**Reading guidelines for Lecture 15: Madden-Julian Oscillation (skip sections 3, and 4)**

1. Why the MJO is important for both weather and climate predictions?
2. The MJO study can be regarded as the *holy grail* of tropical atmospheric dynamics.
3. This review article focuses on five topics: observed features, mechanisms (to be neglected), simulations (to be neglected), air-sea interaction, and influences on ENSO.
4. The so called large-scale circulation and convection coupling is illustrated in Fig. 1.
5. Note the (a) highly-varying dominant period, (b) different zonal scales between circulation and convection, and (c) various propagation speeds in the life cycle of MJO. Hence, the MJO is more a discrete pulse-like event than a sinusoidal wave.
6. Discuss the wave structures of MJO (shown in Fig. 5) which have been considered dynamically essential.
7. Discuss the 4 MJO models shown in Fig. 6.
8. How the zonal asymmetry in winds, water vapor, temperature, divergence, and diabatic heating provides favorable conditions for the eastward propagation of the MJO convective center?
9. How the maritime continent diurnal cycle in convection is affected by the MJO?
10. Identify the westerly wind burst (WWB) events from Fig. 2a.
11. Why the MJO-associated convection over the maritime continent and Amazon basin is much weaker than the surrounding warm oceans (see Fig. 9)?
12. The MJO exhibits a distinctive multiscale structure (see Fig. 8), geographic preference (see Fig. 9), seasonal cycle (see Figs. 9, 10), and interannual variability.
13. While the simultaneous relationship between the MJO activity and SST indices representing ENSO is weak, the MJO activity in the Pacific is vigorous prior to the peak of El Nino and becomes very weak after the peak and during a La Nina. What would be the implication?
14. What are the distinctions between MJO and WWB events?
15. What constitute the MJO forcing which perturbs the upper ocean? Examine the role of each term (see Fig. 15).
16. What are the two types of oceanic responses to the MJO forcing?
17. What are the footprints of the MJO in the ocean?
18. What is the phase relationship between MJO-convection center and MJO-induced SST anomaly (see Fig. 17)? Which processes can affect such a relationship?
19. What is the barrier layer? What is its function?
20. How the equatorial Kelvin wave can lead to the warming of SST in the equatorial eastern Pacific?
21. Discuss the possible relationships between MJO and ENSO.
22. Why the equatorial oceanic current responses stronger to westerly wind forcing than to easterly wind forcing? (Thus, there exists WWB but not easterly wind burst)
23. How can MJO affect (even trigger) an ENSO warm event?
24. If the effect from the MJO on ENSO increases, then the ENSO predictability decreases. What does this mean?