U.S.CLIVAR Workshop "Atmospheric Convection and Air-Sea Interactions over the Tropical Oceans" @ Boulder / May 7, 2019

In-situ challenges of R/V Mirai to capture impact of precipitating systems on the environments: Atmospheric diabatic heating / drying and oceanic near-surface stratification

Masaki KATSUMATA (Japan Agency for Marine-Earth Science and TEChnology; JAMSTEC)

... with many collaborators ...



Photo: @ off Sumatra, 1559LST(0859Z), Dec.27, 2017

R/V Mirai, and onboard instruments



Launched: 1998



Stand-alone observations in western Pacific (case of 2001)



160E



Challenge: Aiming MJO initiation over Indian Ocean

Yoneyama et al. (2008)



Not well known mechanism for initiation Not well reproduced by numerical models Not well reported in-situ detailed observations

Challenge: Networked observations



Period toward MJO onset, observed in MISMO (2006)



CINDY/DYNAMO/AMIE/LASP: Enriched data and results



Moistening by individual Cu / Cg

Using Lidar (Raman signal)









"PALAU2008", for western Pacific BSISO



"PALAU2013", with "Thermistor Chain" to measure near-surface ocean





Case of "YMC-Sumatra 2017"



1500 2000 2500 3000 3500 4000 4500 mm/year

Sfc stratification and weather: A case of "YMC-Sumatra 2017"

Katsumata et al. (in prep.)



- 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 ~ 0.4PSU for 6m layer requires 70 mm precip., which is comparable to the radar-observed rain
- Salinity drop confined at surface ~5m layer also observed at R/V Mirai: not the point event



Near-surface obs in "MR18-04" (2018) in western Pacific (along with R/V Thompson in PISTON)



Surface Drifters

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

※ provide by LOCEAN (Fr.)



<u>SeaSnake</u>

1-10cm (T)

Surface Water Monitoring 4.5m (CT etc.)



<u>RINKO profiler</u>

0.1-10m (CTD etc.)



Near-surface obs in "MR18-04" (2018) in western Pacific (along with R/V Thompson in PISTON)



Near-future plans

Feb-Mar 2020: Eastern edge of warm pool (funded)



<u>Summary</u>

- R/V *Mirai*, equipping C-band radar and other atmos-ocean instruments, have been deployed various fields to capture in-situ evidences of convection and air-sea interaction since 1998.
- "MISMO" project challenged MJO onset over Indian Ocean, by using networked observations (to enable thermodynamic budget analyses). The CINDY/DYNAMO/AMIE/LASP field campaign in 2011-2012 greatly expand the results.
- In tropical western Pacific (TWP), several field campaigns were done to aiming BSISO (BSISV). *PALAU2008* captured clear contrast of Q1, Q2 and radar echo between before / after onset of BSISO convections. The effort in TWP continues as series of field campaigns *PALAU2010*, *PALAU2013*, and new field campaigns *in 2020* and *in 2021*.
- Oceanic near-surface stratification is another fields to be focused. We started it in *PALAU2013* by deploying a thermistor chain (T-Chain). The effort was followed by introducing unmanned boats (*WaveGlider*) in *YMC* field campaign, and surface drifters (*Surpact*) in *MR18-04*.
- Near-future deployment in the western Pacific is scheduled / planned. We do welcome collaborations.