



Diurnal Cycle of Precipitation over the Maritime Continent in Relation to MJO

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Motivation

- ❑ The Madden-Julian Oscillation (MJO), a large-scale disturbance of heavy rainfall that propagates eastward from the tropical Indian Ocean to the West Pacific on a timescale of 30-60 days, has profound impacts on downstream weather across the western hemisphere.
- ❑ About 50% of the time MJOs stall over the Maritime Continent (MC) for reasons we do not understand yet.
- ❑ Such a barrier effect of the MC on MJO is poorly represented in current weather and climate models, severely limiting their subseasonal-to-seasonal (S2S) forecast capabilities.
- ❑ It has been hypothesized that the interaction between MJO and the diurnal cycle of convection over the MC may play a role in the MC barrier effect.

Objective

- ❑ Compare the diurnal cycle of precipitation over the MC for a crossing MJO (MJOC) and a blocking MJO (MJOB) during the TRMM/GPM observing period
- ❑ Perform convection-permitting model simulations to understand the physical processes that govern the interaction between MJO and the diurnal cycle of convection over the MC

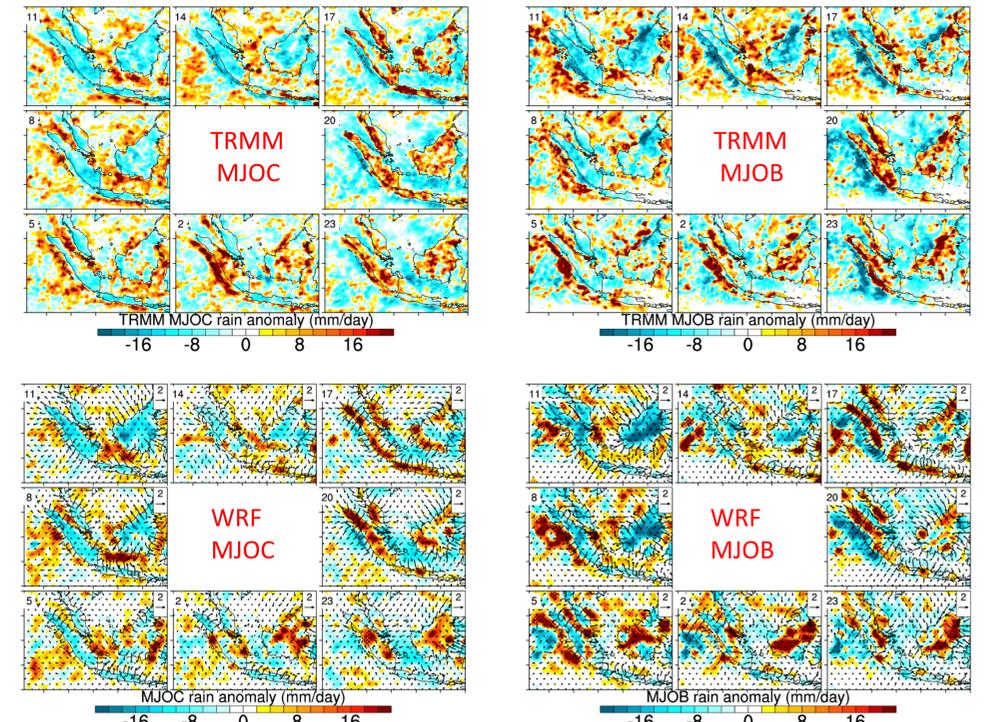
Selected MJO cases

- MJOC: Nov. 20, 2014 – Dec. 09, 2014
- MJOB: Nov. 01, 2012 – Nov. 14, 2012

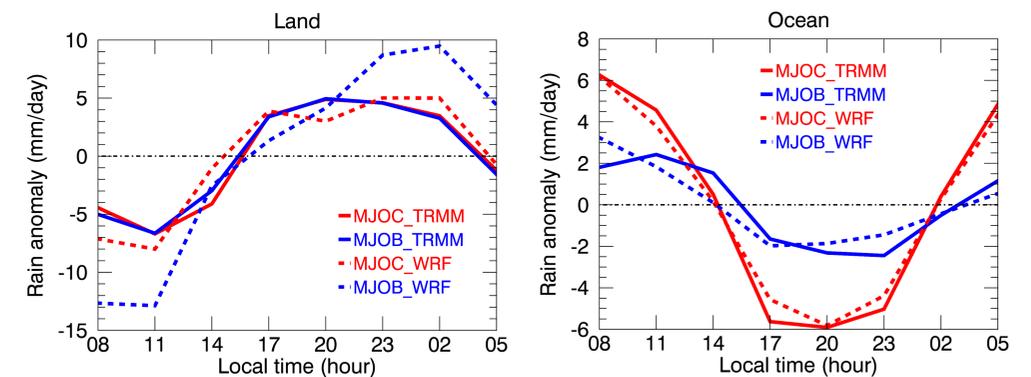
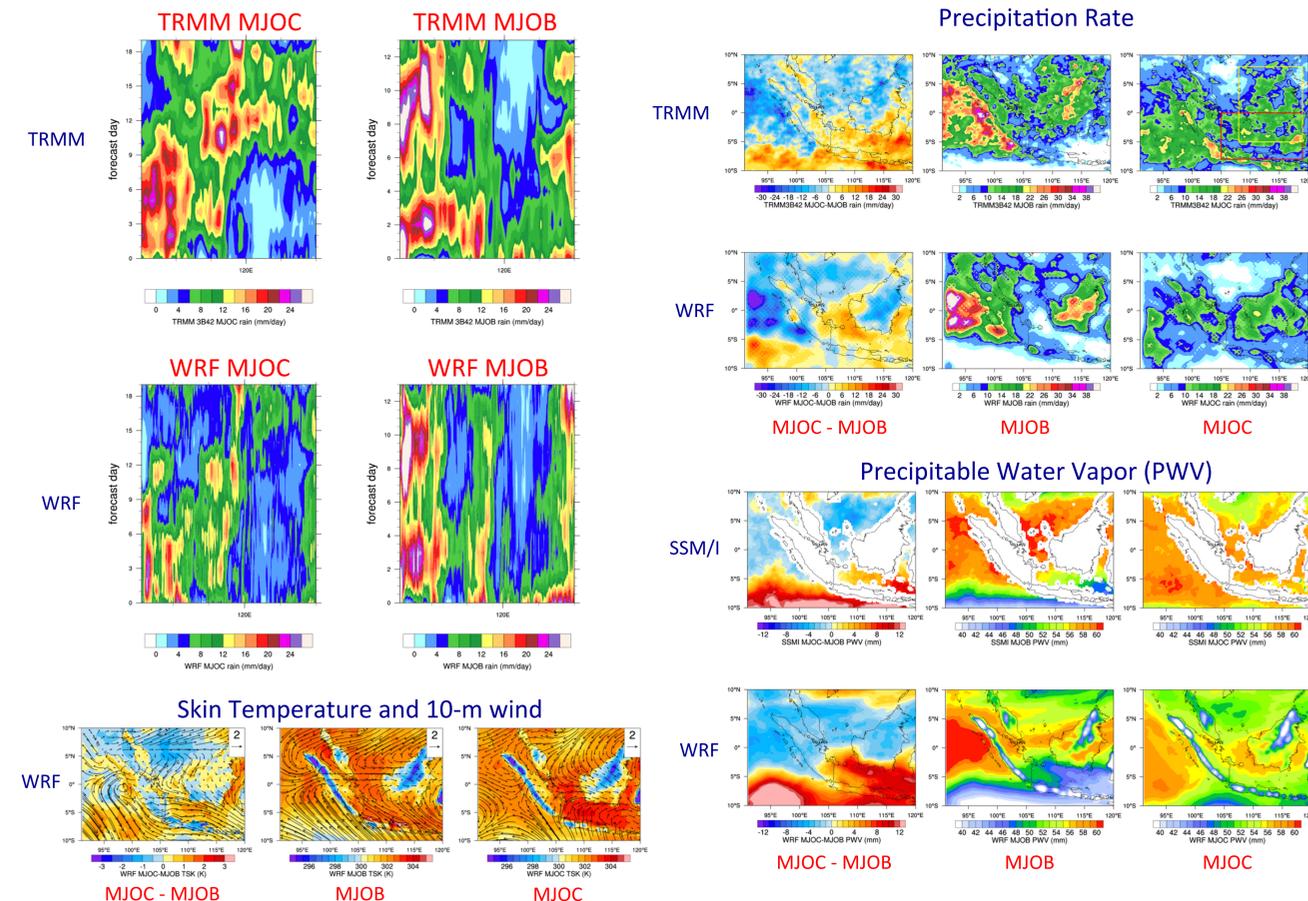
Model set-up

- ❑ WRF V3.8.1
- ❑ Three-nested domains: 36 km, 12 km and 4 km, respectively
- ❑ 50 vertical levels from the surface to 50 hPa
- ❑ Initial and boundary conditions: ERA-Interim
- ❑ SST updated every 6 hour
- ❑ Model physics:
 - Tiedtke cumulus scheme at 36 km and 12 km, no cumulus at 4 km
 - Morrison 2-moment microphysics
 - RRTMG shortwave and longwave schemes
 - Noah land surface
 - YSU PBL

Results – Diurnal variations (daily mean removed)



Results – Daily means



Summary

- ❑ WRF simulations approximately capture the two MJO events but with weaker amplitude of precipitation and its propagation features.
- ❑ We find that the crossing MJO is associated with warmer SST and higher water vapor over the open water in the MC than the blocking MJO, while the land surface temperature exhibits inhomogeneous mixed differences between the two events.
- ❑ Over the water, the crossing MJO is associated with much stronger diurnal variation of rainfall than the blocking MJO.
- ❑ Over the land, the blocking MJO is associated with slightly stronger diurnal variation of rainfall than the crossing MJO.

Acknowledgements

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