Equatorial waves in two-dimensional turbulence on the sphere

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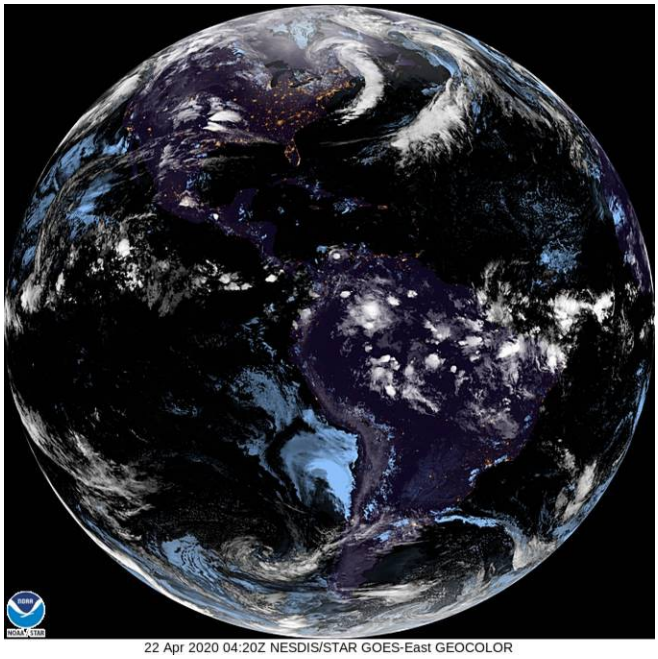

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On any given day in the tropics, satellite observations reveal a rich variety of clouds, accompanied by a range of precipitation types and strengths – even tropical cyclones. Within this sporadic activity, a striking feature is the formation of localized deep convection centers, in which most of the rain occurs. Severe thunderstorms may occur on a daily basis. While individual convection centers are quite short lived and variable, observations spanning several days reveal an organized aggregation of moist convective activity. The cause & effect of this aggregation is still not understood in the scientific community. Spectral analyses of moist convection-related quantities like outgoing long wave radiation show significant power at discrete spatial scales up to ≈ 10 000 km embedded in a red-noise spectrum originating from a fully turbulent atmosphere. The observed maximum variability in brightness temperature corresponds to theoretical equatorial wave dispersion relations on the β-plane. The tropical convection can be seen to also aggregate in large scales driven by features found in dry dynamics, like tropical Rossby, gravity, Kelvin waves, and the MJO - one prominent 60-90 day time scale planetary wave, which has a strong influence on weather in the tropics and outside (influencing seasonal prediction skill). The interaction and influence of moisture on these large scale patterns is still not understood at a basic level. In computer simulations, groups around the globe are beginning to include the role of moisture in simple shallow water flow to better understand the challenge it poses from a physical perspective, as it makes the physics irreversible. We present first results from an ensemble of simulations indicating possible multiple-equilibria in the tropical flow, once latent heat release passes a certain threshold.

The talk will be organized as department seminar in zoom with several opportunities to reflect & ask questions.