Group Session 1: Atmospheric Observations

< PURPOSES >

(1) To know planned observations each other

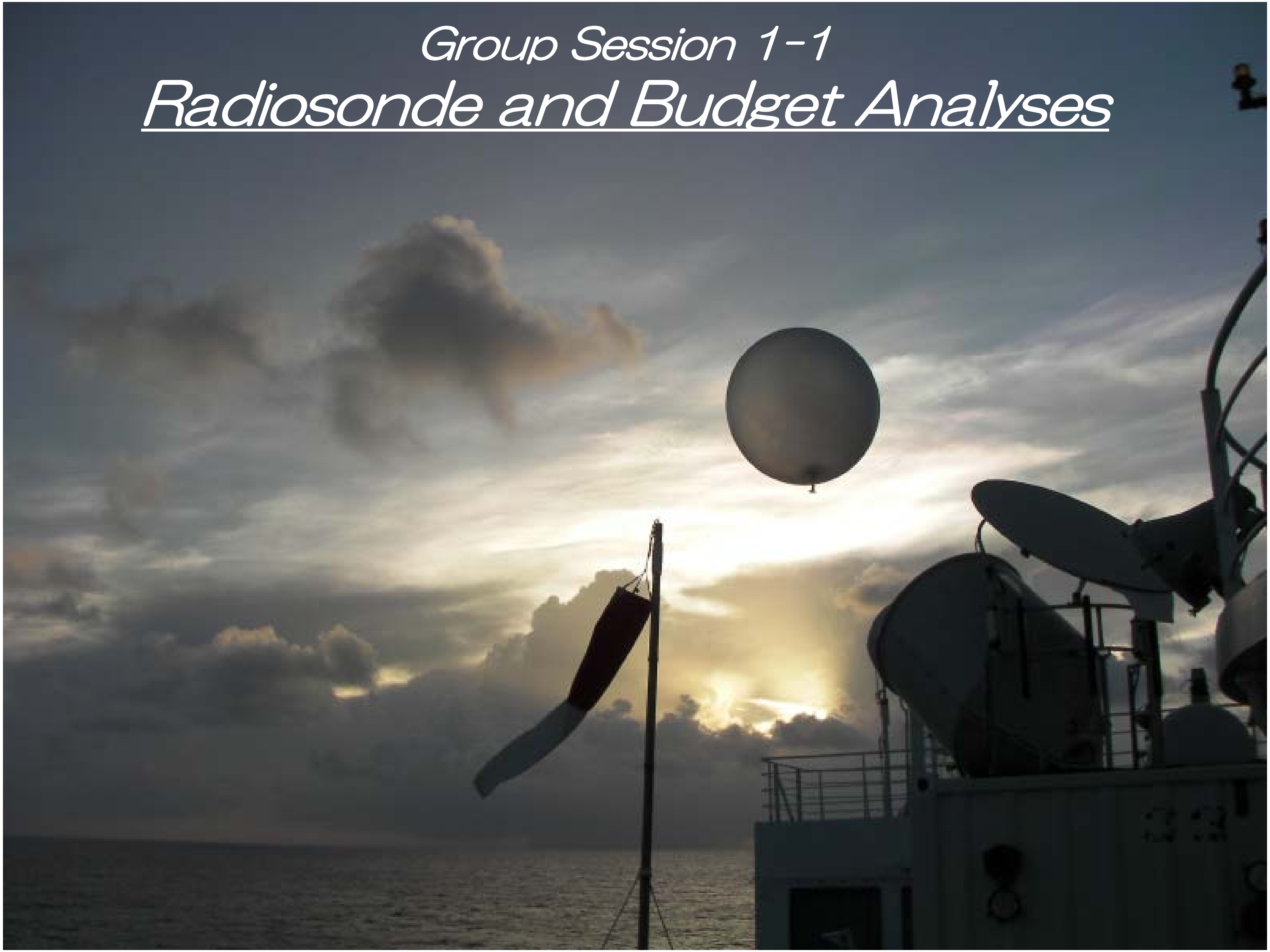
(2) To build consensus on / to highlight discussion points on:

- *Configurations of atmospheric instruments, especially (internationally / interagency) common ones (e.g. radiosonde, radar, etc.)*
- *Data transaction (e.g. GTS)*
- *Requests on the configuration of observation platforms (e.g. ship position and period) and on other observations and models (e.g. distribution of real-time forecast)*

1-1: Radiosonde and Budget Analyses
1-2: Water Vapor
1-3: Rain and Clouds
1-4: Others

Group Session 1-1

Radiosonde and Budget Analyses



Targets in Science Plans

CINDY Science Plan (Apr. 2009)

Atmospheric Research

a. Preconditioning processes
b. Equatorial Waves
c. Diabatic heating
d. Diurnal cycle
e. Column integrated humidity
f. Squall-line and cold pool
g. Population of clouds

Air-Sea Interaction

a. IOD / zonal SST distribution
b. Diurnal variation of SST / SSST
c. Flux (heat, moisture, momentum …)

Oceanic Research

a. Mixed layer
b. Diurnal warm layer
c. Oceanic wave (MRG, Kelvin, …)
d. Biogeochem responce

DYNAMO SPO (Jul. 2009)

Role of Moisture

a. Moist layer vs. Convections
b. Moisture above cloud base
c. Moistening vs large-scale drying

Role of Cloud Population

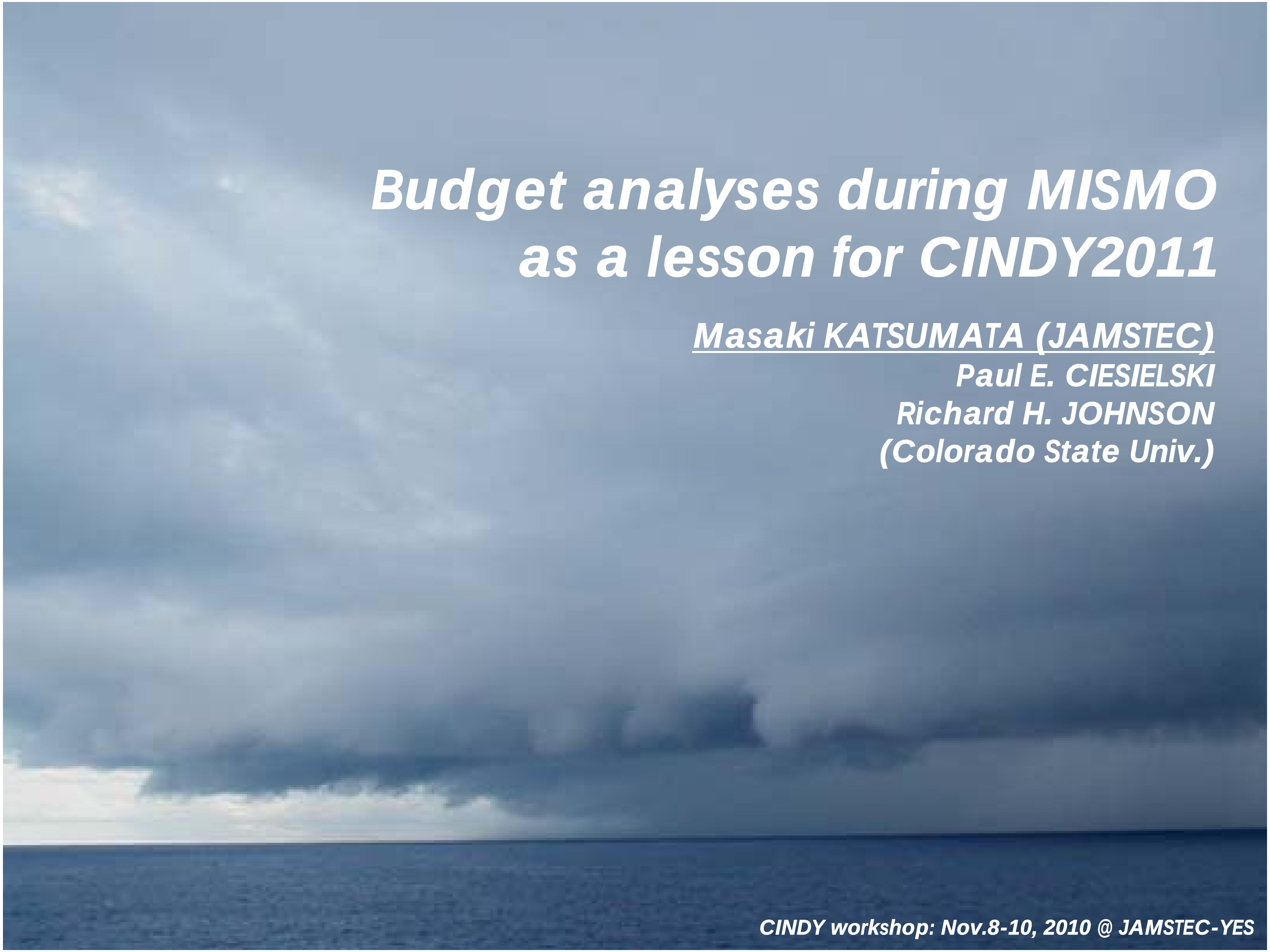
a. Cloud population distribution
b. Relationship to stage or moisture environment
c. Transition of stages
d. Heating profile / convergence
e. Resulting moisture transport

Role of Air-Sea Interaction

a. Flux (w/wind, humidity, SST, …)
b. Barrier layer
c. Diurnal mixing
d. Heat budget

Demands on Radiosonde Observations

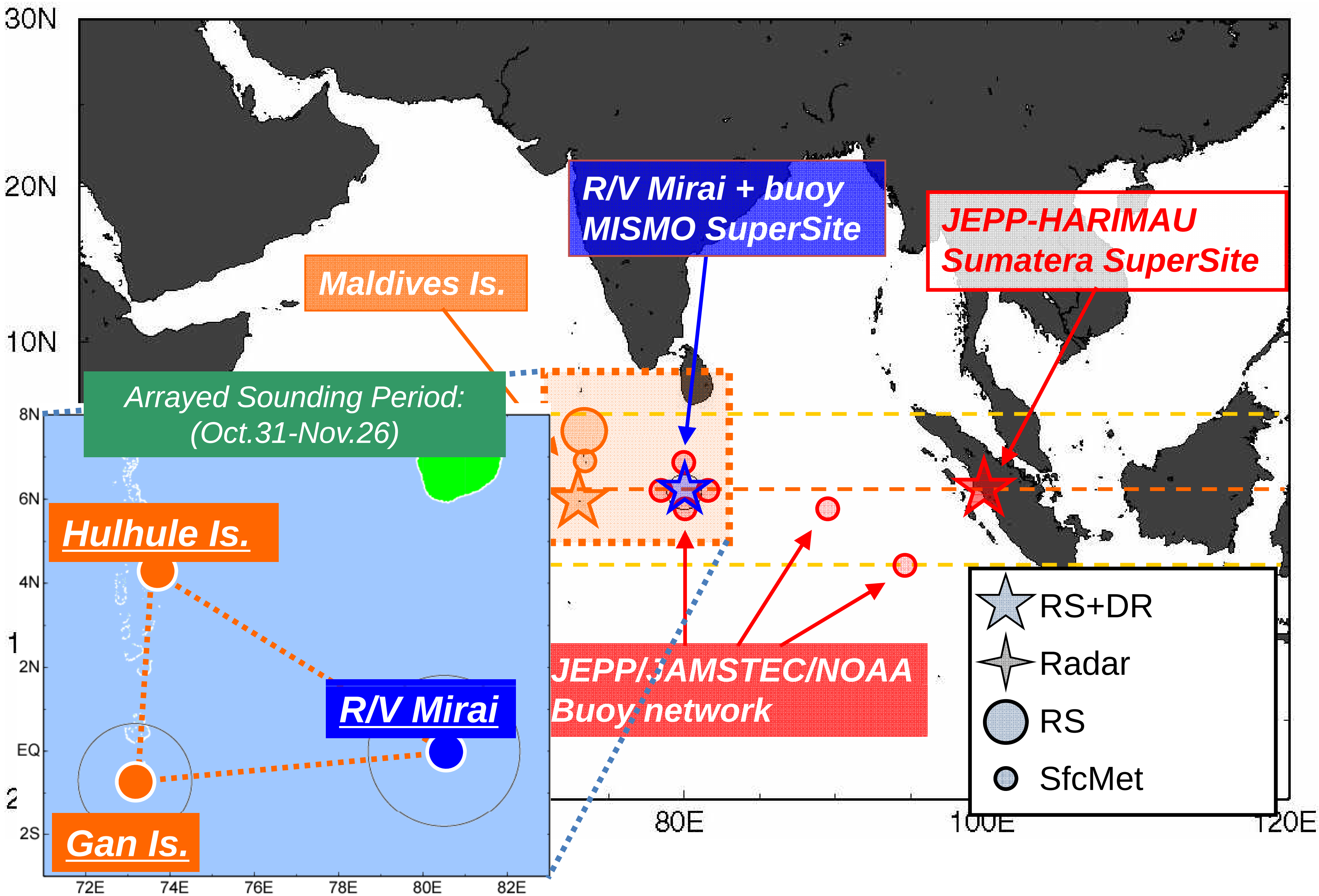
- *Cover Full Cycle of MJO*
- *Estimate Diabatic Heating / Drying*
- *Measure Water Vapor Distribution*
- *Monitor Equatorial Waves*
- *Resolve Diurnal Cycle*



Budget analyses during MISMO as a lesson for CINDY2011

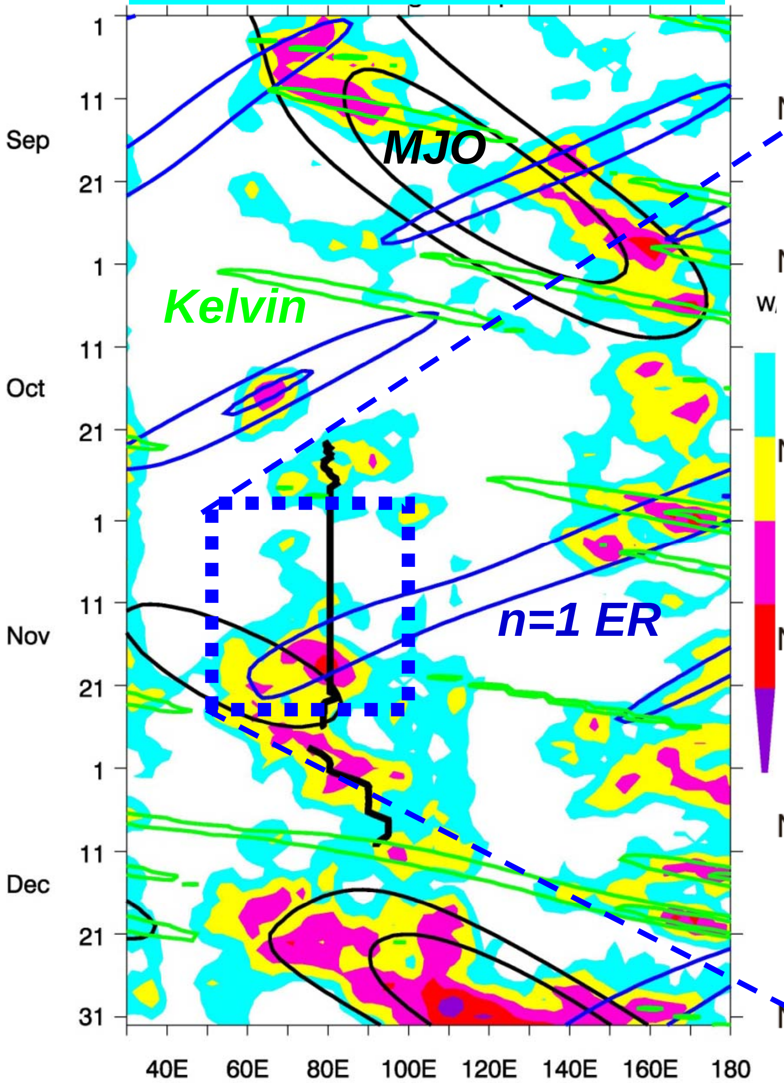
Masaki KATSUMATA (JAMSTEC)
Paul E. CIESIELSKI
Richard H. JOHNSON
(Colorado State Univ.)

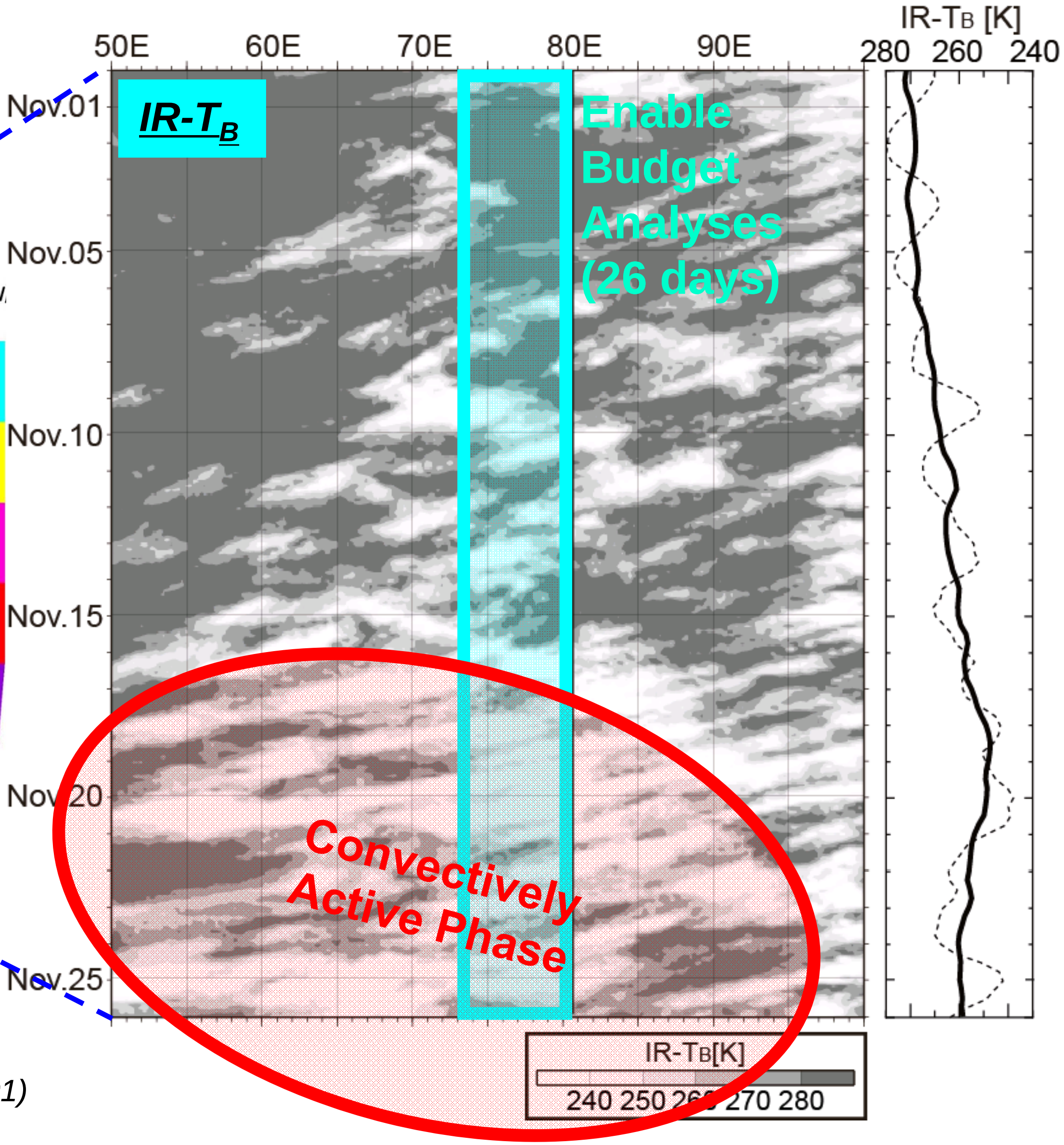
Sites in MISMO Intensive Observation Period



Outline of the Observation Period

OLR and mode analyses

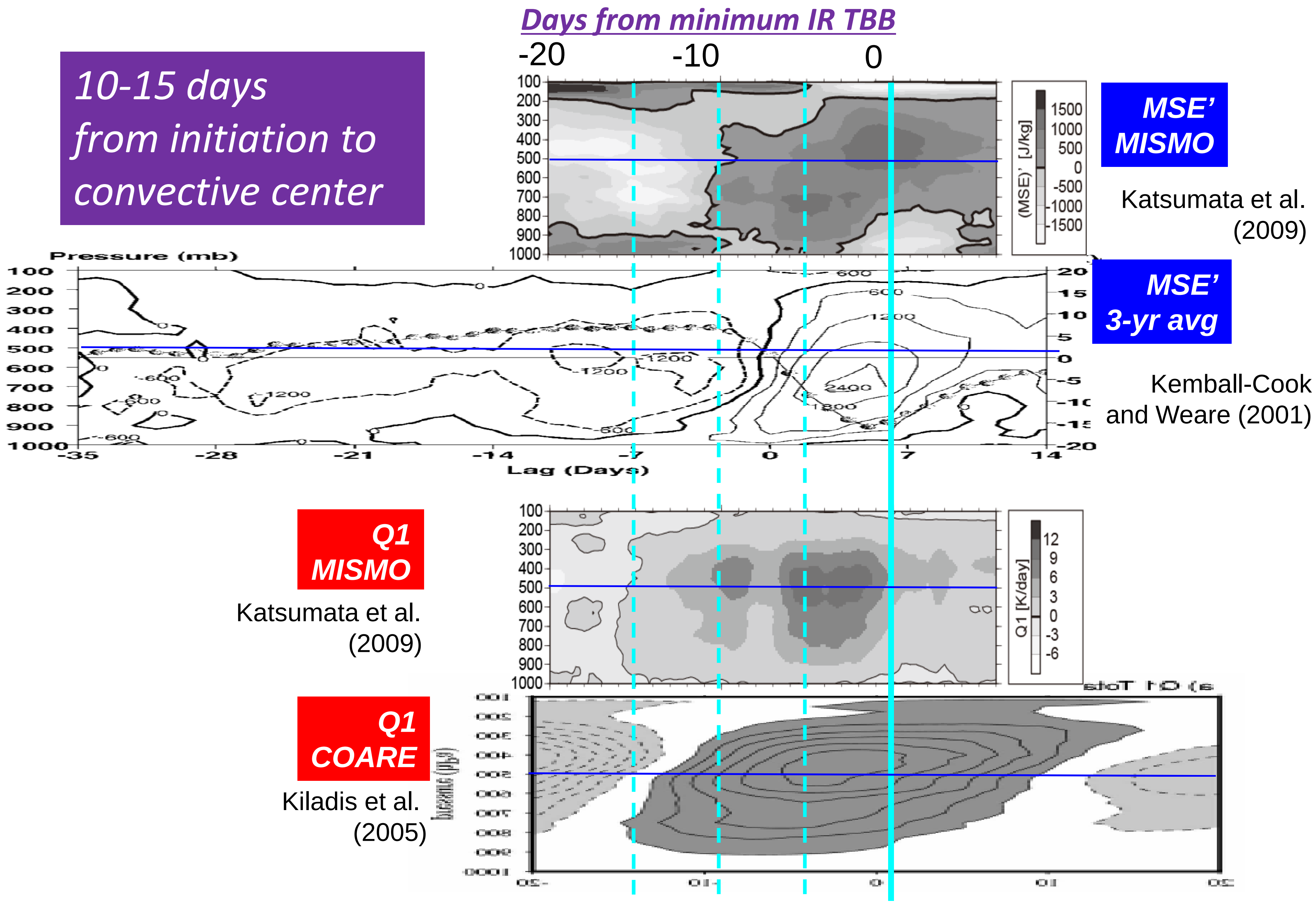




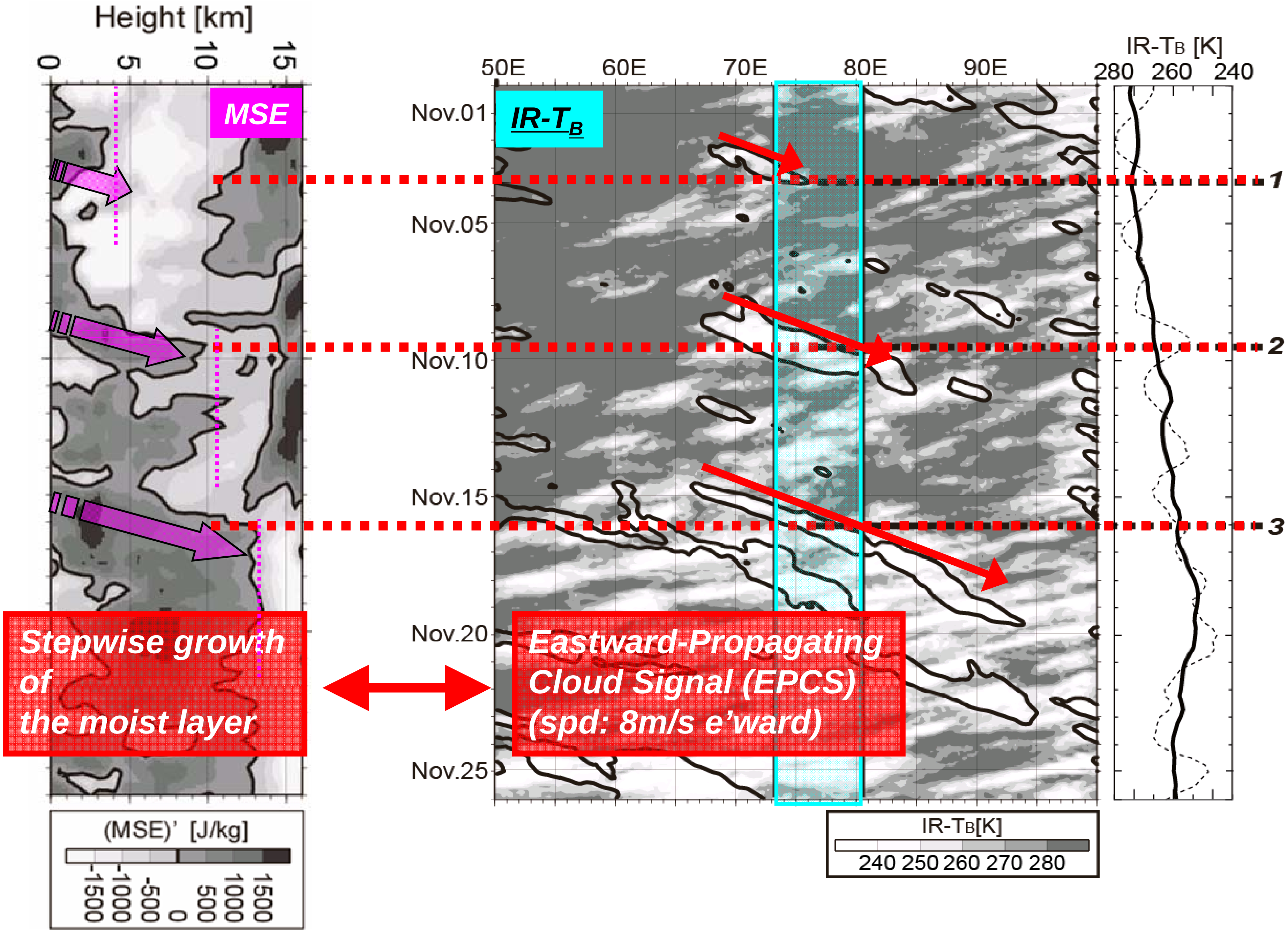
OLR mode analyses after Wheeler and Kiladis (2001)
contour: 7.5W/m^2, negative only

Evolution of the vertical structure

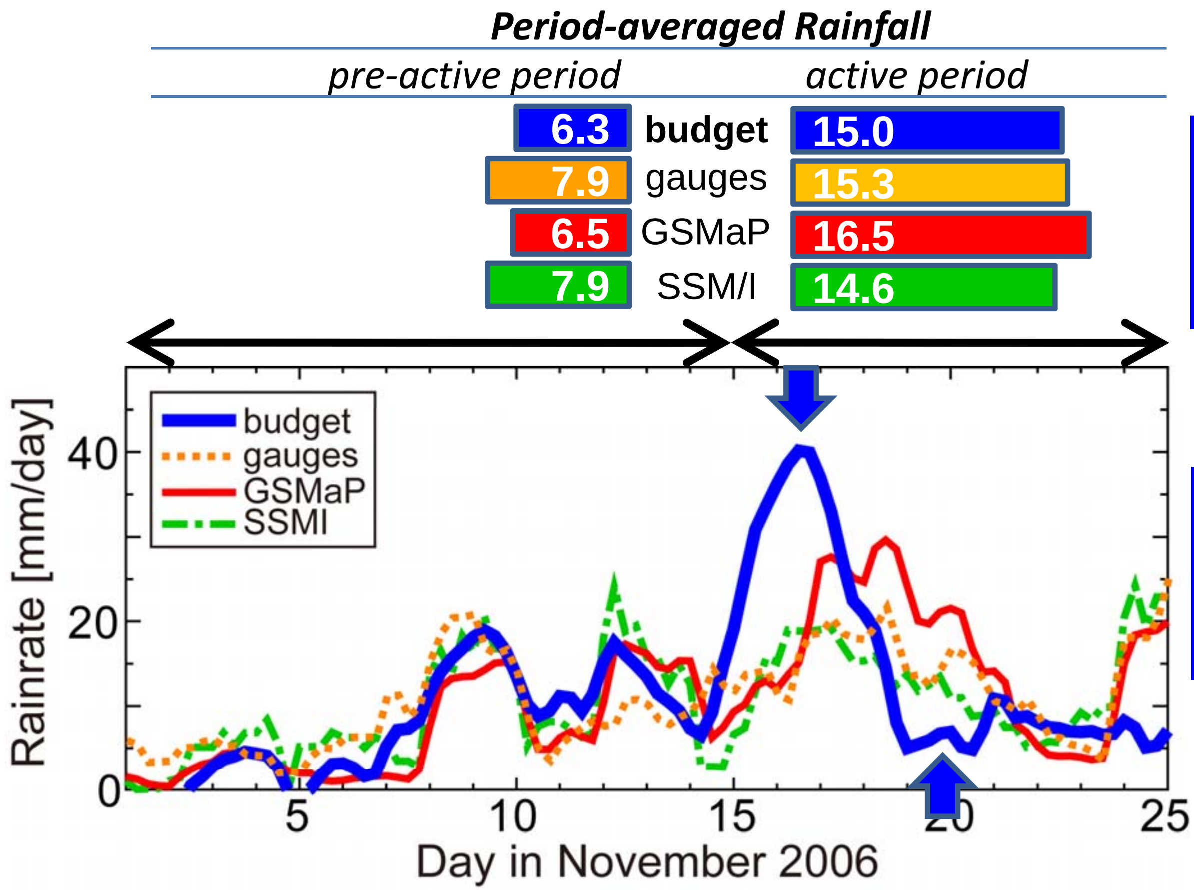
10-15 days from initiation to convective center



Stepwise Mostening <-> Eastward-Propagating Cloud



Comparing rainfall: to evaluate reliability of budget analyses



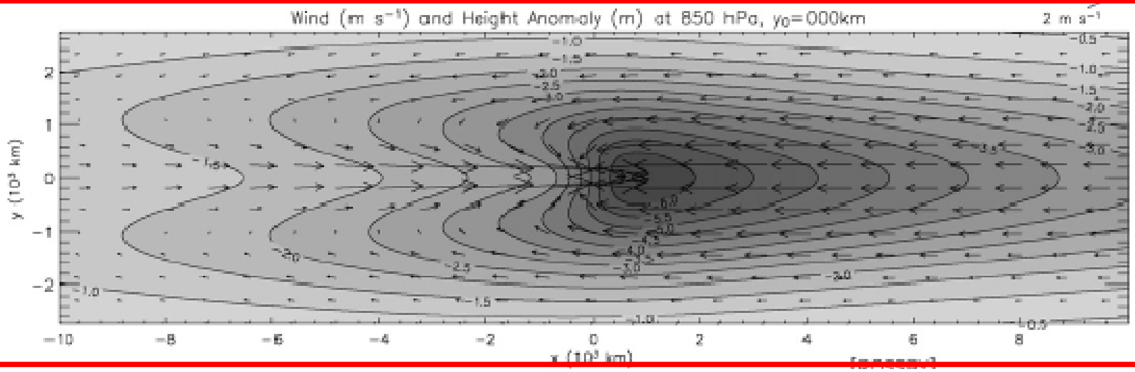
Good agreements in period-averaged rainfall amounts

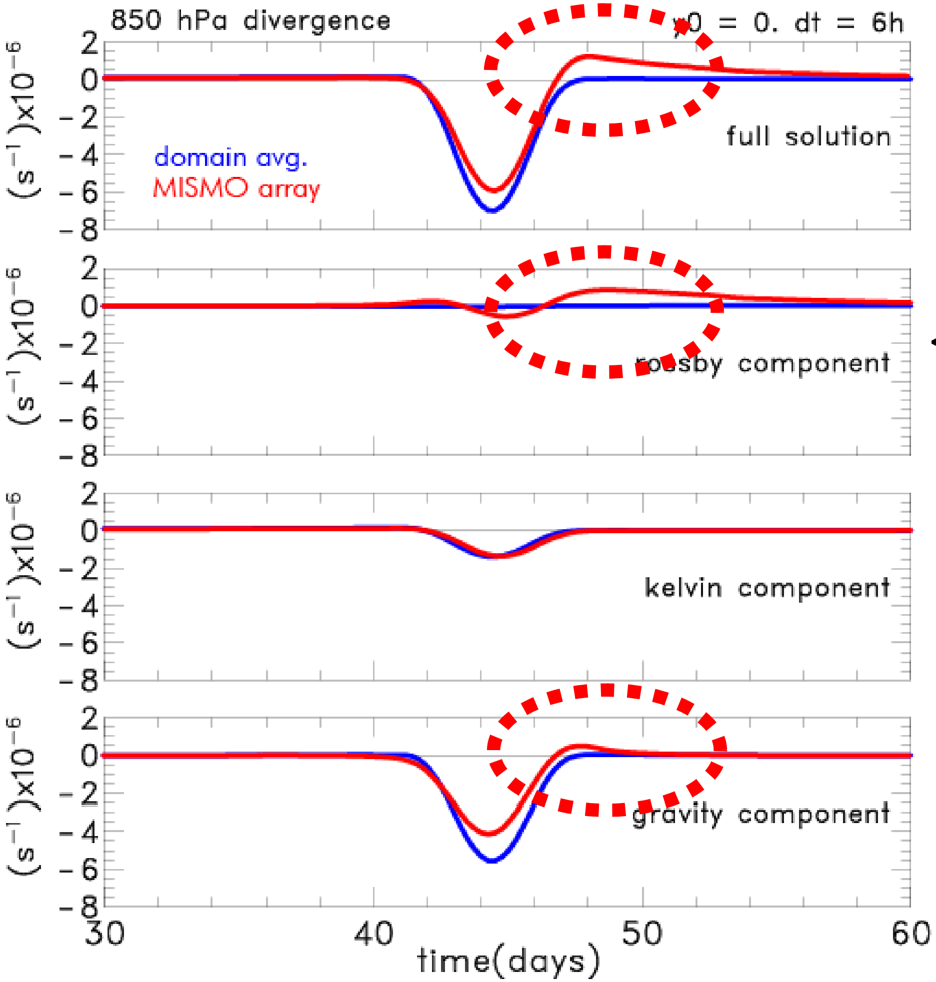
Discrepancy in temporal change (a few to several days) in active period

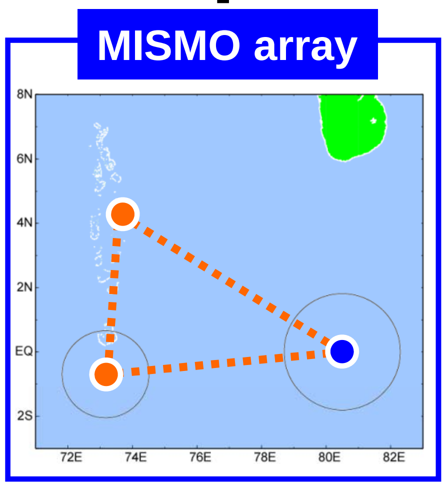
Katsumata et al. (2010, JAMC)

Simulating budget analyses: using linear model

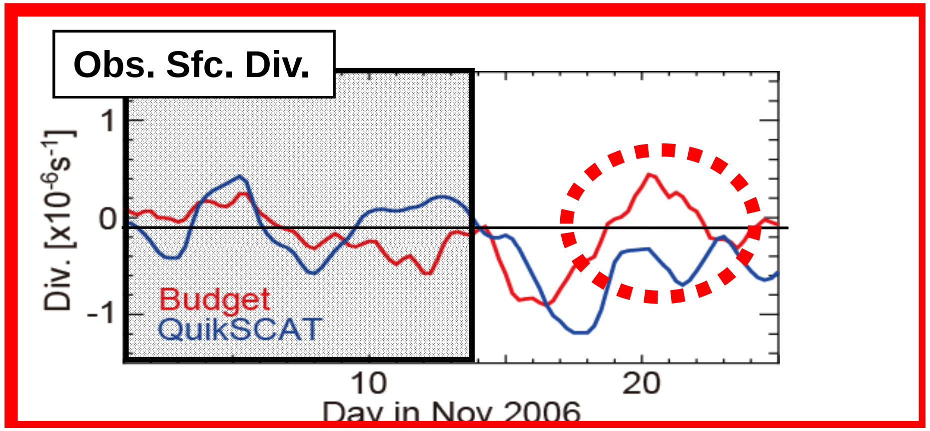
Theoretical Wind Field
with TOGA/COARE-like heating
(Schubert and Masarik 2006)





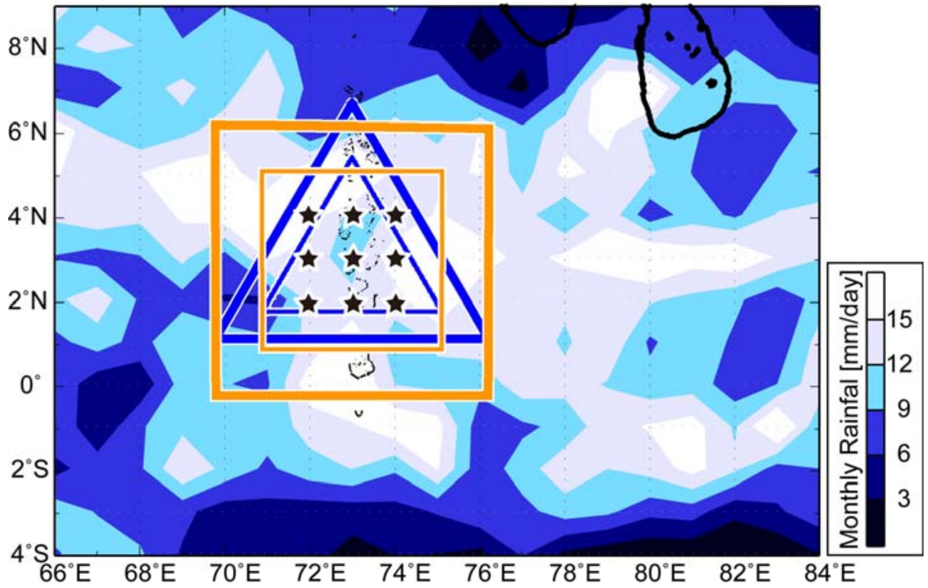


Katsumata et al. (2010, JAMC)



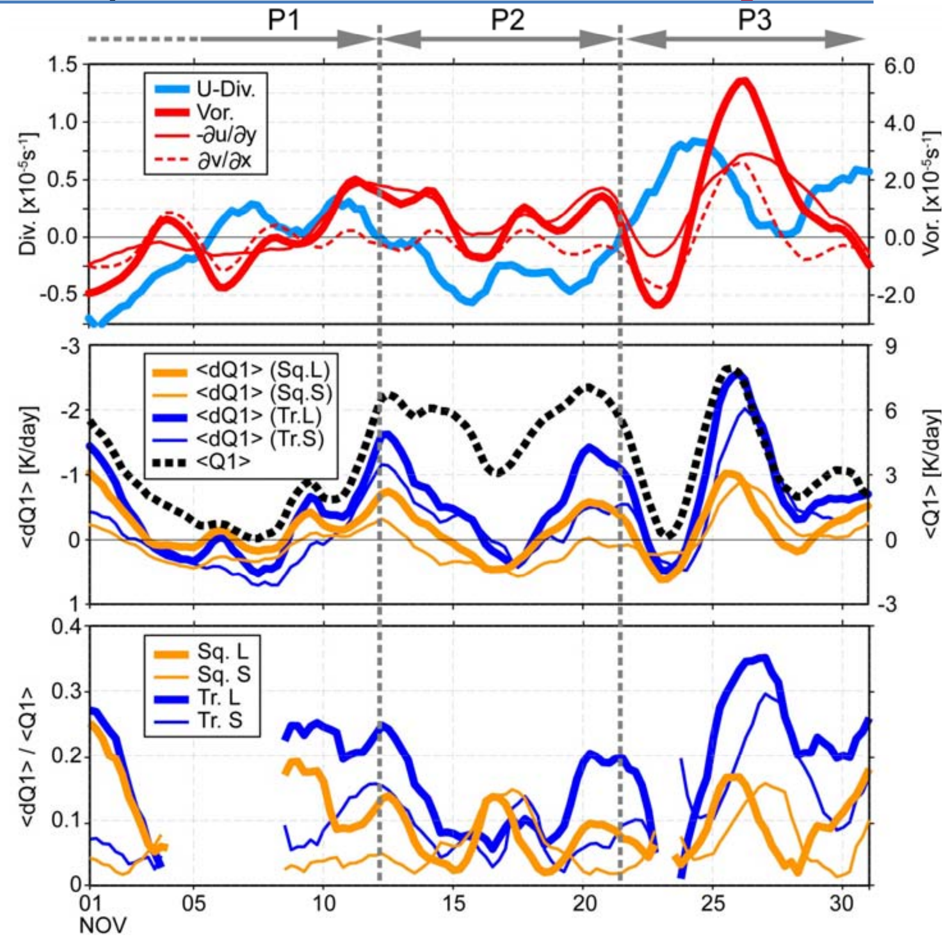
Simulating budget analyses: using high-resolution AGCM (NICAM)

idealized arrays (rectangular vs triangle)

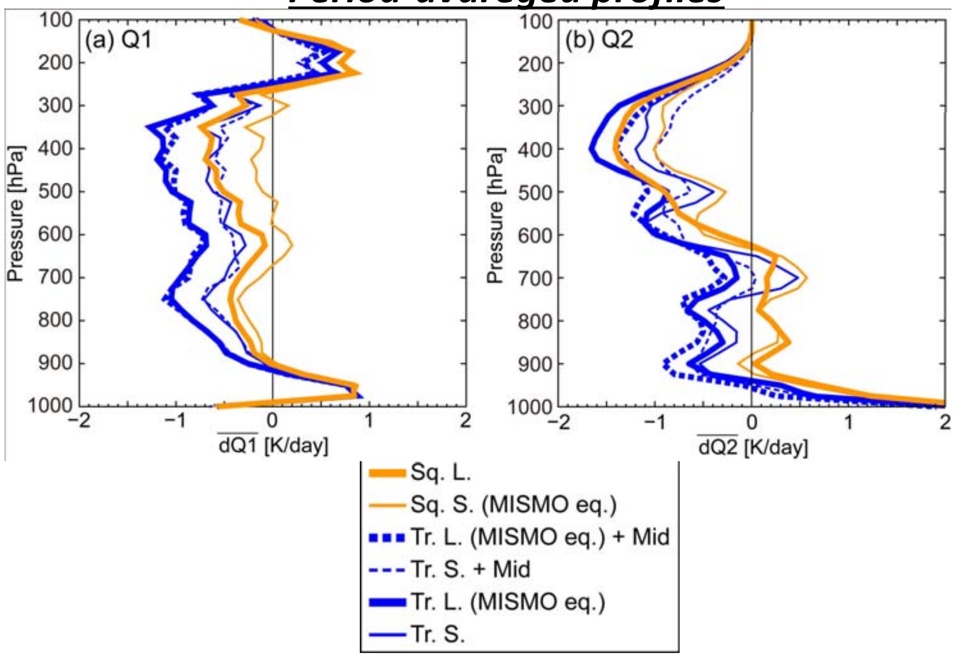


Temporal Variations: Three stages

Q1	Small	Large	Large
Zonal Div.	Weak	Conv.	Div.
Vorticity	Small	Small	Large



Period-avareged profiles



Summary

• 10-15 days were consumed from the initiation to the convection peak

<u>in DYNAMO: Continuous observation with minimized gaps</u>

• The synoptic-scale disturbance (a few to several days in cycle) played important role on moistening in pre-active period.

<u>in DYNAMO: Resolve synoptic-scale disturbances by deploying spatially with enough temporal interval</u>

• The triangle MISMO array resulted erroneous temporal variation of the divergence (and resulting Q1/Q2) in the active period. The quadrilateral array is superior at capturing wide range of the disturbances.

<u>in DYNAMO: Quadrilateral sounding array</u>

Height Coverage and Balloon Size using MIRAI shipboard launcher: Recent observations in MISMO and TWP

Kunio YONEYAMA
Masaki KATSUMATA
Hiroyuki YAMADA
(JAMSTEC)

CINDY workshop: Nov.8-10, 2010 @ JAMSTEC-YES

Balloon Size for Radiosonde Observation

Type : Vaisala RS92-SGPD

DigiCORA-III (MW-21)

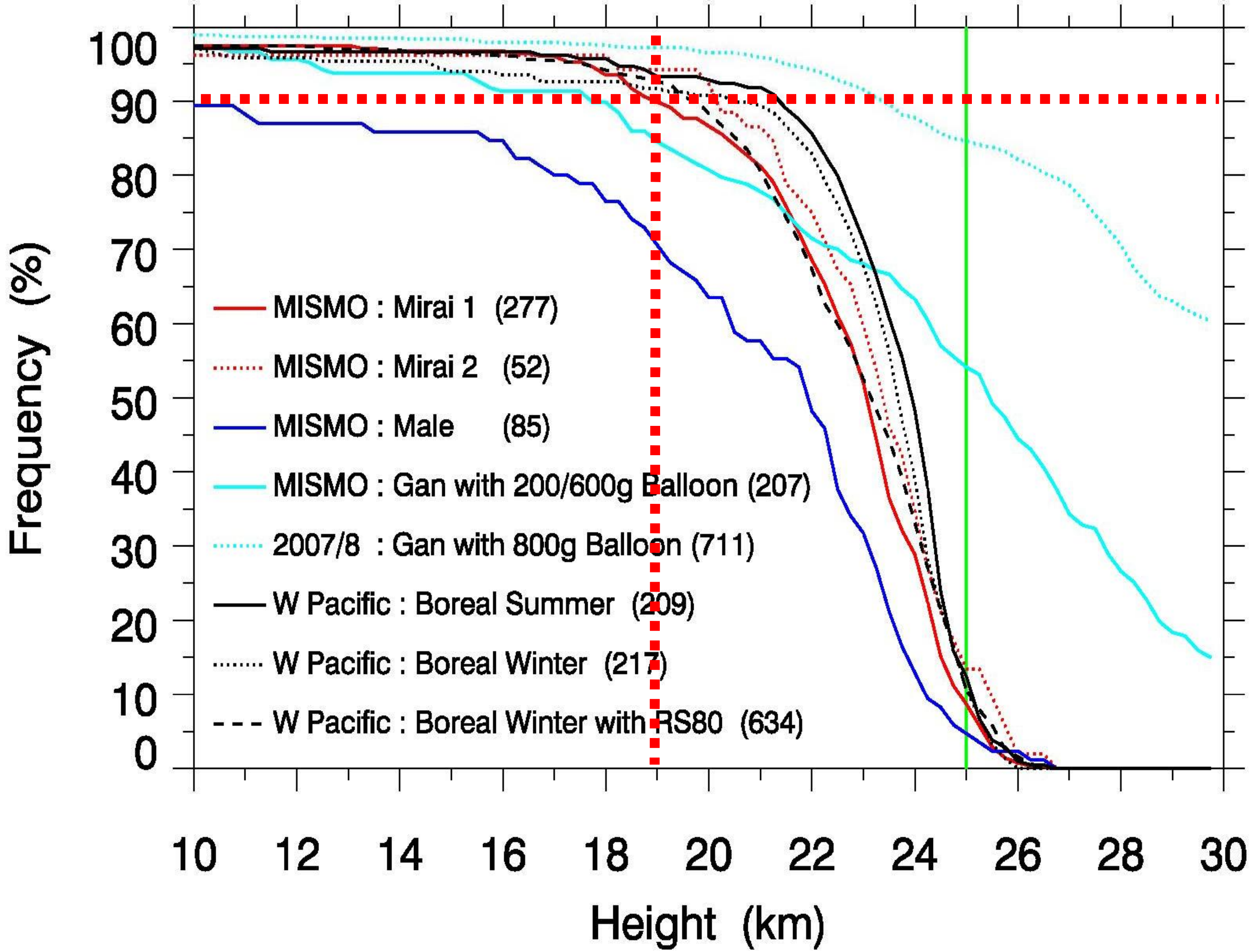
Frequency : 8 times / day during whole cruise (Leg-1 & 2)

(launch at 02:30, 05:30, 08:30, 11:30, 14:30, 17:30, 20:30, 23:30 UTC)

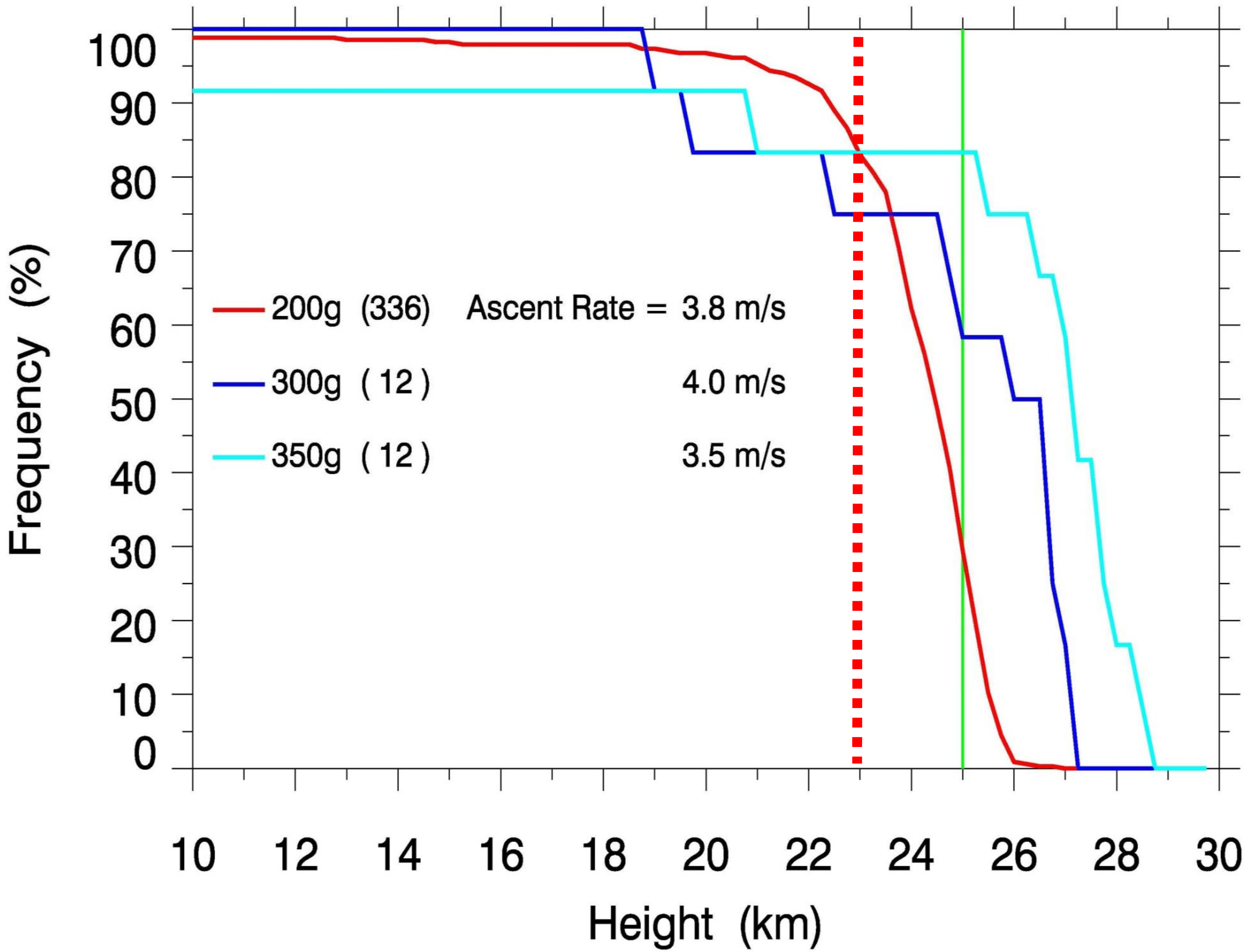
Sampling : every 2 sec during ascent

GTS : All sounding data is sent to GTS via JMA

In MISMO and past TWP obs.



In TWP (PALAU2010), with different balloon sizes



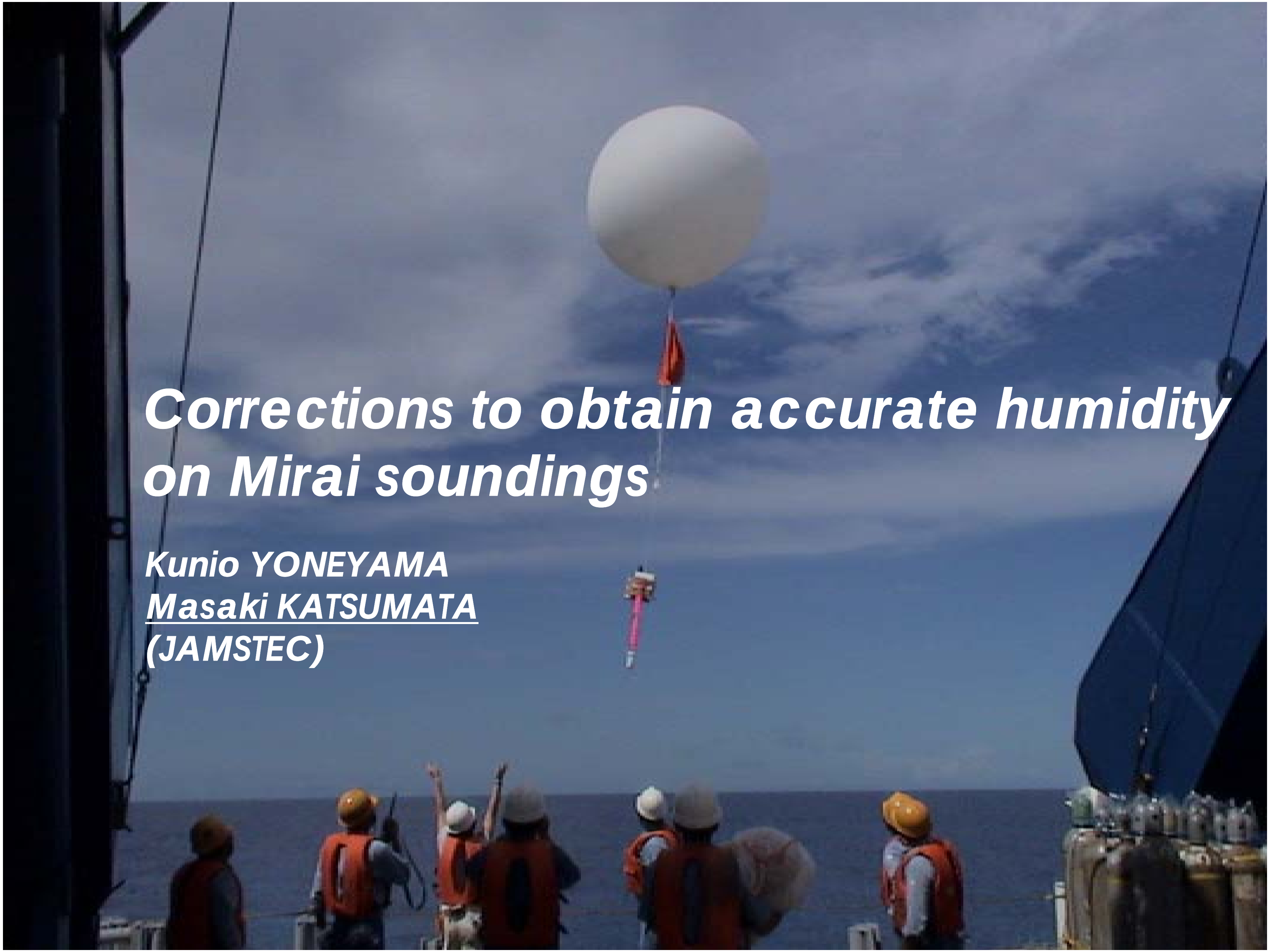
Summary

- In MISMO and past observations in TWP (both using 200-g balloons), 90% of soundings reaches 19-km height, but less than 20% penetrate over 25-km height.

- The 200-, 300- and 350-g balloons were examined in project PALAU2010 in TWP.

- More 200-g balloon reached 23-km height than 300- or 350-g balloons, while 300-g balloon is better to reach 25-km height (but only 60%)

- 350-g balloons were unfavorable in Mirai in (1) reduced ascent speed, and (2) difficulties in operation.



Corrections to obtain accurate humidity on Mirai soundings

Kunio YONEYAMA
Masaki KATSUMATA
(JAMSTEC)

How to obtain precise humidity data

Precise measurement is essential for observations.

In particular, humidity is one of the most important parameters for the study of initiation process of MJO convection. However, it is well known that Vaisala radiosonde, which will be used at all sounding sites in the CINDY2011 field campaign, often shows dry bias.

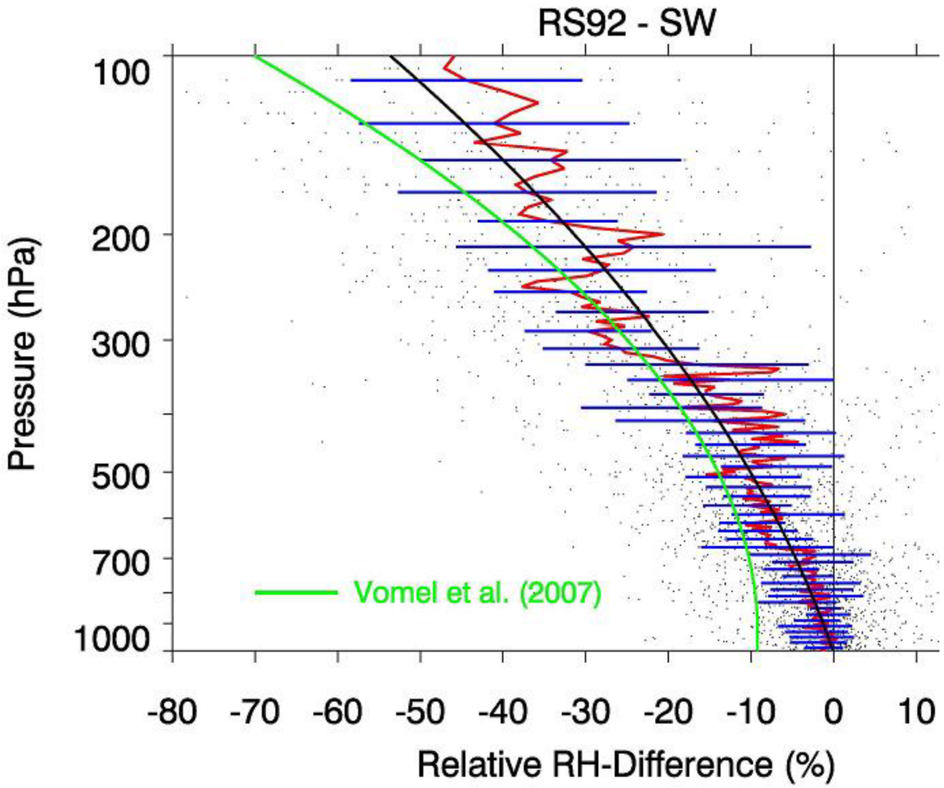
Here, two previous works to remove humidity errors will be noted.

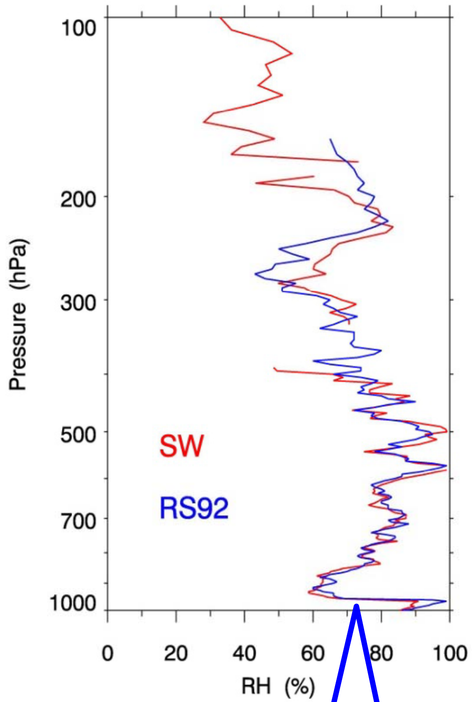
(1) Dry bias by solar-radiation

(2) Near-surface contamination by ship body

Comparison with Snow-White sonde

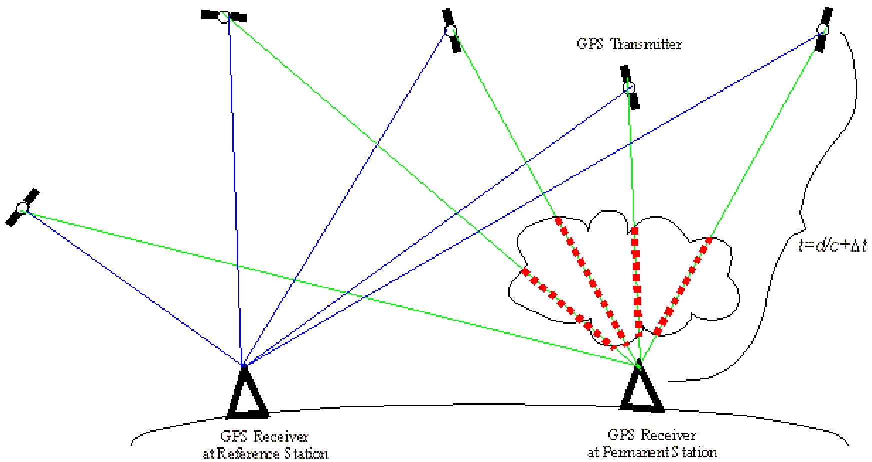
During MISMO, we launched "Snow-white" chilled-mirror dew/frost-point hygrometers simultaneously with RS92 sonde 15 times (14 times were launched near local noon).

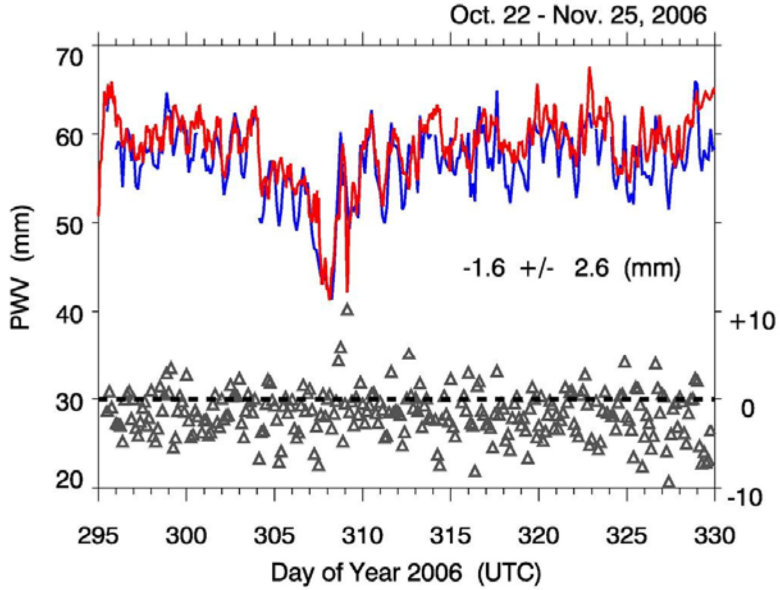


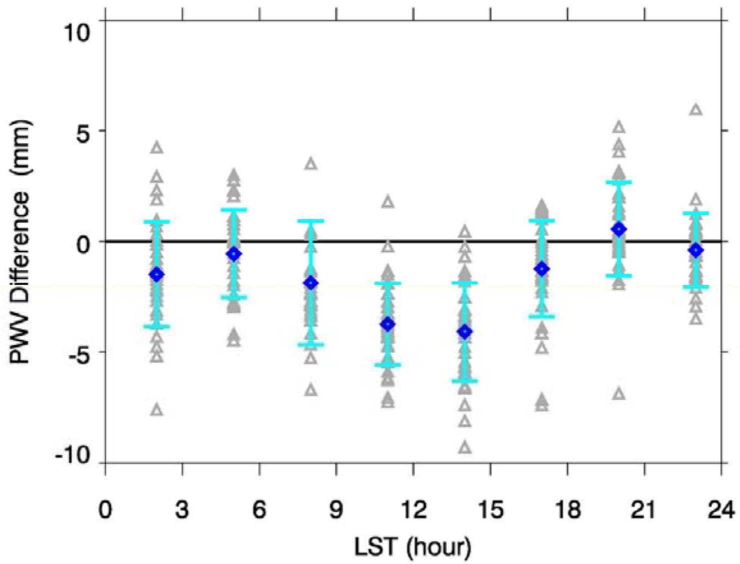


One case of local evening launch.

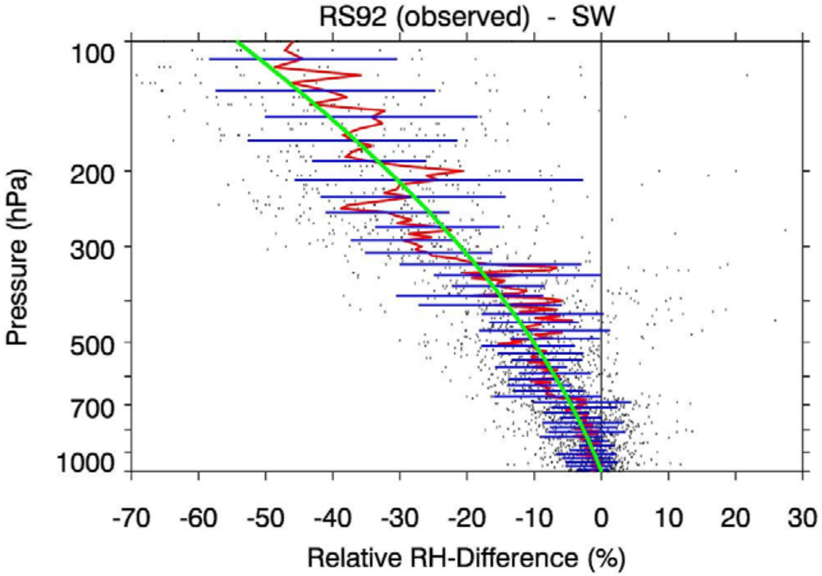
Comparison with GPS-derived Precipitable Water Vapor

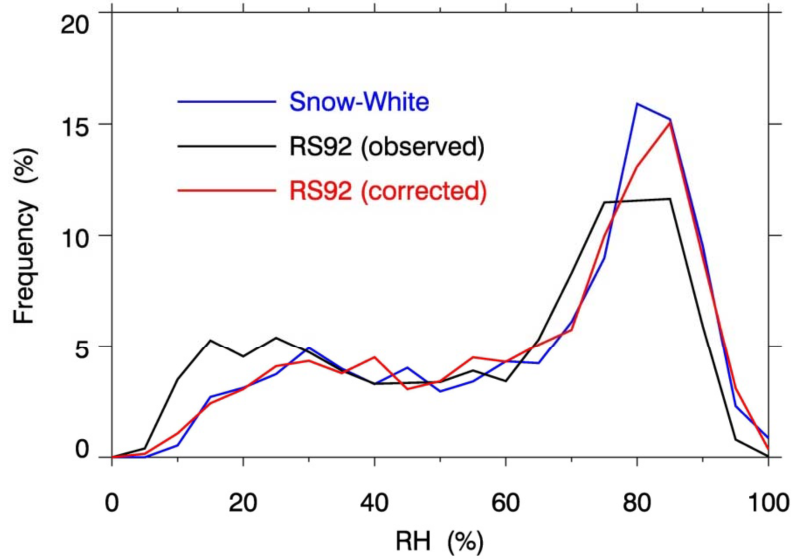






Correction scheme as a function of pressure and local time





$$RHcor = \frac{100}{100 + c \times RHdif} RHobs$$

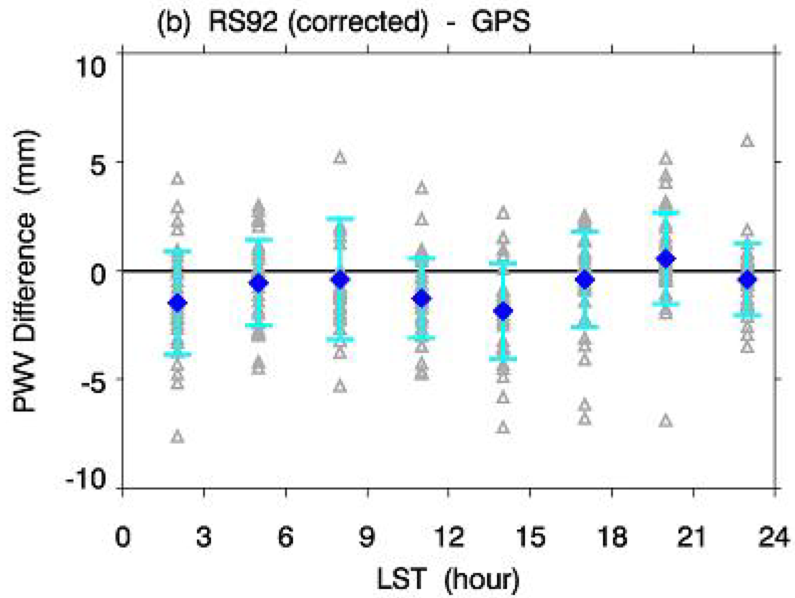
where,

RHcor : corrected RH,

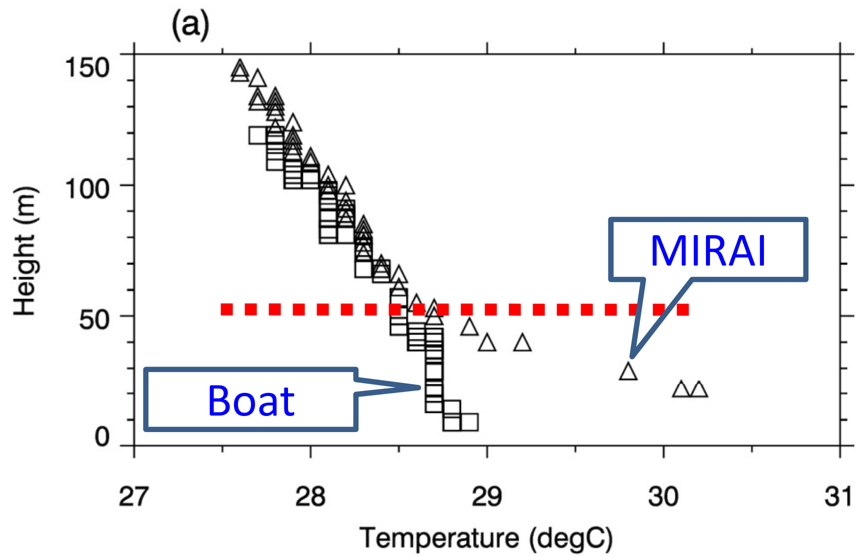
RHobs : observed RH,

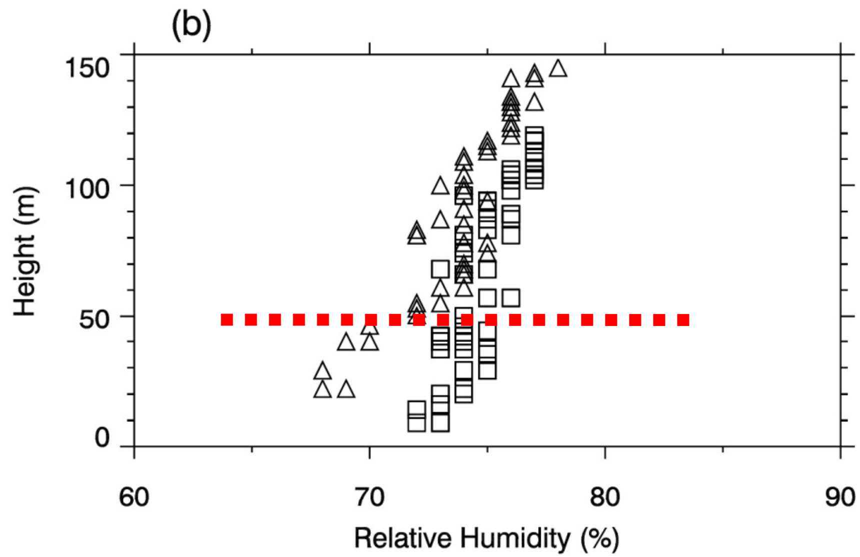
$RHdif = -5.61 (\ln P)^{2} + 88.17 (\ln P) - 341.51,$

$c = \cos \theta / \cos (23.1)$

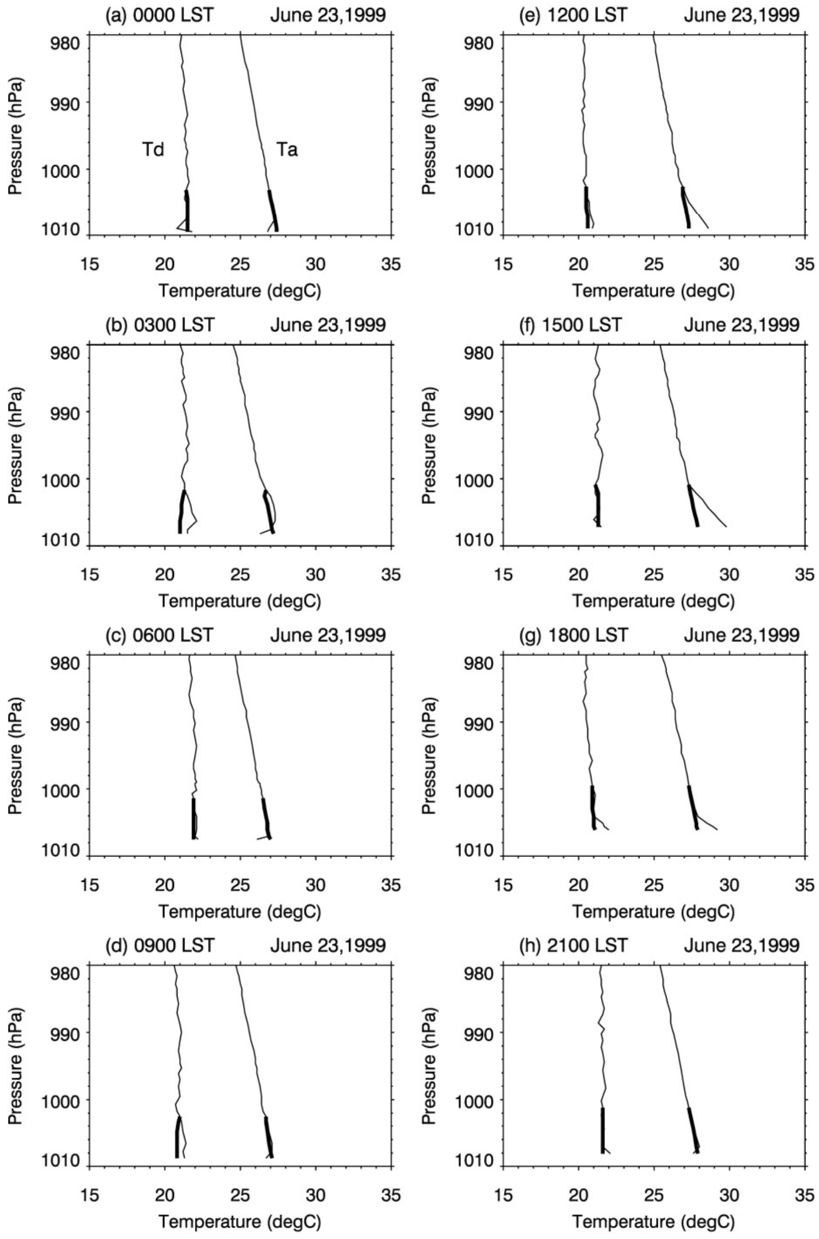


Near-surface profile over Mirai and over Small Boat





Correction by Extrapolation



Data within 6hPa from the surface is replaced with one that is calculated from linear extrapolation using data in 6-18 hPa layer above the surface.

Tips for Precise Radiosonde Measurement

Below are some recommendation to obtain precise radiosonde data. Some of them are noted in Yoneyama et al. (2002, JAMSTECR) and Miloshevich et al. (2009, JTECH).

1) **Use "new" radiosonde** as much as possible. Old aged sondes degrade easily due to a chance of contamination. It is recommended to use sondes **younger than 1 year** from the manufacture calibration. Serial number indicates sonde age.

2) Keep **desiccant dry (use fresh one)**, which is used for ground check. Calibration chamber should be tightly sealed.

3) Save and **archive raw PTU data** in case correction is needed in future.

4) **Record the surface meteorological parameters** when launch, as much as possible. These data may be used to develop a correction scheme when dry bias is found.

5) To avoid round-off error of ±0.5%, it is recommended **FLEDT data** (with two decimal places) be archived.

Requirements for Radiosonde Observations

- ***Full Cycle of MJO***
  - *enough long period*
  - *minimize temporal gap (esp. by absence of vessels by port call)*
  - *wide coverage to surround CINDY core area (esp. along equator)*

- ***Diabatic Heating / Drying***
  - *quadrilateral array*
  - *6-hourly or more frequency*

- ***Water Vapor Distribution***
  - *accurate calibration on humidity*
  - *high vertical resolution*
  - *enable post-processing … archive raw data*

- ***Equatorial Waves***
  - *well cover whole troposphere … trade-off to logistics, handing, etc.*

- ***Diurnal Cycle***
  - *launch 4 times / day, or more*

Items to be coodinated

1) Frequency of Radiosonde sounding at each site

2) Sampling rate during ascent
   It should be high resolution, 2 sec is required

3) Balloon size for sounding from ship; 200 g or 300 g ?

4) Exact launch time
   ex. “02:30” for nominal “0300” UTC
   WMO Guide requests the launch btwn 45-15 min
   prior to nominal time.

5) Data correction
   On-board the MIRAI, simultaneous launch of SW (or CFH) and RS92
   is planned several times.
   GPS-derived water vapor may help correction.

6) Data exchange
   GTS … objective analyses, archiver (U.Wyoming, NOAA/ESRL, etc.)
   Transaction between sites (monitor and quasi-real-time analyses)