

Diagnostic Studies Using SoWMEX/TiMREX Sounding Data

Richard H. Johnson

Paul E. Ciesielski

Colorado State University

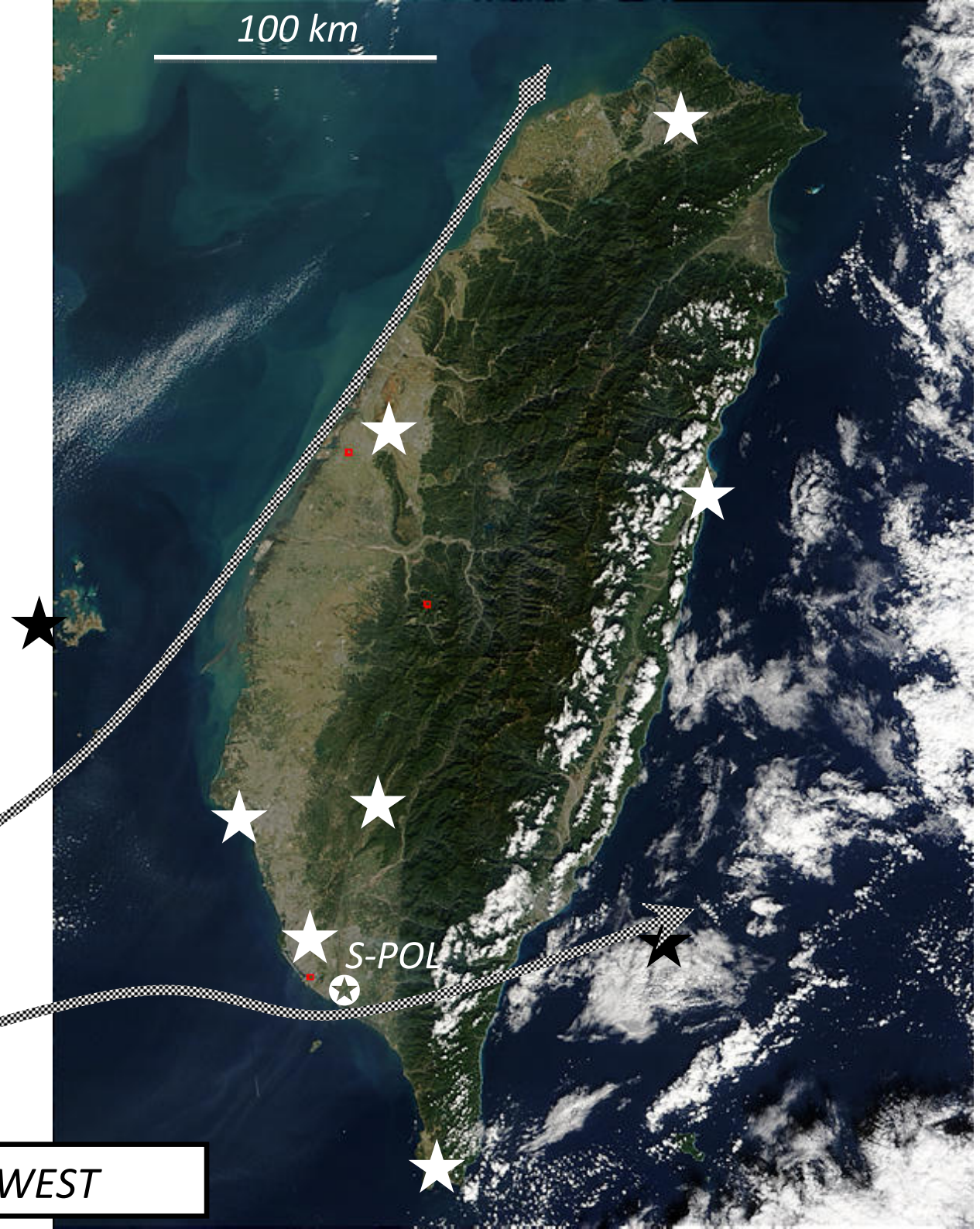
2nd SoWMEX/TiMREX Science Workshop

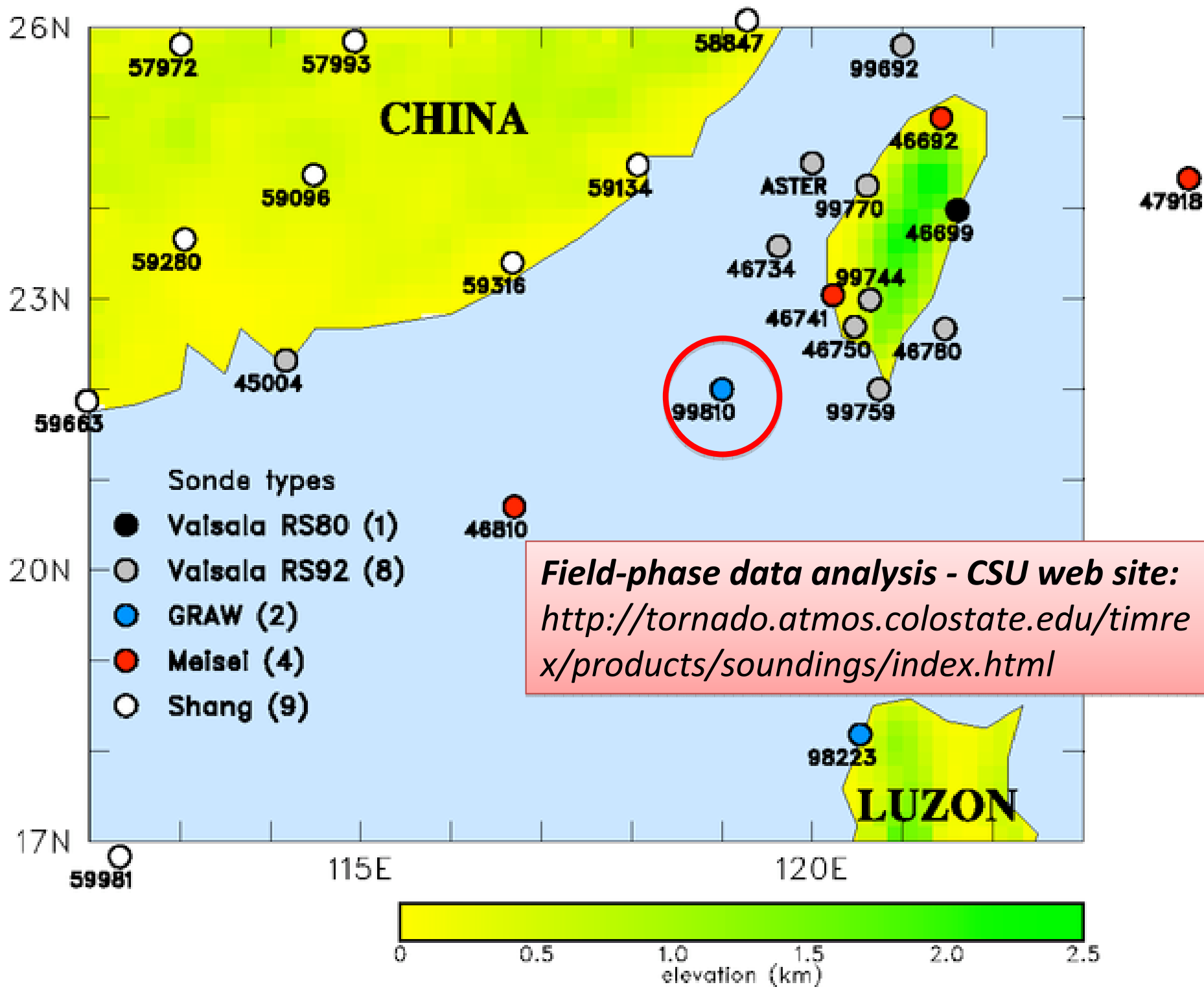
Taipei, Taiwan

20-22 October 2009

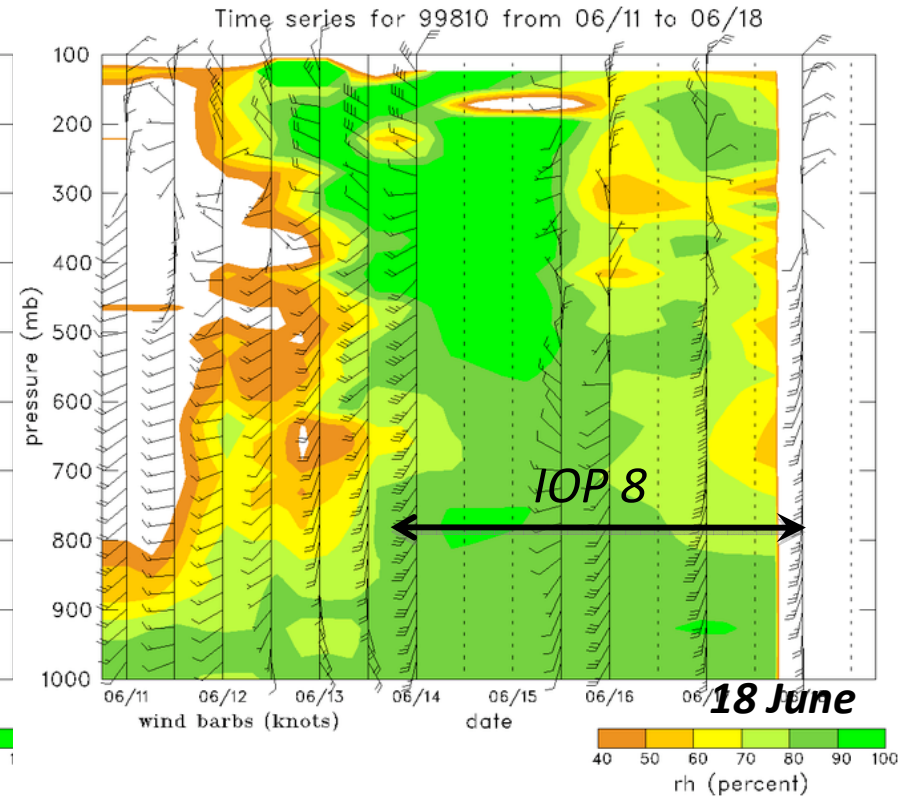
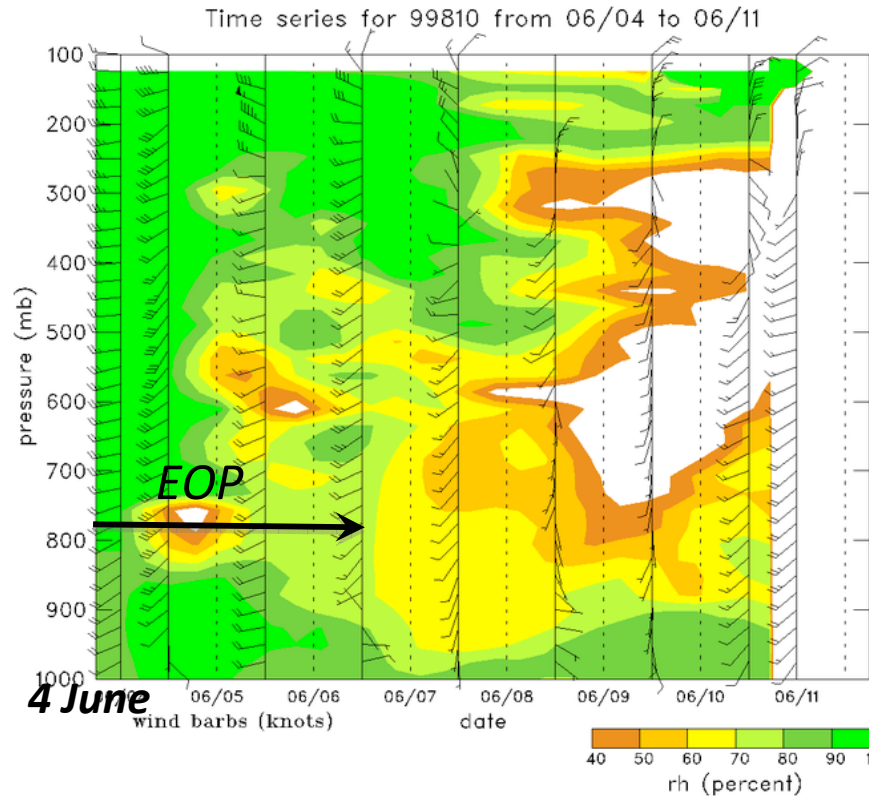
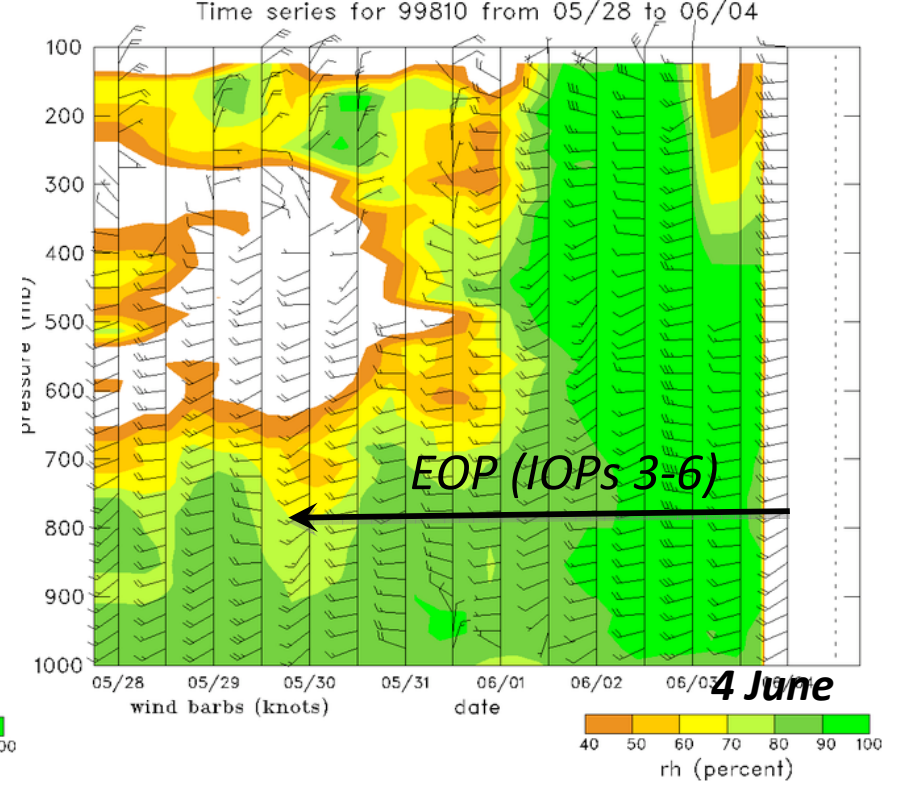
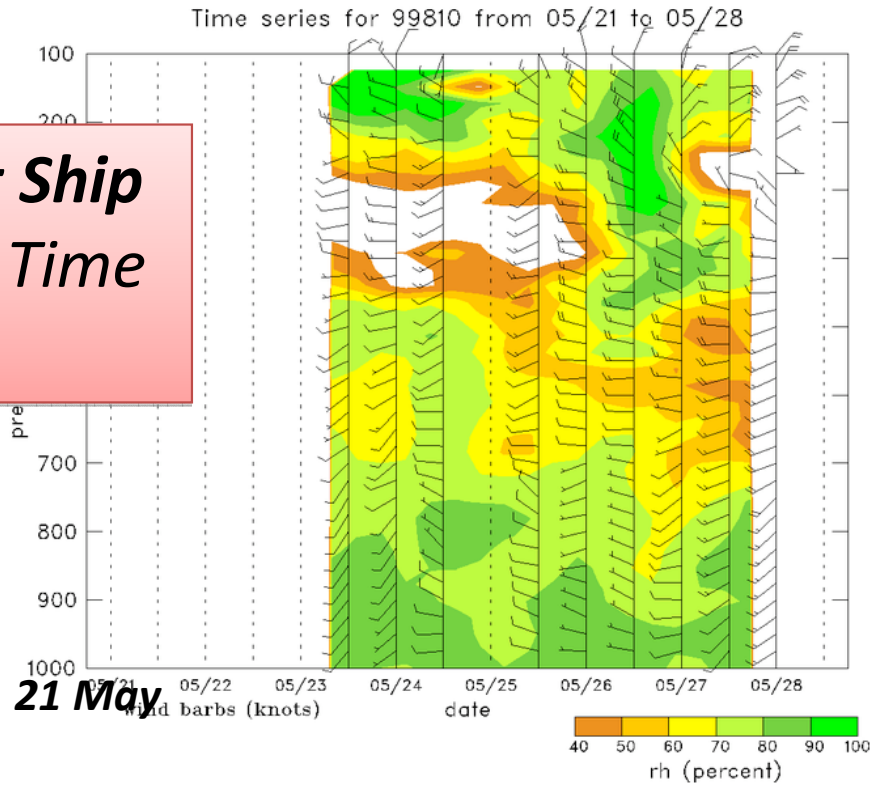
TiMREX Sounding Network

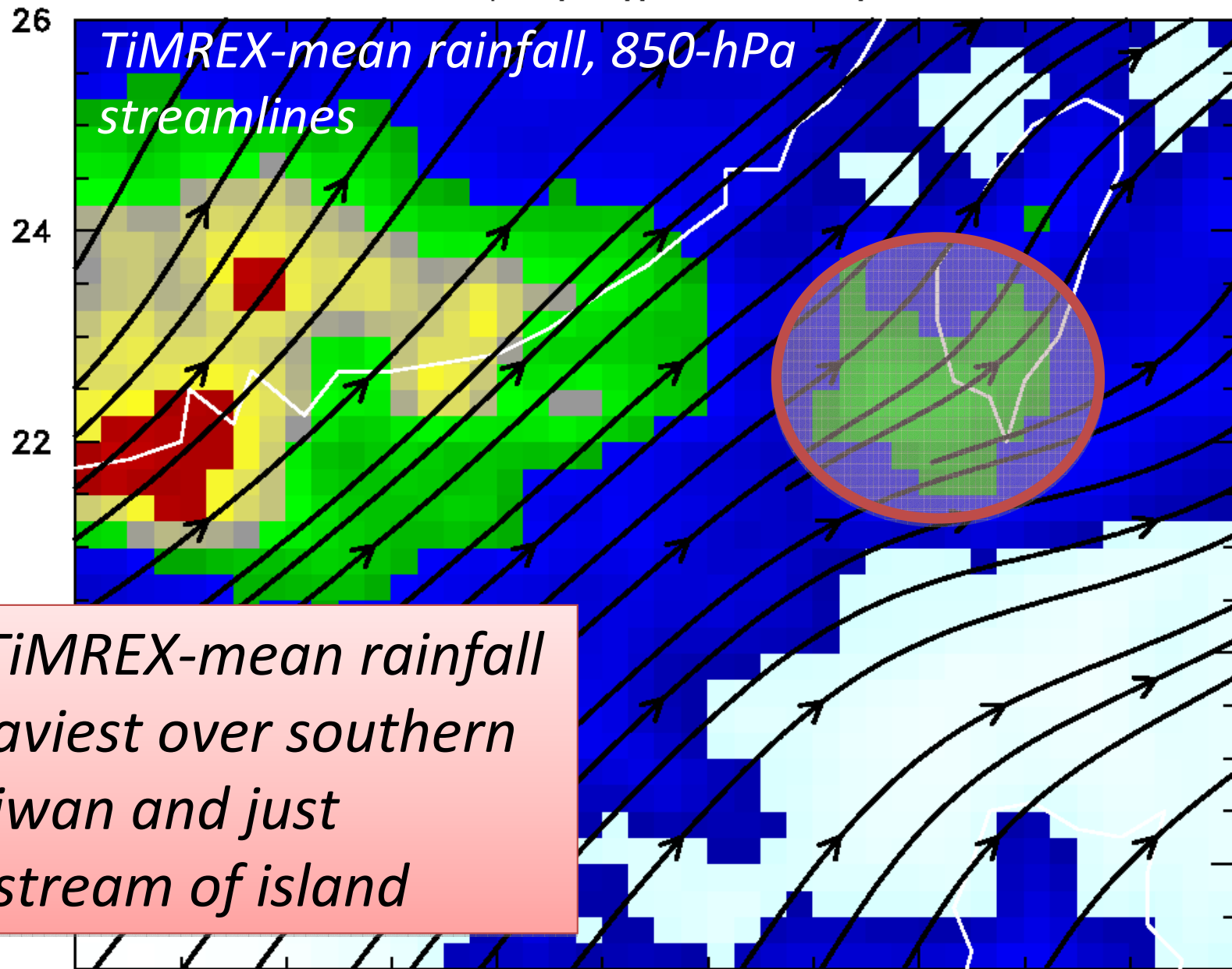
- *Nine IOPs; 15 dropsonde missions*
- *Quality-control efforts continuing (Paul's talk Weds.)*
- *Sounding, dropsonde, profiler, surface data will be integrated into gridded data set*



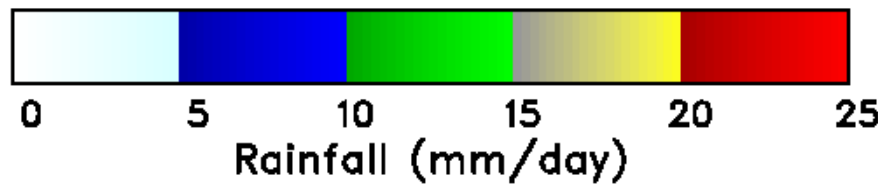


Southwest Ship Winds, RH Time Series

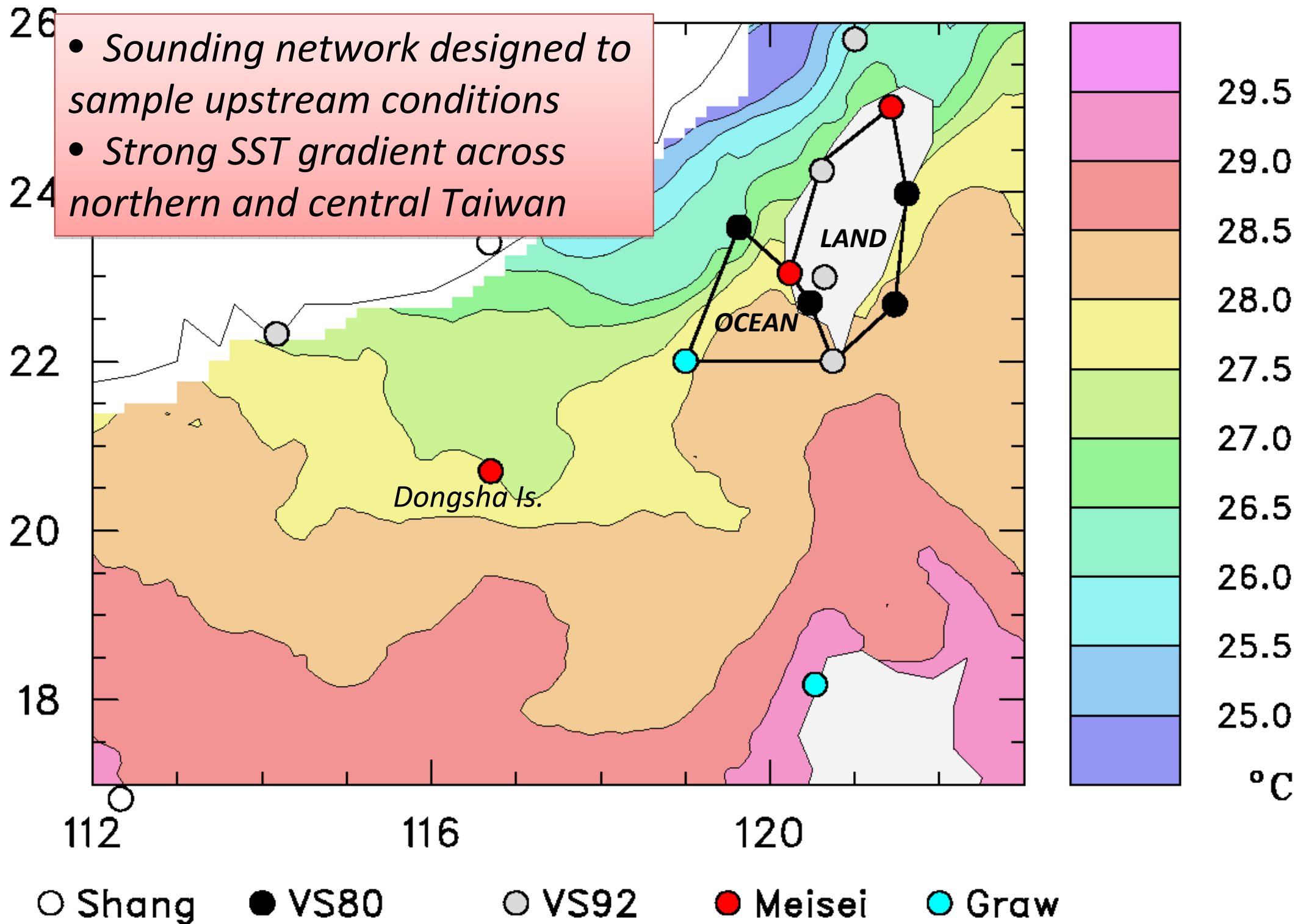




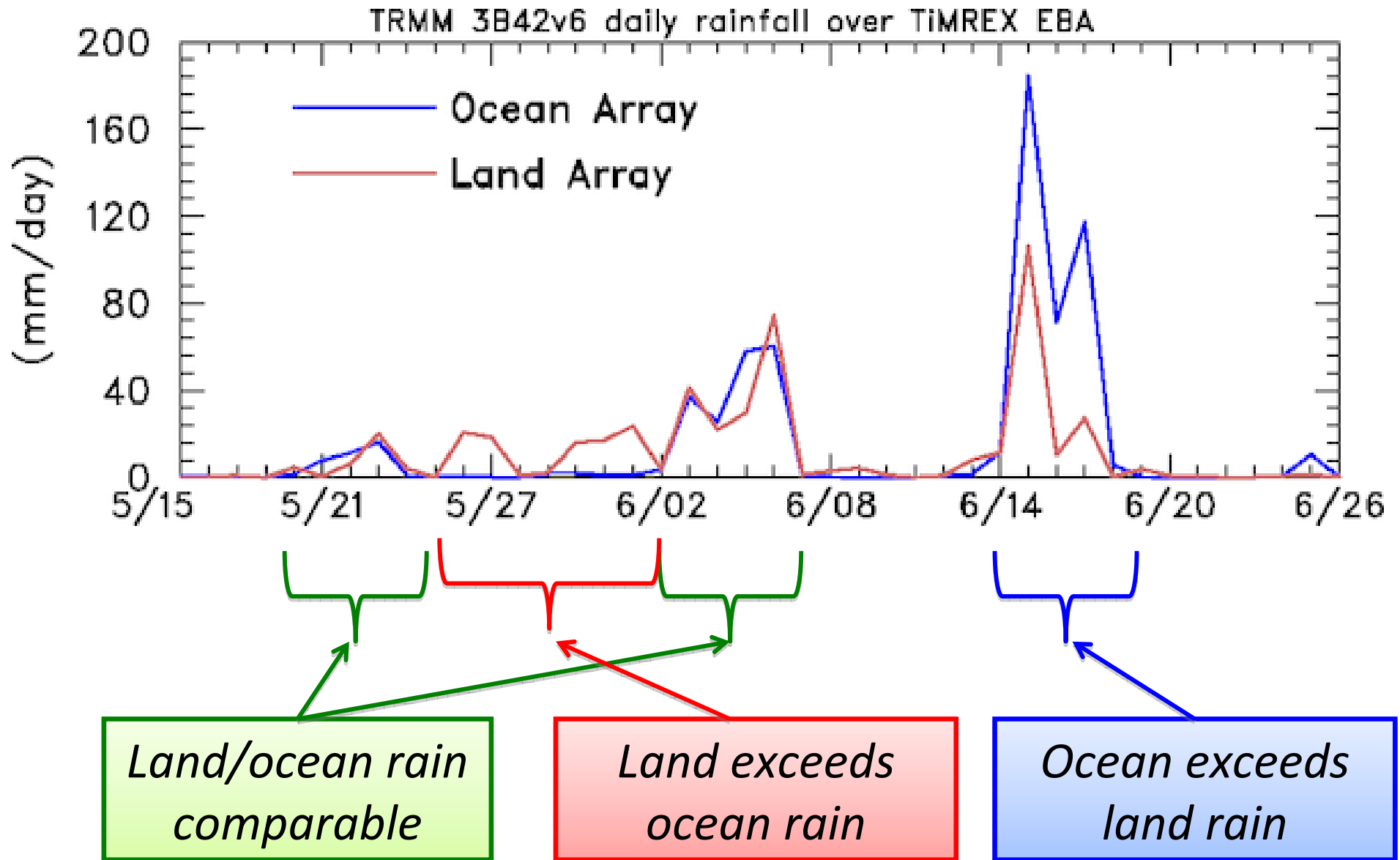
• *TiMREX-mean rainfall heaviest over southern Taiwan and just upstream of island*



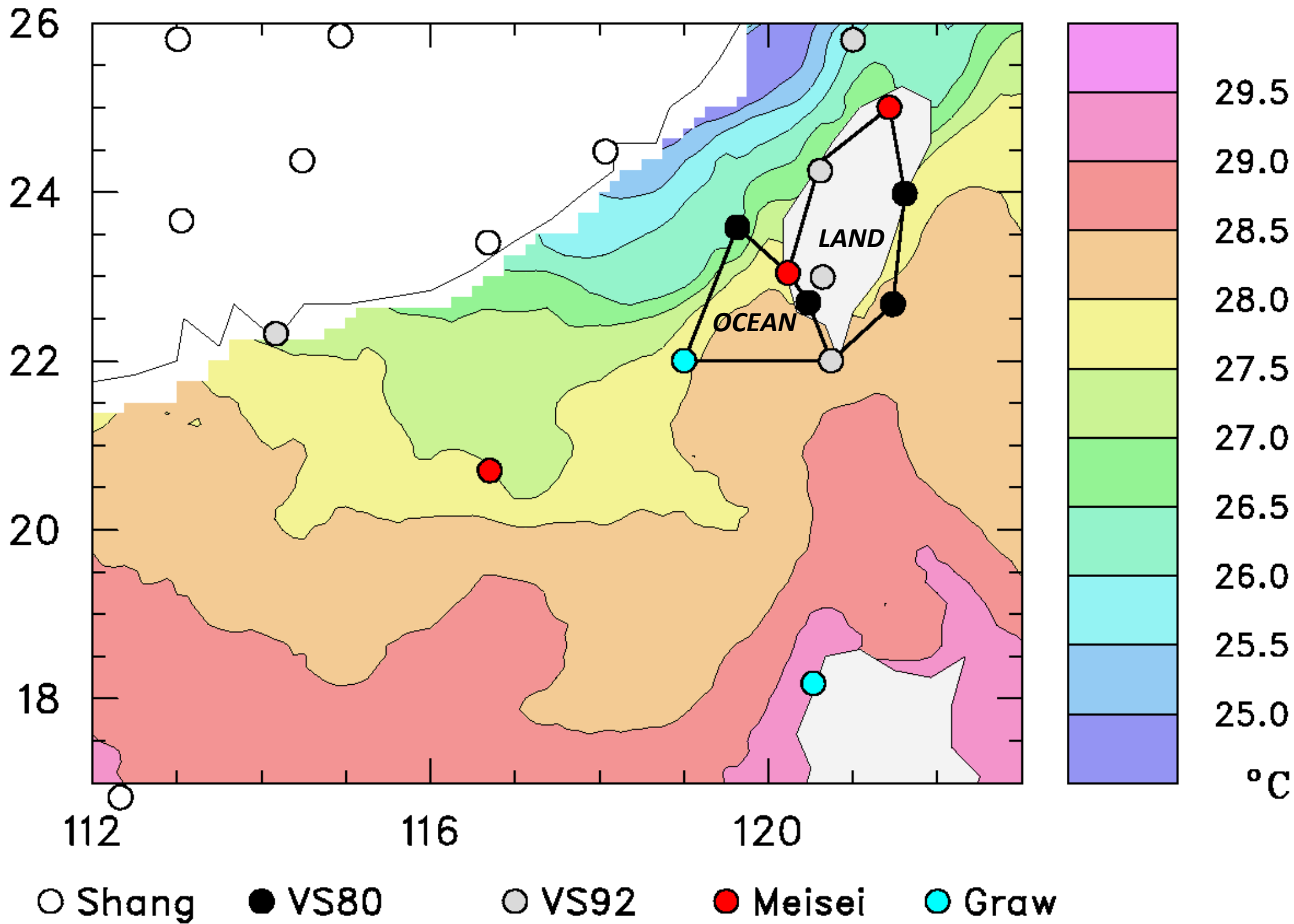
TiMREX Sounding Network and SST field 2009 (May-June)



Land/Ocean Rainfall Time Series

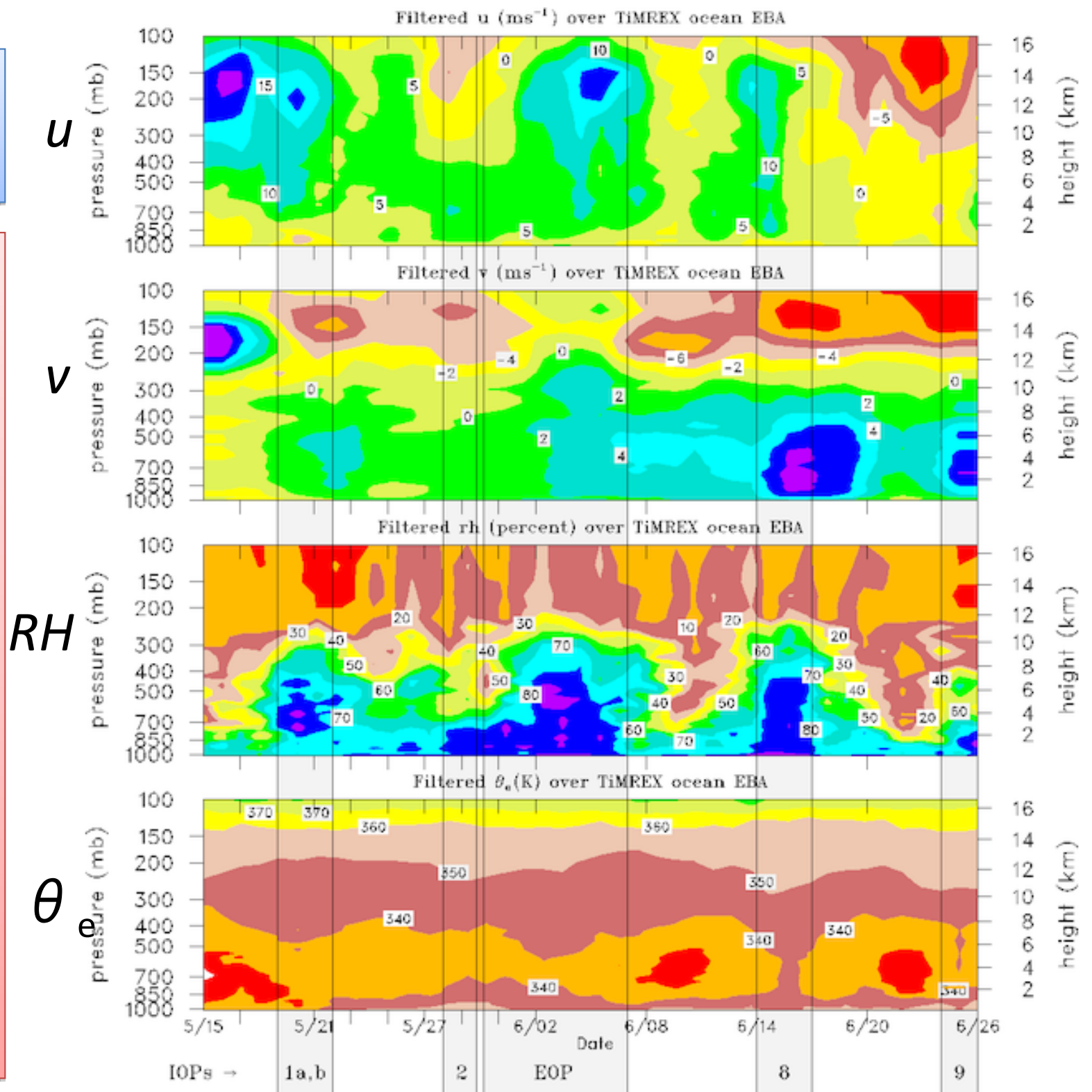


TiMREX Sounding Network and SST field 2009 (May-June)



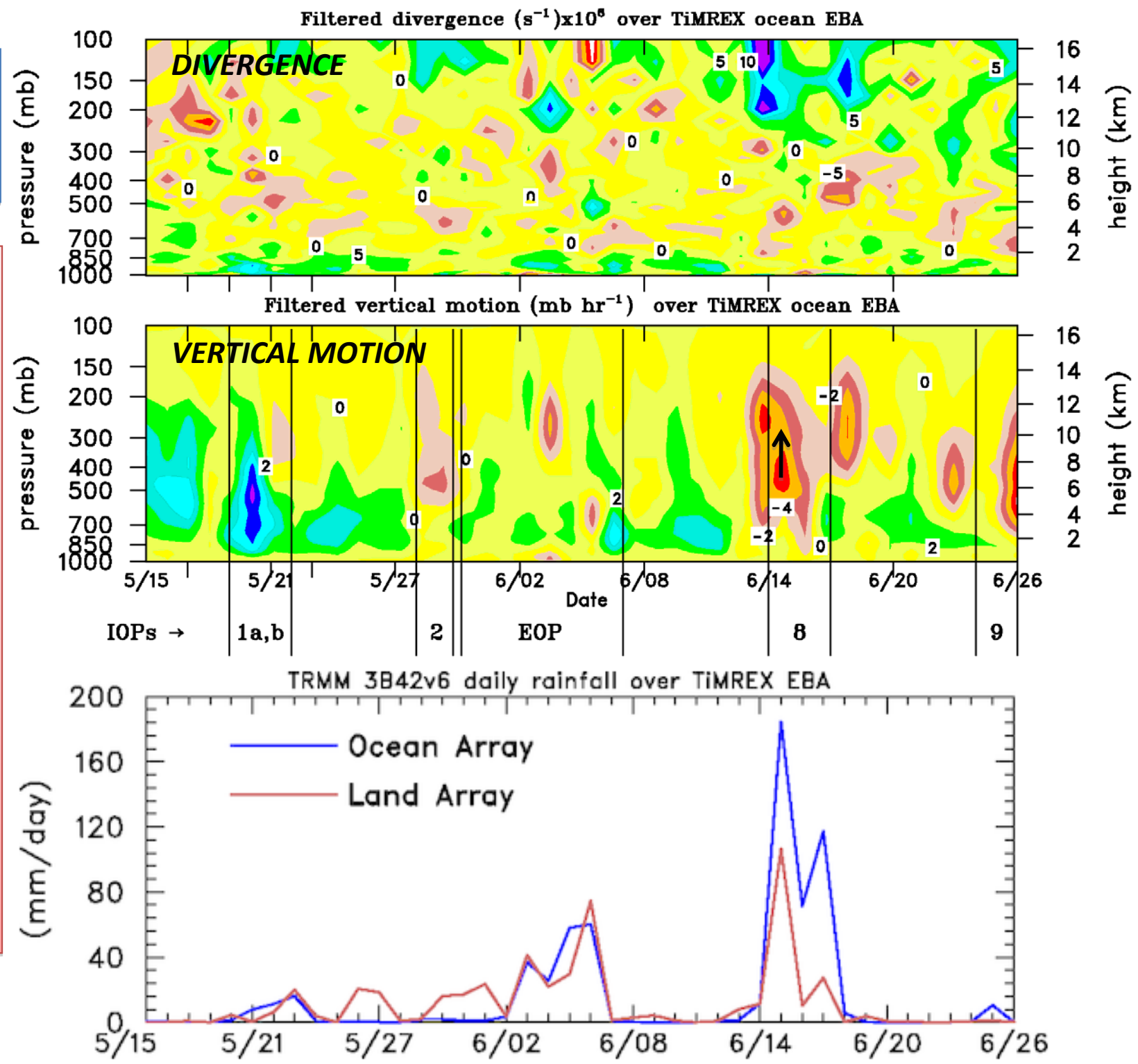
Ocean Time Series

During IOPs: enhanced southwest-erly flow, deep moisture, and increase in midlevel θ_e (reduced potential instability)



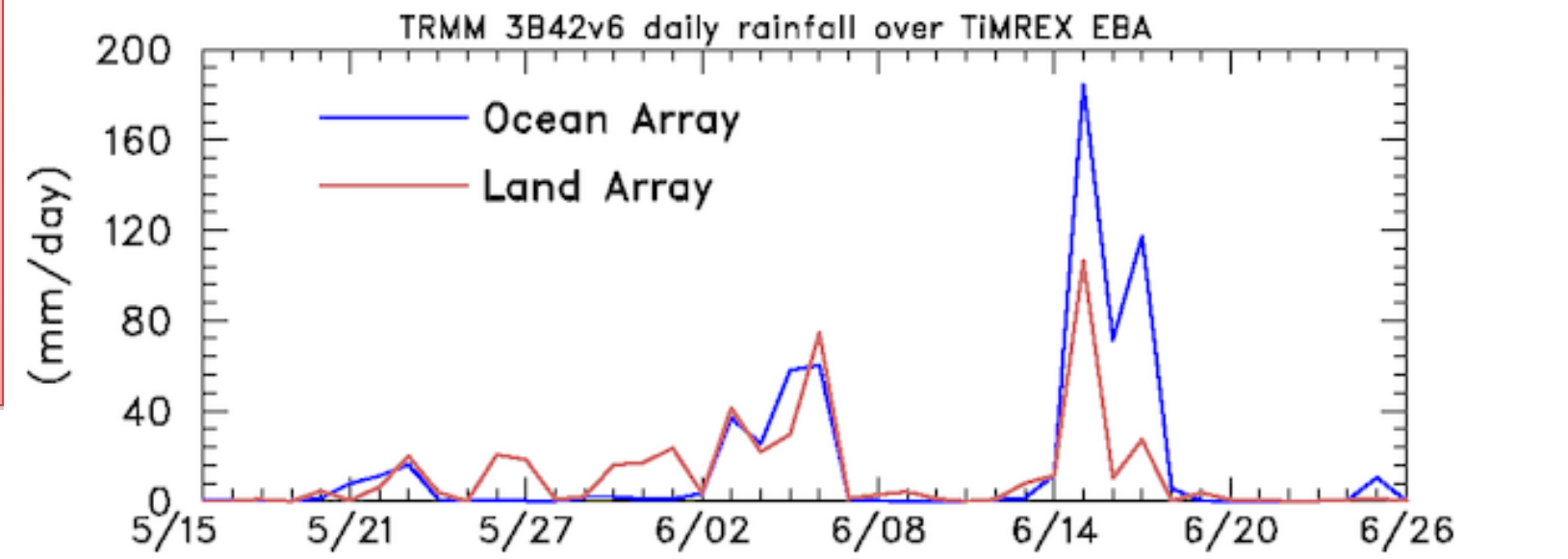
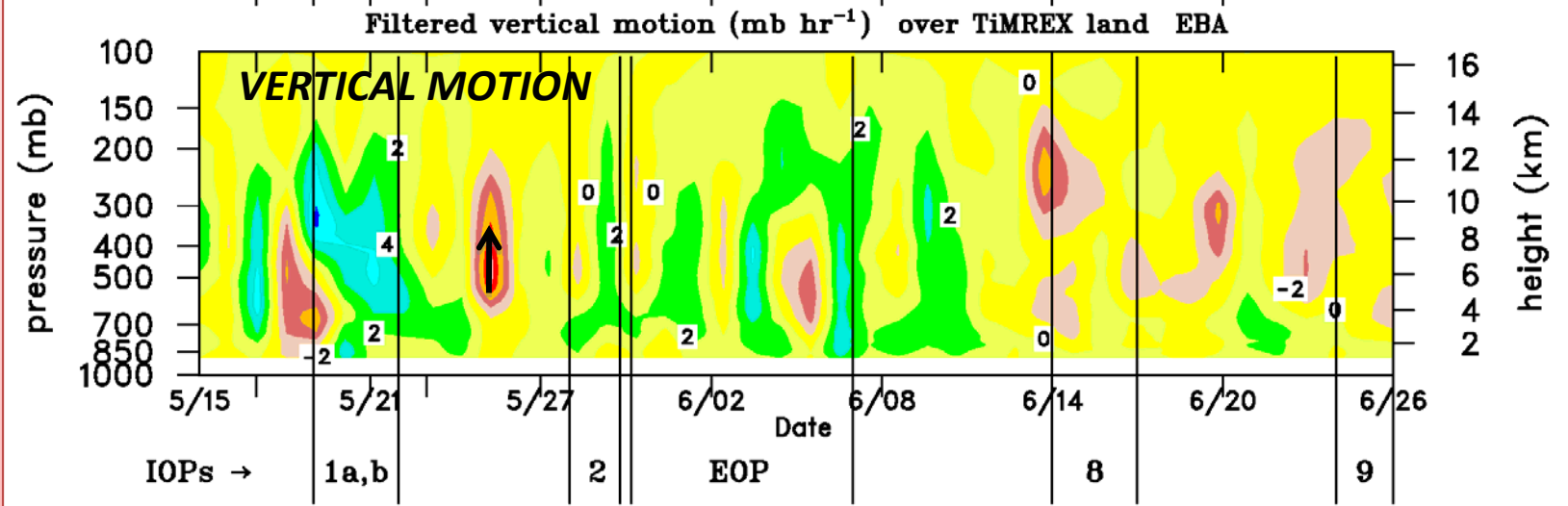
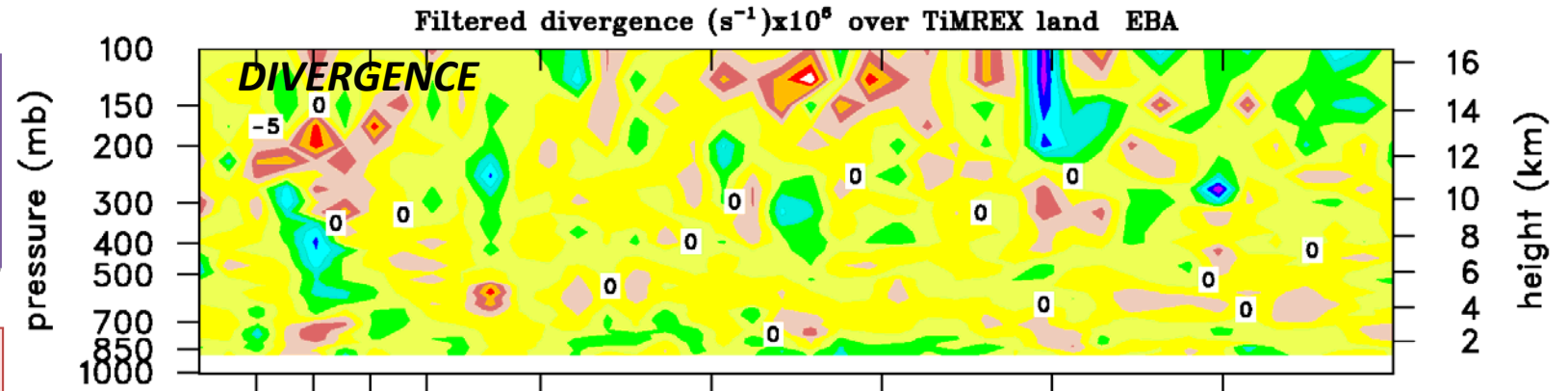
*Ocean
Time Series*

*Periods of
rainfall
over ocean
generally
correspond
to periods
of
diagnosed
upward
motion*

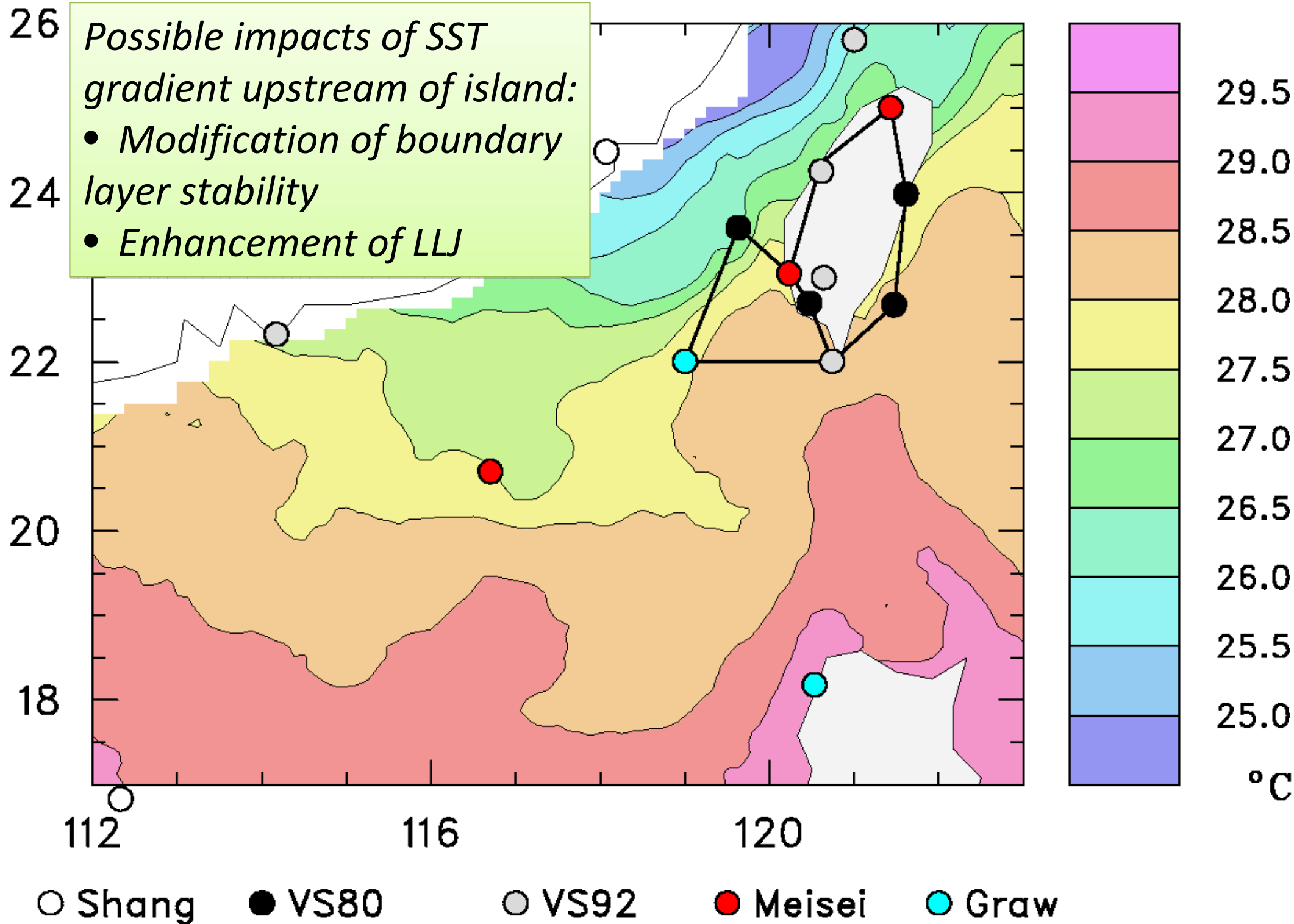


Land Time Series*

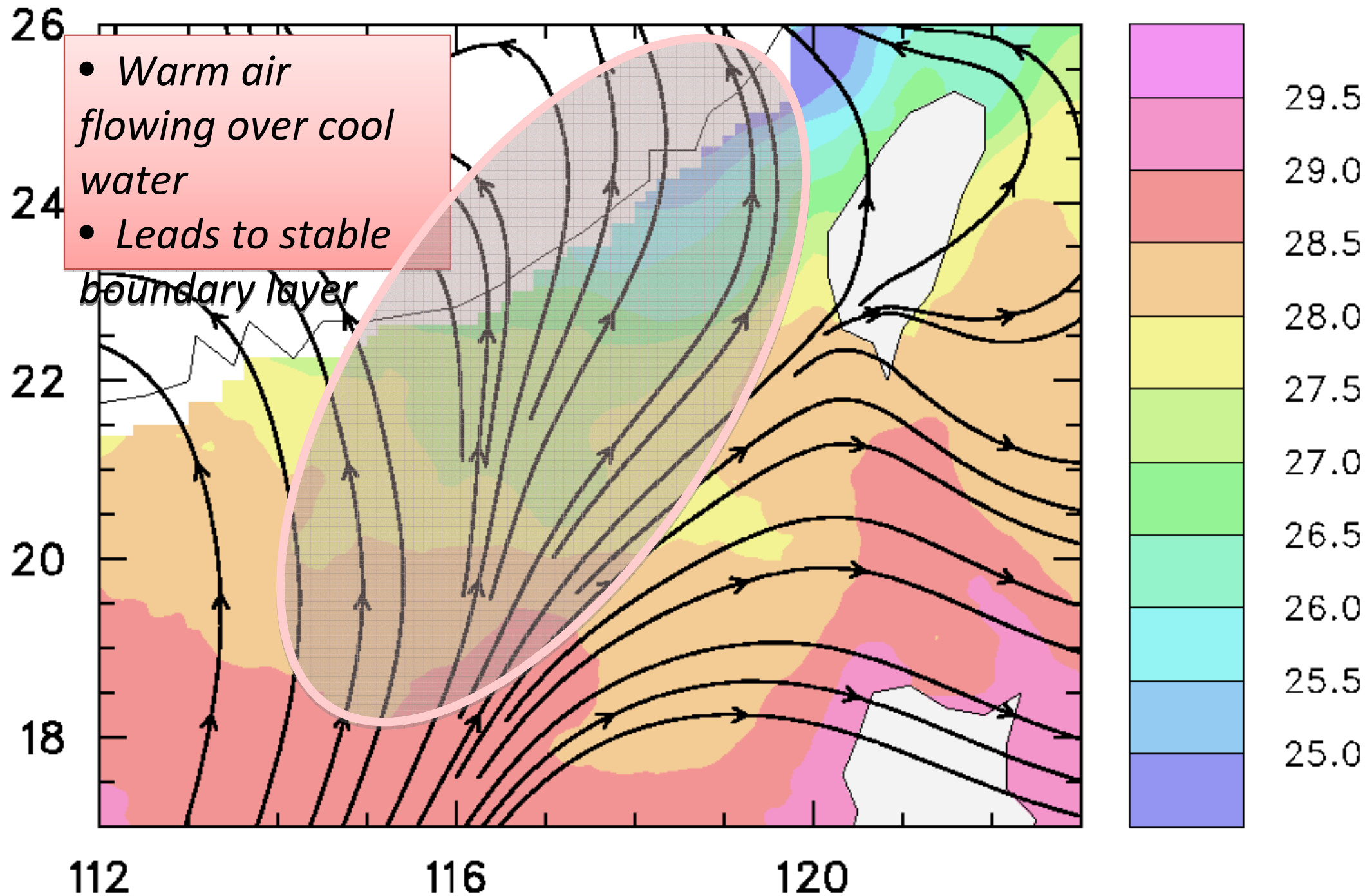
Periods of rainfall over land generally correspond to periods of diagnosed upward motion



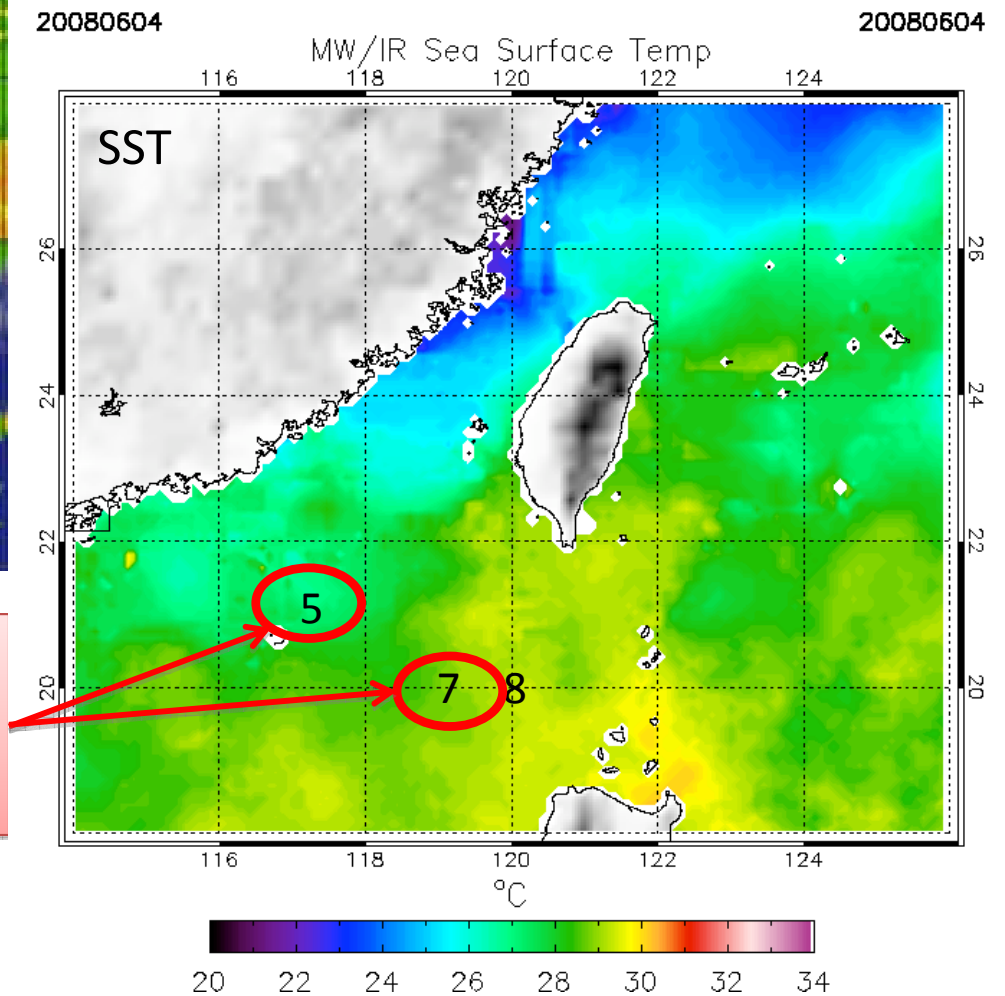
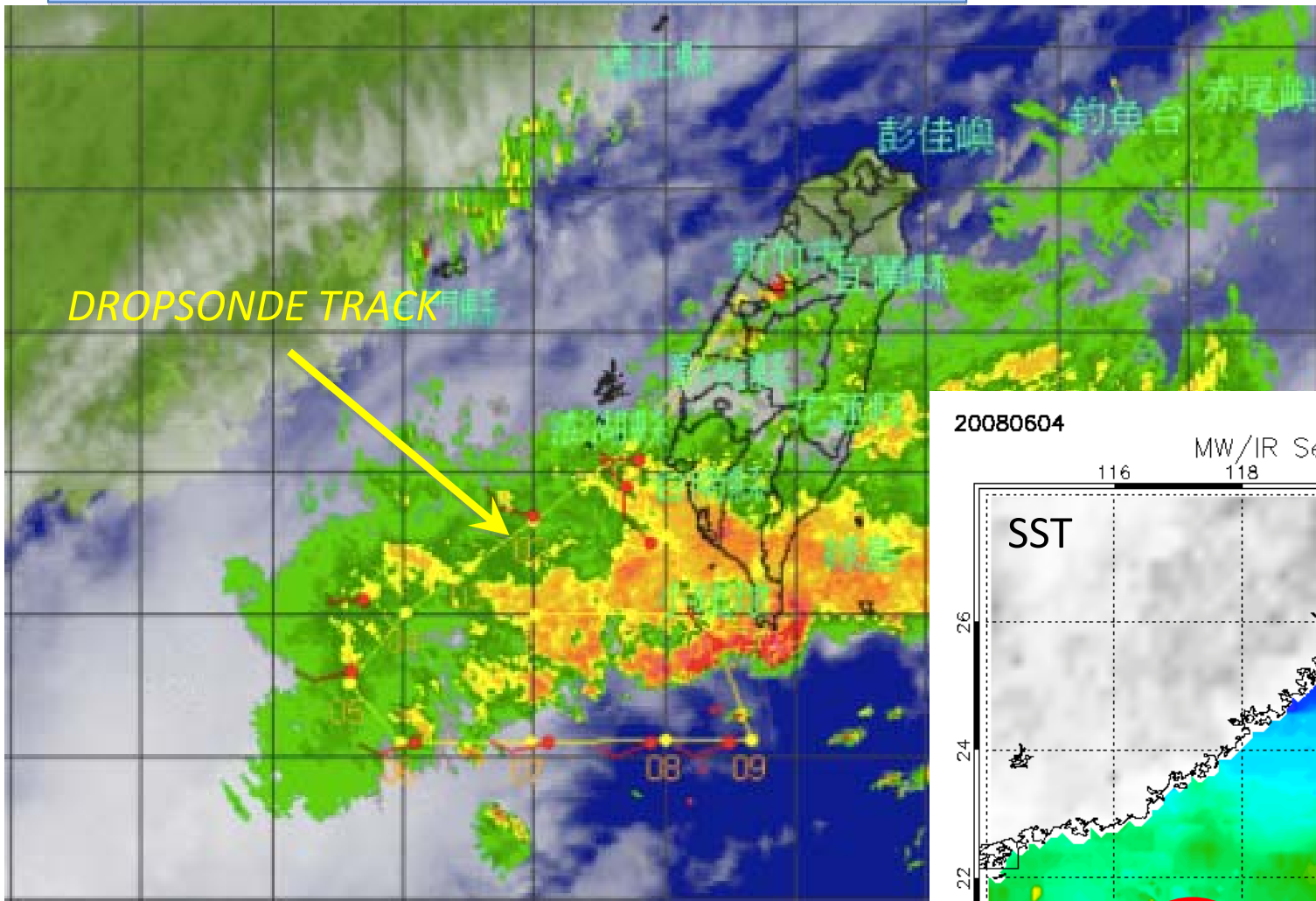
TiMREX Sounding Network and SST field 2009



SST and sfc streamlines for SOP (43 days)

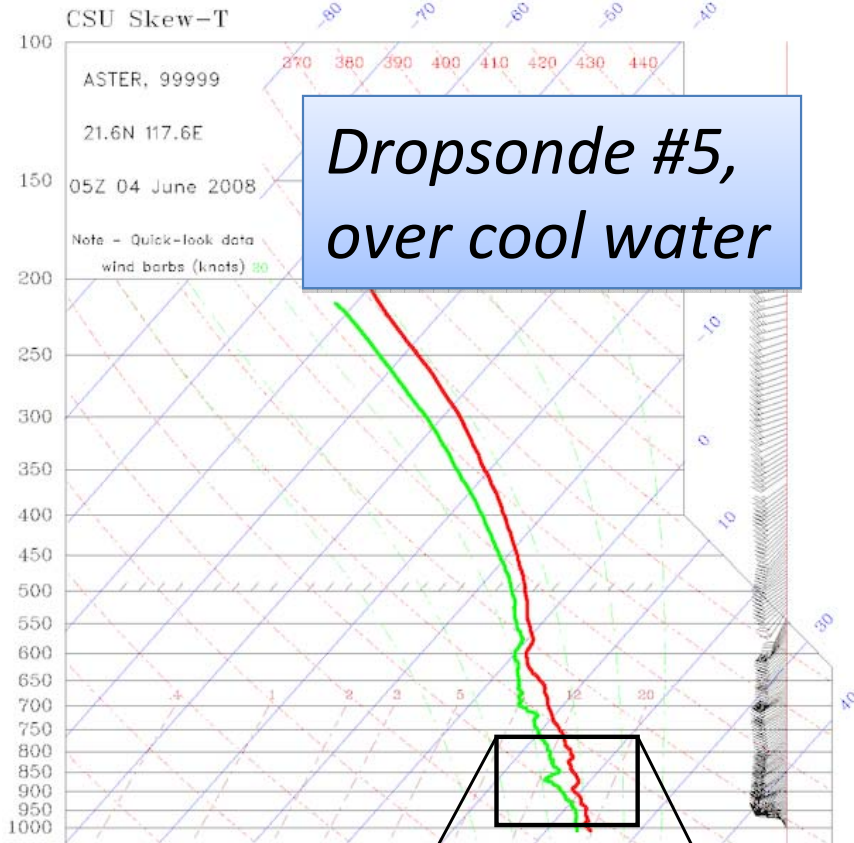


Dropsonde mission on 4 June 2008



Dropsonde #5 over cooler water, #7 over warmer water

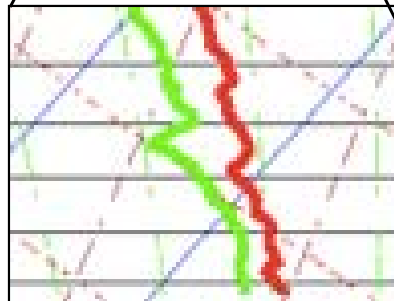
Stable boundary layer



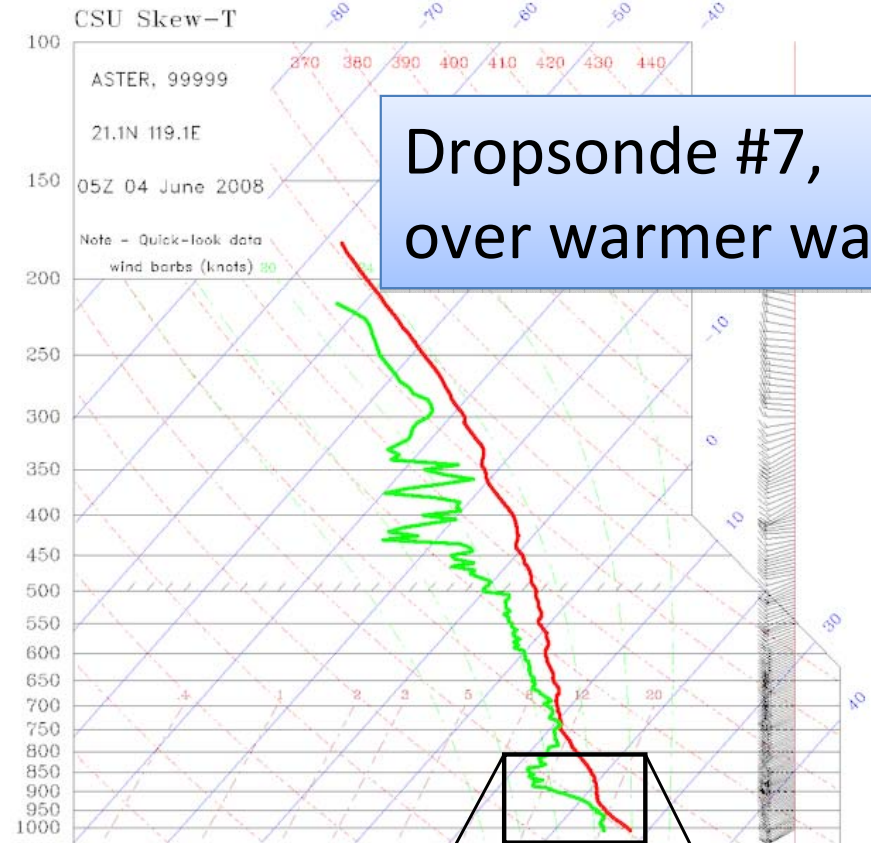
hPa

900

1000



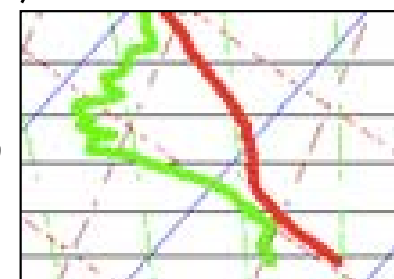
Well-mixed boundary layer



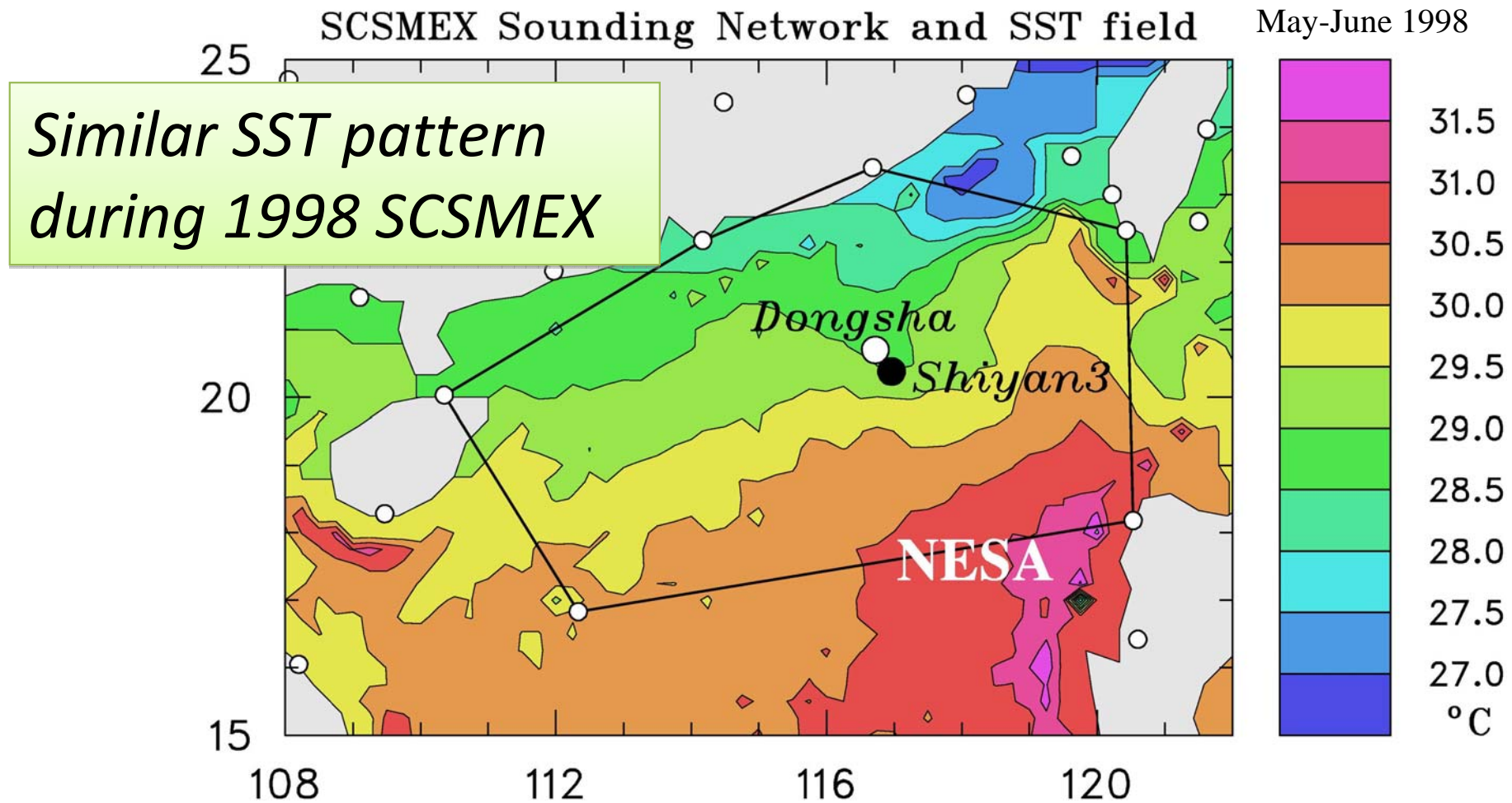
hPa

900

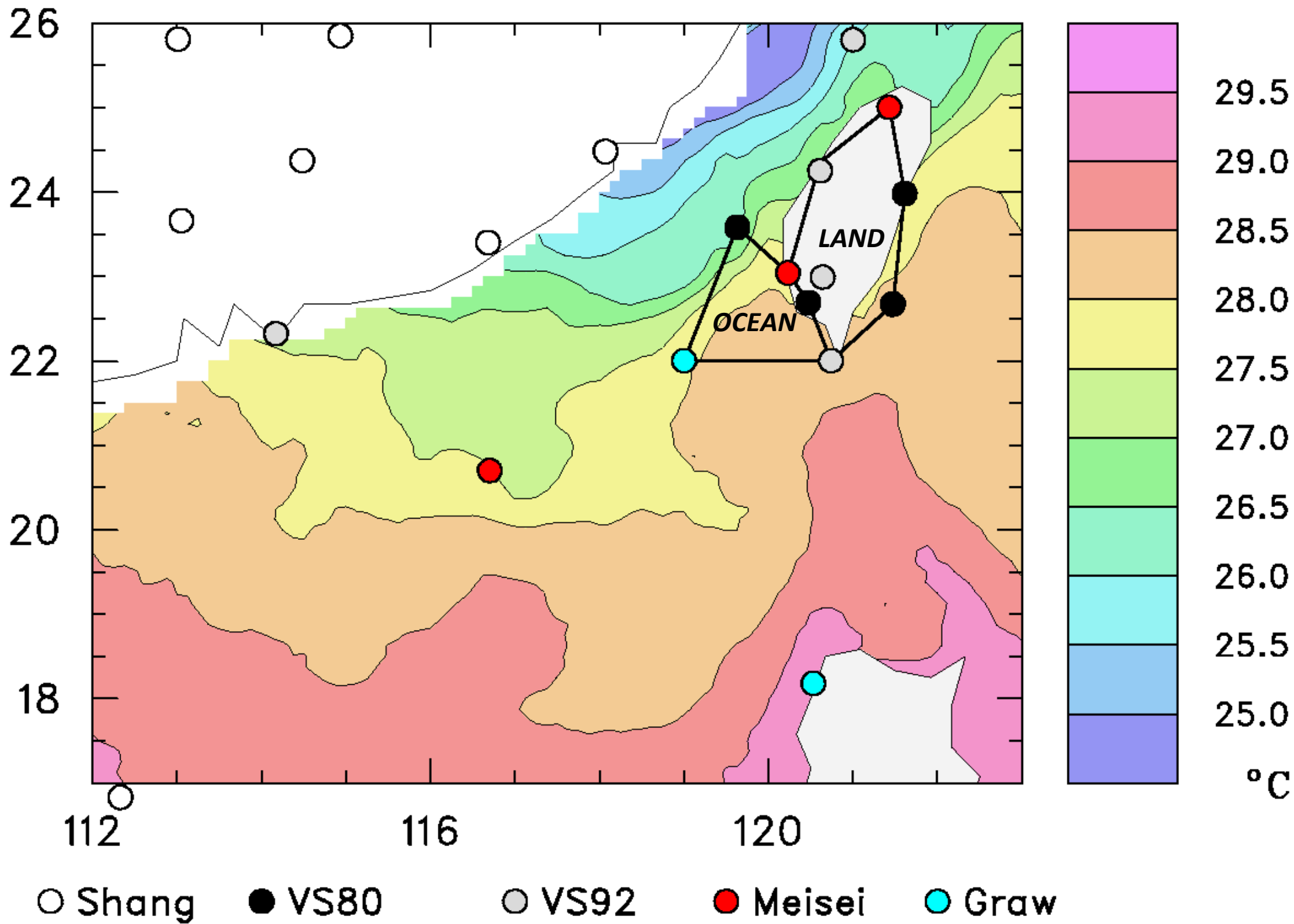
1000



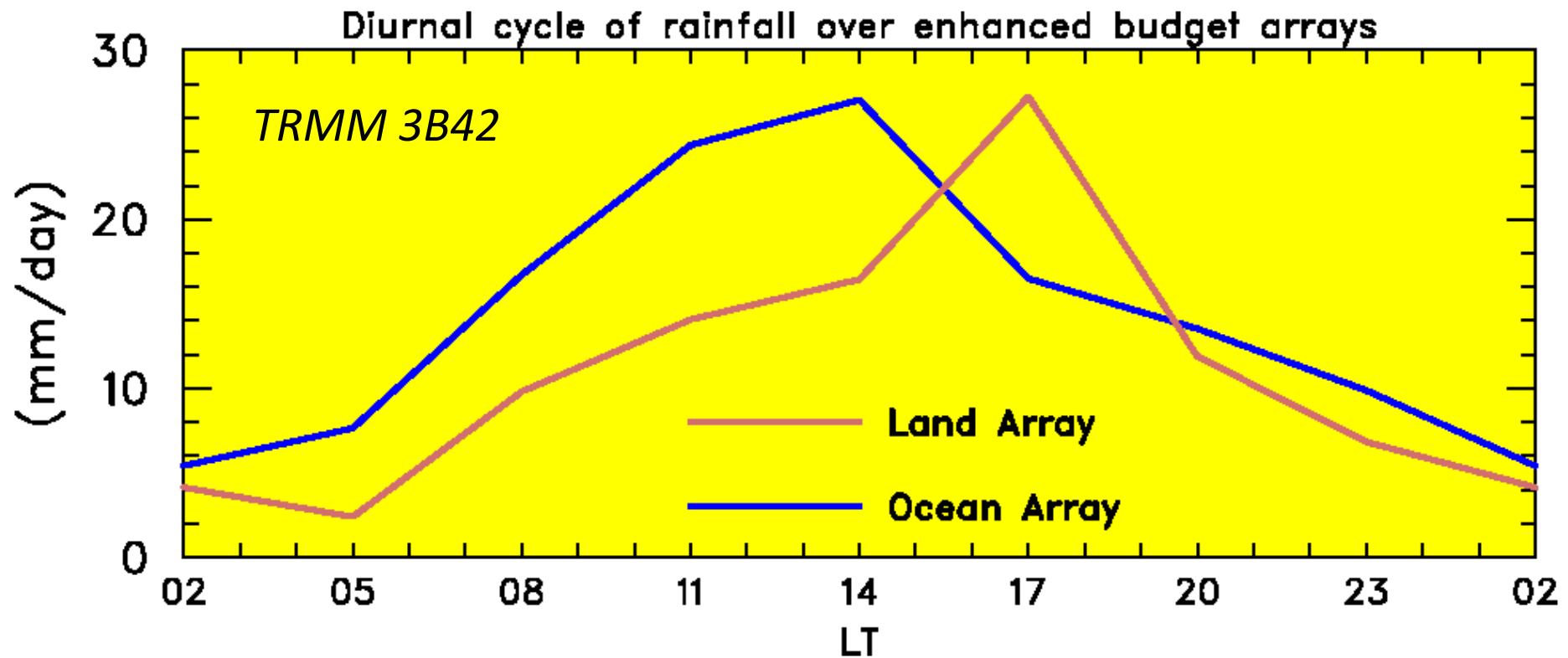
South China Sea Monsoon Experiment (SCSMEX) - May-June 1998



TiMREX Sounding Network and SST field 2009 (May-June)



Mean Diurnal Cycle of Rainfall

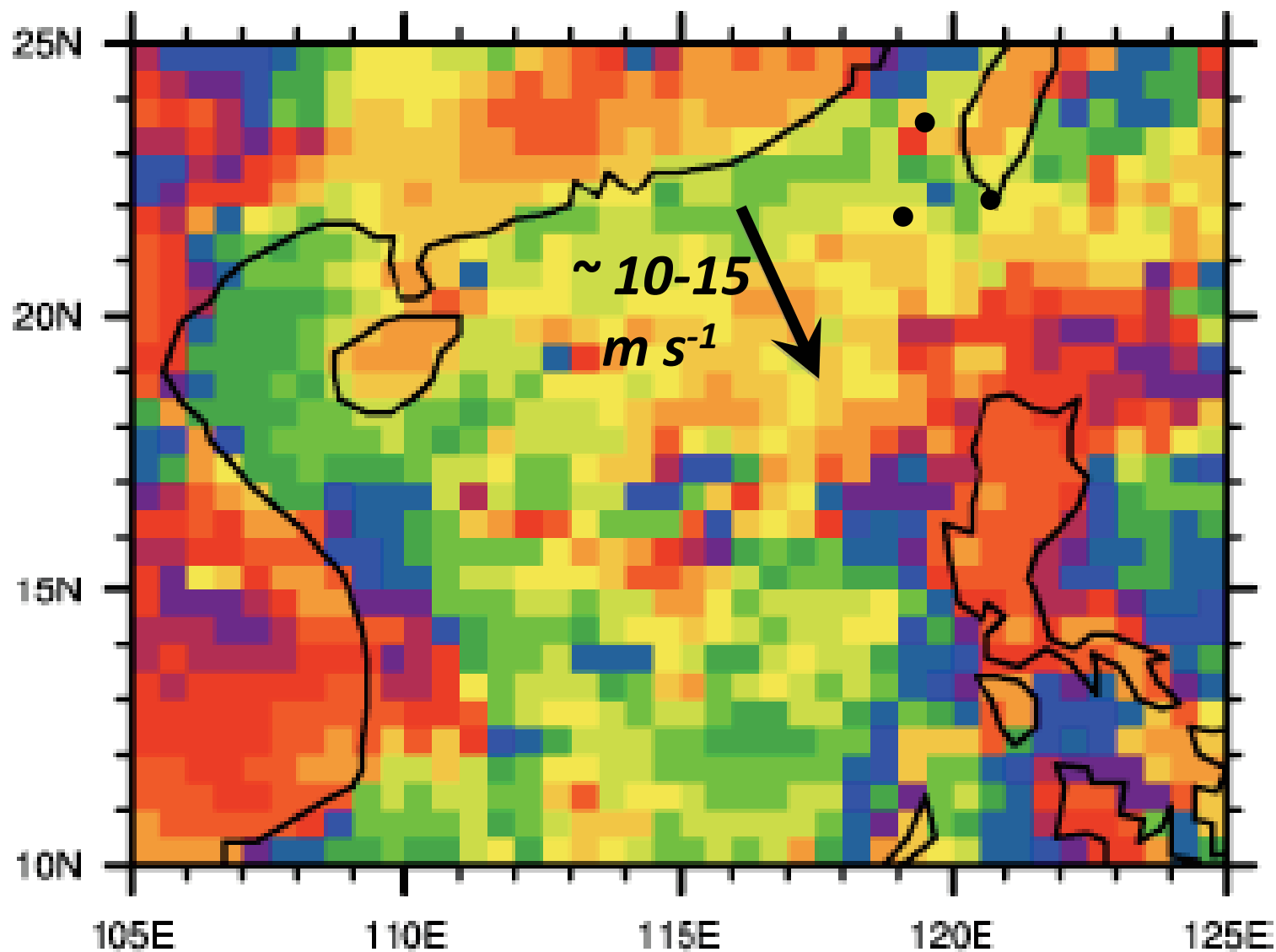


- *Afternoon/evening rainfall maximum over land*
- *Mid-day maximum in rainfall over ocean (???)*

TRMM - TMI

Rain Rate

*May-July
1998-2005
TRMM - TMI
Rain Rate*

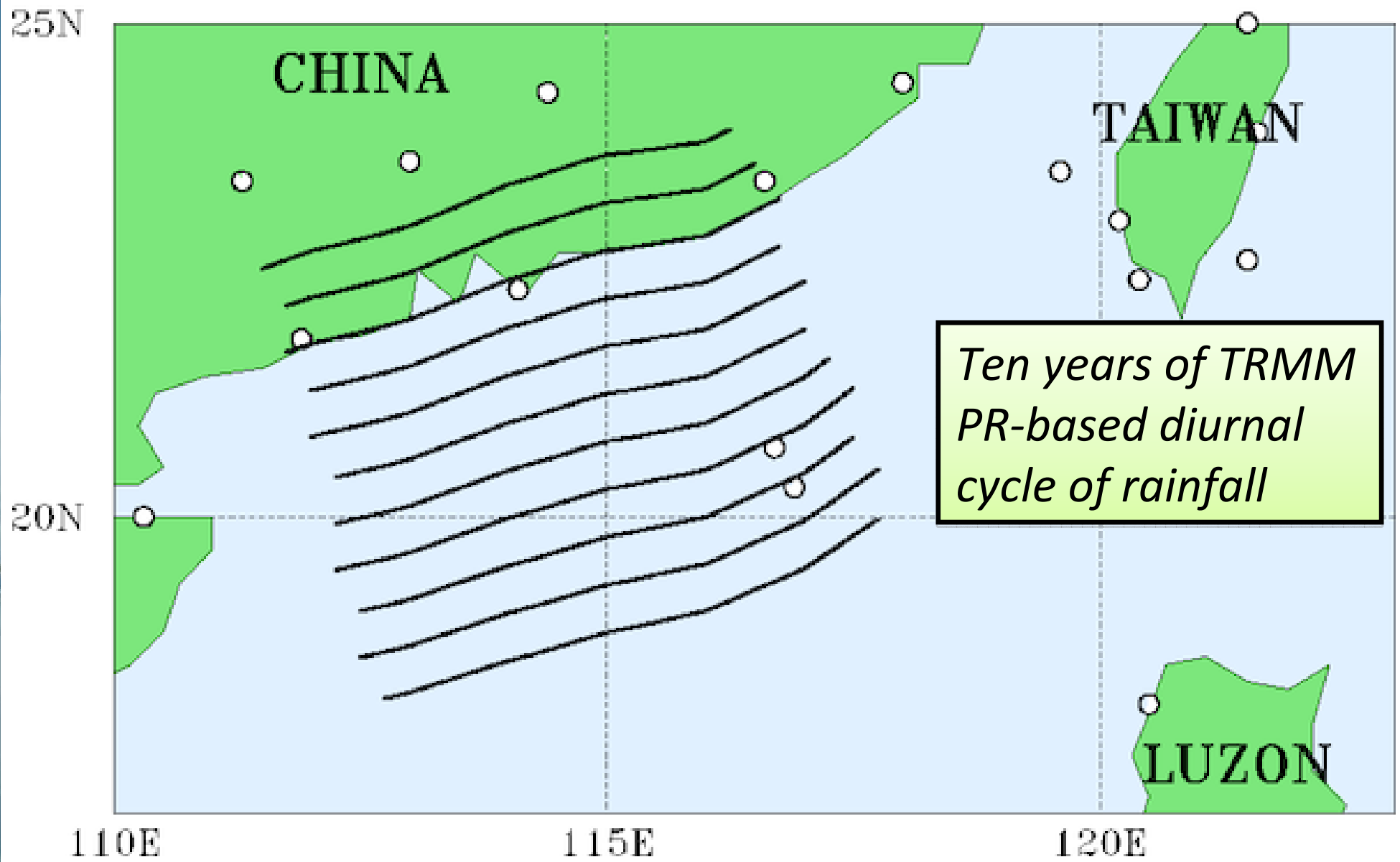


*(Courtesy
Steve Nesbitt)*

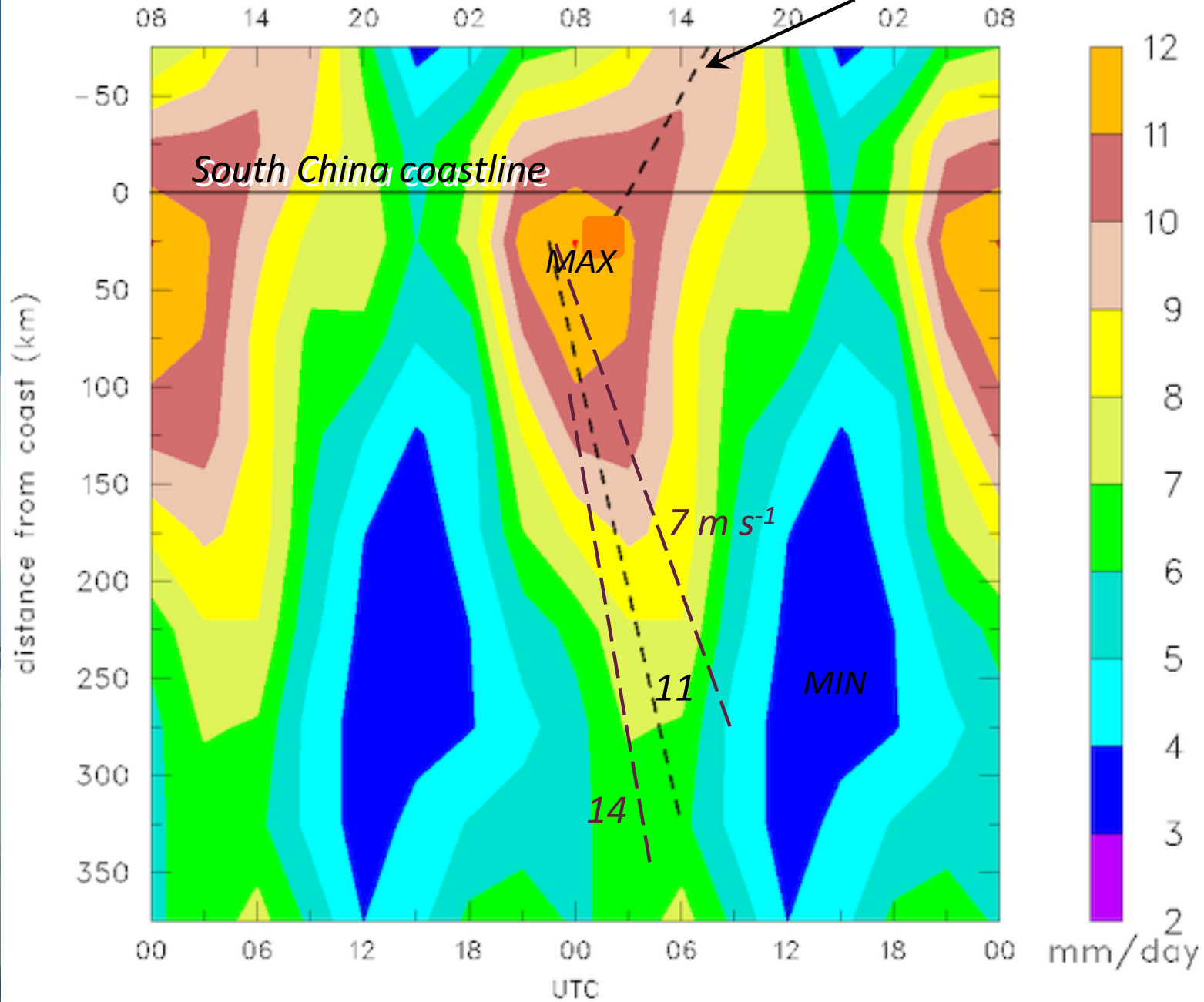
Phase of first diurnal
harmonic (LT)



SCSMEX domain and 2A25 averaging bins

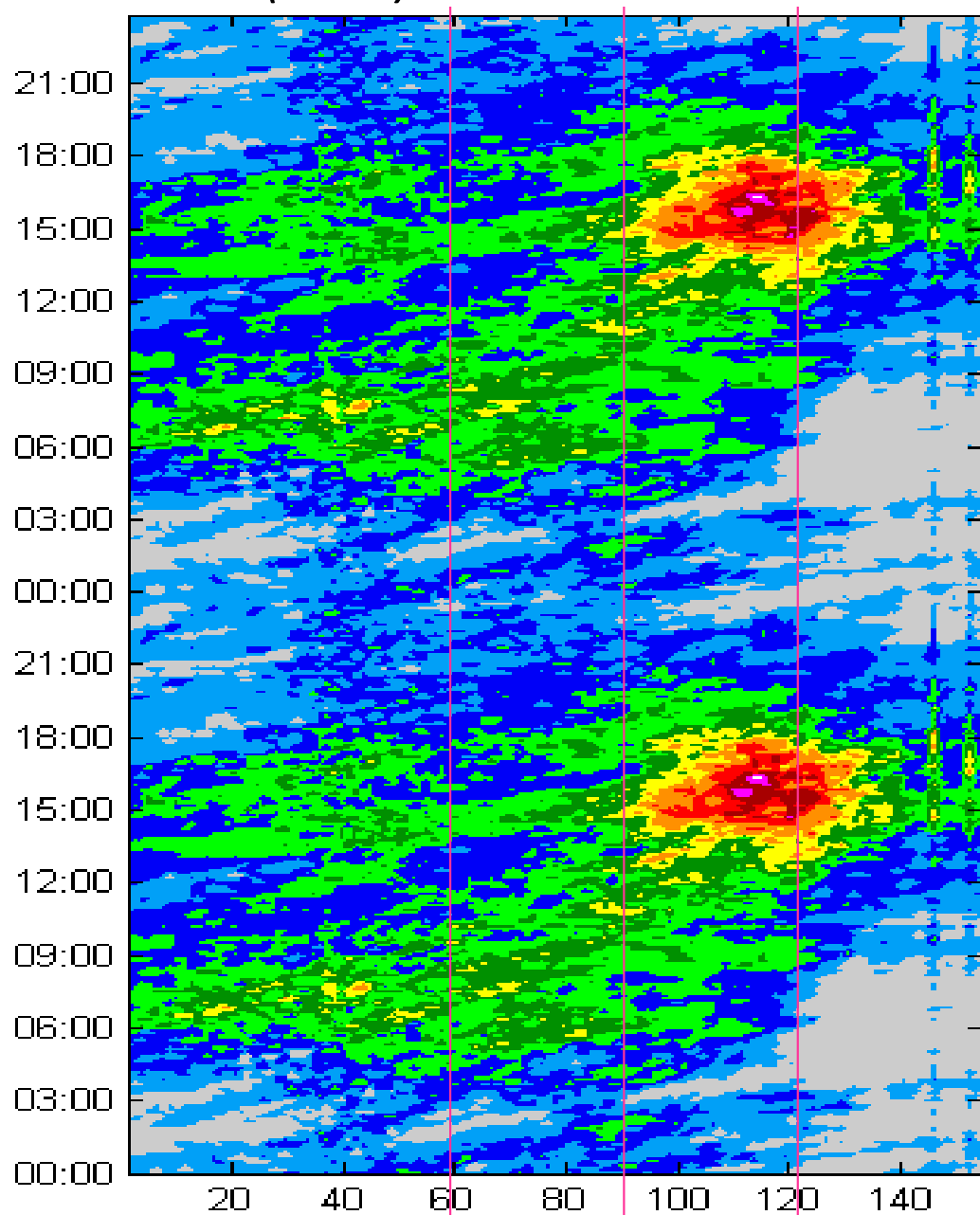


TRMM 2A25 rainfall (mm/day) for post-onset 98-07
Aves and Johnson (2008)

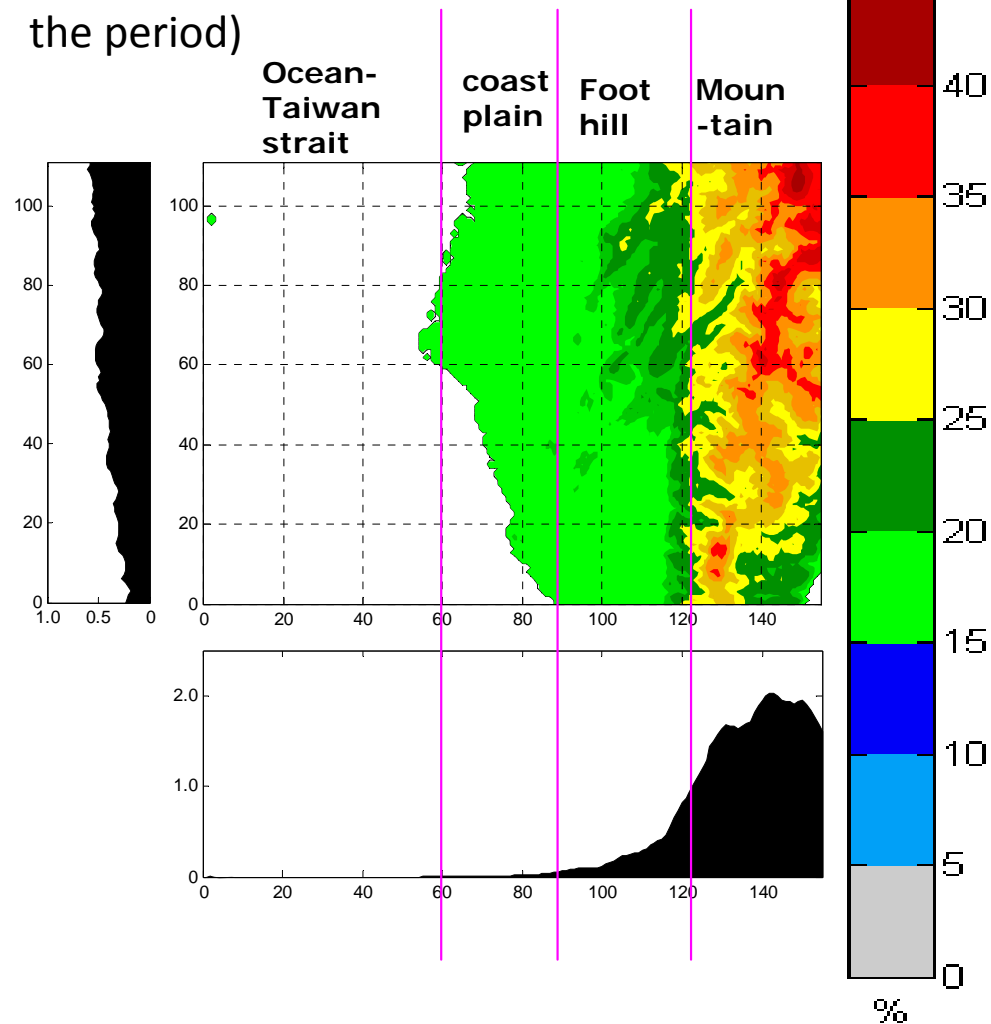


Diurnal cycle of precipitation systems over southwestern Taiwan during the 2008 Meiyu season

Jou et al. (2009)



Early morning max over the strait, eastward propagation in the morning, afternoon max foothills and mtns, weak aftn max over strait (40 precipitation features identified during the period)



Year of Tropical Convection (YOTC)

A Scientific Framework for Addressing the Multi-scale
Organization of Tropical Convection and its
Interaction with the Global Circulation

*Duane Waliser, JPL/Caltech
Mitch Moncrieff, NCAR
Co-chairs, Science Planning Group*



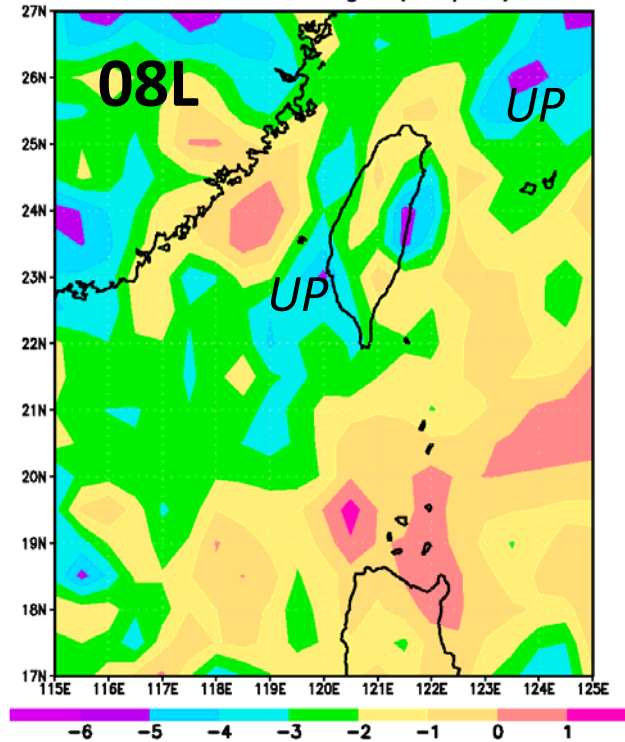
**YOTC Data Archiving Period
May 2008 – Oct 2009**

A Contribution to Seamless
Weather-Climate Prediction

*ECMWF YOTC
Special
Operational
Analysis and
Forecast Data
Set – T799 (25-
km grid; 4 per
day)*

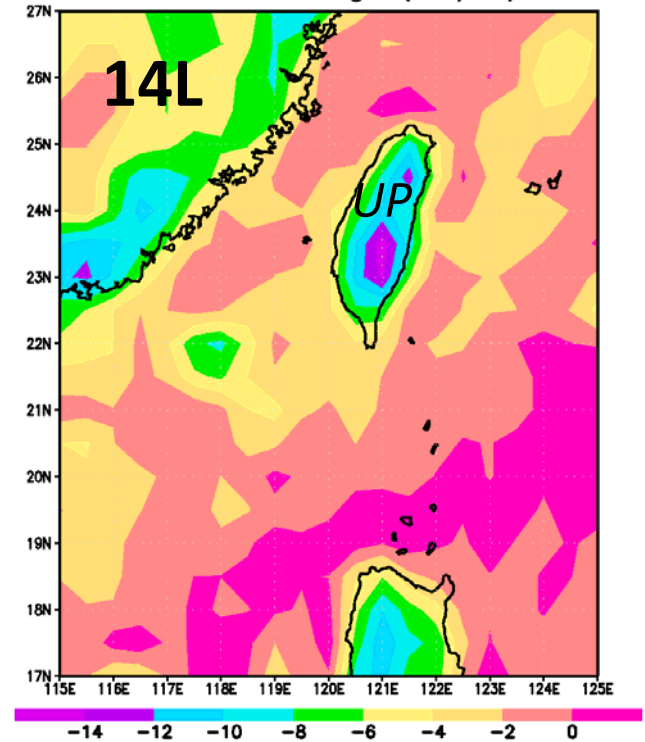
<http://data-porta.l.ecmwf.int/data/d/yotc>

ECMWF 500-hPa omega (mb/hr) at 00Z

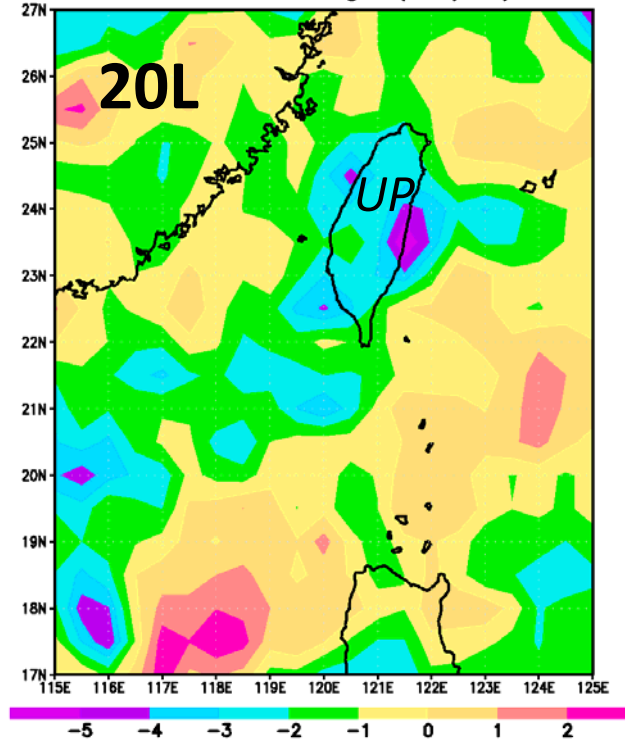


**500
hPa
 ω**

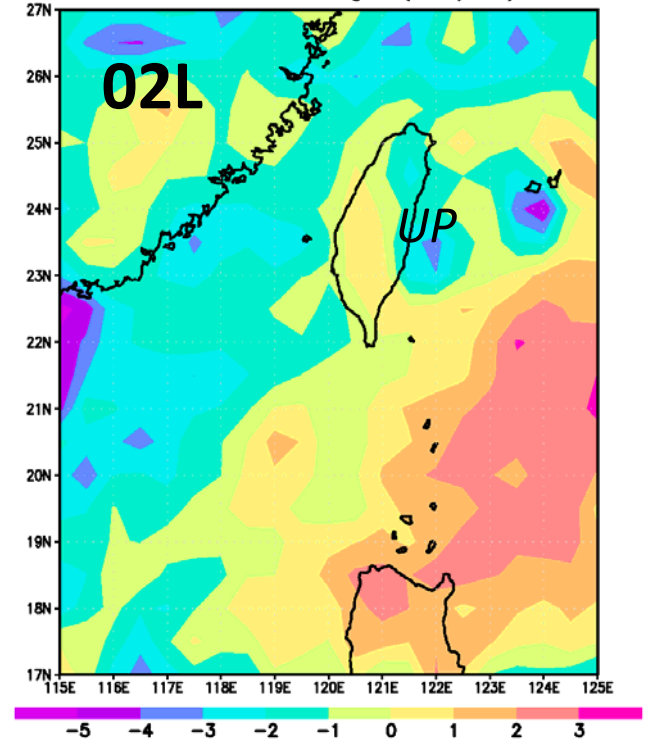
ECMWF 500-hPa omega (mb/hr) at 06Z



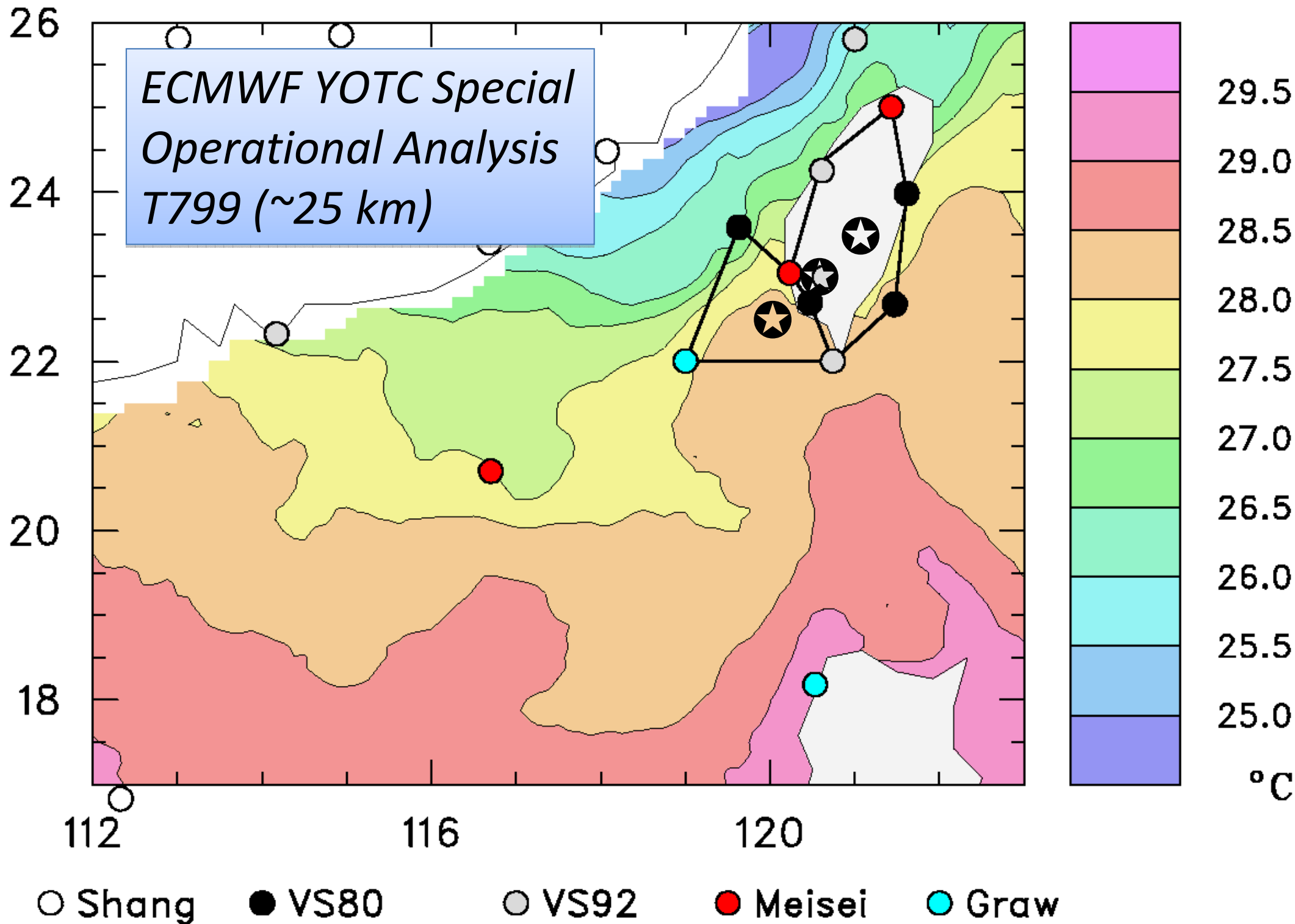
ECMWF 500-hPa omega (mb/hr) at 12Z

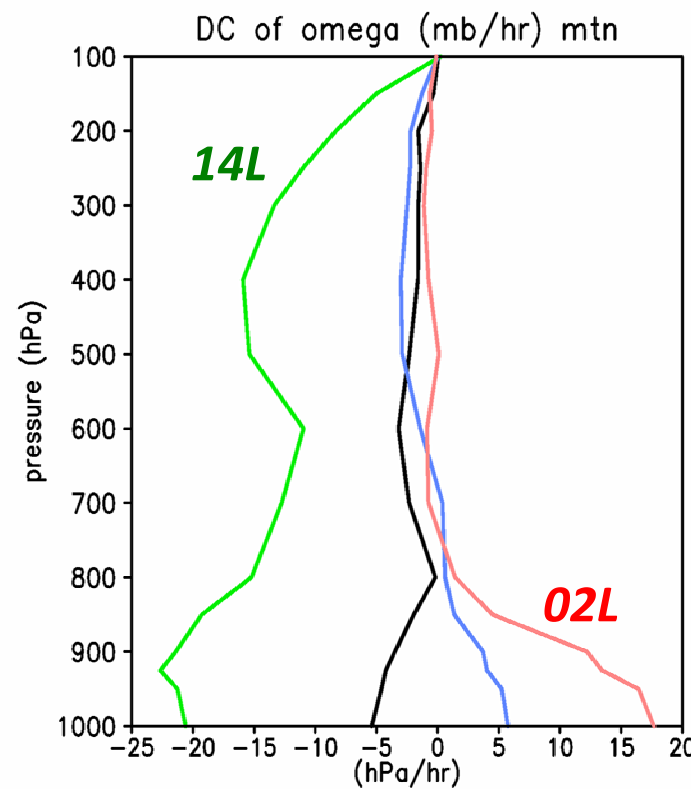
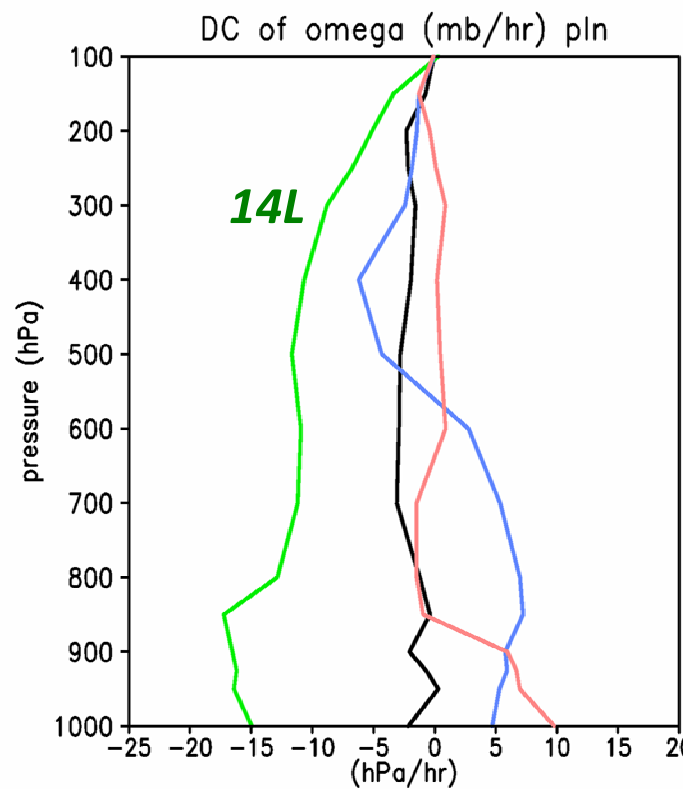
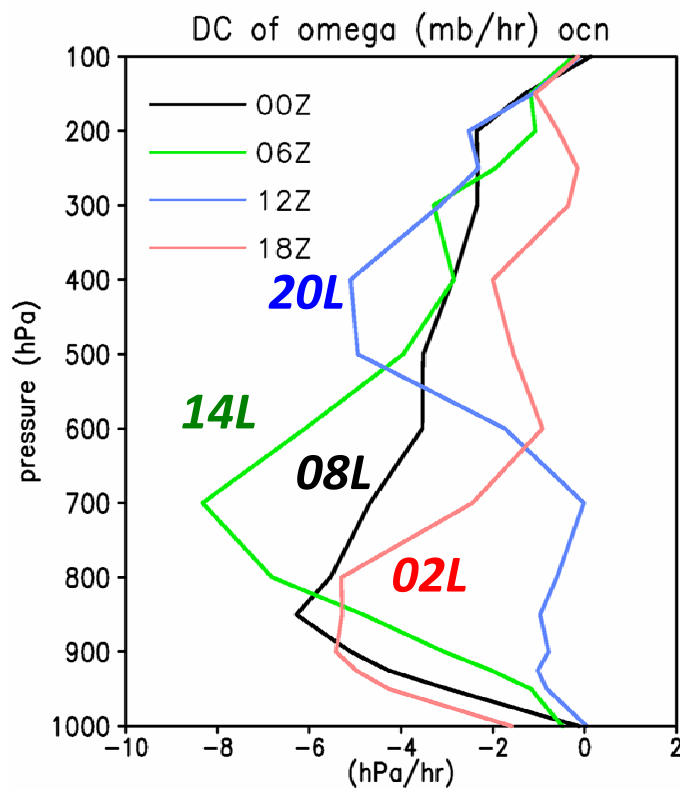
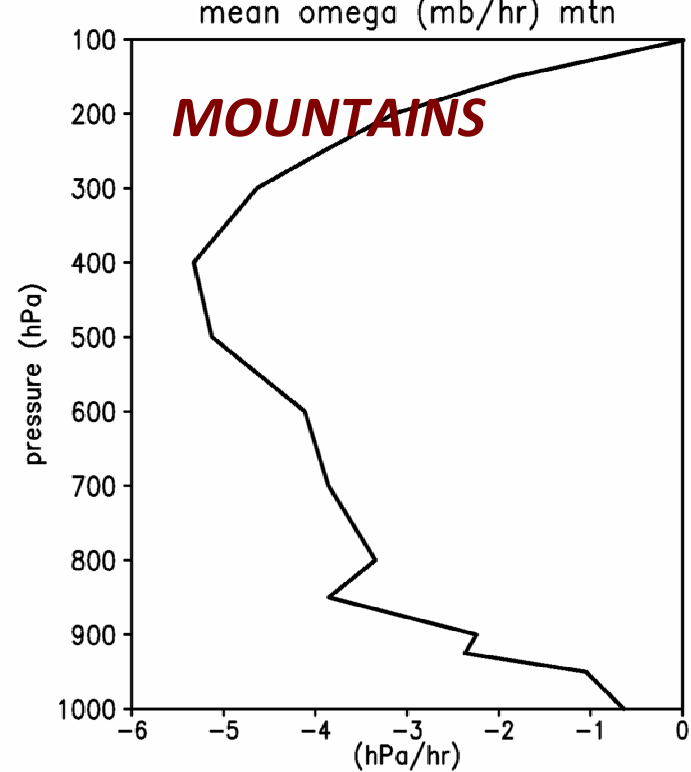
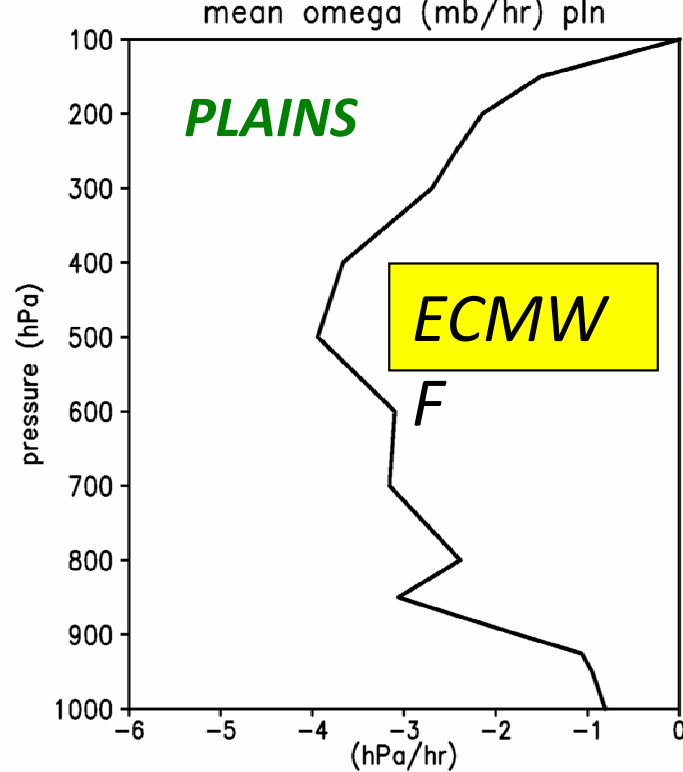
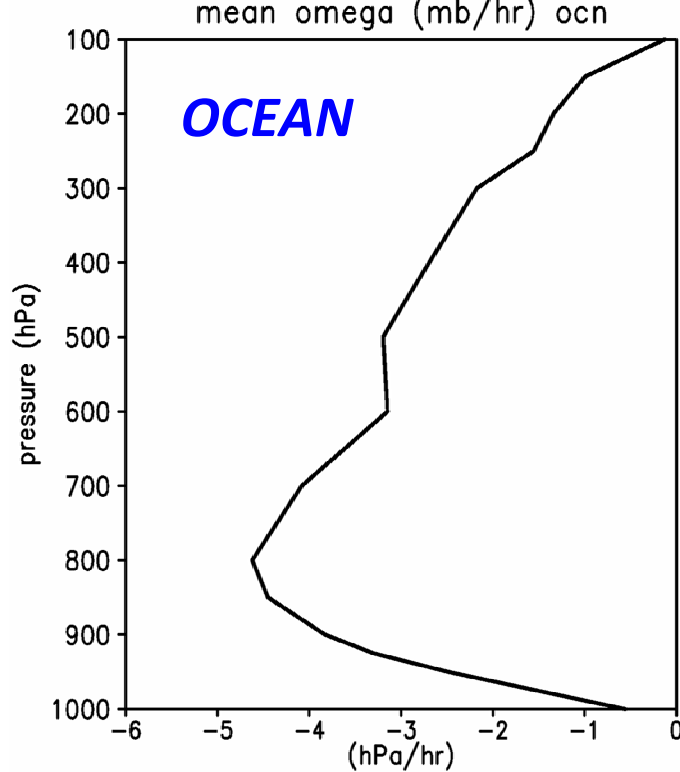


ECMWF 500-hPa omega (mb/hr) at 18Z



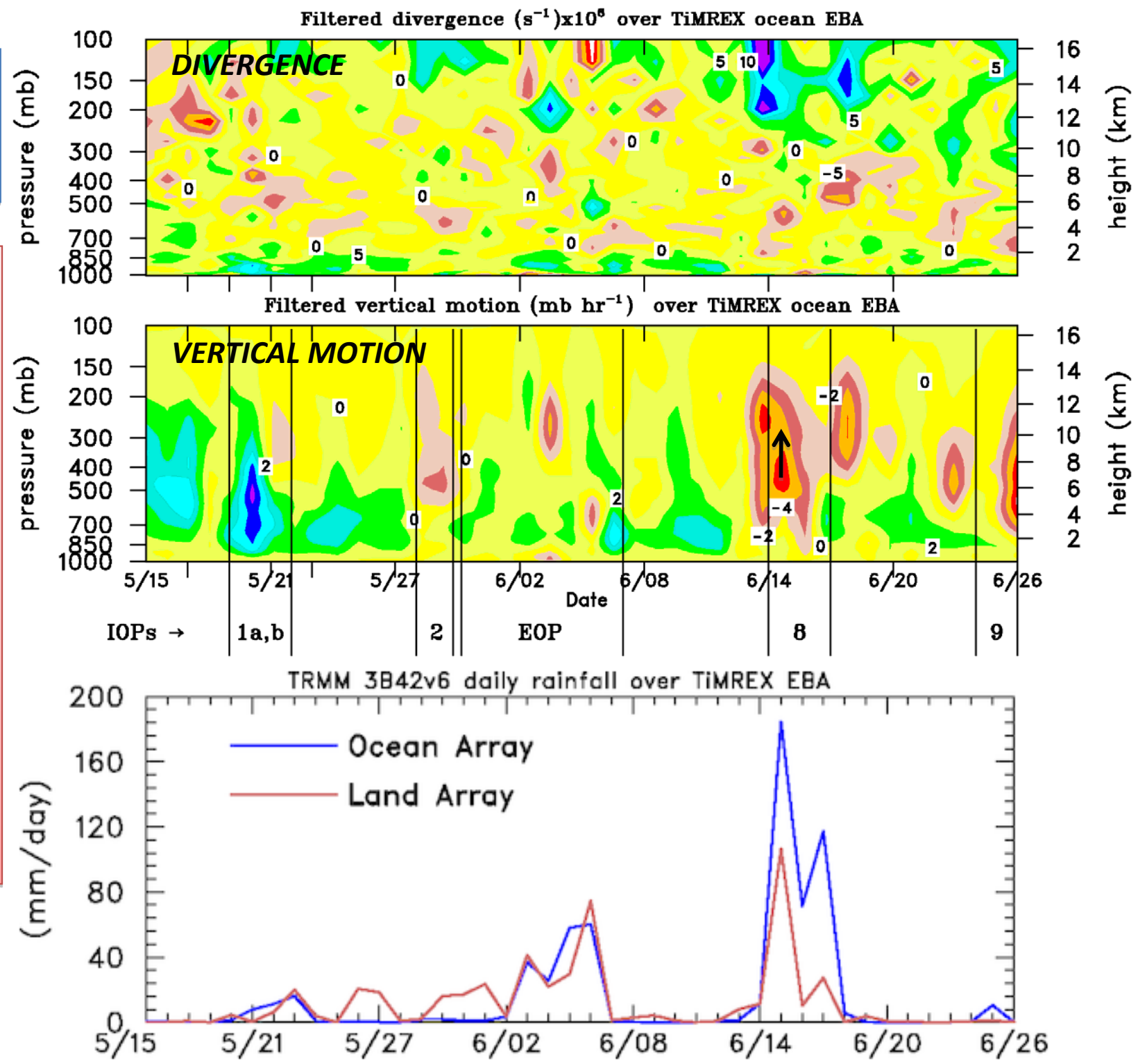
TiMREX Sounding Network and SST field 2009 (May-June)





*Ocean
Time Series*

*Preliminary
analysis
suggests
mid-to-
upper-level
maximum
in vertical
motion
over ocean*



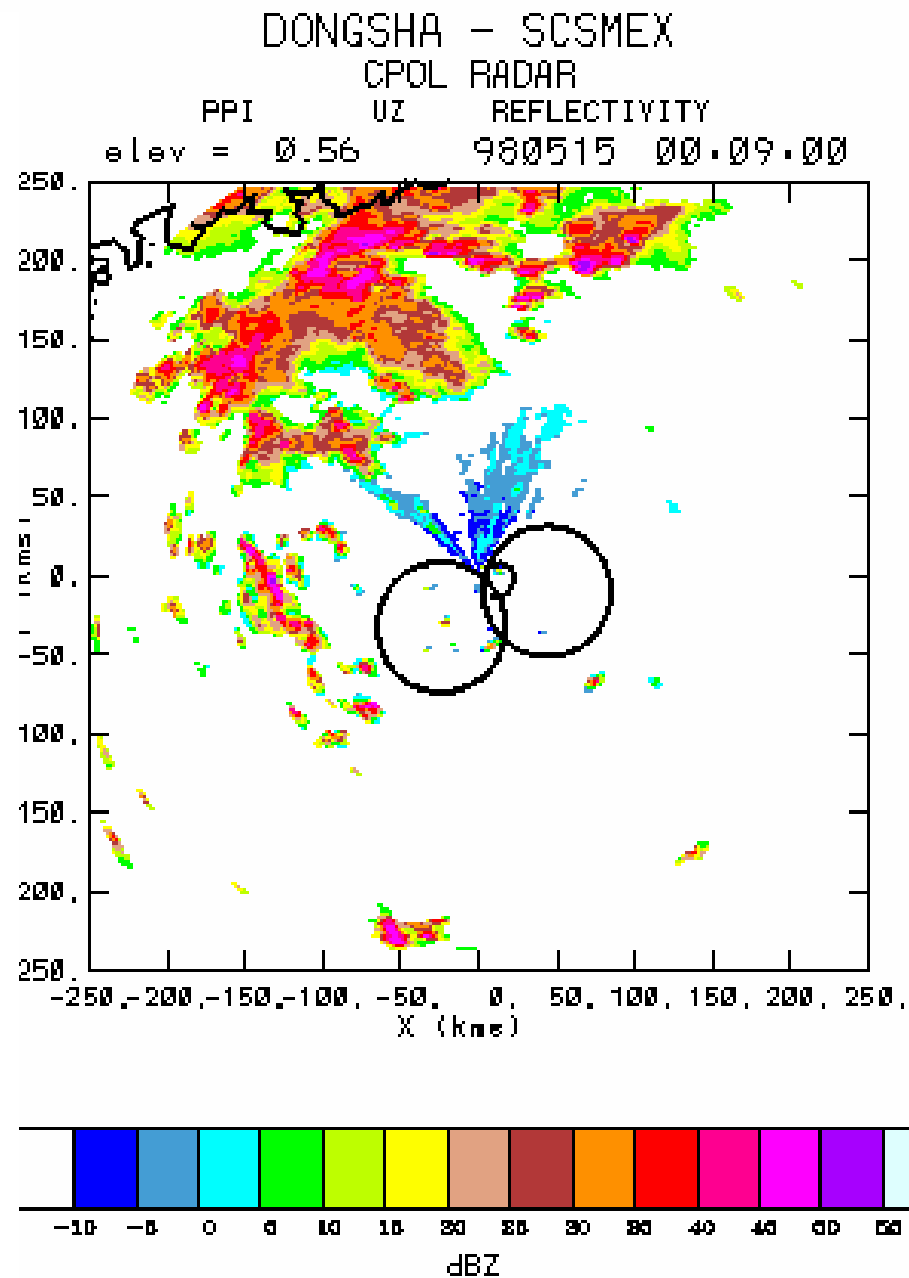
Summary and Conclusions

- ❑ Averaged over 43-day TiMREX SOP, heaviest rainfall occurred over southern Taiwan and upstream of island; land vs. ocean proportion varied with time
- ❑ Strong SST gradient over Taiwan Strait; gradient in PBL structure; enhancement of LLJ(?); stable PBL over northern SCS, warm air flowing over cool water
- ❑ Preliminary results: sounding data describe time series of ω reasonably well, but more work needed
- ❑ Diurnal cycle: further work underway, including comparisons with ECMWF YOTC, 25-km product

**BMRC
C-POL
Radar
Animation**

**15 May
1998**

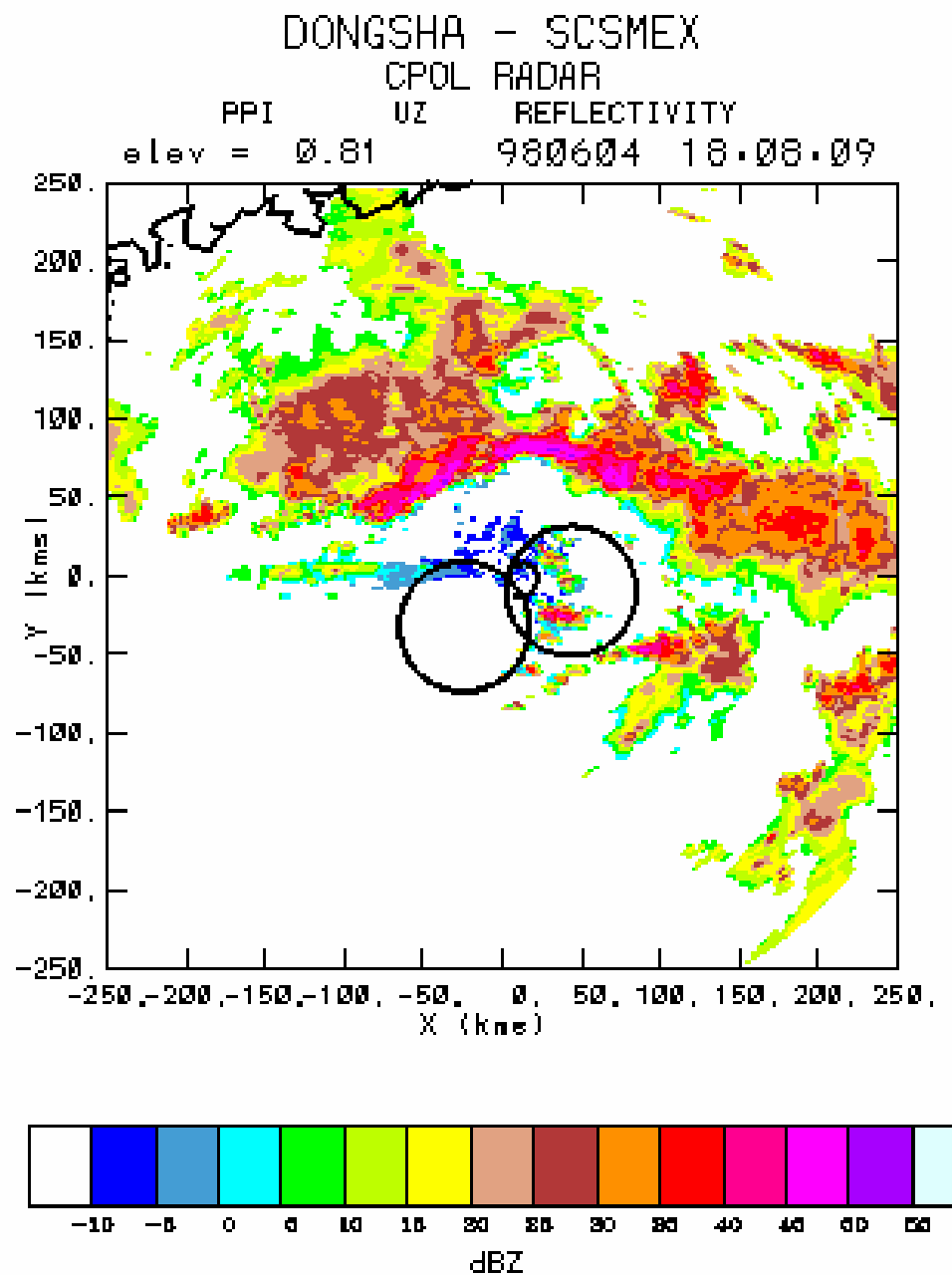
08-20 L



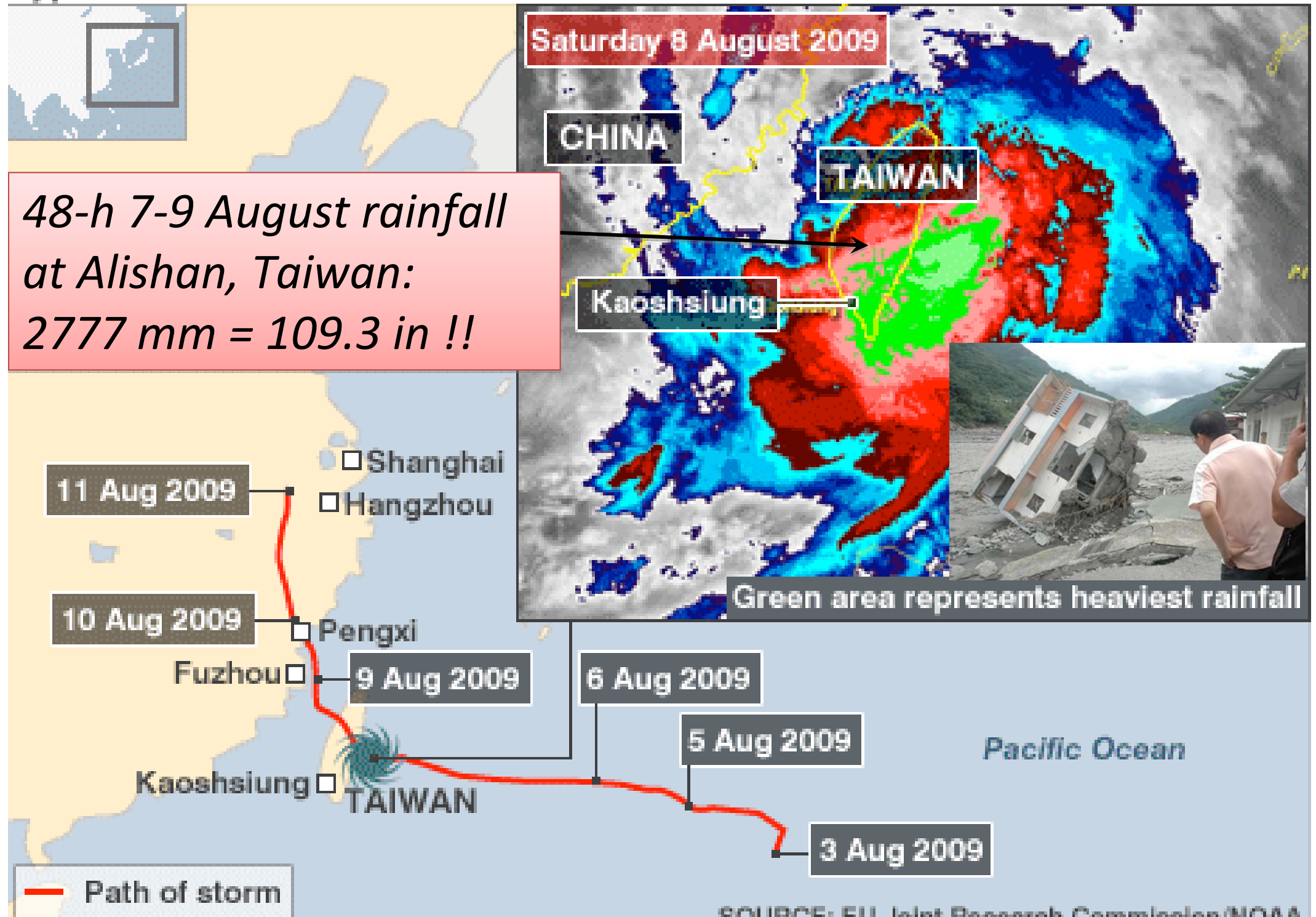
BMRC C-POL Radar Animation

5 June
1998

02-14 L



Typhoon Morakot hits Taiwan and China



ASTER dropsonde mission on 31 May 2008, Taiwan Straits



Photo by Paul Ciesielski