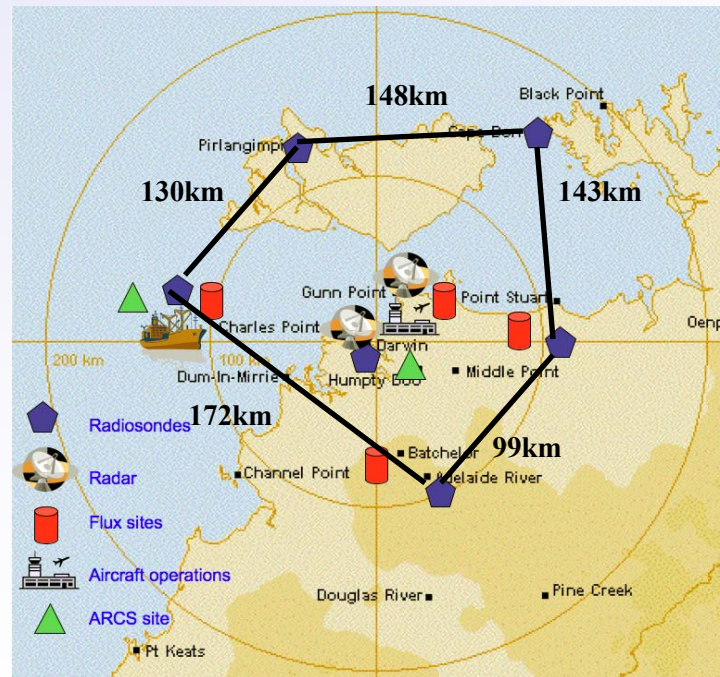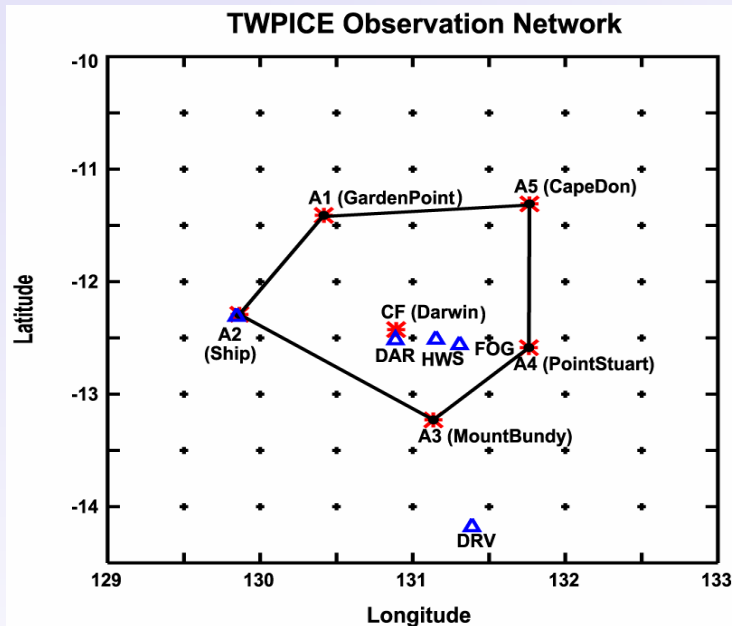# Update on the Variational Analysis of Tropical Warm Pool International Cloud Experiment (TWP_ICE) Data (01/22/2006 – 2/13/2006)

A joint effort between LLNL (Xie, McCoy, Klein), BMRC (Hume, Jakob), SUNYSB (Zhang), and other TWPICE participants

The TWP_ICE Workshop , NASA/GISS, New York, NY, 13-15 November, 2006

A Quick Update

TWPICE Observation Network

Done!

- ✓ **3-hourly radiosondes (6 stations)**
- ✓ **Background field from the ECMWF analysis**
- ✓ **Radar precipitation**
- ✓ **Surface turbulence fluxes from Monash University (Darwin Harbour, Howard Spring, Fogg Dam, and Daly River)**
- ✓ **ARM Surface radiative fluxes (Darwin, Cape Don, and Garden Point)**
- ✓ **Surface pressure, temperature, relative humidity, and winds (from sounding data)**

Working on ……

TOA radiative fluxes (Japan's Multi-functional Transport Satellite- MTSAT)

Surface radiative fluxes from Monash university

MWR measured cloud liquid path

Surface fluxes from the Ship

Aircraft measured surface turbulence fluxes

Surface meteorological data from local surface mesonet

Issue #1: Daytime Dry Bias in the RS-92 Sondes

A radiation heating dry bias is found in the middle/upper troposphere in the RS-92 sondes

Comparison of humidity from RS92
And Cryogenic Frostpoint Hygrometer.

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

Impact on the derived forcing fields and SCM/CRM needs to be examined
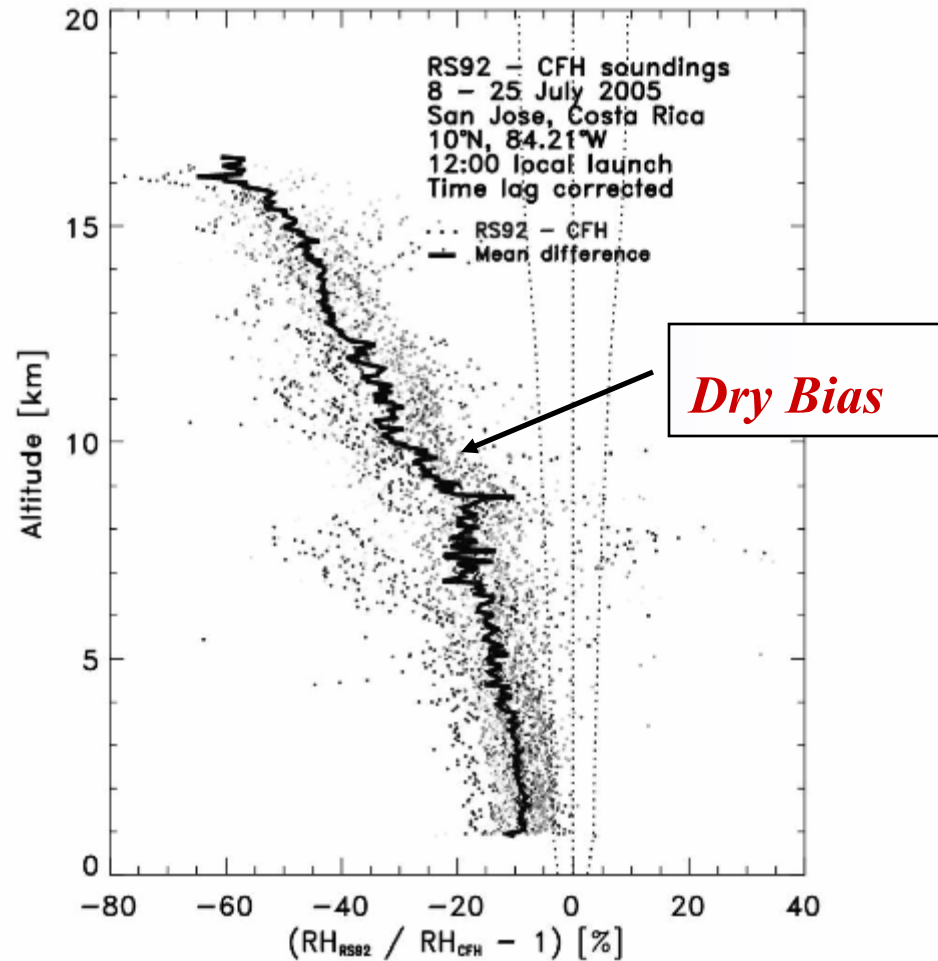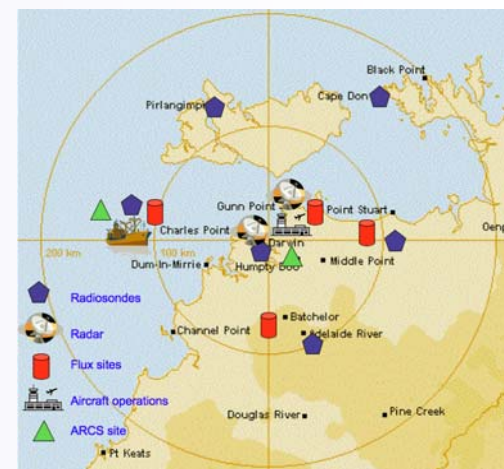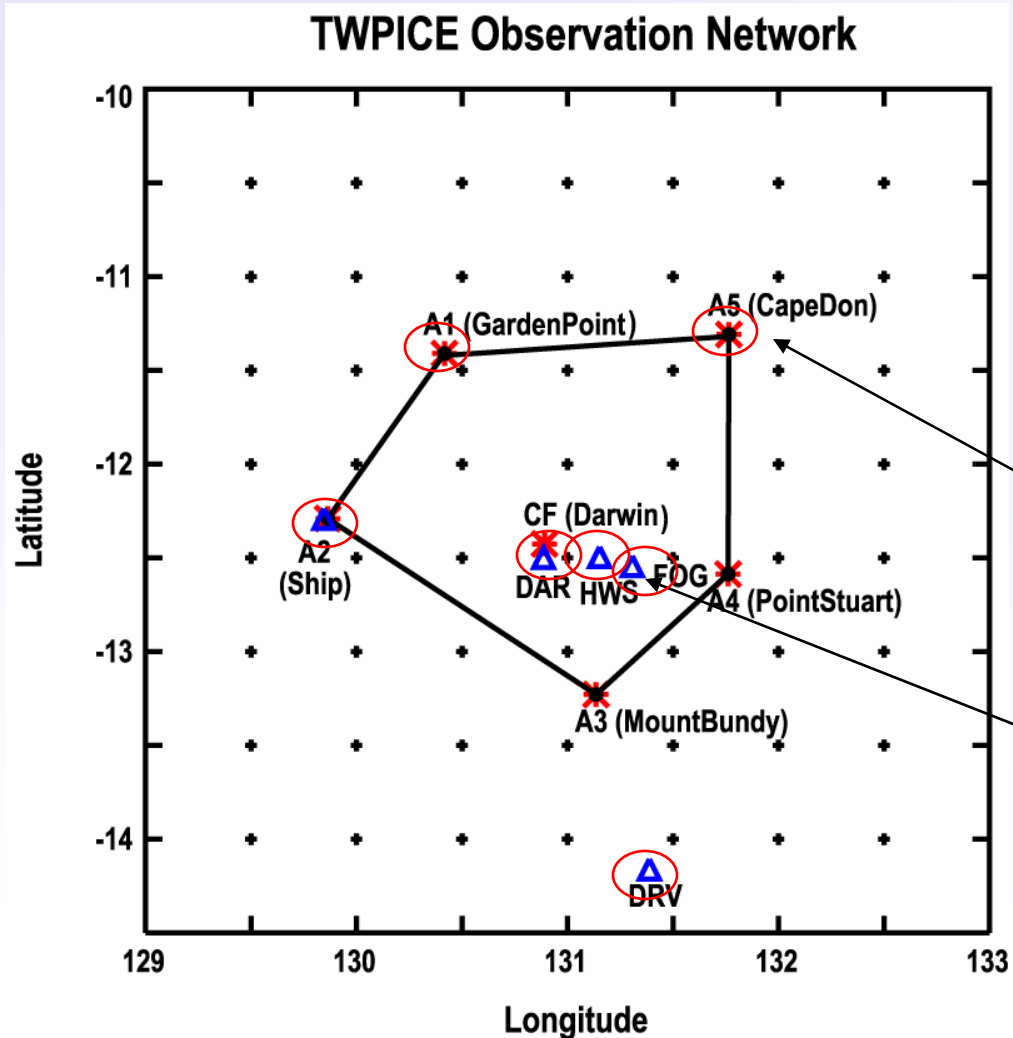
When will the correct data be available?

Dry Bias

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

Issue #2: Surface and TOA Constraints

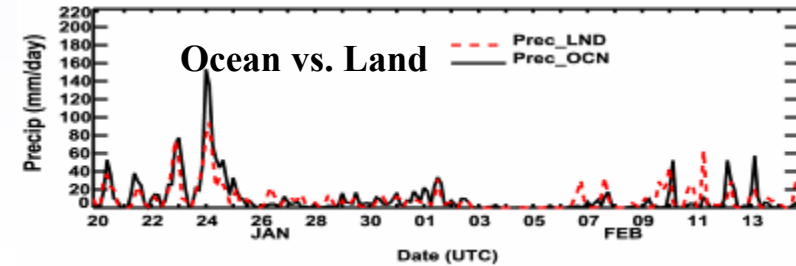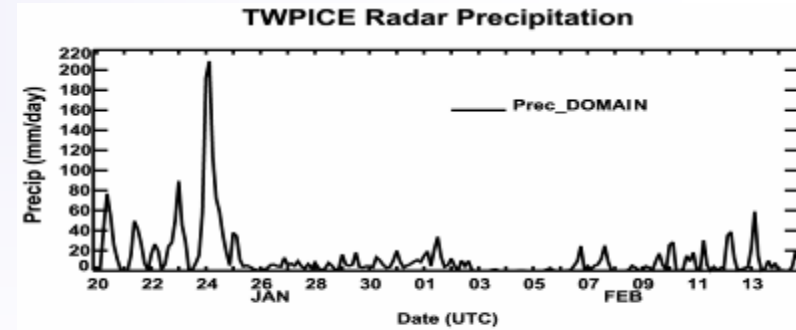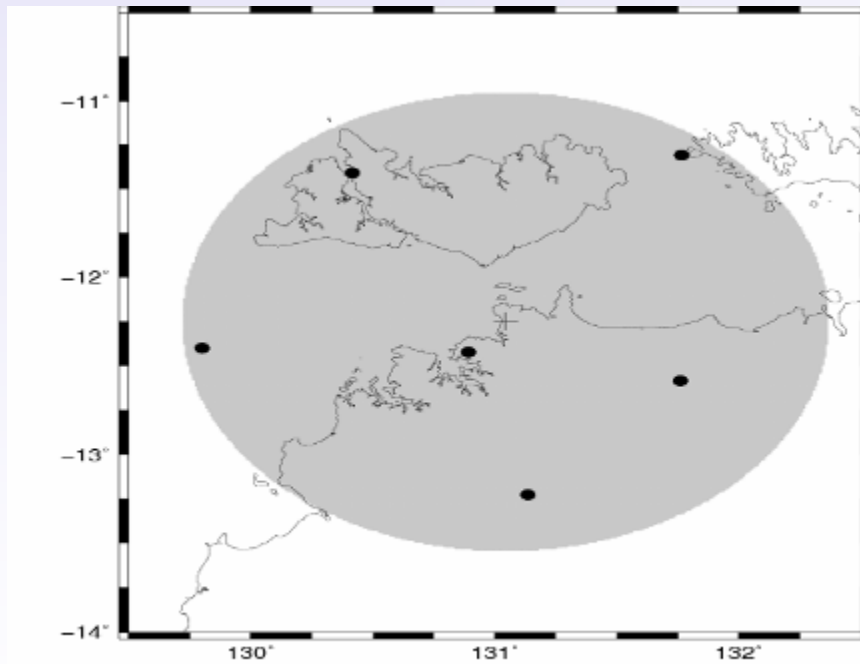*Can the limited number of surface stations represent well the spatial variations of the surface fluxes?*

TWPICE Observation Network

Radiative Flux Stations

Turbulence Flux Stations

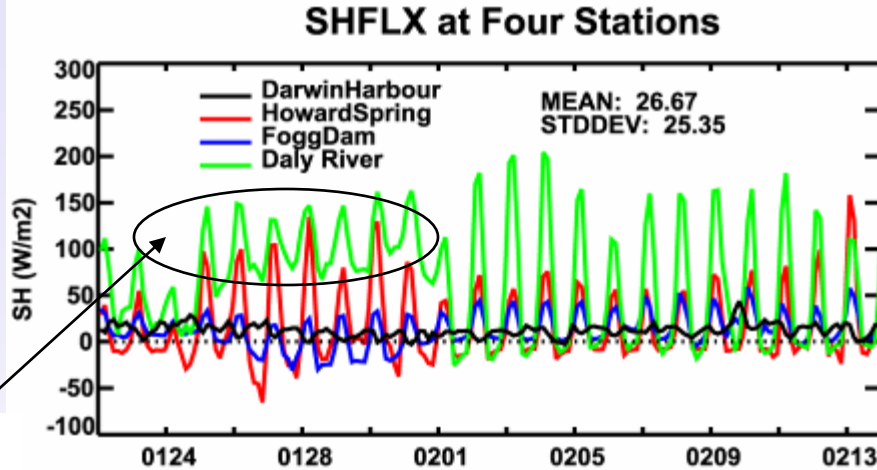# The BOM Precipitation Radar Well Covered the Region
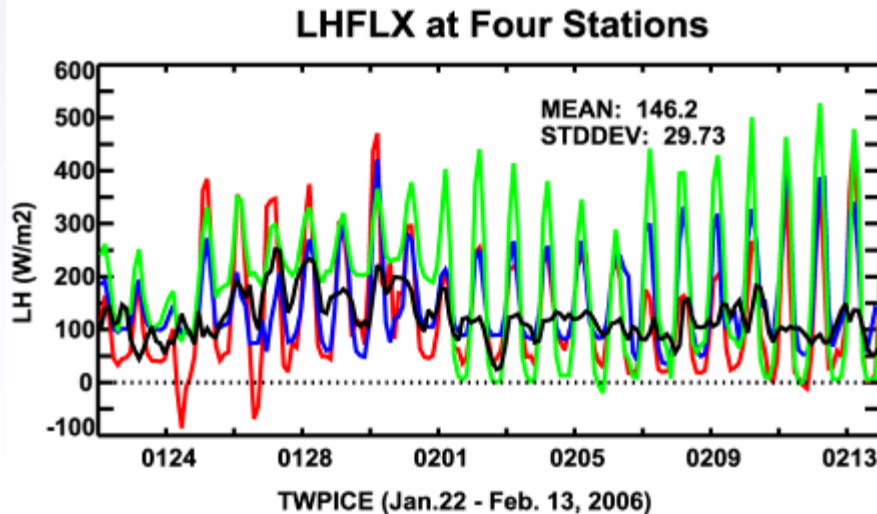
**BOM Precipitation
Radar Coverage**

Courtesy of Drs. Hume and Jakob

Turbulence Fluxes Show Large Spatial Variation

SH & LH over Different Surface types

SHFLX at Four Stations

DarwinHarbour
HowardSpring
FoggDam
Daly River

MEAN: 26.67
STDDEV: 25.35

SH (W/m2)

???

LHFLX at Four Stations

MEAN: 146.2
STDDEV: 29.73

LH (W/m2)

TWPICE (Jan.22 - Feb. 13, 2006)

4 Turbulence Flux Stations

Darwin Harbour: Inshore waters

Howard Springs: Eucalypt open forest savanna

Fogg Dam: Typical northern floodplain

Daly River: Eucalypt woodland/grassland savanna

Need to get surface type data for the domain average
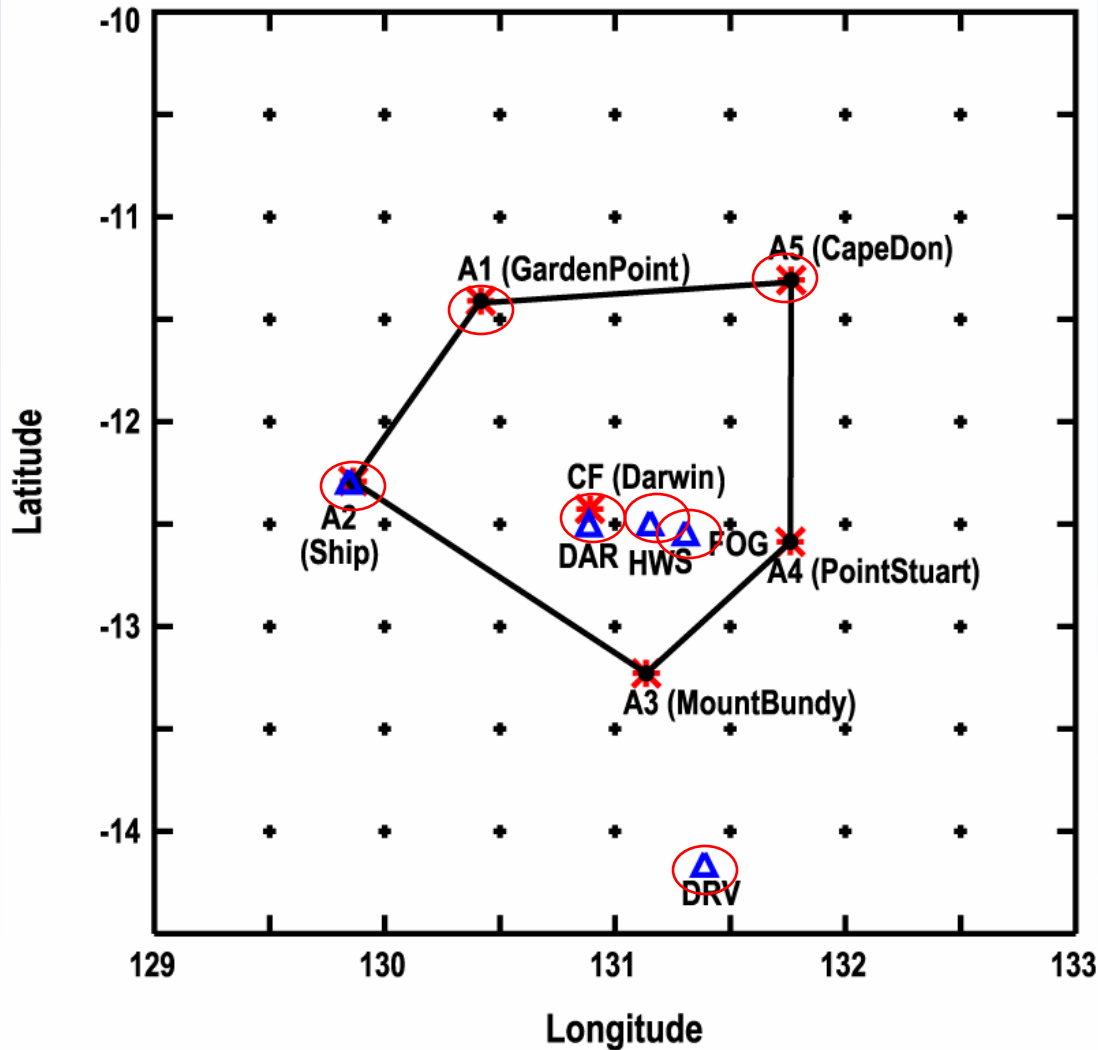
Strong Ocean-Land Contrast
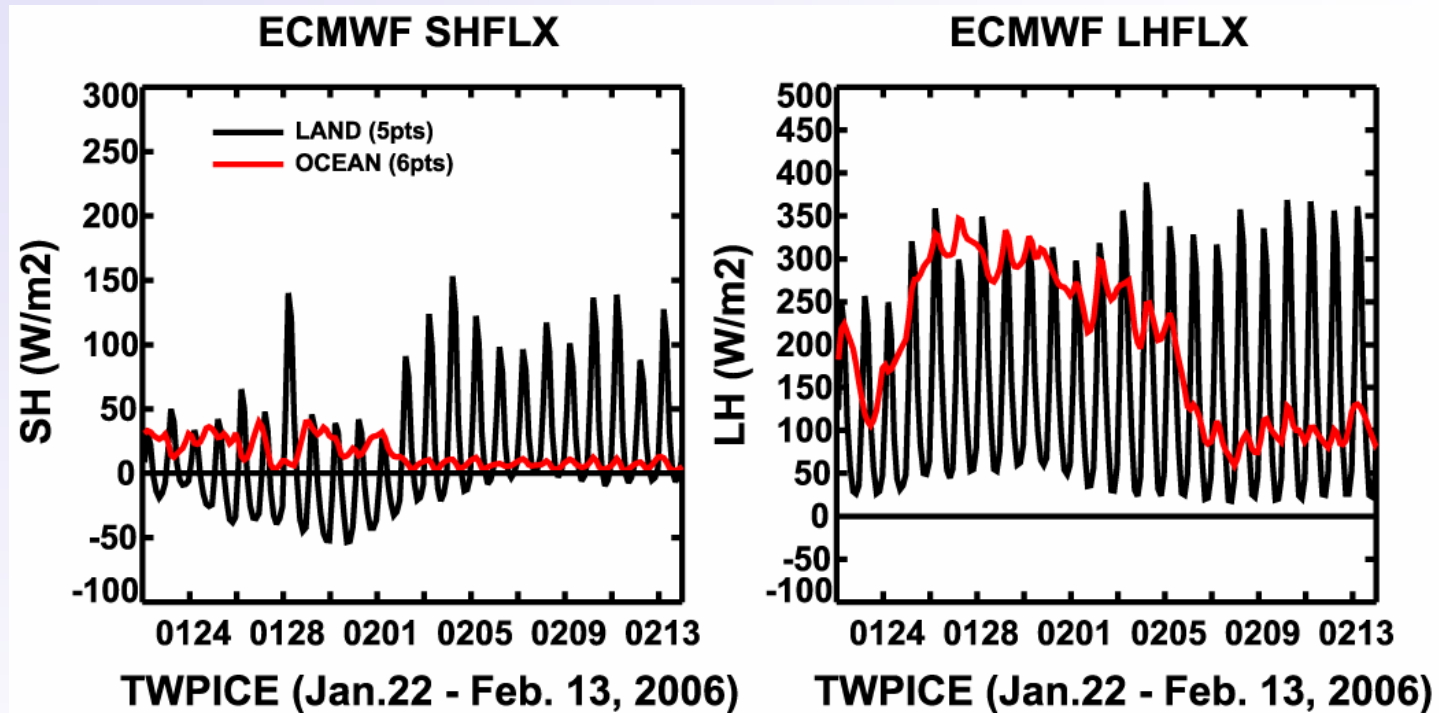
Ocean fluxes are needed for domain average

➢ Ocean fluxes from the Ship
➢ Ocean fluxes from ECMWF
➢ Aircraft data

Surface Radiative Fluxes

TWPICE Observation Network

Problems:

- **No upwelling SW & LW at CapeDon and Garden Point**

- **Some issues need to be addressed with the Monash University's radiative fluxes**

Can we calculate upwelling SW and LW based on surface albedo and temperature?

TOA Satellite Measured Radiative Fluxes

Japan's Multi-functional Transport Satellite (MTSAT)
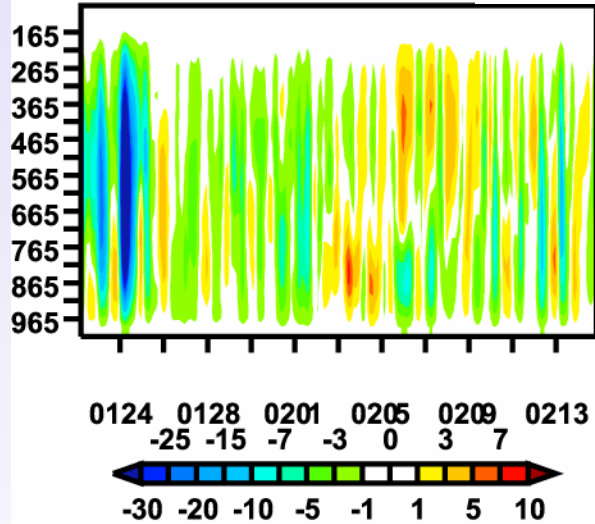*Hourly MTSAT-1R VISST products from Pat Minnis Group*

A Test Run of the Variational Analysis

Sounding data + Observed Precip + all other constraints from ECWMF
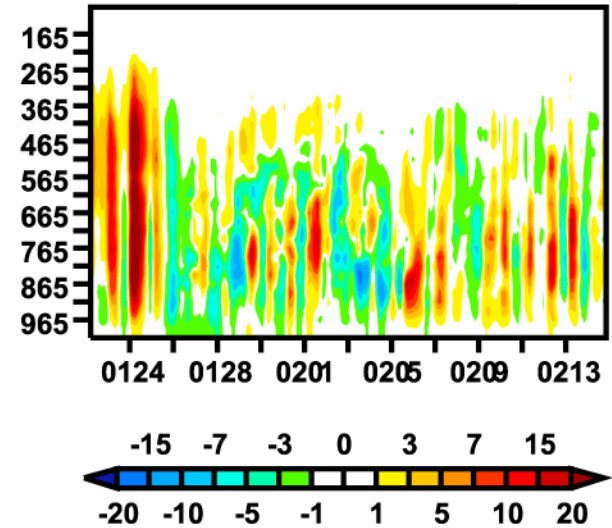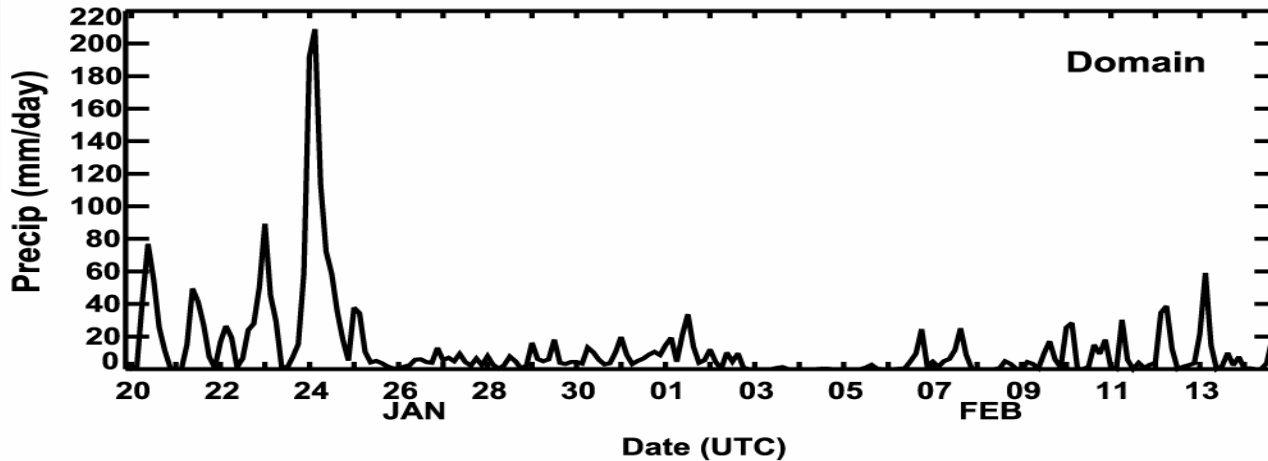
Derived Large-scale Forcing Fields
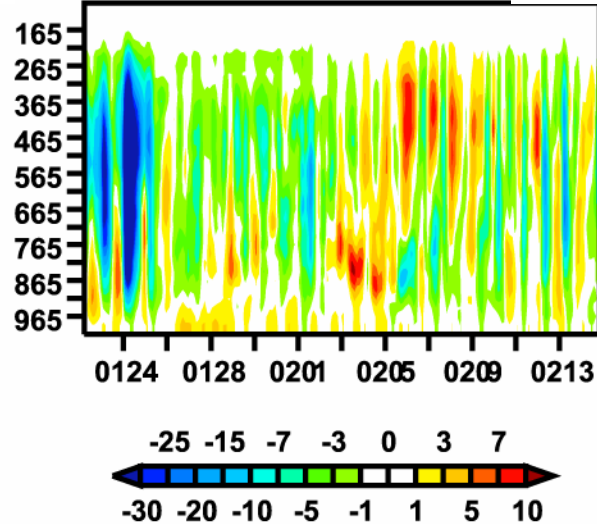
Summary

Issues need to address:

- *Dry bias in RH*

- *Uncertainties in the surface and TOA constraints*

- *How do the derived forcing fields respond to those uncertainties in RH and constraints?*

- *How do SCMs/CRMs respond to the uncertainty in the forcing fields?*

Uncertainty information about the forcing fields

In addition to the domain-mean fluxes, we are planning to also provide ocean mean fluxes and land mean fluxes with their spatial standard deviations for CRMs

We plan to deliver the forcing data set by the next ARM STM

The END

# Sensitivity Test to Uncertainties in Surface SH & LH

3 Runs

T1: Sounding data + Observed Precip + all other constraints from ECWMF

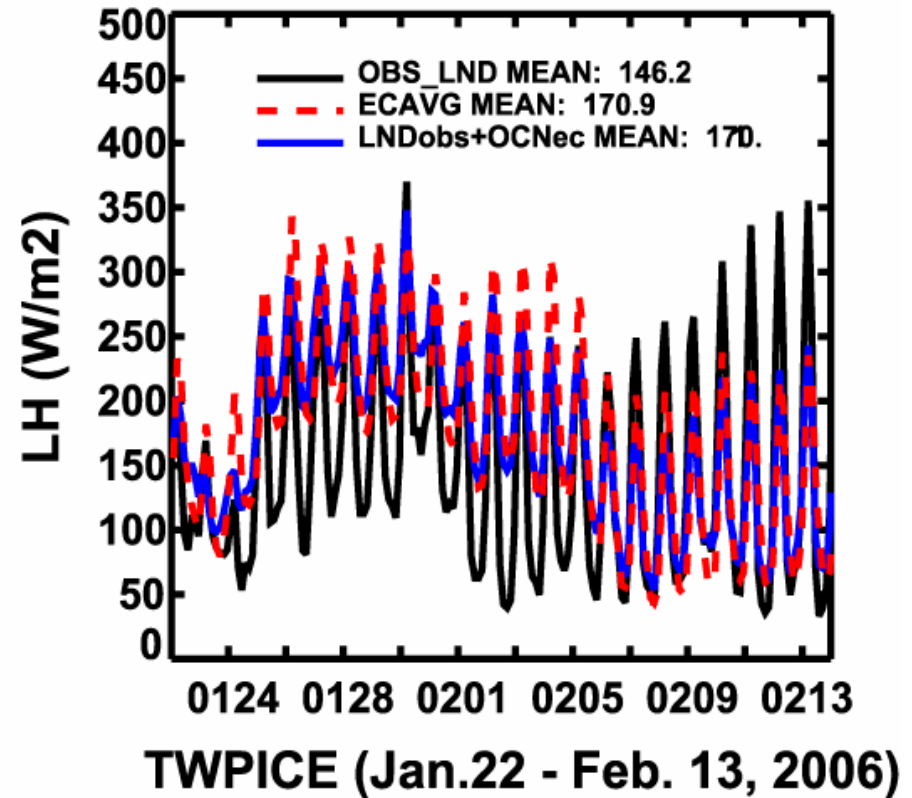**T2: Same as T1 except that SH & LH are from the four surface flux stations**

T3: Same as T1 except that SH & LH are the combination of ocean fluxes from ECMWF and land fluxes from the four surface flux stations

Domain-averaged SH & LH used in the Test Runs
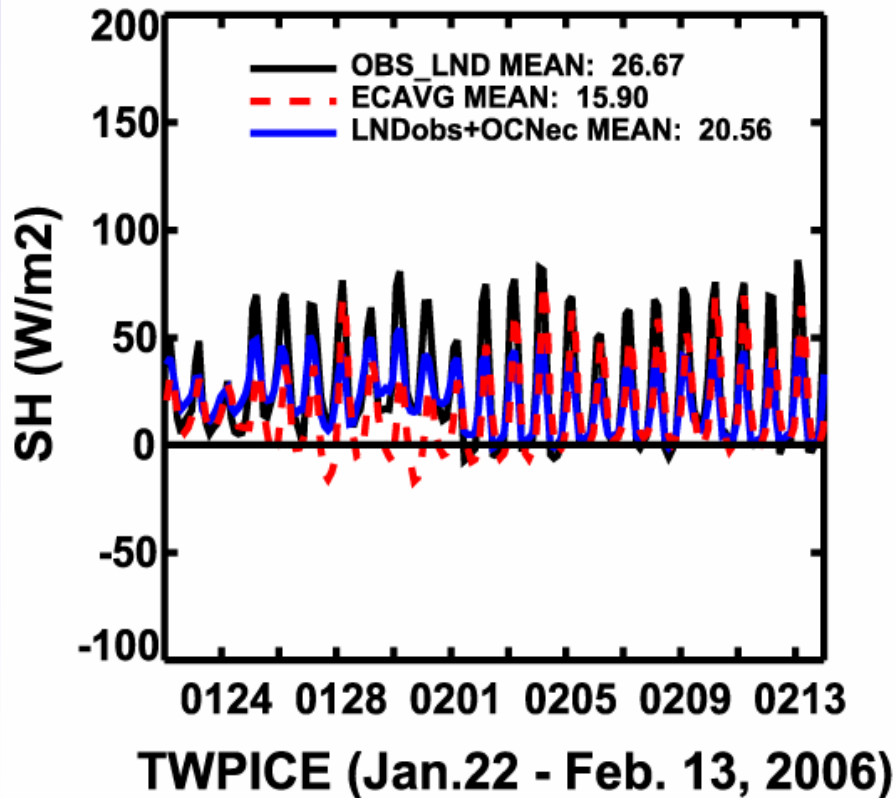
How sensitive are the forcings to uncertainties in SH&LH?