

# Madden-Julian Oscillation in E3SMv1

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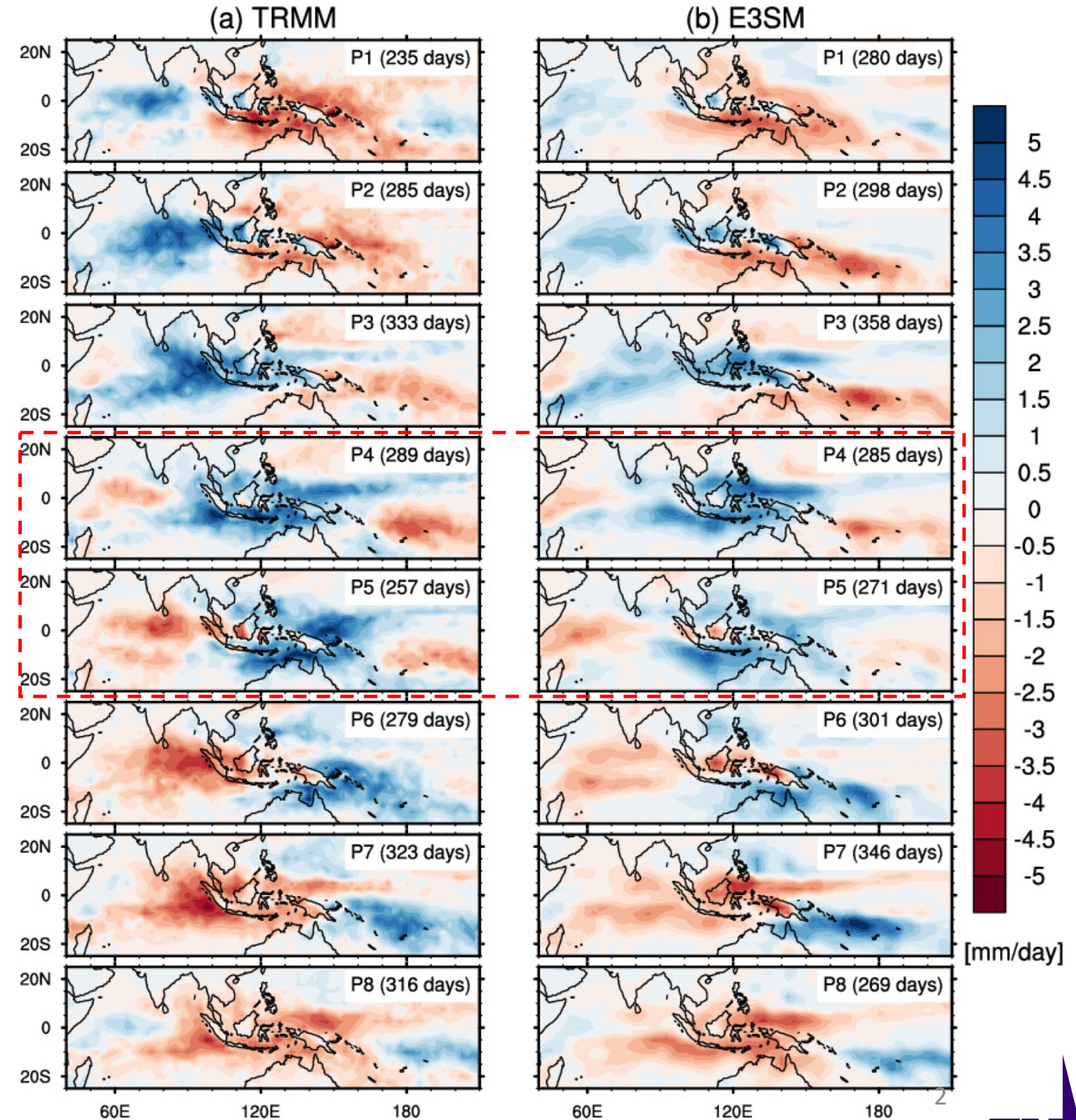
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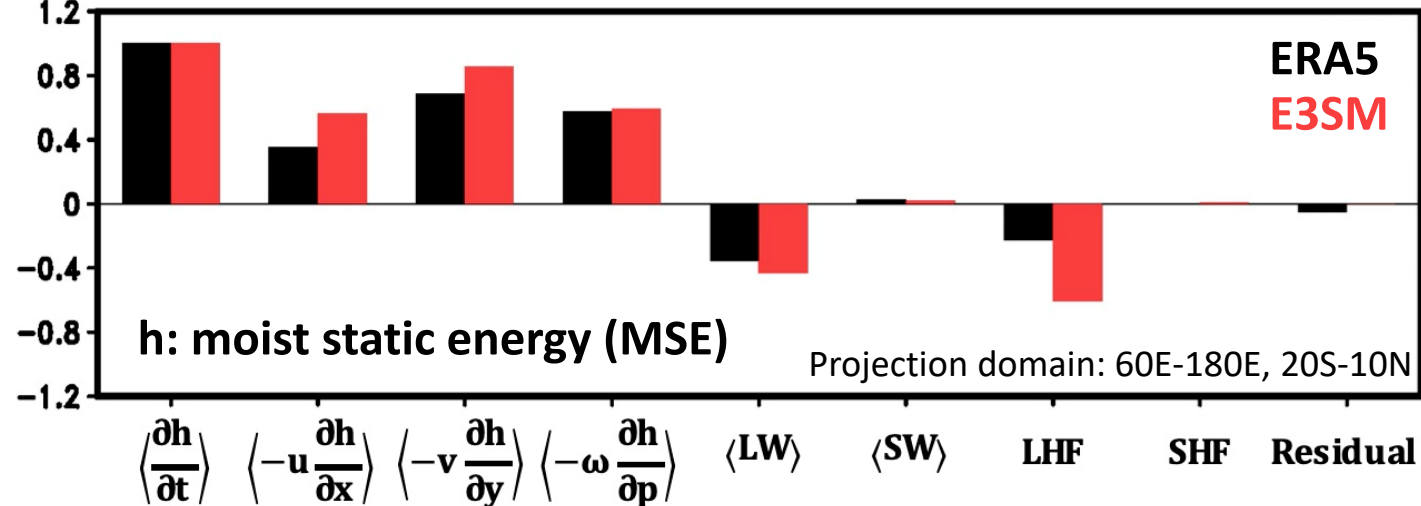
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# MJO propagation

- E3SM realistically simulates MJO's eastward propagation, including the spatial pattern of precipitation anomalies around the Maritime Continent (MC) - phases 4 and 5
- MJO MSE budget shows that horizontal and vertical advection terms are responsible for the eastward propagation, as in observations and consistent with the moisture mode framework

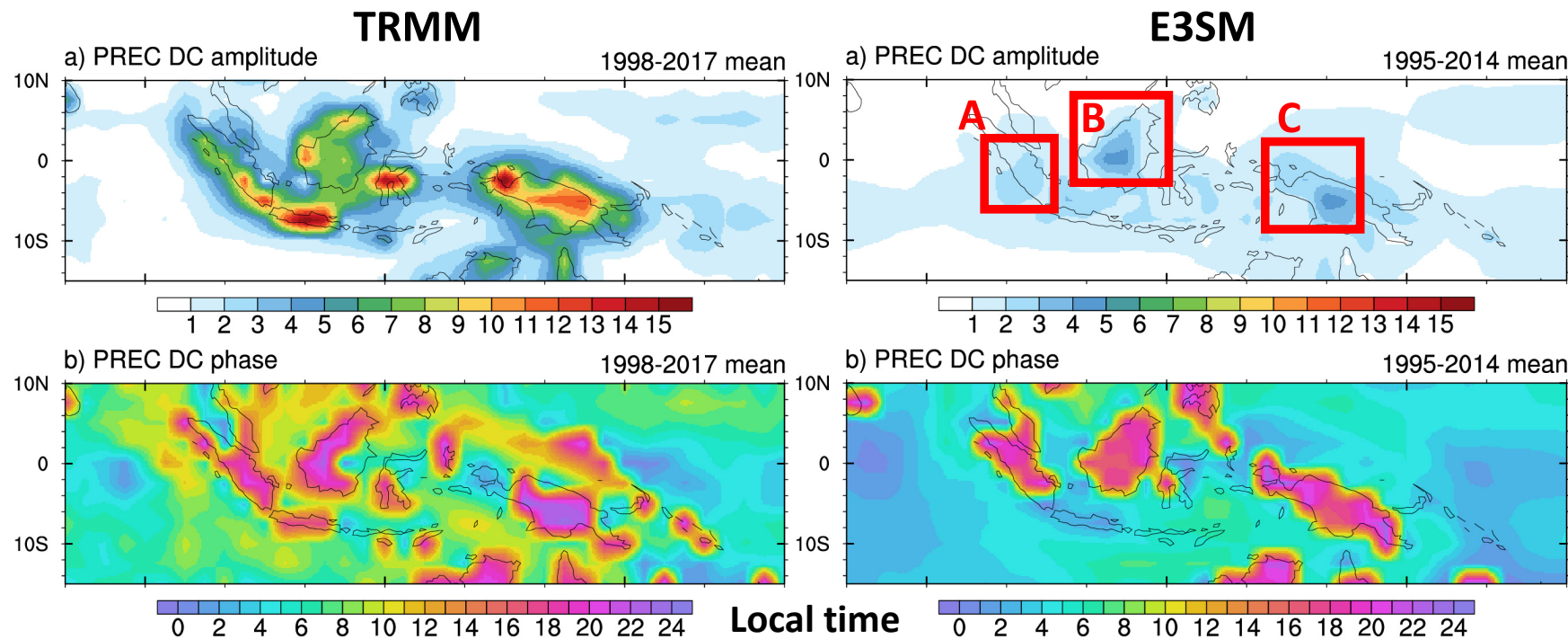


Contribution to MJO propagation (P2+P3)

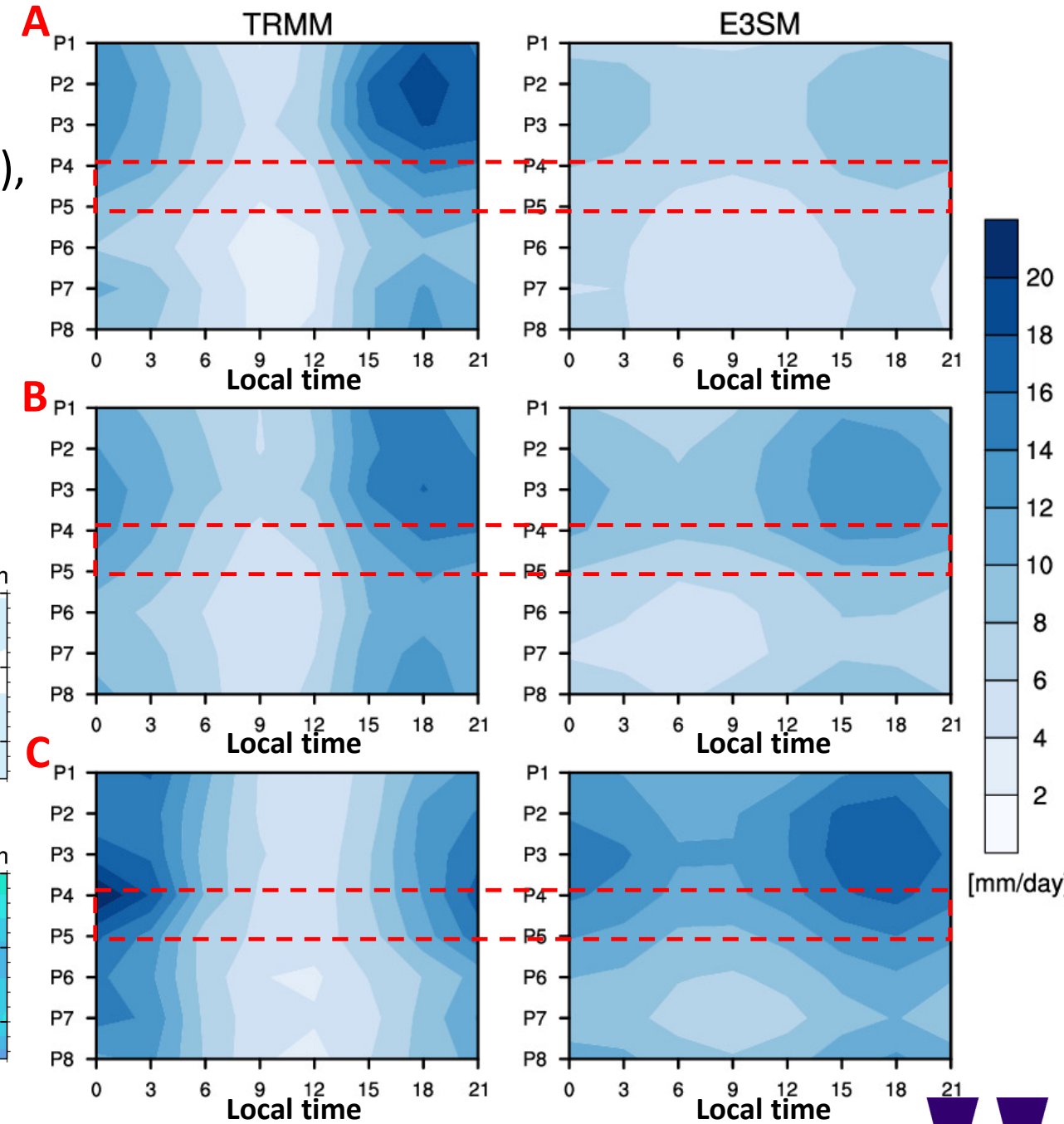


# MJO Modulation of MC Diurnal Cycle

- The role of Maritime Continent (MC) diurnal cycle (DC) on the propagation of the MJO is poorly understood
- E3SM exhibits much weaker DC amplitude than the observed (20-30%), whereas DC phase is realistic (evening peak in land, morning peak in the ocean)
- Despite the amplitude bias, increase in diurnal precipitation before the main envelop of MJO is realistically captured in the model

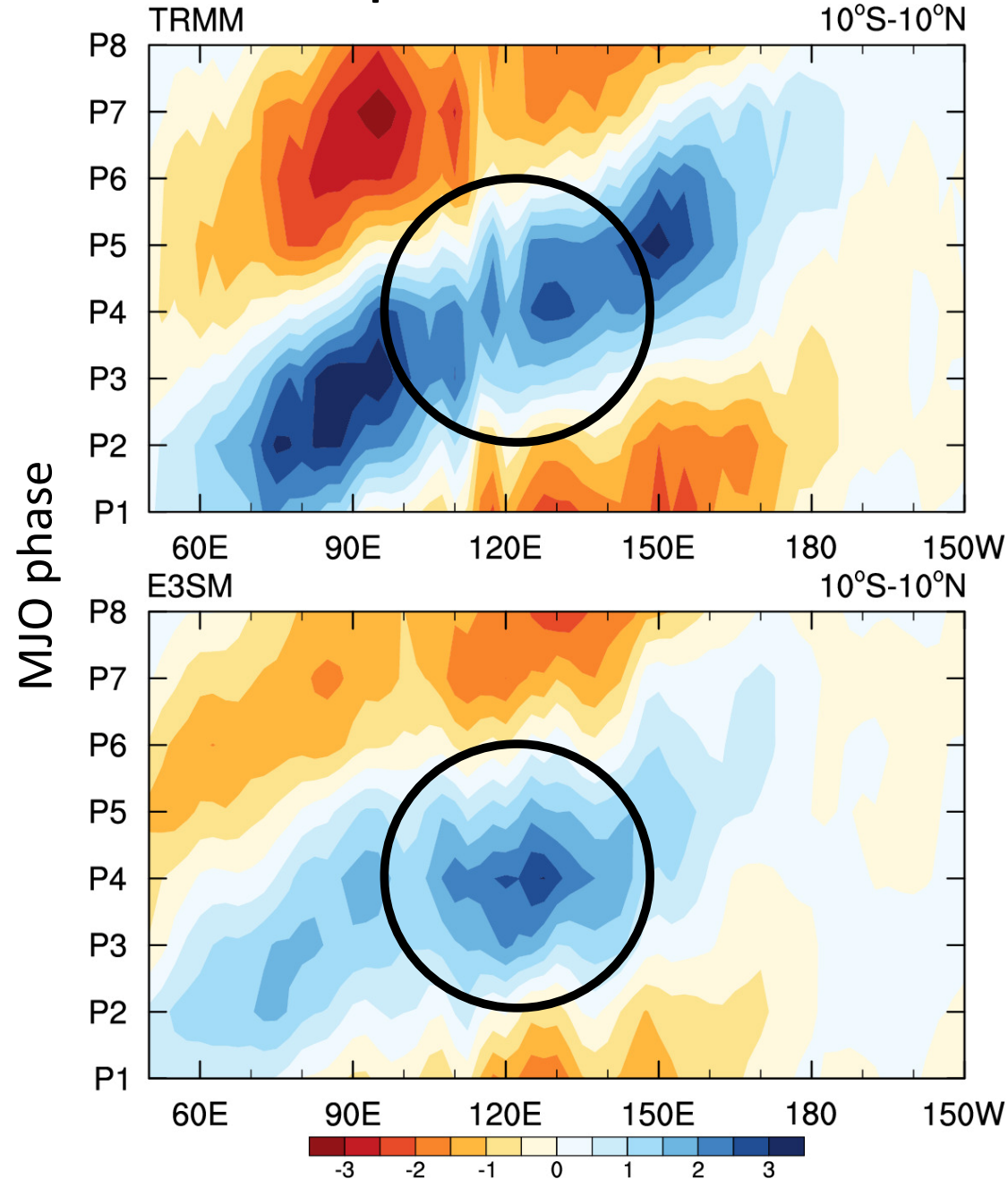


## MJO modulation of DC precipitation in MC land



# MC Barrier Effect on MJO

## MJO composite of PREC anomalies



- The MC barrier effect on MJO is not fully understood and is poorly represented in many climate models
- The MC barrier effect is not present in E3SM, in which MJO precipitation anomalies are stronger in the MC than in the adjacent ocean basins
- Jiang et al. (2019) argued that MJO weakens in the MC region due to the steep negative zonal moisture gradient to the east of Sumatra and Borneo, which is contradictory to our results
- The weak MC barrier effect in E3SM might be due to the weak diurnal cycle amplitude

## Climatology of zonal moisture gradient (integrated between 925-700 hPa)

