Radar/Lidar


Chemistry/Aerosol/Atm state

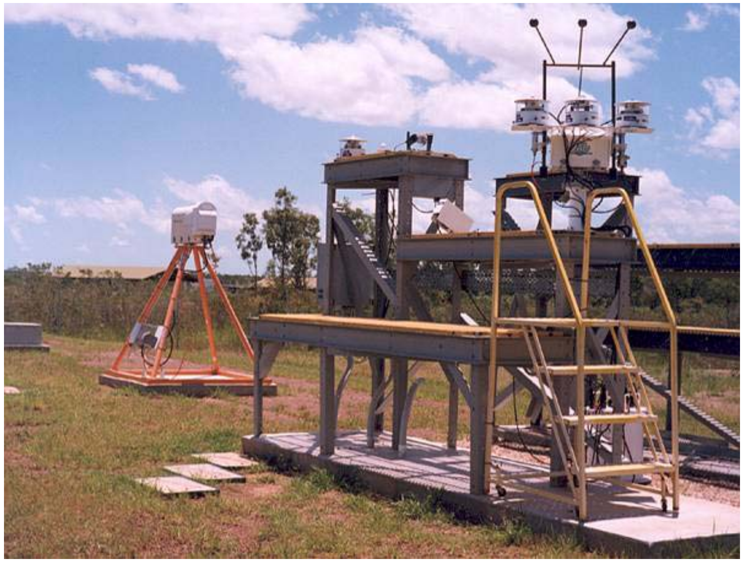

Fluxes/Atmospheric state



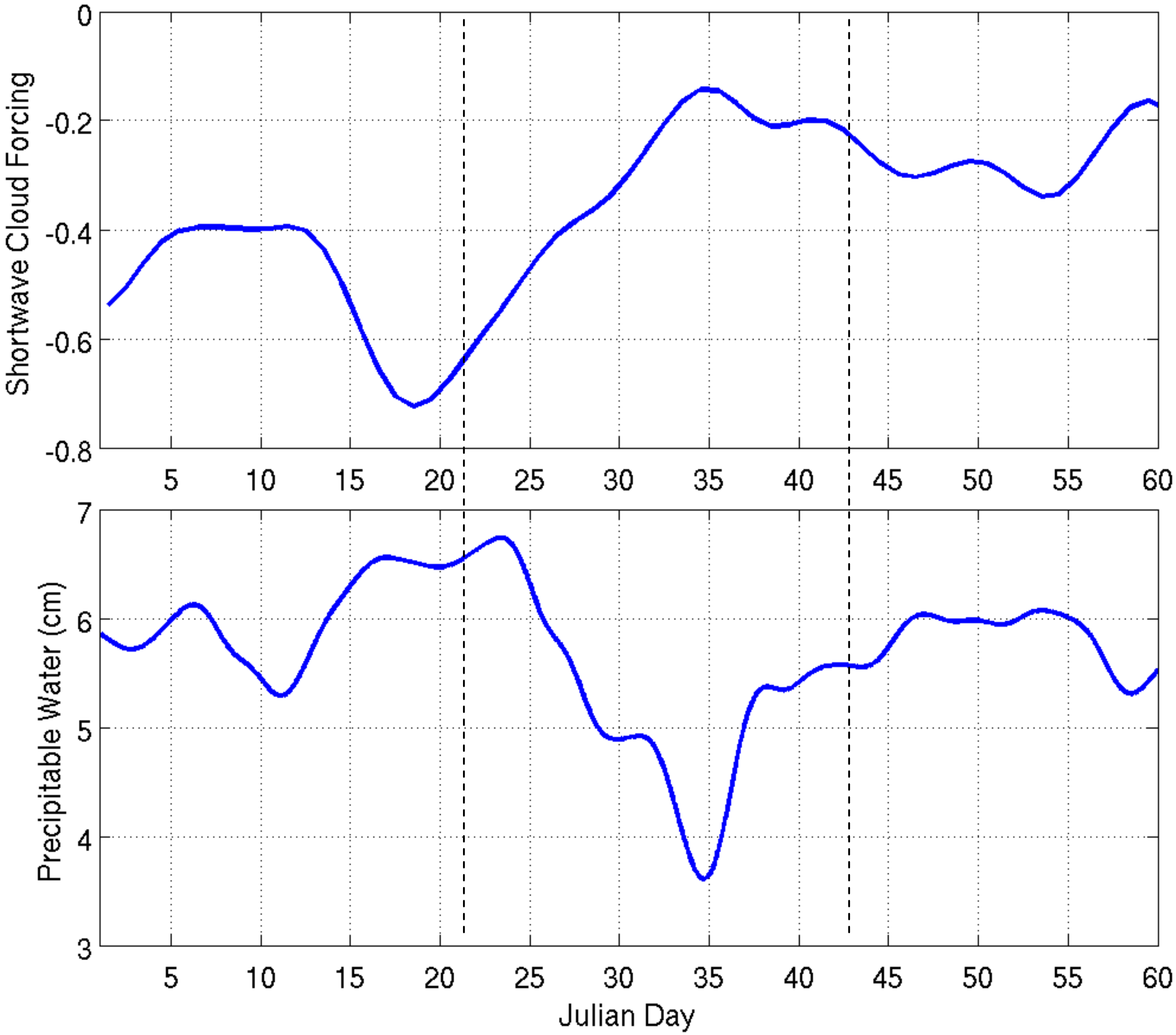
# Darwin ARM Measurements

- Cloud Profiles - mm radar and lidar
- T/RH/Wind Profiles – radiosondes (BOM)
- Column water - microwave radiometer
- Column Aerosol – solar spectral radiometer

- Surface radiation budget - solar and terrestrial
- Surface meteorology - T, RH, Wind



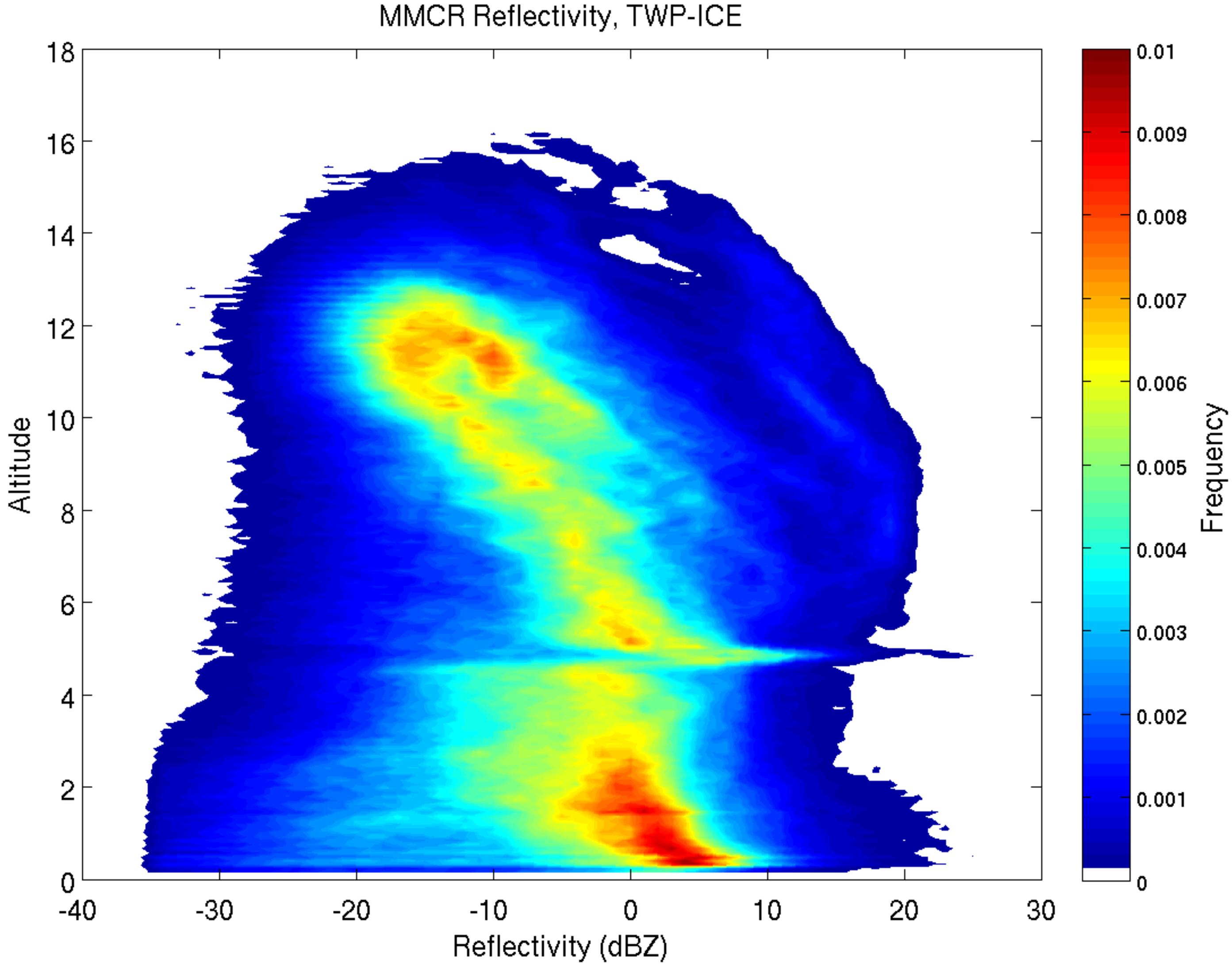
# Time Series of Shortwave Cloud Forcing and Precipitable Water from ARM Site



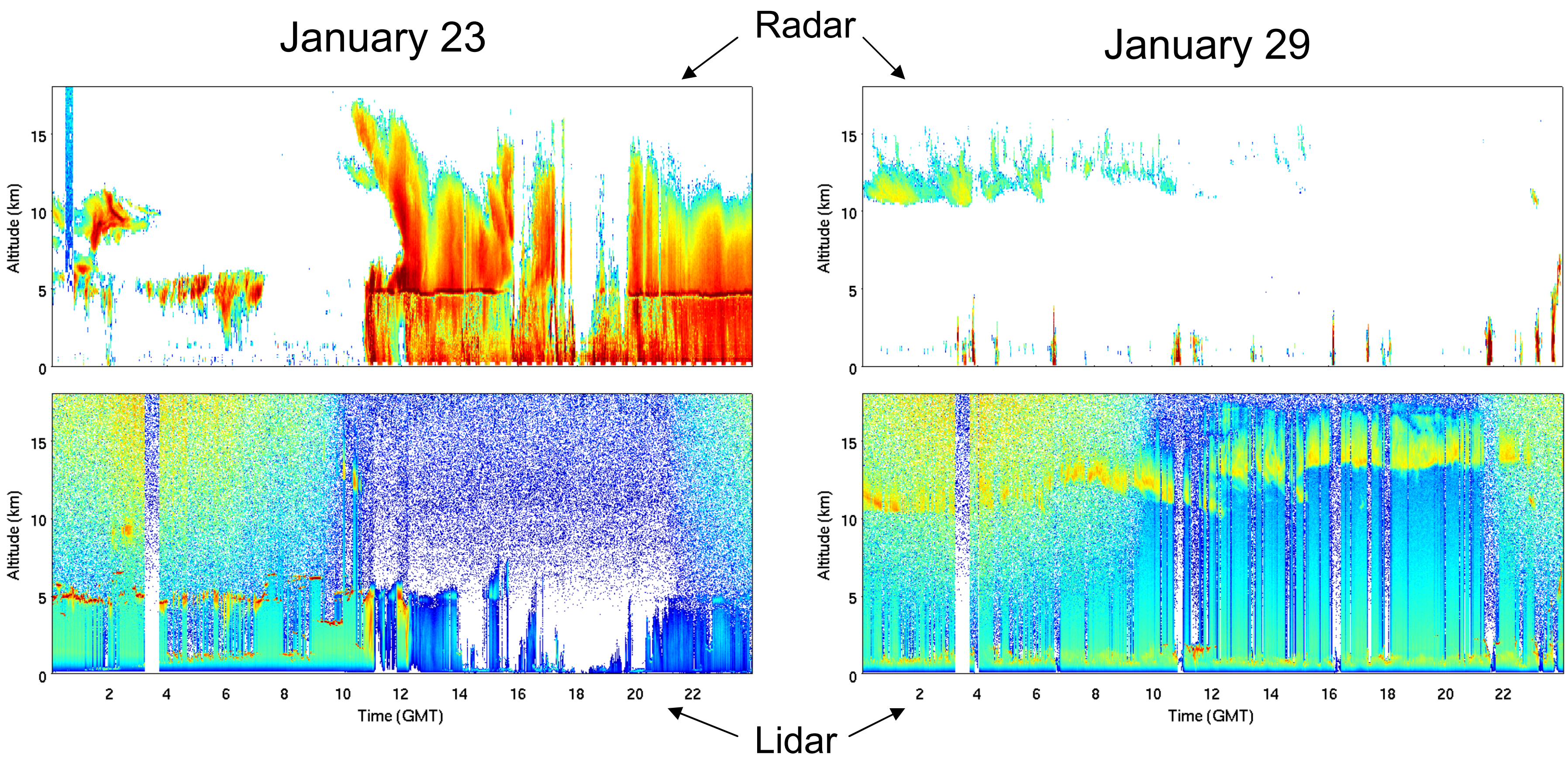

From Eppley PSP radiometers and clear sky calculations

From Radiometrics two-channel microwave radiometer

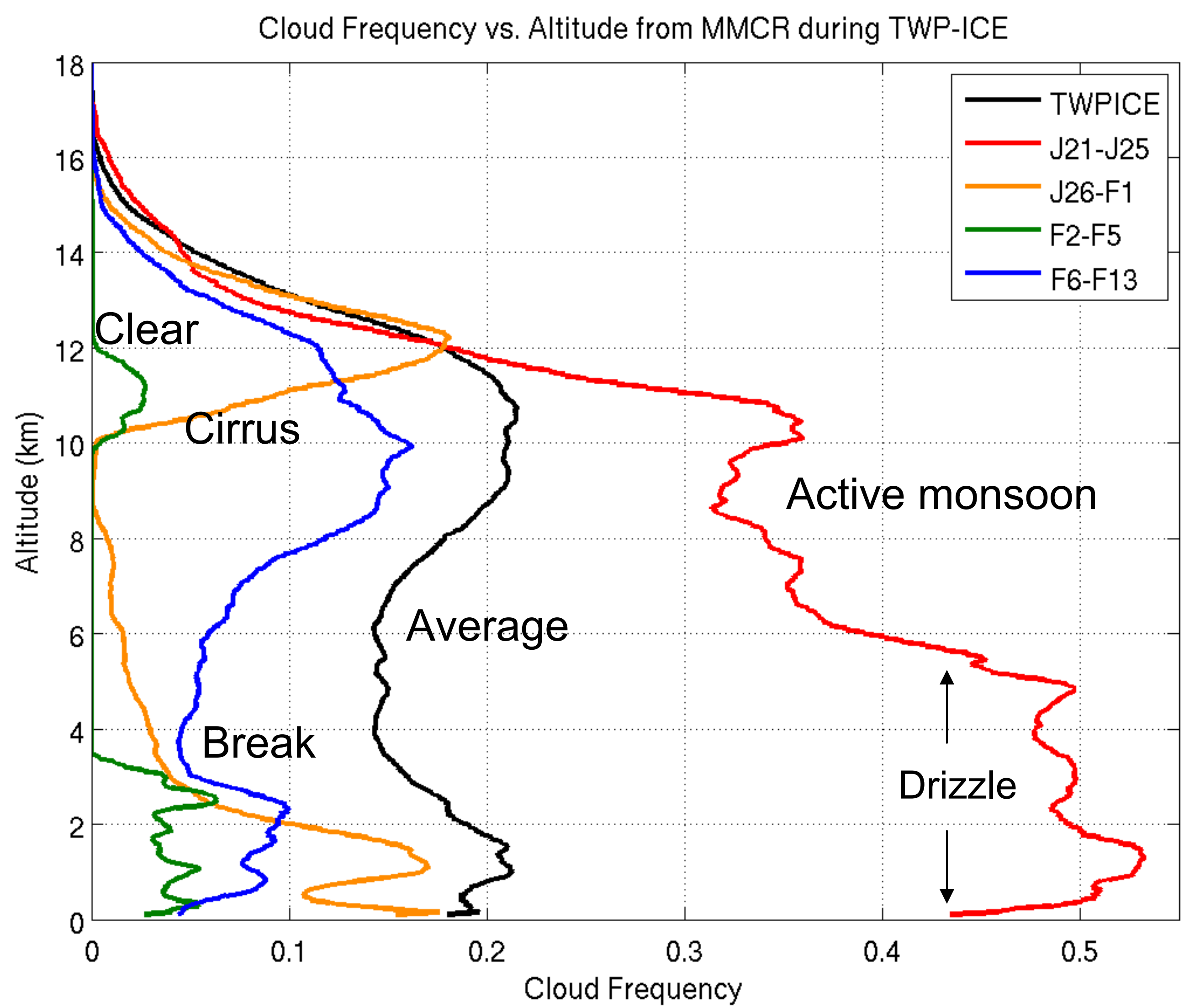
# Reflectivity Distribution from Darwin MMCR during TWP-ICE



# 35 GHz Radar/Lidar Profiles from Darwin ARM site




ARSCL files have been submitted for Nov 2005-Feb 2006



Cloud Frequency vs. Altitude from MMCR during TWP-ICE
Altitude (km)
Cloud Frequency
0
2
4
6
8
10
12
14
16
18
0
0.1
0.2
0.3
0.4
0.5
TWPICE
J21-J25
J26-F1
F2-F5
F6-F13
Clear
Cirrus
Active monsoon
Average
Break
Drizzle

# Monash Flux Sites

N. Tapper, J. Berringer, L. Hutley

Darwin Harbor

Figure 8: Fogg Dam (wetlands) surface energy balance site

Fogg Dam

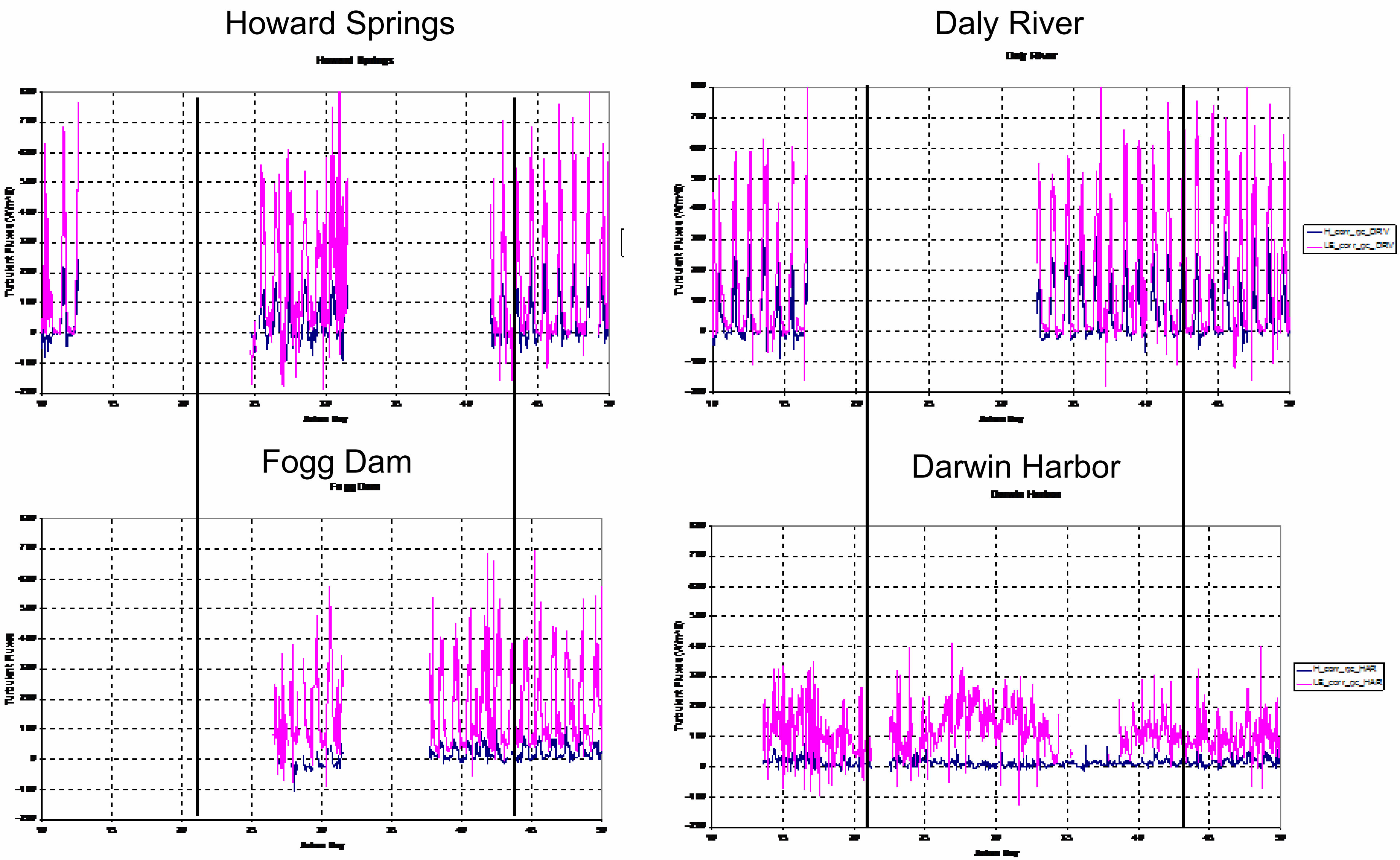
Figure 6: Howard Springs surface energy balance site

Howard Springs

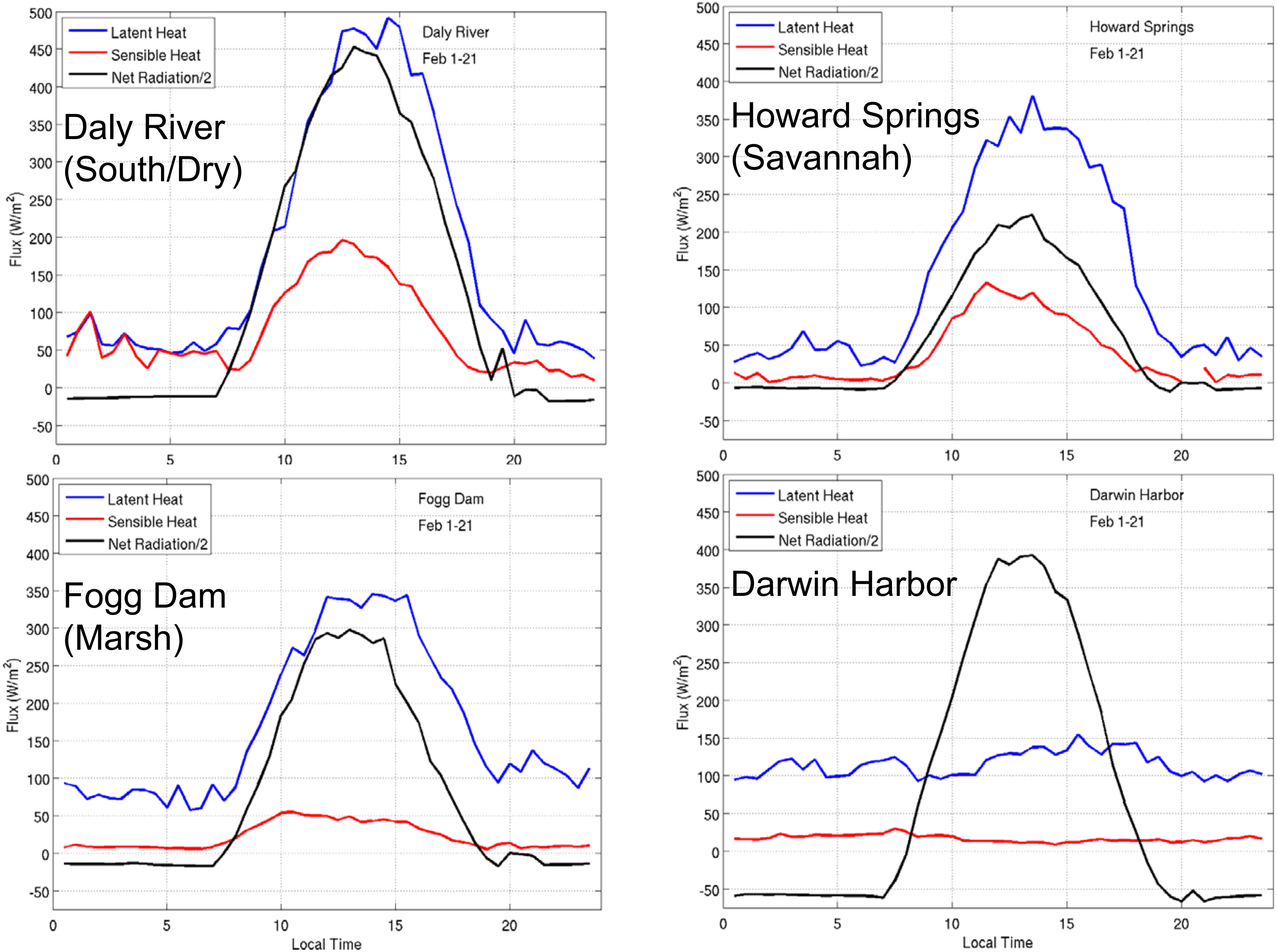
## Surface Flux Sites

N. Tapper, J. Berringer (Monash U.) and
L. Hutley (CDU)

| Location | Lat/Long | Nature of Landscape | Instrumentation/ Measurements |
|---|---|---|---|
| Darwin Harbour | 12º 29.942'S<br>130º 53.194'E | Inshore waters | 3-D eddy covariance system (sensible, latent heat flux, 30 min av.). Pyrgeometers/ pyranometers/net radiometer (net radiation, upward and downward directed short and longwave fluxes, including diffuse, 1 min av*.) Basic AWS |
| Howard Springs | 12º 29.655'S<br>131º 09.143'E | Eucalypt open forest savanna with woollybutt, stringybark and a sorghum tall grass understory | 3-D eddy covariance system (sensible, latent heat flux, 30 min av.). Pyrgeometers/ pyranometers/net radiometer (net radiation, upward and downward directed short and longwave fluxes, including diffuse, 1 min av*.) Basic AWS |
| Fogg Dam | 12º 32.552'S<br>131º 18.413'E | Typical northern floodplain with sedges, rushes, grasses and scattered pandanus and gebang | 3-D eddy covariance system (sensible, latent heat flux, 30 min av.). Pyrgeometers/ pyranometers/net radiometer (net radiation, upward and downward directed short and longwave fluxes, including diffuse, 1 min av*.) Basic AWS |
| Daly River | 14º 09.557'S<br>131º 23.280'E | Eucalypt woodland/grassland savanna | 3-D eddy covariance system (sensible, latent heat flux, 30 min av.). Pyrgeometers/ pyranometers/net radiometer (net radiation, upward and downward directed short and longwave fluxes, including diffuse, 1 min av*.) Basic AWS |


Howard Springs
Daly River
Fogg Dam
Darwin Harbor

# Surface Fluxes from Monash University (Tapper)



# R/V Southern Surveyor

**Owner: CSIRO Australia**
**Length: 66.1 m**
**Beam: 12.3 m**
**Gross Tonnage: 1594**
**Captain: Les Morrow**
**Chief Scientist: Matthias Tomczak**
**Cruise dates: 20 Jan to Feb 14, 2006**

Radiosondes

Surface fluxes (Radiation and turbulent)

Surface meteorology (incl. precipitation)

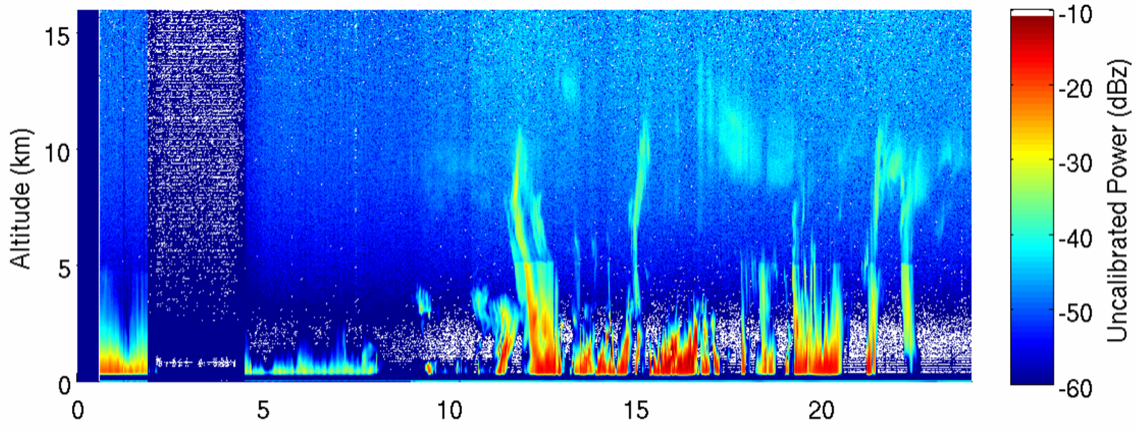
Radar, lidar, ceilometer
microwave radiometer

M-AERI

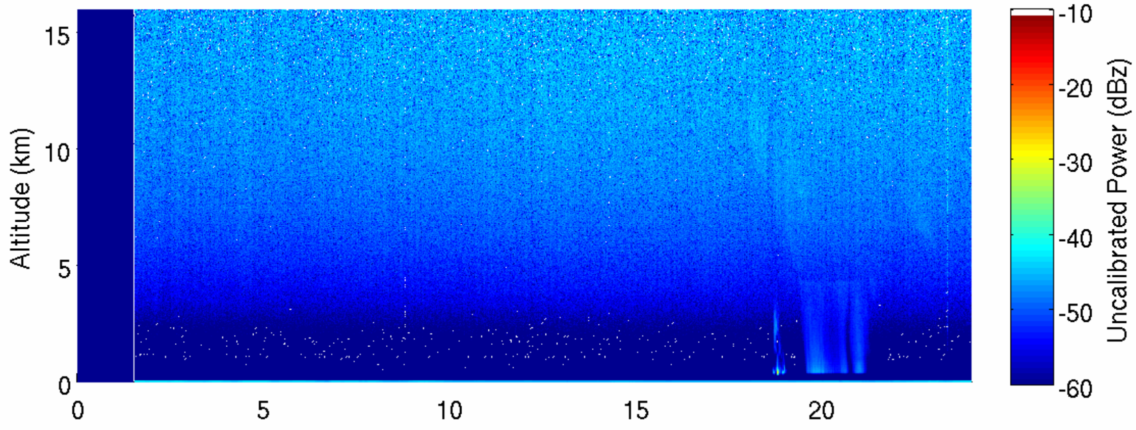
Ocean CTD profiles

# PARSL Radar Reflected Power

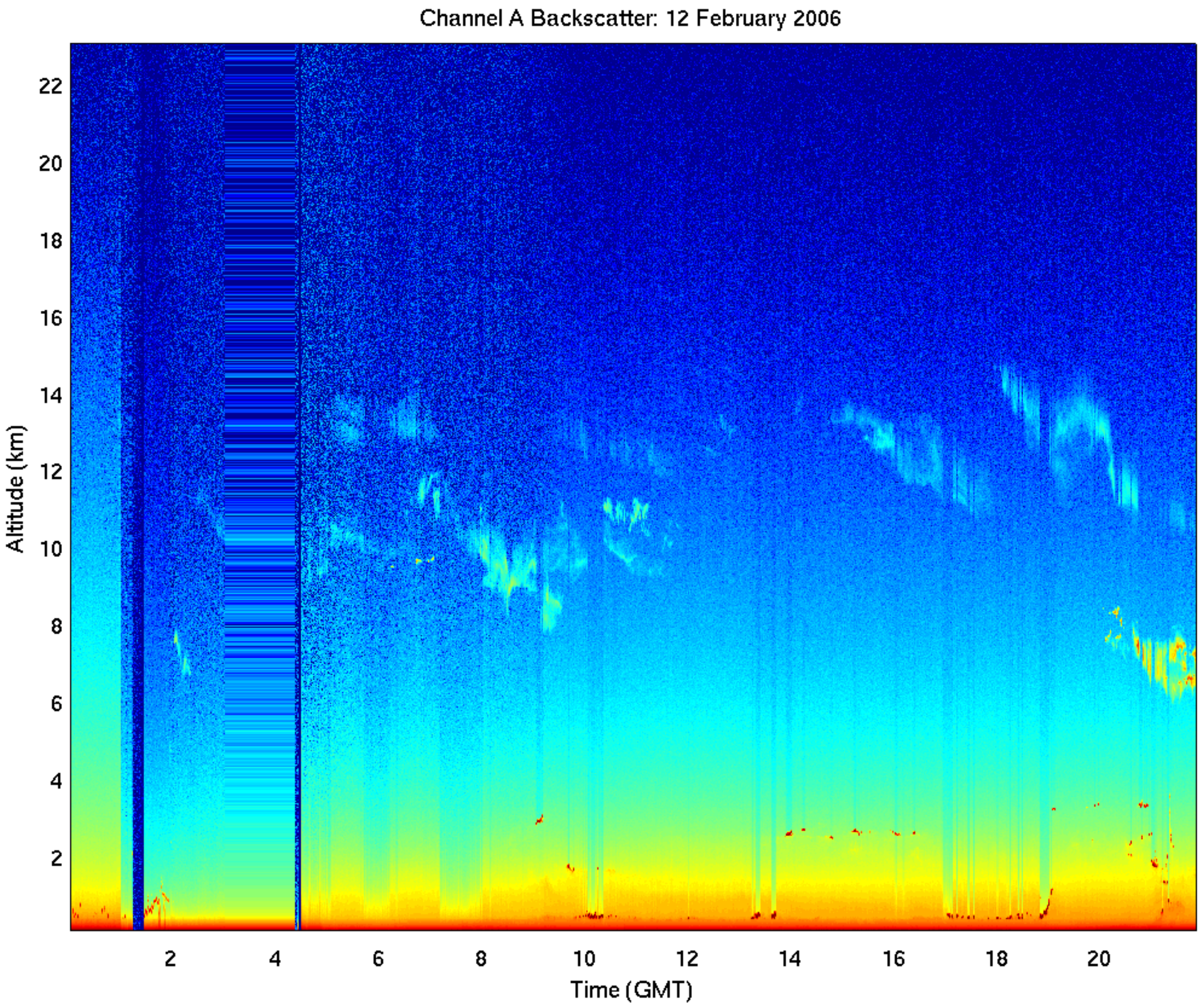
Radar Moments for January 24, 2006



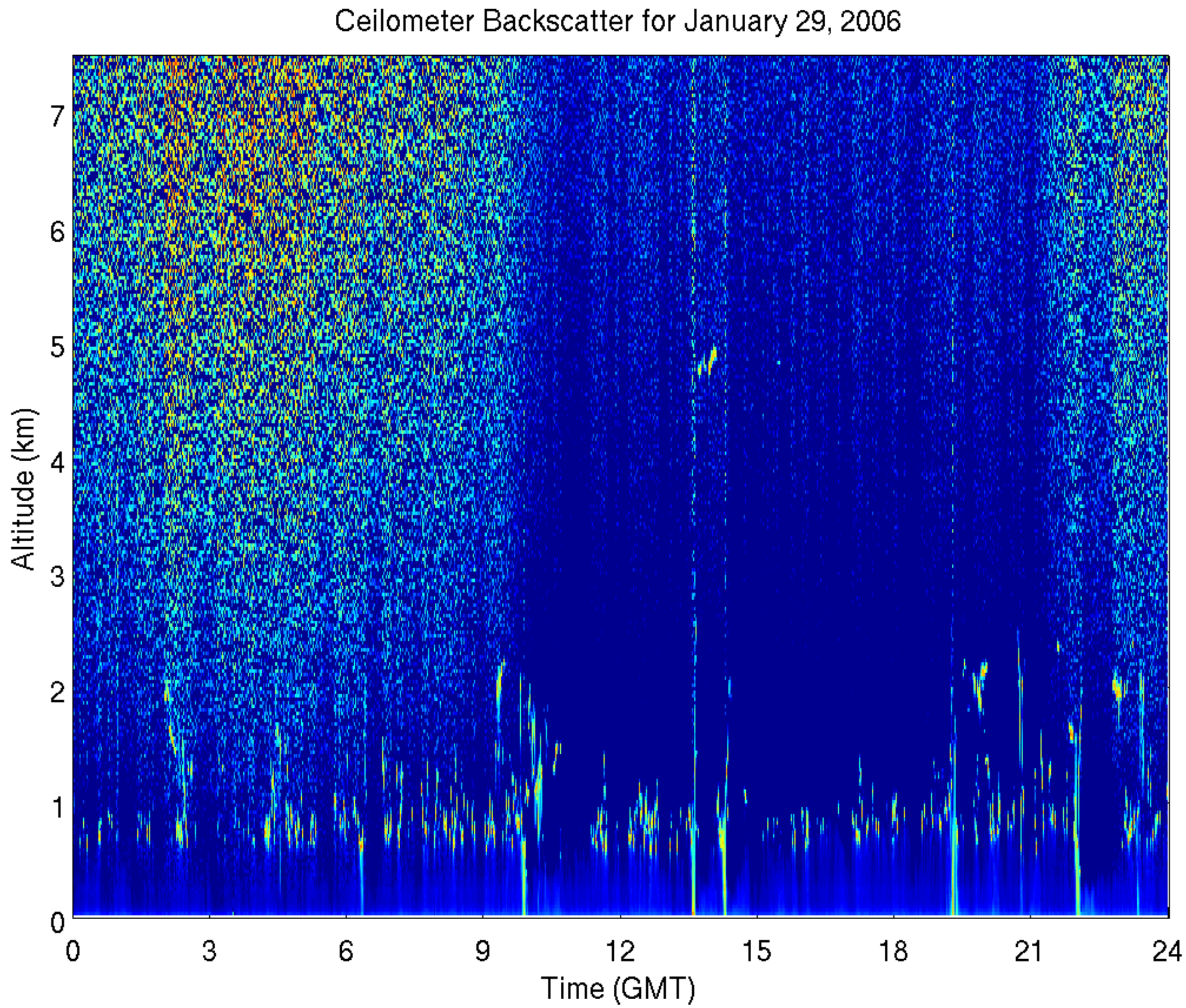

Radar Moments for February 9, 2006



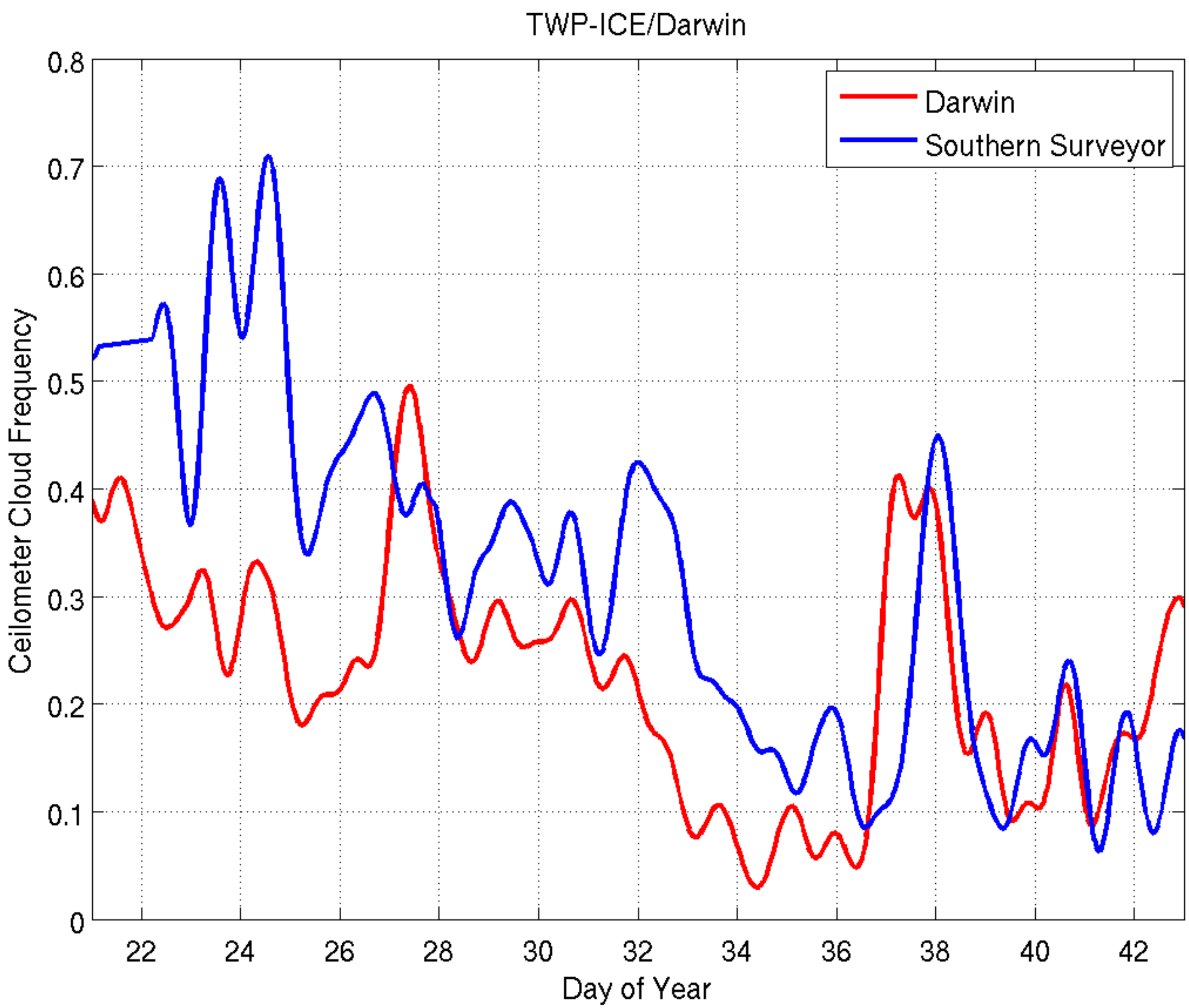
# PARSL Lidar



Channel A Backscatter: 12 February 2006
Altitude (km)
22
20
18
16
14
12
10
8
6
4
2
2
4
6
8
10
12
14
16
18
20
Time (GMT)



Ceilometer Backscatter for January 29, 2006
Altitude (km)
0
1
2
3
4
5
6
7
0
3
6
9
12
15
18
21
24
Time (GMT)


TWP-ICE/Darwin
Darwin
Southern Surveyor
Ceilometer Cloud Frequency
Day of Year
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
22
24
26
28
30
32
34
36
38
40
42

# TWP-ICE WORKSHOP

# NASA-GISS, New York City, 13-15 Nov 2006

## R/V SOUTHERN SURVEYOR

## MARINE METEOROLOGICAL PROGRAM

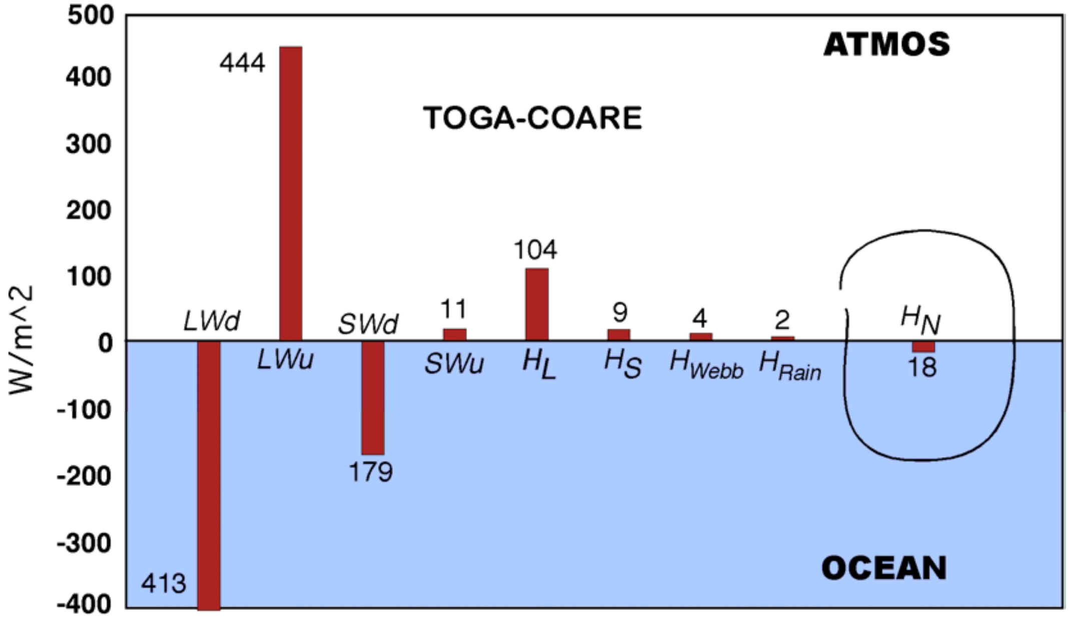

**R. Michael Reynolds, USA, RMR Company**

**Eric Schulz, Australia, BOM**

**Frank Bradley, Australia, CSIRO Land and Water**

**Peter Minnett, USA, Univ. Miami, RSMAS**

# OCEANIC ENERGY FLUX BUDGET




***THE NET FLUX IS A SMALL RESULTANT FROM LARGE COMPONENTS. ACCURACY, ESPECIALLY FOR RADIATION IS ESSENTIAL.***

**The TOGA COARE experiment data were used in development of the COARE-3 algorithms. We will use the COARE results here for comparison with TWP-ICE.**

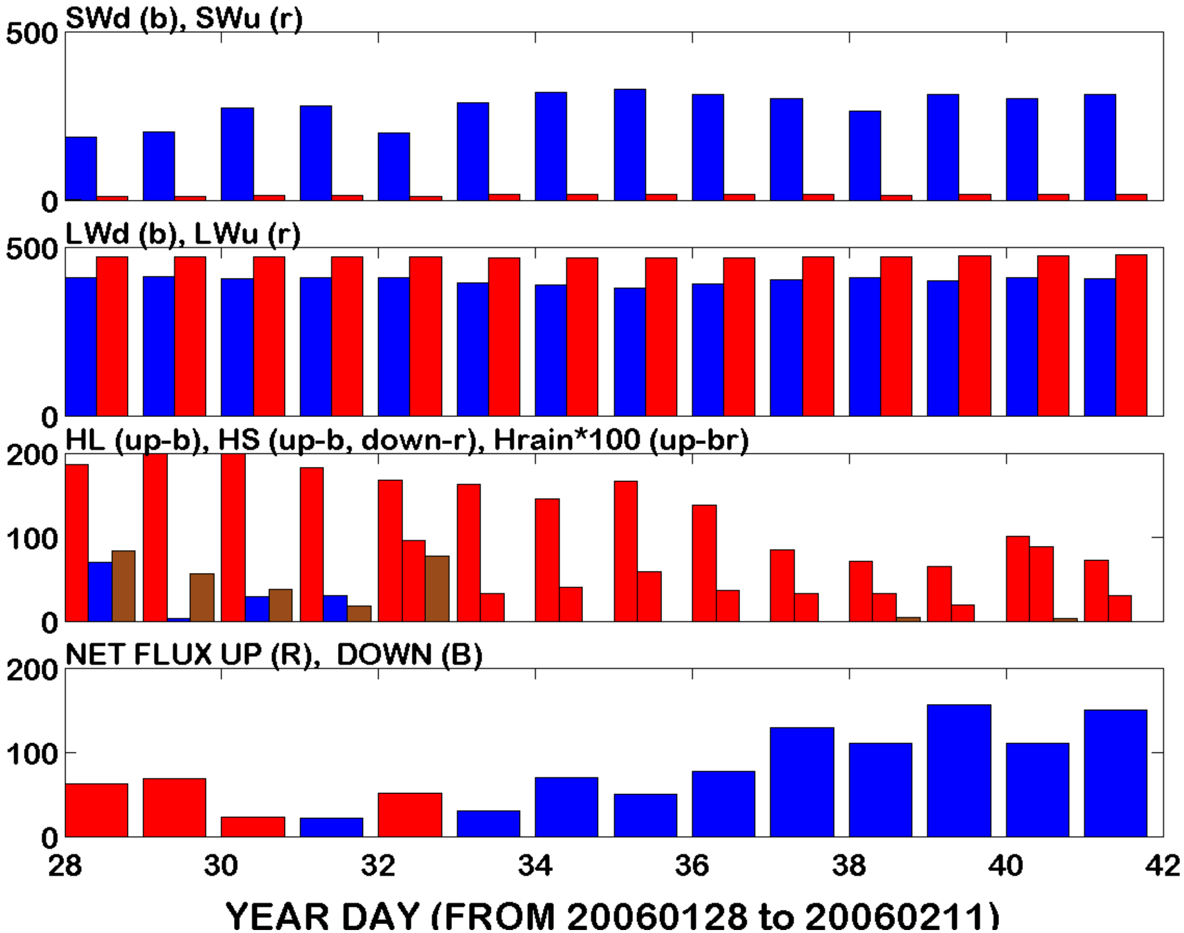
**Fairall, Bradley, *et al*. (1996) JGR, 101, C2, 3747-3764.**

**LW_d : Longwave Downward Flux**
**Lw_u : Longwave Upward Flux**
**SW_d : Shortwave Downward Flux**
**SW_u : Shortwave Albedo**
**H_L : Latent Heat Flux (Evap)**

**H_S : Sensible Heat Flux**
**H_W : Webb Correction Flux**
**H_R : Rain Heat Flux**

# FLUXES USING COARE-3 BULK ALGORITHM

## DAILY MEAN FLUXES




- Red for upward flux, i.e. ocean cooling. Blue for downward flux, i.e. ocean warming.
- First part of the experiment, before YD 36, had strong winds, high evaporation, positive fluxes.
- Second part had low winds, high insolation, and large negative fluxes.
- Note the different ordinate scales. Note the rain flux is multiplied by 100.
- Sensible heat fluxes are negative during the windy period and positive (red) during the low wind speed period. Depends on air-sea temperature difference.

M. Reynolds, F. Bradley, E. Schulz

# CONCLUSIONS

• No discernible differences between upwind and downwind movement.

• Rainfall is a most difficult measurement with conventional instrumentation. Fortunately, its contribution to the net heat flux is relatively small in most cases.

• The heat computations are very sensitive to RH. A bias of 1%RH increases Hnet by 4.5 W/m^2.

• Over the time period 1/28 to 2/12 the net heat flux, Hnet = 45 W/m^2 into the sea.

• From days 2/05 to 2/10, a 5.3 day period of low winds and high insolation, the Mean(Hnet) = 150 W/m^2.

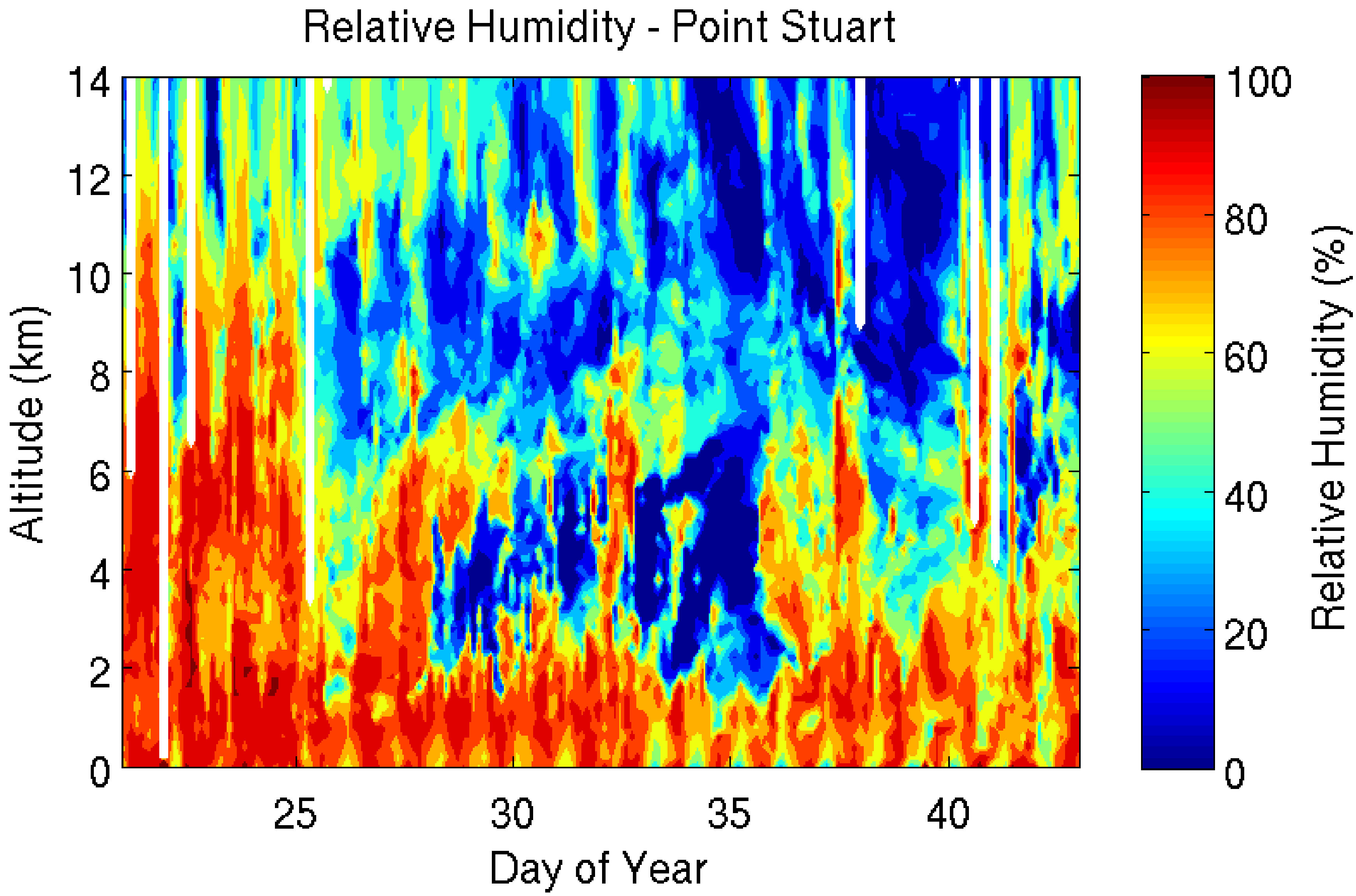
• Ocean temperature increased by 0.75 C to a depth of 20 m, and by 0.15 C from 20 to 40 m.

• This change in mixed layer temperature required 156 W/m^2 assuming no horizontal heat advection was active. This differs by 4% from the COARE-3 estimate.

• We conclude that the COARE-3 heat flux algorithms, when presented with an accurate set of meteorological measurements, does a credible job.

• In order to truly represent a particular region, a long accurate data set, encompassing a true mix of weather conditions, needs to be developed.

# Upper Troposphere Daytime Water Vapor Bias



Comparison of humidity from RS92
And Cryogenic Frostpoint Hygrometer.

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

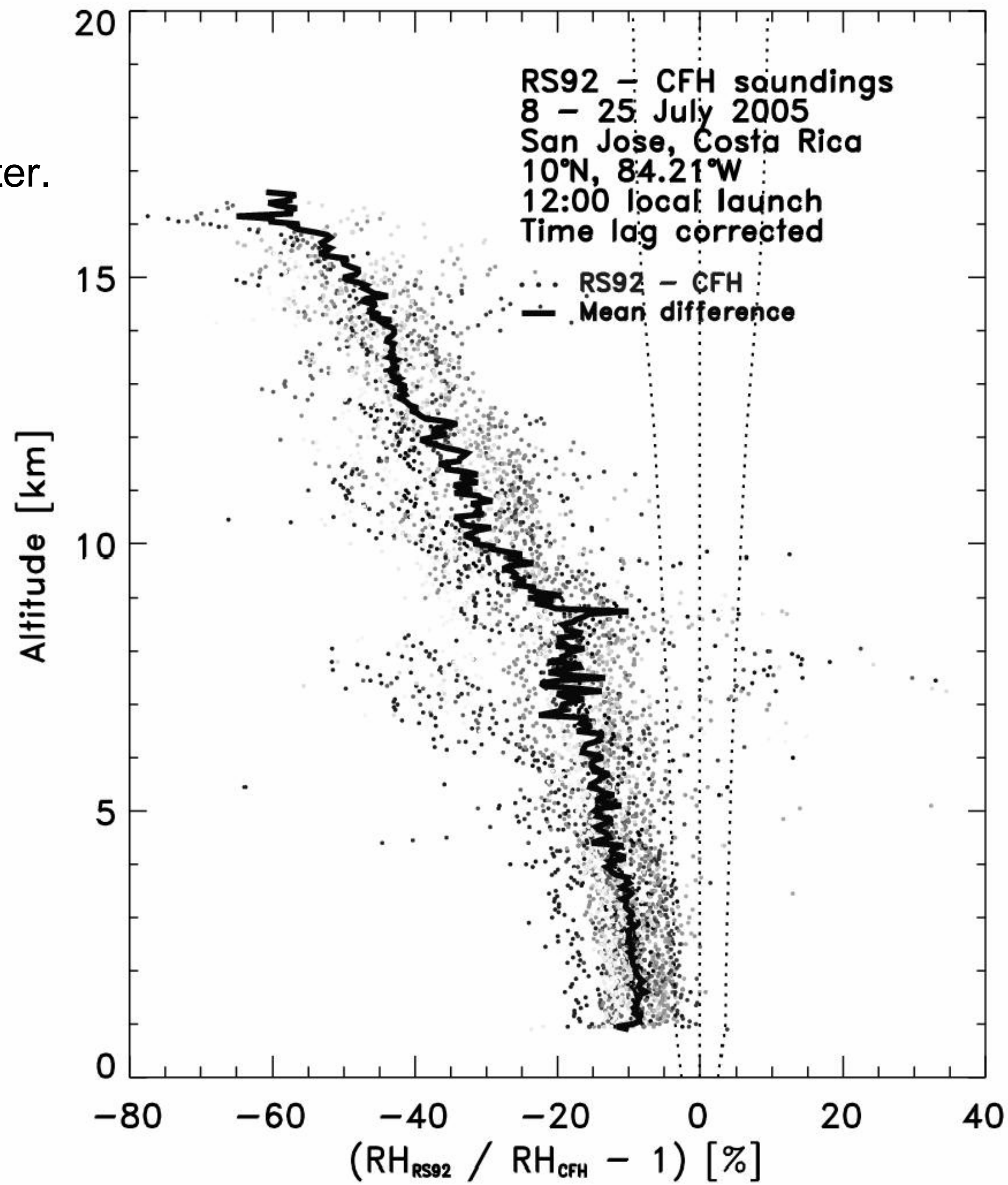
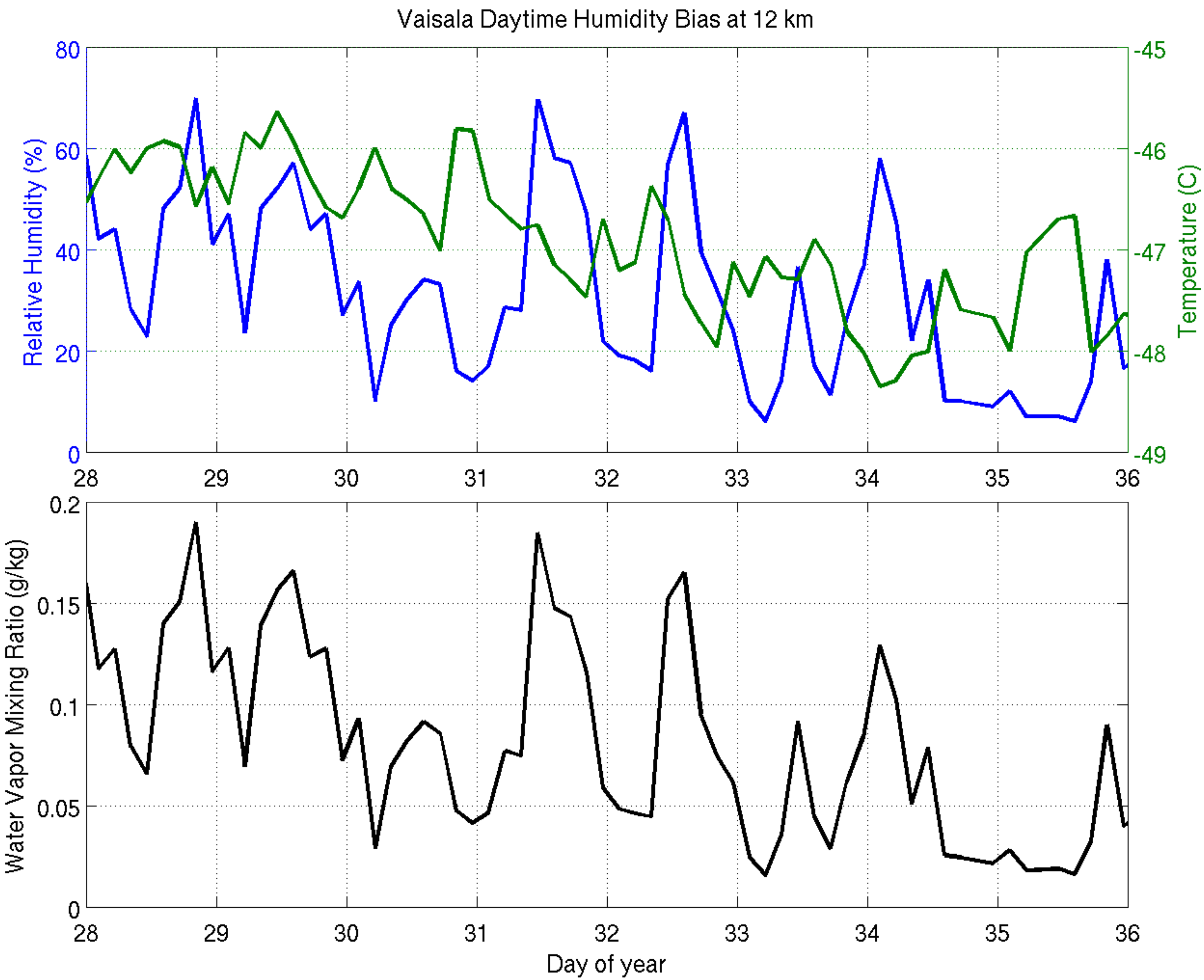



Figure 6: Relative difference between the Vaisala RS92 and CFH daytime RH.



Vaisala Daytime Humidity Bias at 12 km
Relative Humidity (%)
Temperature (C)
80
60
40
20
0
-45
-46
-47
-48
-49
28
29
30
31
32
33
34
35
36
Water Vapor Mixing Ratio (g/kg)
0.2
0.15
0.1
0.05
0
Day of year