

## **Ocean Processes and MJOs - Physics, Low-Frequency Rectification, and Bio-Physical Feedbacks**

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Ocean response to MJOs has been investigated extensively and abundant evidences are found in models that MJOs are a coupled phenomenon. Details of ocean processes including the mixed layer thermocline interactions and complex vertical structures in the ocean remain active areas of investigations. Here we focus on ocean ecosystem response and rectification of surface chlorophyll (Chl) concentration when forced by composite Madden-Julian Oscillation (MJO) events. In addition to the shoaled mixed layer depth (MLD) previously reported, it is also found that isothermal depth (ITD) and iso-nutrient depth are shoaled and barrier layer thickness (BLT) is reduced in the seasonal / annual mean by MJO forcing. Case studies reveal that the MJO forcing increases variations of the MLD, ITD, and iso-nutrient depth mostly in the upper ocean, which translates into a weakened vertical stability, and contributes to the increased Chl concentration in the surface layer. The reason for the reduced long-term mean BLT is found to be the rectifying effect of the MJO forcing on the ITD. Conversely, an increased mean BLT by the MJO forcing is detected in the southern Bay of Bengal. This is due to climatologically deep ITD in the active MJO season (boreal summer) which limits the rectifying effect of the MJO forcing. Observational data support model results in the limited region and season, but further investigation is necessary to confirm the effect of atmospheric ISV on mean surface Chl concentration. Bio-physical feedbacks in other regions of the Indo-Pacific are also discussed with regional specificities of oceanic processes and bio-feedbacks. Some speculation is offered about the potential role of these feedbacks in MJO life cycles.