

R/V Mirai Observations: C-Pol radar outline, and 2018 cruise results

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R/V Mirai, and onboard instruments



- Upgraded to Dual-Pol Radar, since Jun. 2014
- In operation for available cruises

Radiosonde
launcher

C-band
Dual Polarimetric
Radar

Ceilometer

Surface Met.
(PT,RH,WS/WD,
SWR,LWR,...)



Upper Deck
(For temporary
instruments)

CTD
+ Water Sampler

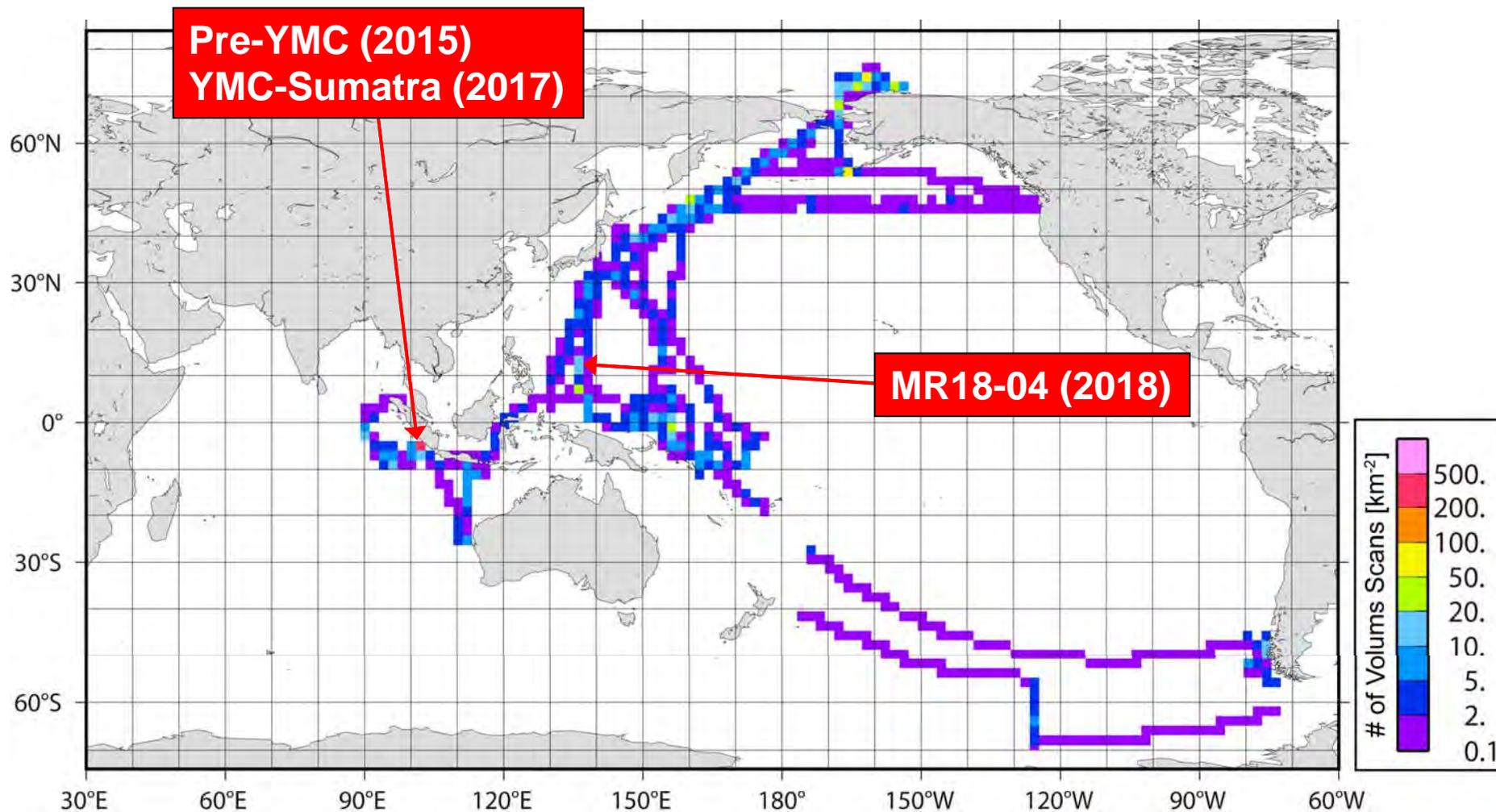
Lidar
(Mie/Raman, 3λ)

Disdrometer

Surface Water
Monitoring
(T,S,...)

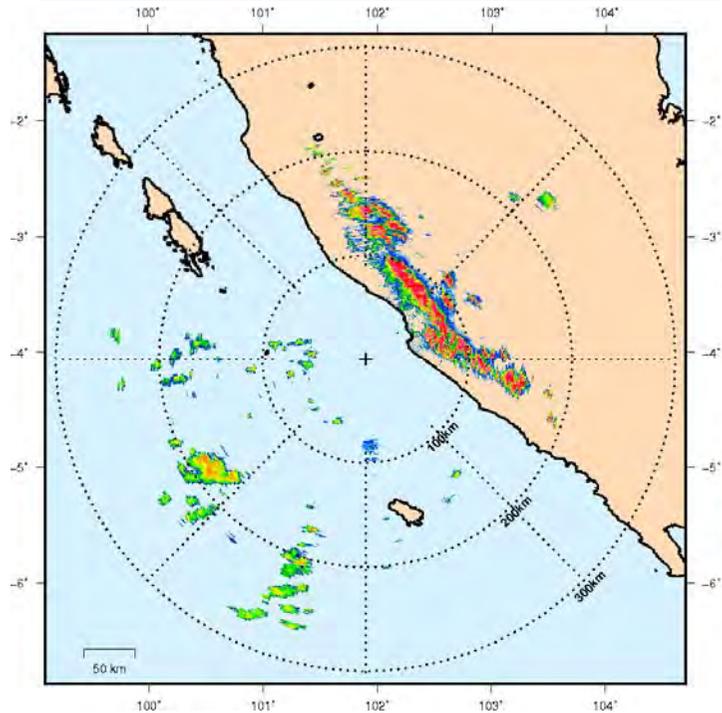


Obtained data on the Map: Mirai C-POL Radar (2014-present)

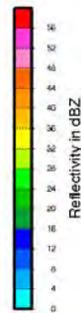


Mirai Radar PPIs during Pre-YMC (2015)

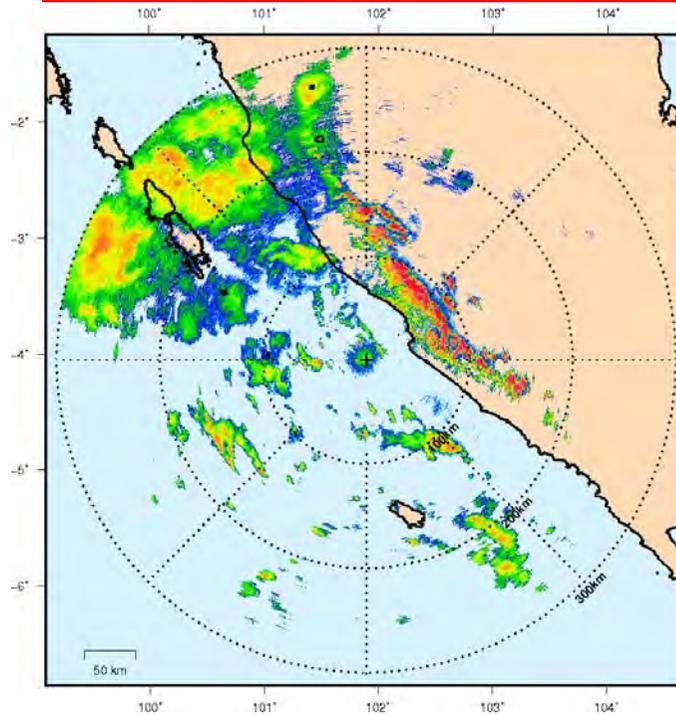
Former in SOP (11/28-12/02):
before MJO active period



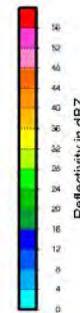
R/V MIRAI
PPI-ZH
PW : 2.0/200.0 (us)
PRF : 400 (pps)
EL : 0.5 (deg)
LAT : -4.065998 (deg)
LON : 101.900000 (deg)
HDG : 356.7 (deg)
00:59:30
28/Nov/2015 UTC



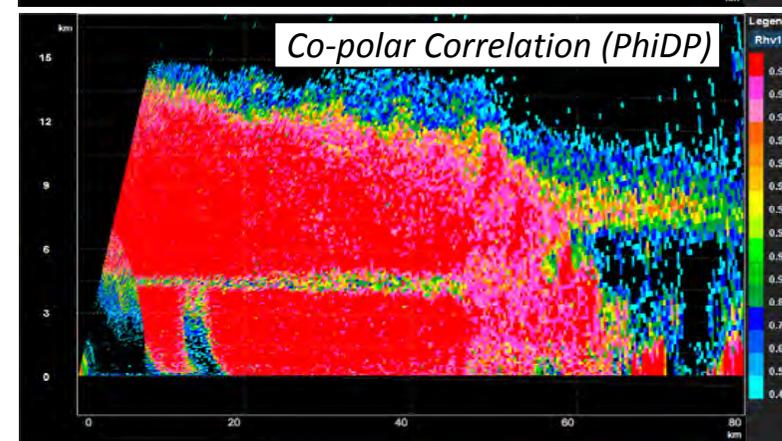
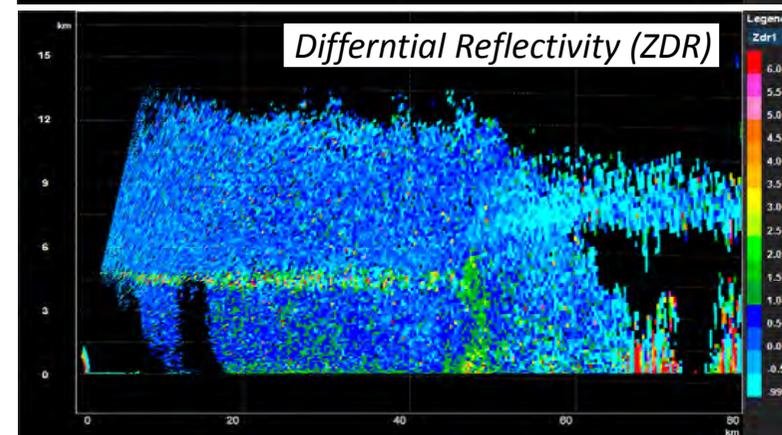
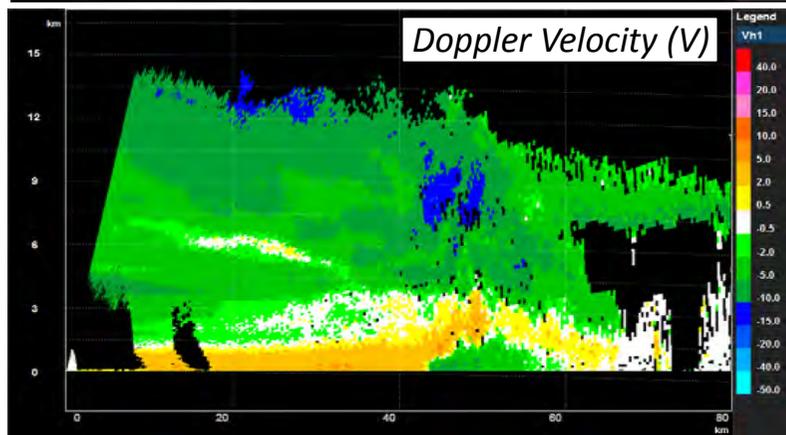
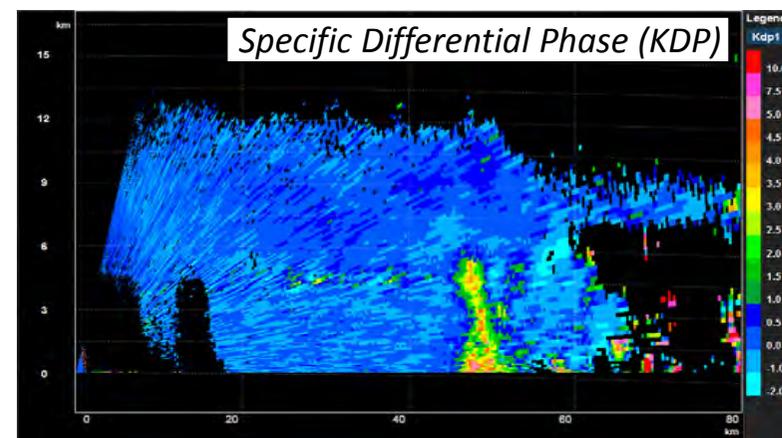
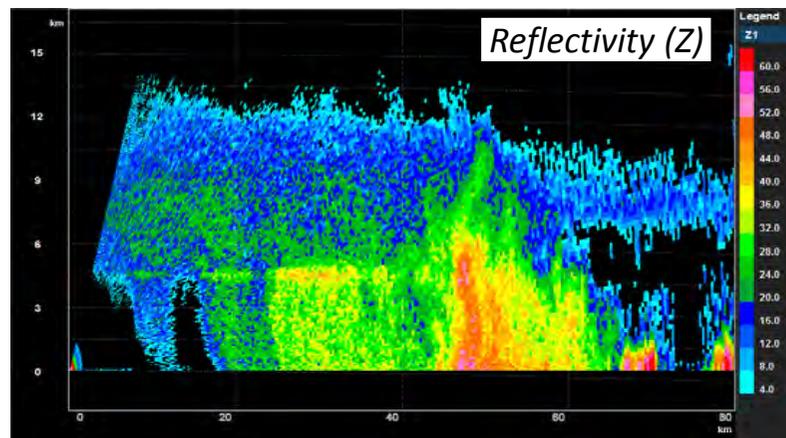
Latter in SOP (12/13-12/16):
during MJO active period



R/V MIRAI
PPI-ZH
PW : 2.0/200.0 (us)
PRF : 400 (pps)
EL : 0.5 (deg)
LAT : -4.056998 (deg)
LON : 101.895000 (deg)
HDG : 304.2 (deg)
00:59:30
13/Dec/2015 UTC

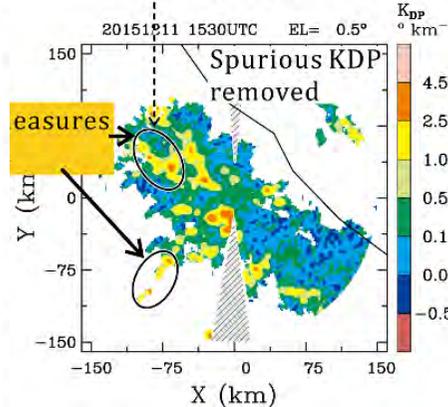
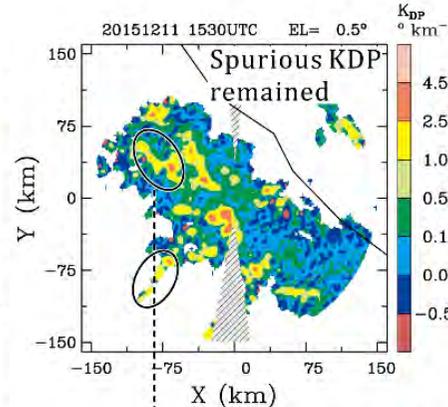
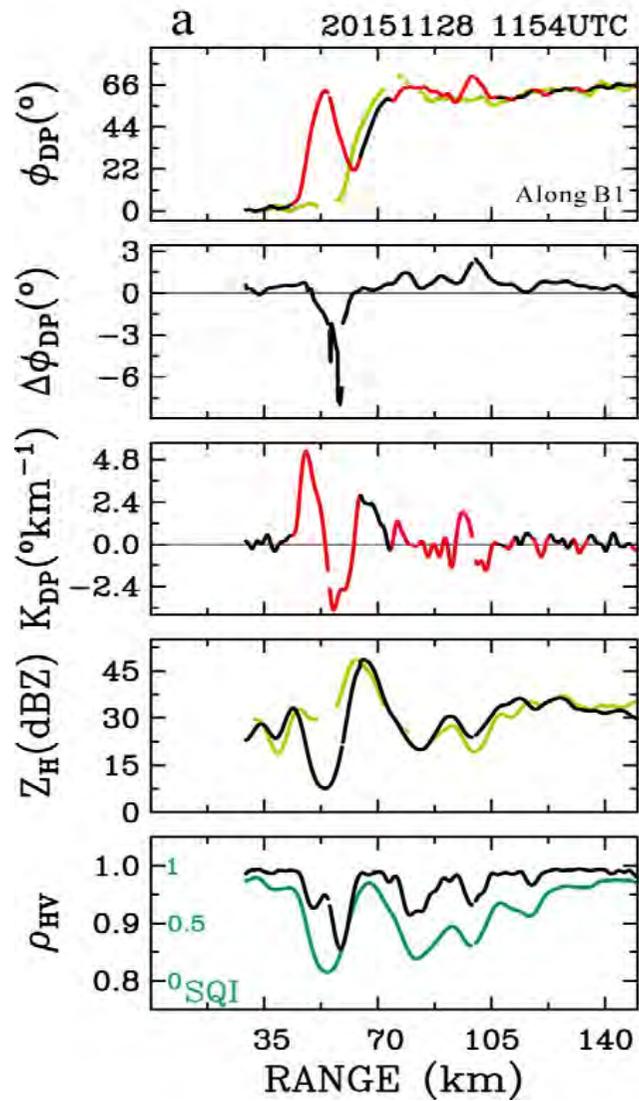


Examples (1) RHI during Pre-YMC (2015) off Sumatra

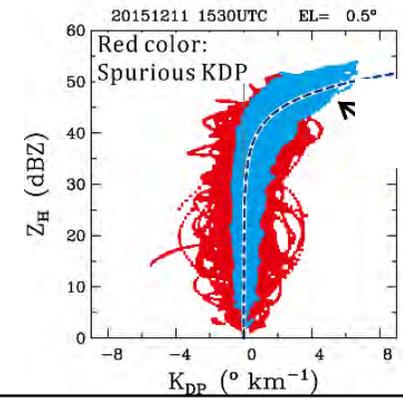
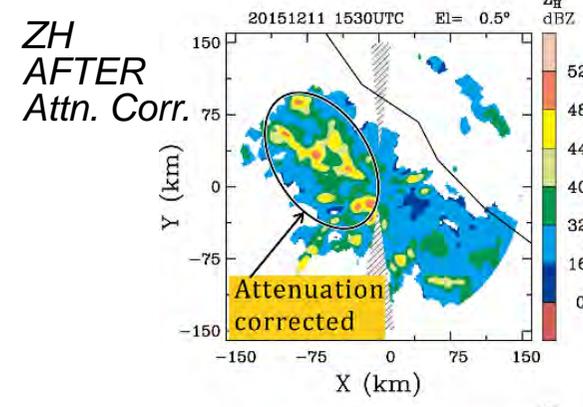
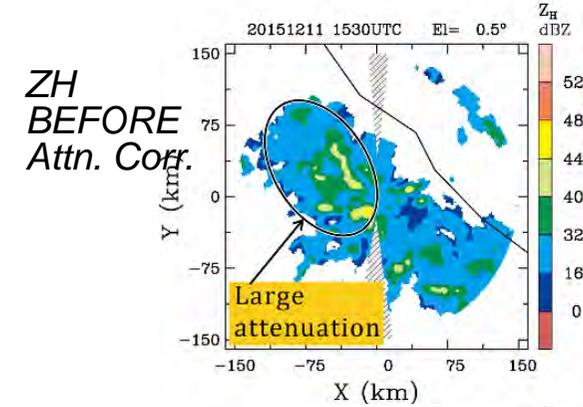


RHI @ Mirai 1144Z 03Dec2015 Az=65.

KDP filtering (remove spurious data)

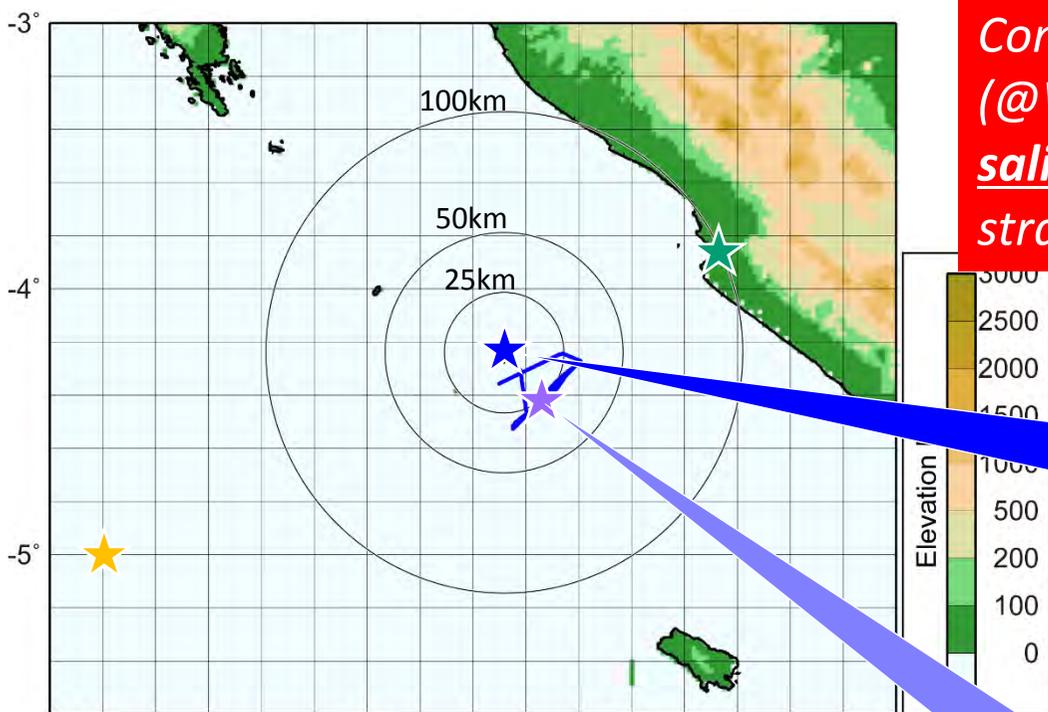


attenuation correction of ZH (iteratively with KDP filtering)



Application: on "YMC-Sumatra 2017", in Dec. 2017

Compare radar-derived rain vs. in-situ (@Wave-Glider) measured ocean-surface salinity & temperature and their stratification



Radar Site: R/V Mirai



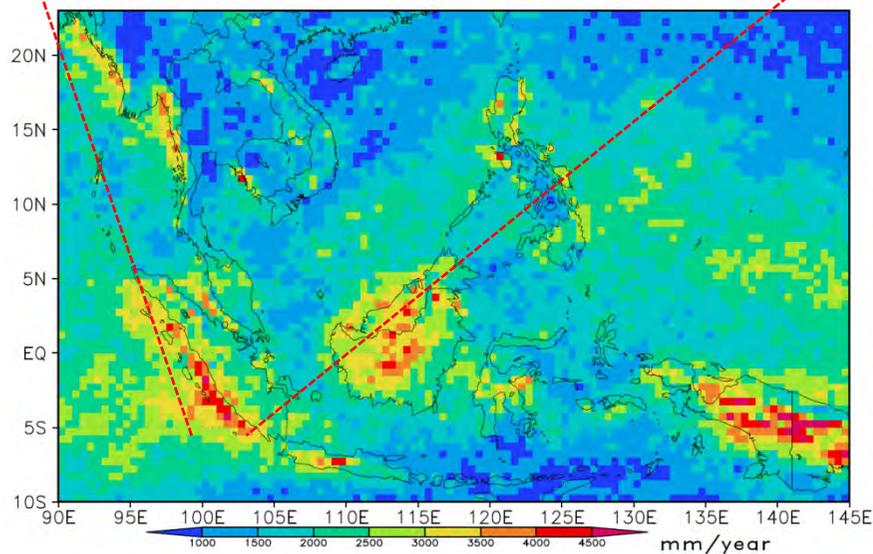
C-POL radar
Surface Met.
CTD profiler
CTD @ 5m
etc.

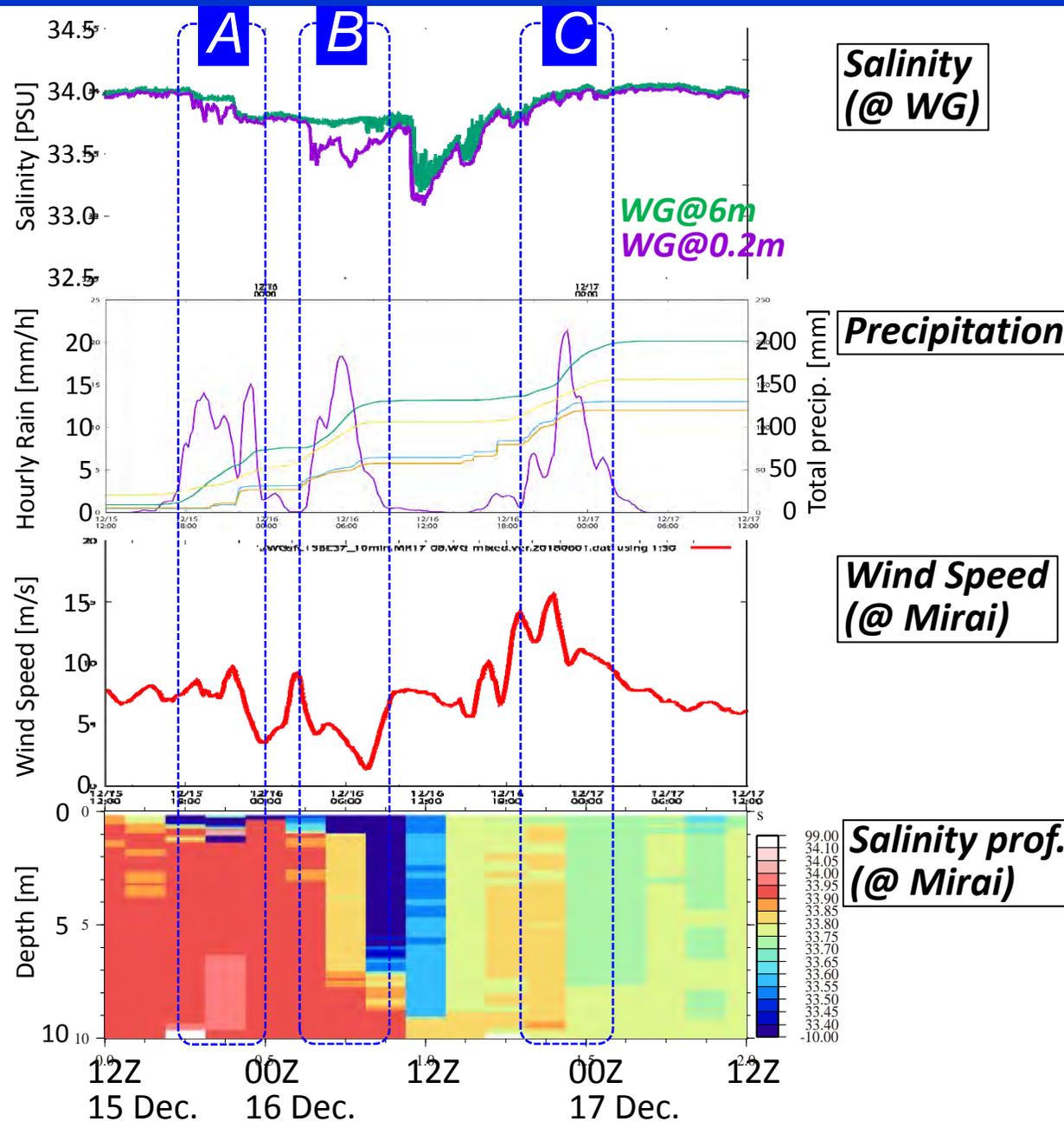
Ocean Site: Wave Glider



CTD @ 0.2m
CTD @ 6m
Surface Met.

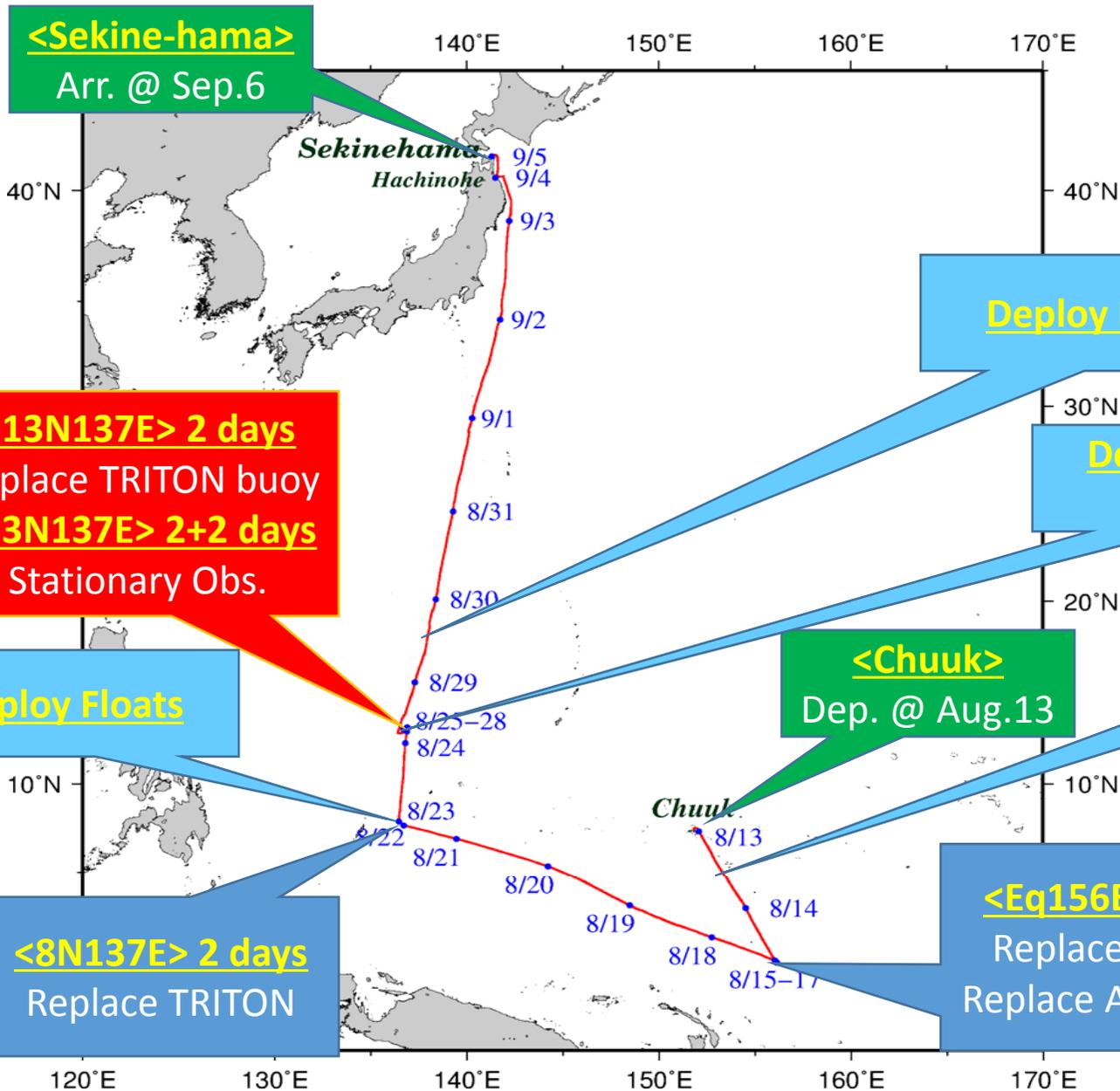
Annual Rainfall (1998.1~2005.12 average, TRMM 3A2532)





- Precipitation amount @ WG resembles all 3 events
- Surface salinity gradient differ:
 - strongest in **B** (with weak wind)
 - mid in **A** (with moderate wind)
 - not found in **C** (with strong wind)
- At event **B**, salinity drop ~ 0.4 PSU for 6m layer requires 70 mm precip., which is comparable to the radar-observed rain
- Salinity drop confined at surface ~ 5 m layer also observed at R/V Mirai: not the point event

MR18-04 (in summer 2018): Cruise Track and Actions



<Sekine-hama>
Arr. @ Sep.6

<13N137E> 2 days
Replace TRITON buoy
<13N137E> 2+2 days
Stationary Obs.

Deploy Floats

<8N137E> 2 days
Replace TRITON

<Chuuk>
Dep. @ Aug.13

Deploy Drifters

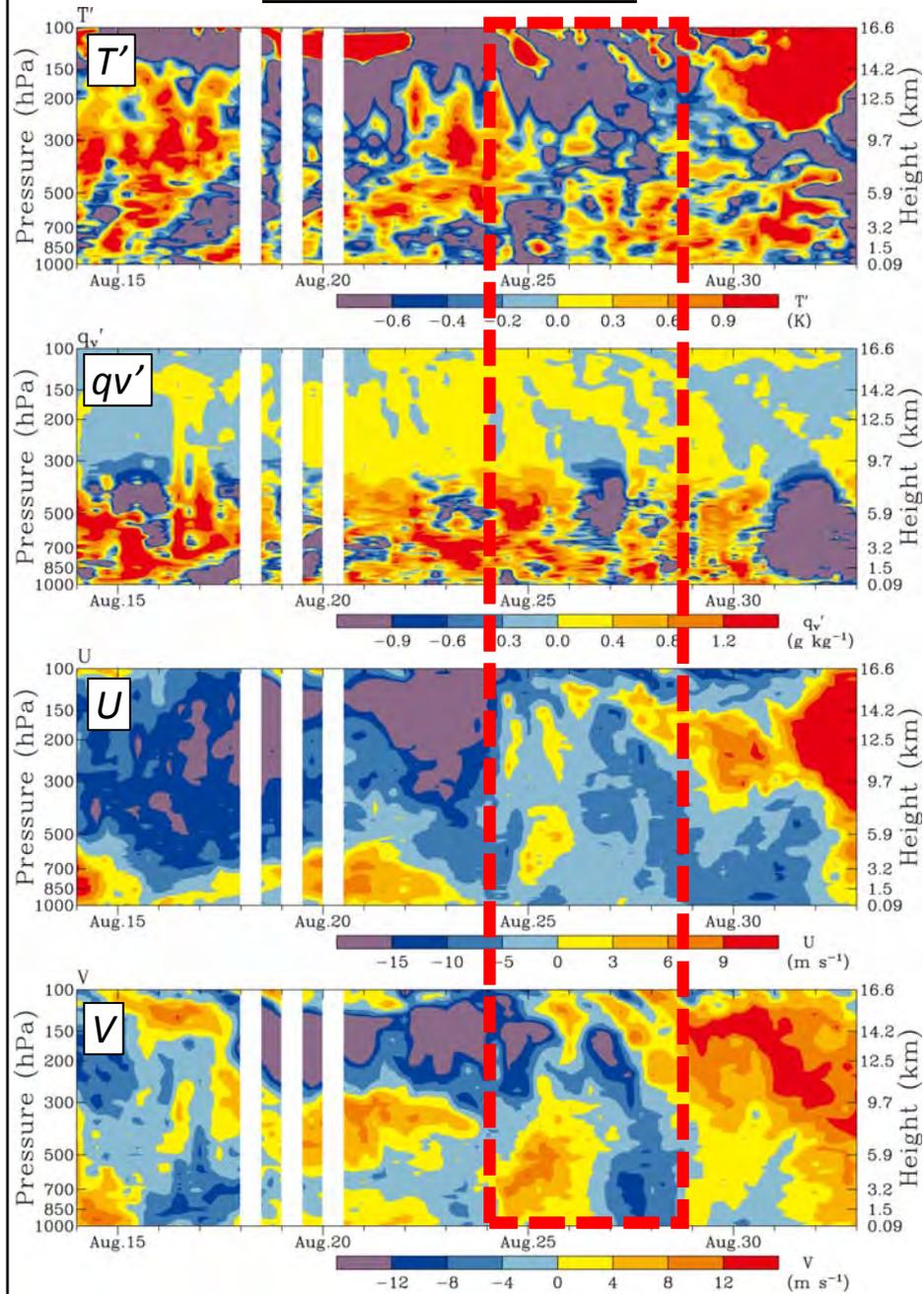
Deploy Deep-APEX

Deploy Drifters

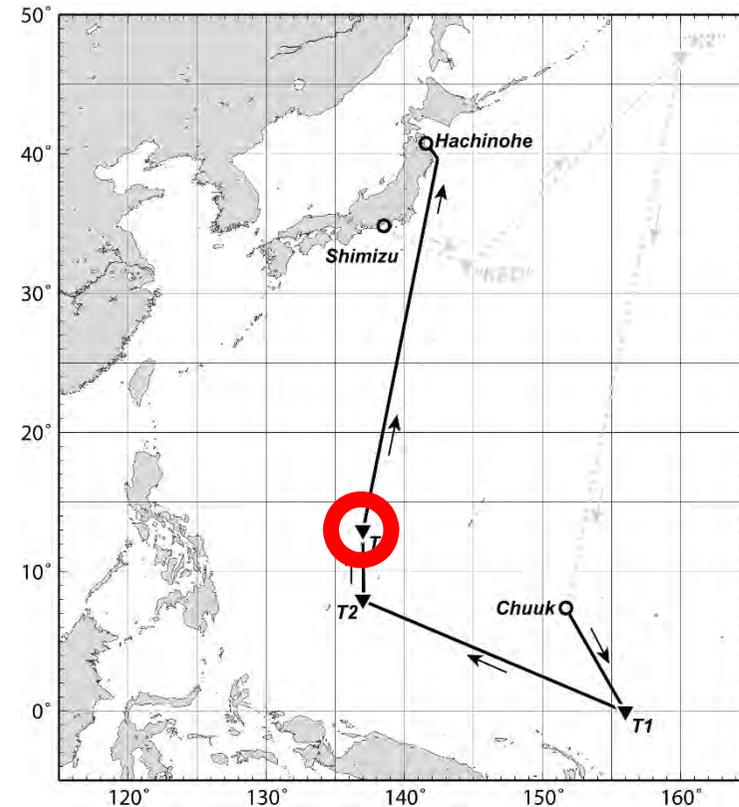
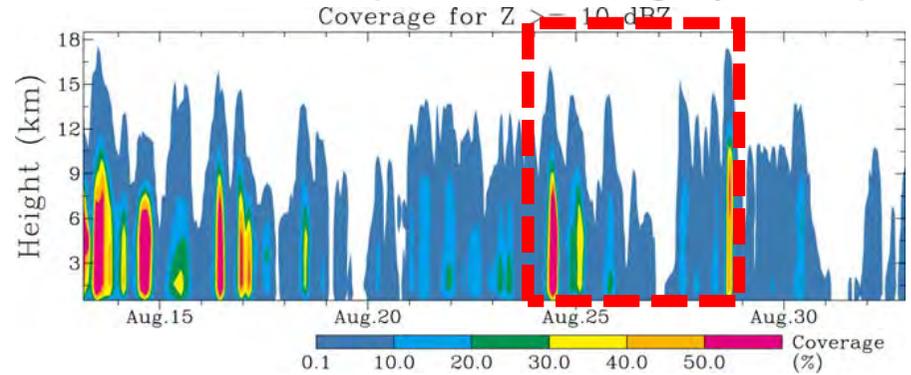
<Eq156E> 3 days
Replace TRITON
Replace ADCP buoy

Captured situation through the cruise

from Radiosonde

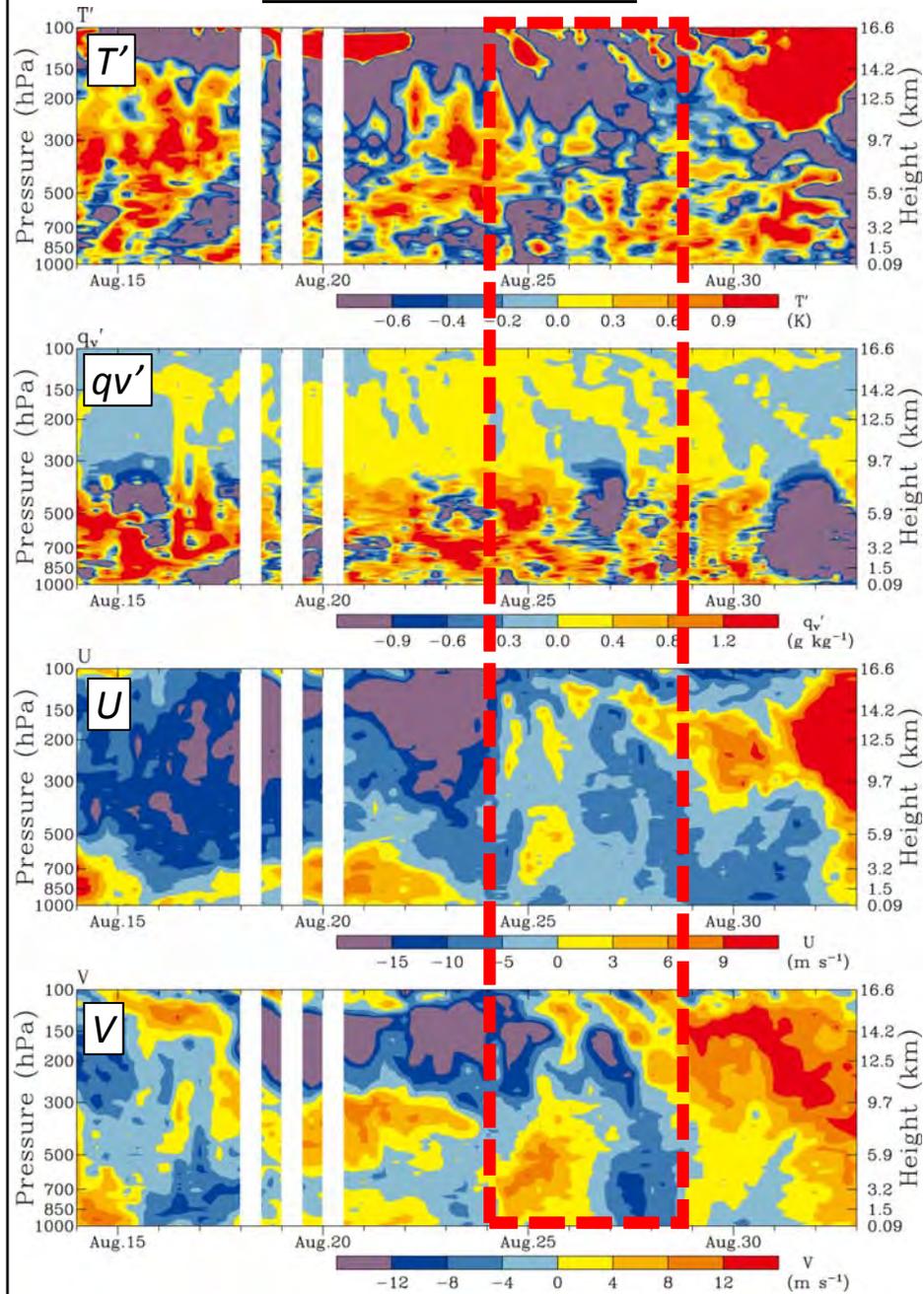


From Radar (echo coverage profile)

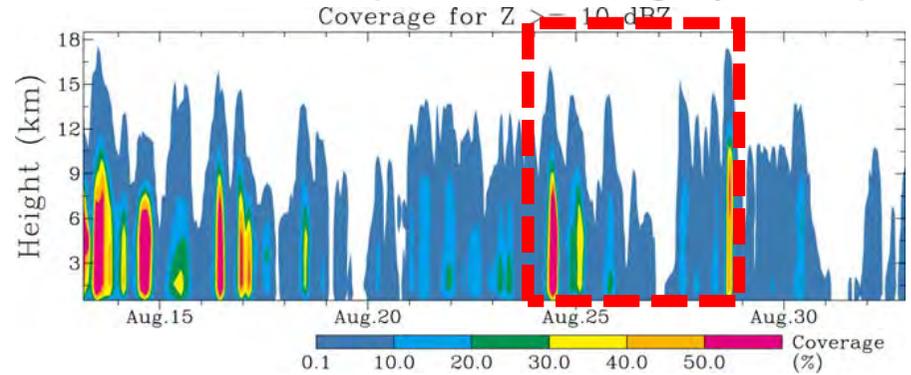


Captured situation through the cruise

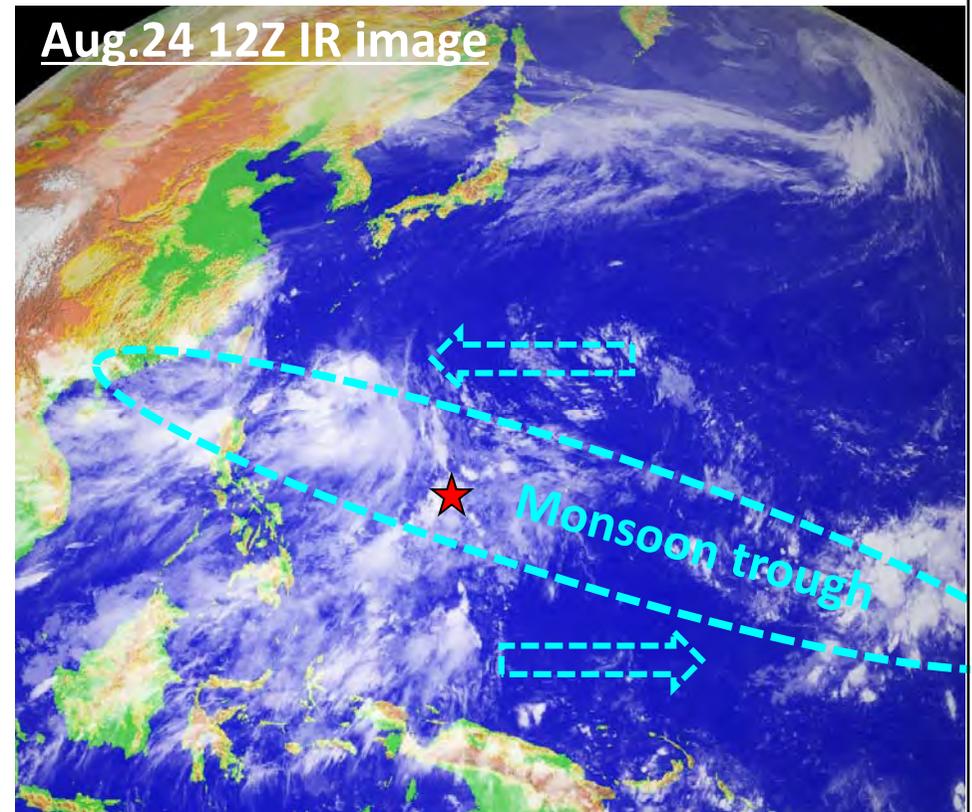
from Radiosonde



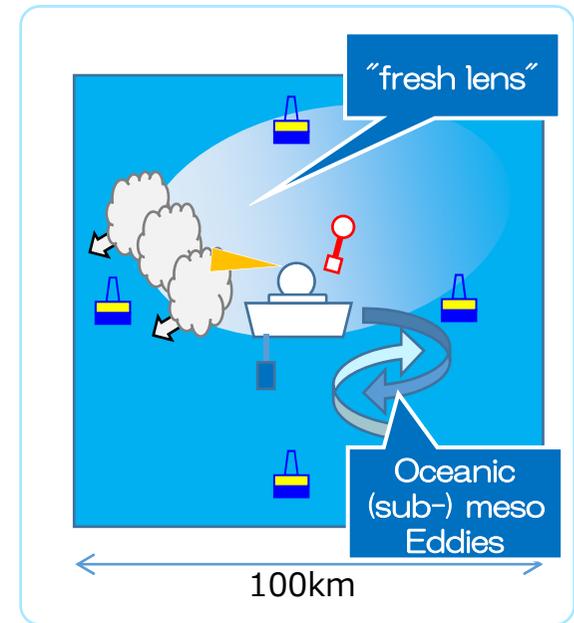
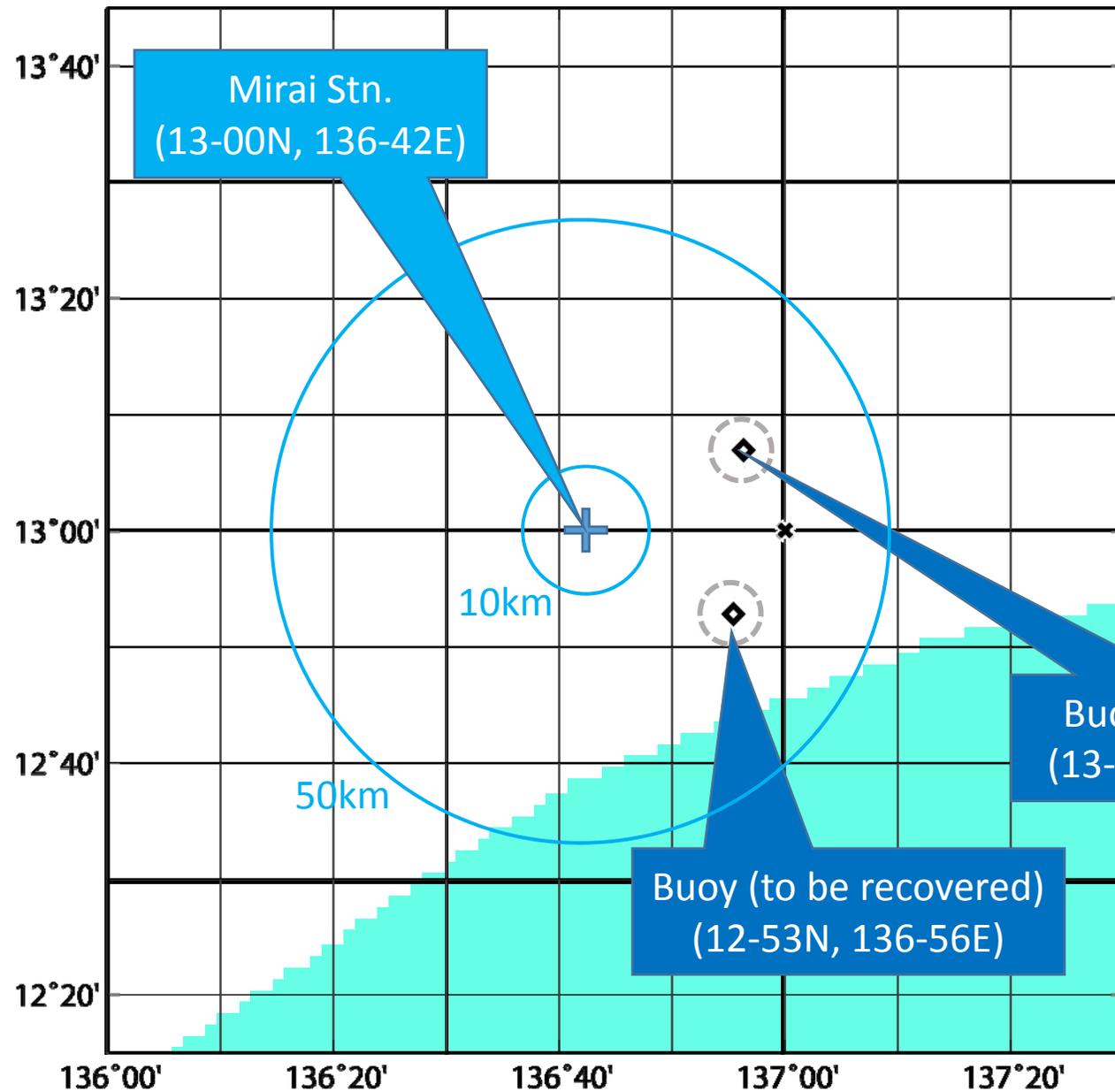
From Radar (echo coverage profile)



Aug.24 12Z IR image

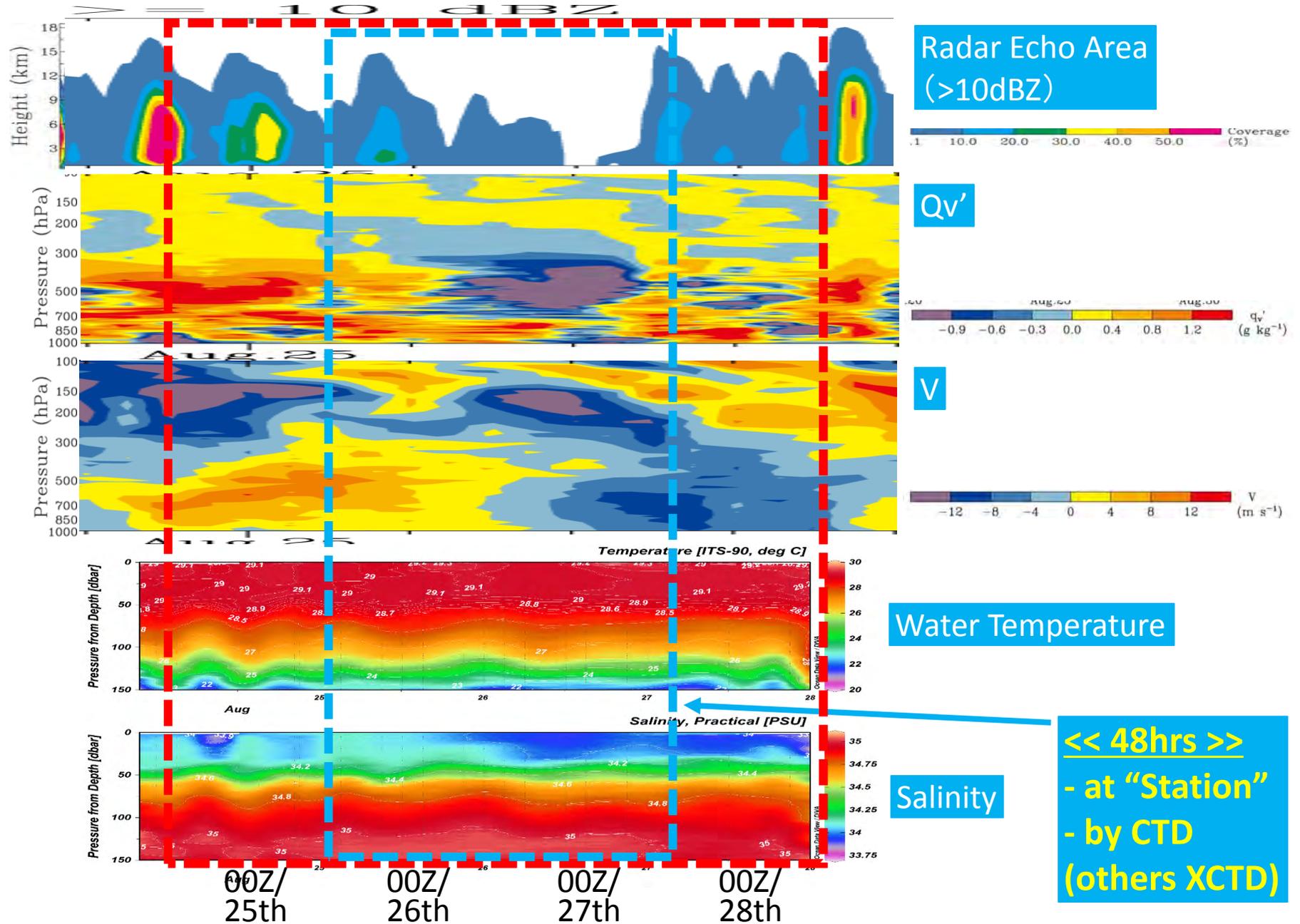


Special Obs. (1) Mesoscale observation on Atmosphere AND OCEAN



2 buoys in operation
→ Capture spatial distribution

Special Obs. (1) Mesoscale observation on Atmosphere AND OCEAN



Special Obs. (2) Oceanic Near-Surface Stratification (and rainclouds)



Surface Drifters

4cm (CT) [Surpact / DST]
20cm (T) [SC40]
36cm (CT) [SC40]
26cm (CT) [DST]
62cm (CTD) [DST]

※ provide by LOCEAN (Fr.)



SeaSnake

1-5cm (T)
10-50cm (T)

Surface Water Monitoring (TSG)

4.5m (CT etc.)

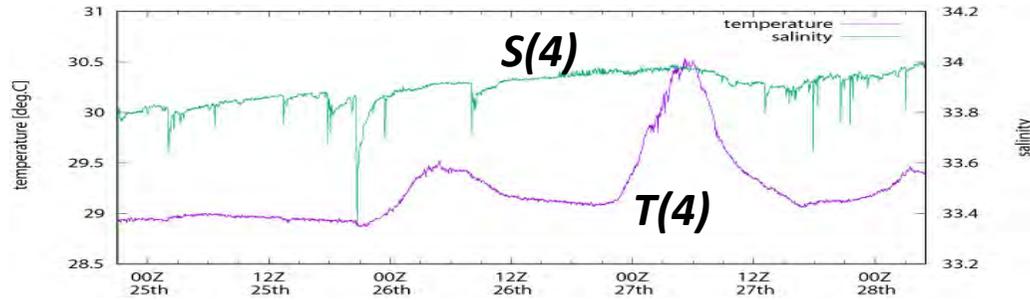


RINKO profiler

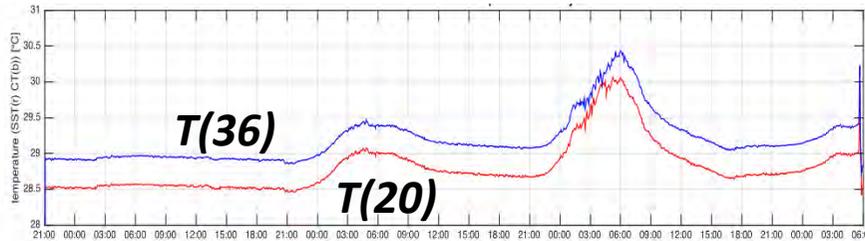
0.1-10m (CTD etc.)

On R/V Mirai

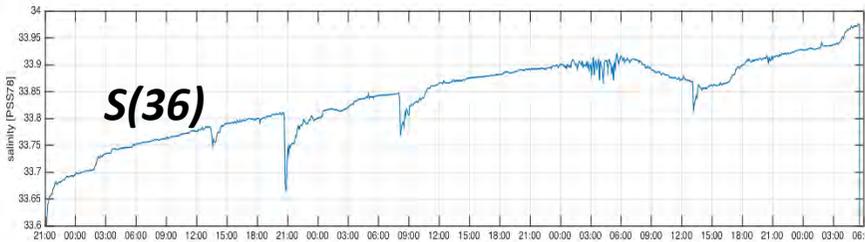
Special Obs. (2) Oceanic Near-Surface Stratification (and rainclouds)



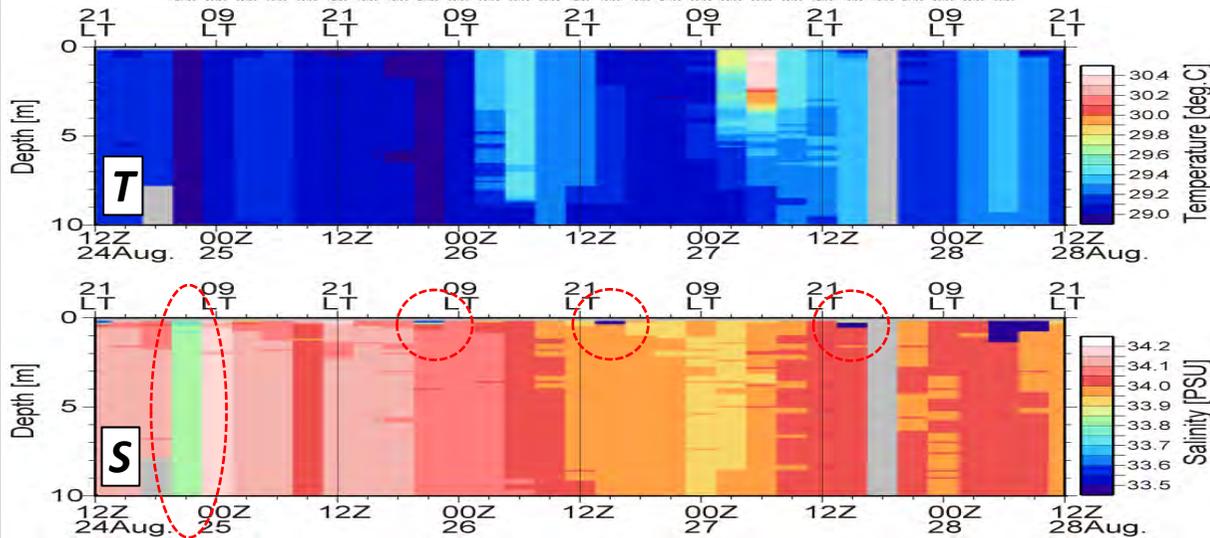
Drifter "Surpact" (4cm)



Drifter (20&36cm)



Drifter (36cm)

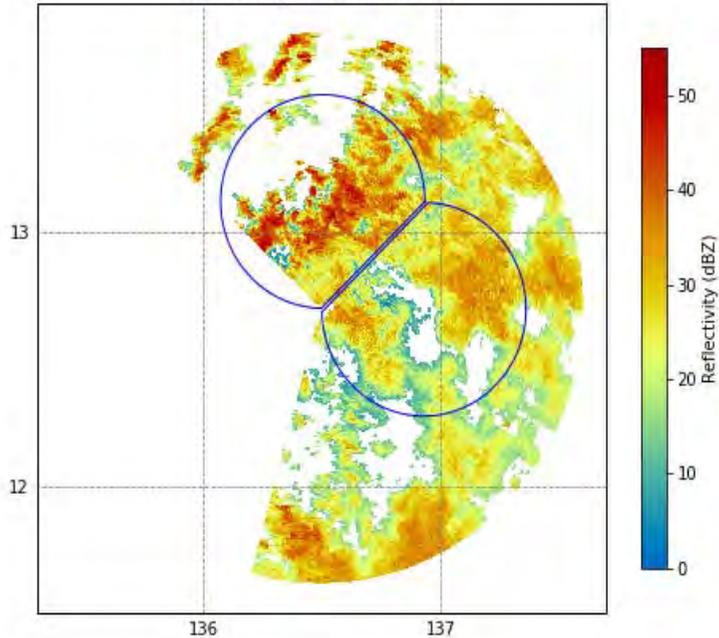


RINKO profiler (3hrly)

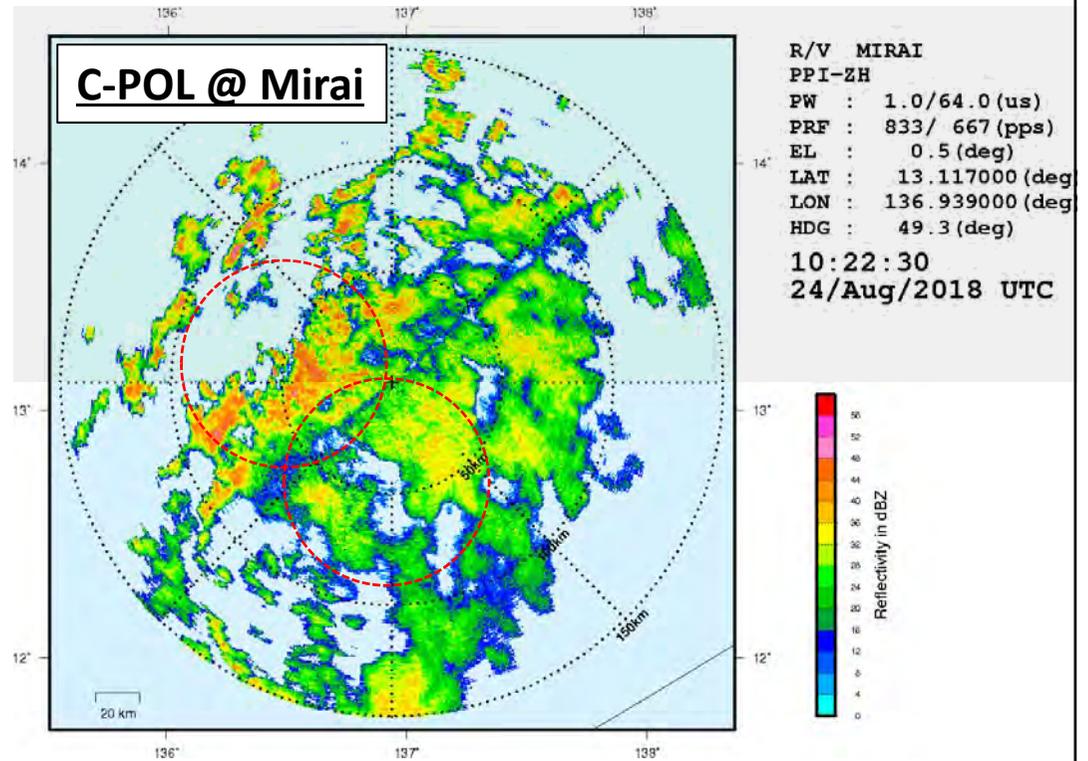
Special Obs. (3) Dual-Doppler w/ SEA-POL (@ TGT in PISTON)

SEA-POL @ R/V Thomas G. Thompson

SEAPOL 0.5 Deg. 2018-08-24T10:22:42.526000Z
Reflectivity (Combo Filtered)



C-POL @ Mirai

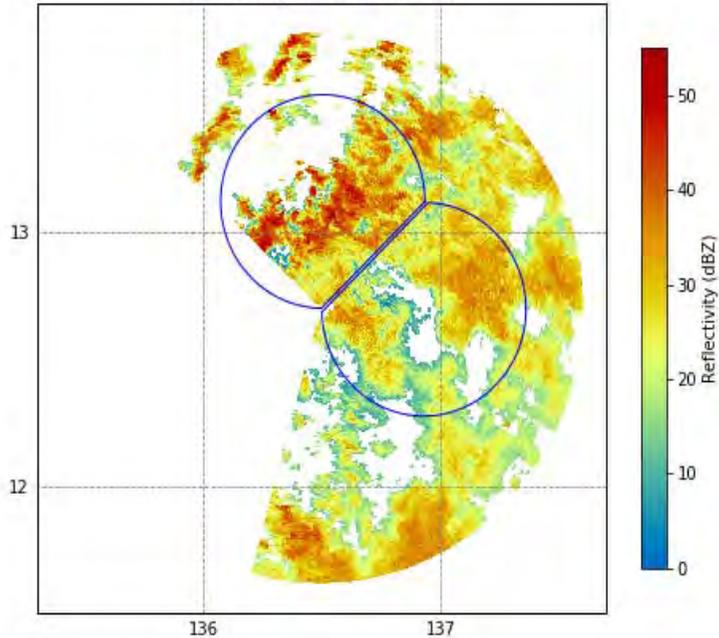


- Obtained data for 4 days in total
- Captured variations of meso-scale precip. systems

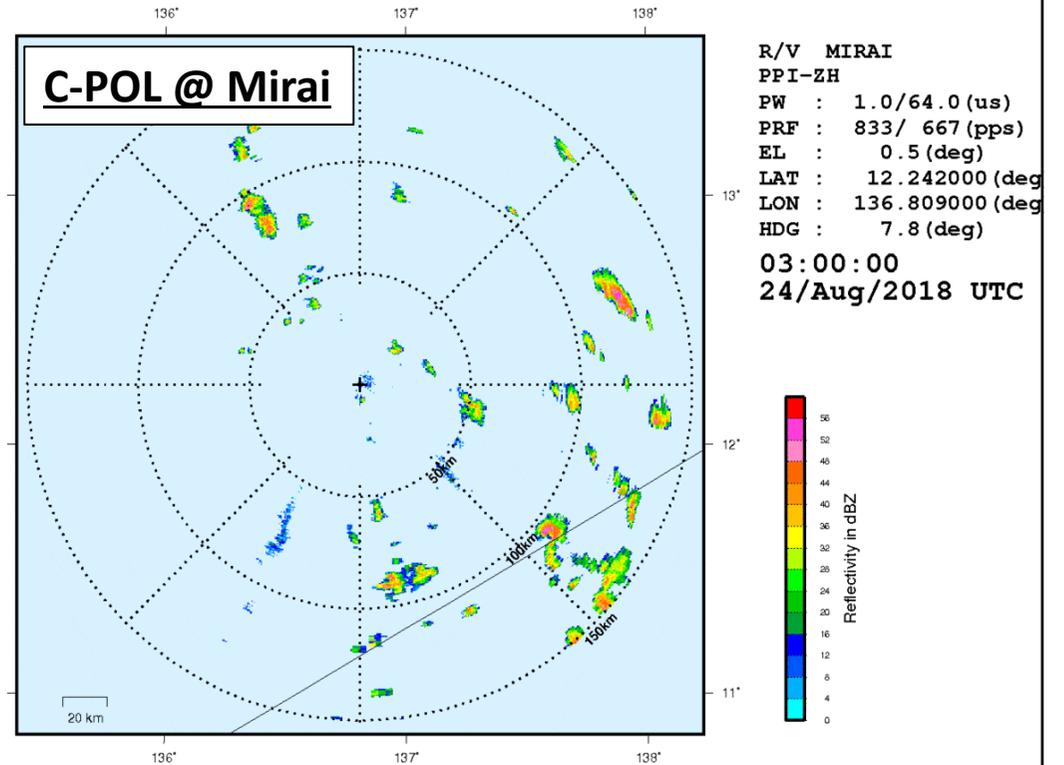
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SEAPOL 0.5 Deg. 2018-08-24T10:22:42.526000Z
Reflectivity (Combo Filtered)



C-POL @ Mirai



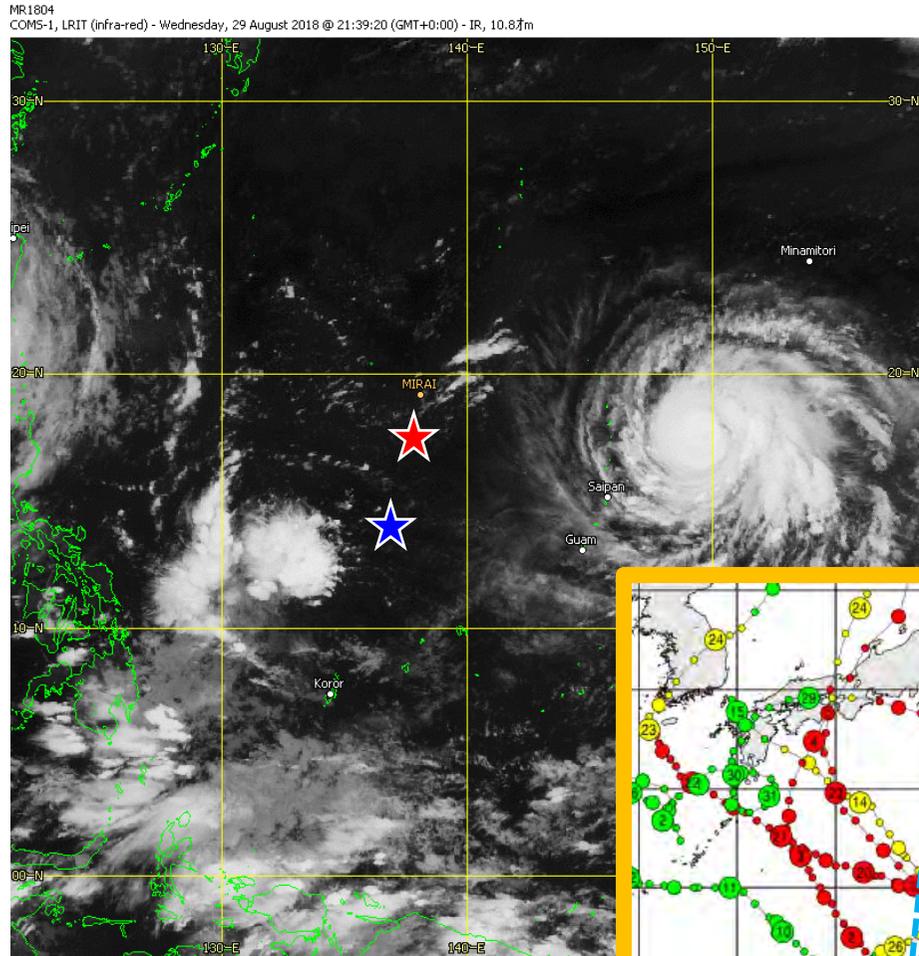
R/V MIRAI
PPI-ZH
PW : 1.0/64.0 (us)
PRF : 833/ 667 (pps)
EL : 0.5 (deg)
LAT : 12.242000 (deg)
LON : 136.809000 (deg)
HDG : 7.8 (deg)
03:00:00
24/Aug/2018 UTC



- Obtained data for 4 days in total
- Captured variations of meso-scale precip. systems

After Special Observation: On the way heading north ...

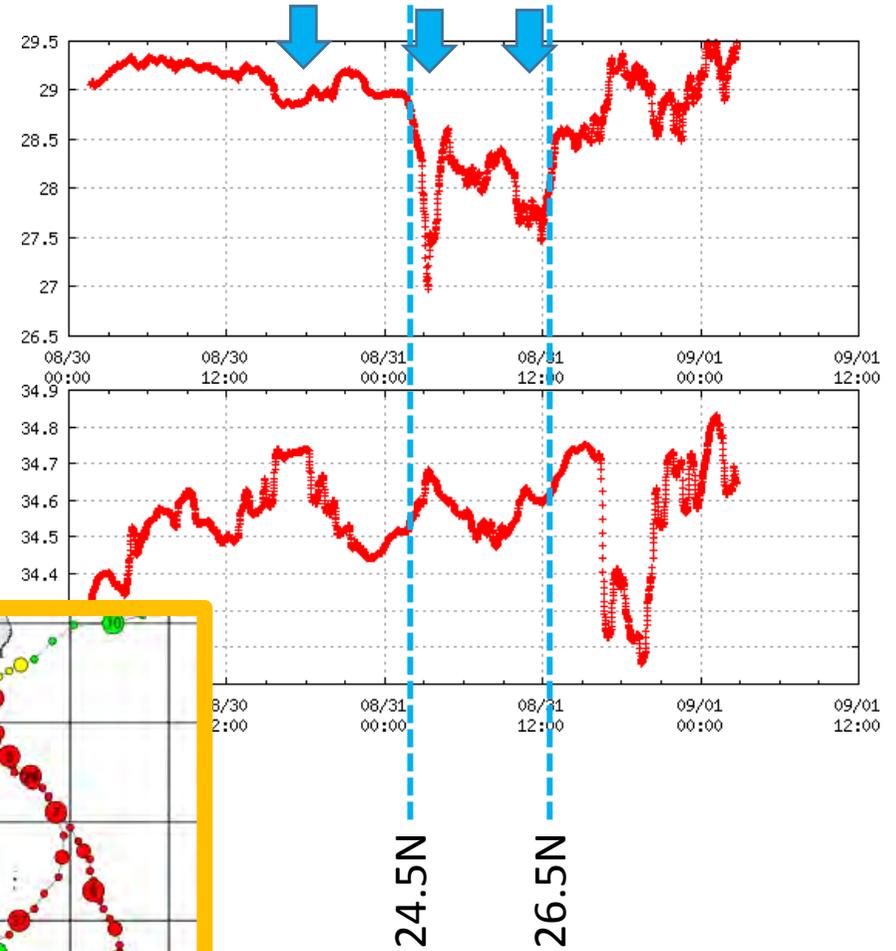
RS and drifter obs west of Typhoon Jebi



Mercator (WGS 84) projection.
Data is calibrated.

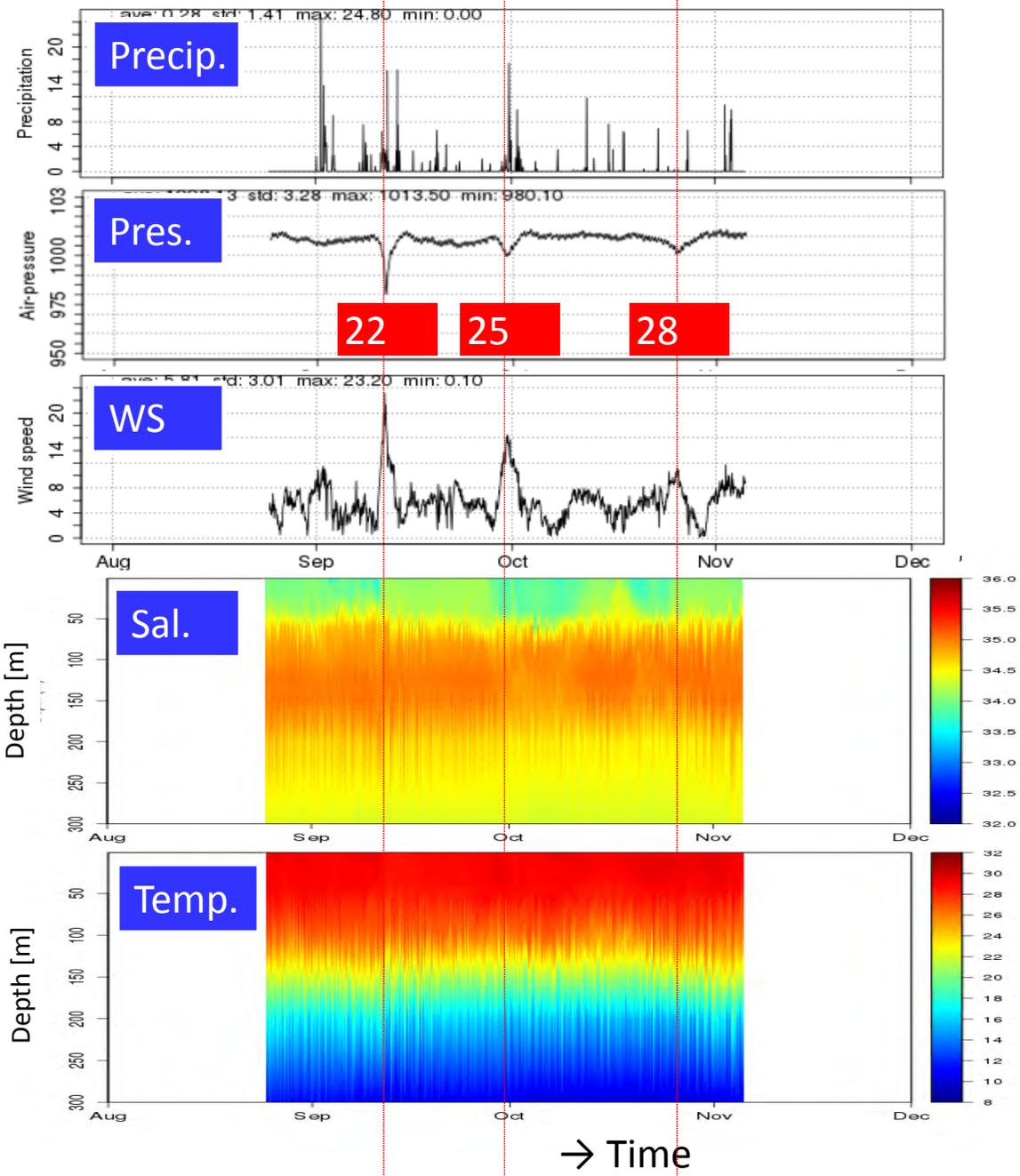
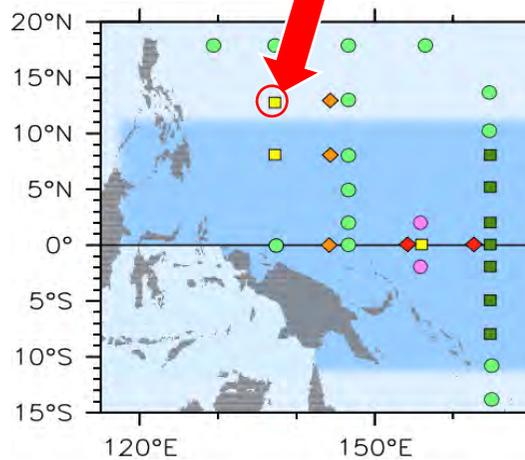
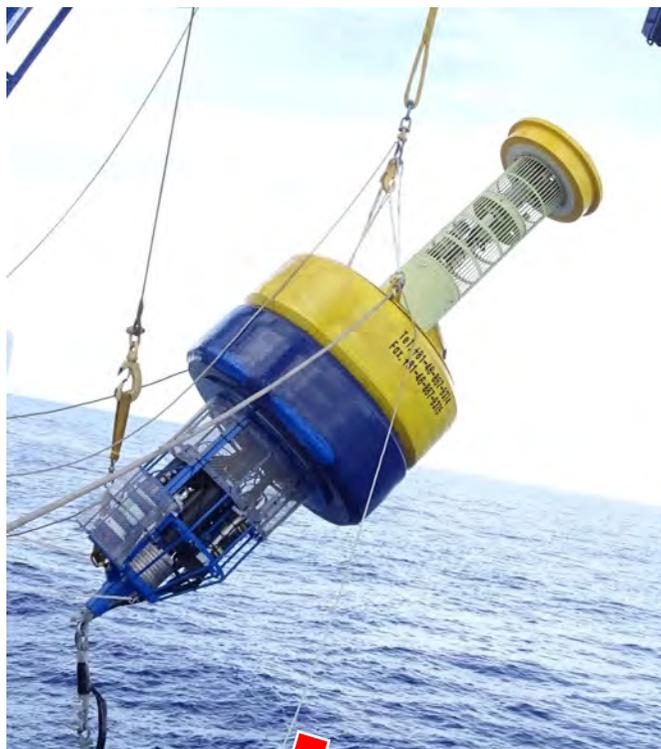
R/V MIRAI

Sfc Water on the track (along 139.5E): Cooling by typhoons in Aug. ?



Tracks of Typhoons in Aug.

After Special Observation: Buoy is working at 13N137E



Summary

- R/V Mirai continuing underway (and special stationary, of course) precipitation observations, using onboard C-POL radar and other instruments
- MR18-04 Leg-2 cruise was conducted in summer 2018, when YMC-BSM2018 and PISTON were on-going
- Special observation at (13N, 137E) was completed during the cruise, especially emphasizing observations on:
 - Meso-scale atmosphere-ocean structures
 - Oceanic near-surface stratification (collaboration with LOCEAN, France)
 - Dual-Doppler observations (collaboration with U.S. PISTON project)
- The buoys are on operation, with capturing a few typhoons in fall 2018

Suppliments

Example (2): TY1418 "Phanfone", under extratropical transition

Katsumata et al. (2016)

