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

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The C-band weather radar onboard the research vessel “Mirai” have been continuously provided the three-dimensional nature of the precipitating systems. By combining with the other observations, the data can be utilized to investigate impacts of the precipitating systems on the surrounding environmental atmospheric and oceanic fields. In this presentation, we introduce two paths of such efforts: Atmospheric diabatic heating / drying, and oceanic near-surface stratification.

The atmospheric diabatic heating can be estimated by using networked soundings and the thermodynamic budget analyses (Yanai et al. 1973). The first attempt using Mirai was in MISMO project in the Indian Ocean in 2006. In MISMO, we successfully captured the initiation of the MJO (Katsumata et al. 2009). Along with the lessons from MISMO (Katsumata et al. 2011), CINDY/DYNAMO/AMIE/LASP field campaign successfully captured MJO initiation (Yoneyama et al. 2013) and its thermodynamic impact (Johnson et al. 2015).

On the other hand, the similar field campaigns were also conducted for boreal summer intraseasonal oscillation (BSISO) in the tropical western Pacific. As a series of field campaign named PALAU in 2008, 2010 and 2013. In PALAU2008, one event of BSISO were successfully captured by the radars sounding network to reveal the clear contrast of diabatic heating / moistening and convection between before and in the convectively active phase (Katsumata et al. 2013).

The field studies for the impact on the oceanic near-surface stratification started in PALAU2013. In that field campaign, the thermistor chain was deployed from Mirai to successfully capture an event of near-surface (< 1 meter) temperature drop under the precipitation with weak wind (Bellenger et al. 2016). The second try was in YMC-Sumatra 2017 off the west coast of Sumatra, by utilizing an unmanned surface vehicle “wave glider”. The sensors at wave glider successfully captured salinity stratification in near-surface layer (< 6 meters) under the precipitation with weak wind. The effort also continues in R/V Mirai MR18-04 cruise (in the summer of 2018 in the western Pacific northern edge of the warm water pool) in which French surface drifters (including “Surpact”, see Reverdin et al. 2013) were deployed under the radar coverage and nearby the surface mooring.

These efforts have been captured many interesting relationships. Further comprehensive analyses of these obtained dataset, as well as further field campaigns to enrich the dataset, are essential to further reveal the impact of precipitating systems on the environmental atmospheric / oceanic status (and vice versa to understand interactions).