Intraseasonal Dynamics of Equatorial Atmosphere and Oceans

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Climate modeling intercomparison studies demonstrate a clear divergence of future climate predictions for equatorial regions, calling for better understanding of tropical atmosphere-ocean dynamics. Equatorial regions are unique in that they have the warmest sea surface temperature on the earth, show strong zonal and meridional inhomogeneities, and feel the influence of earth's rotation through the beta effect. The energetic nature of tropics causes their influence to pervade globally, and hence the role of tropical dynamics in global environmental predictions cannot be overemphasized. Current weather prediction from global to meso scales is conducted using a chain of scale-specific models nested appropriately, but efforts are afoot to develop 'seamless' modeling across weather to climate scales, which require a deeper understanding of processes at various space-time scales (e.g., meso, synoptic, seasonal, decadal) as well as transitional phenomena in between. To this end, intraseasonal disturbances of tropical atmosphere and oceans that occupy time scales form about 10 to 60 days have gained recent attention because of its relation to Boreal summer monsoons and rainfall and improving predictability in advance of few weeks. Of particular importance are the migration of the Intertropical Convergence Zone, equatorial planetary waves that propagate in all directions within atmosphere and oceans, interaction of these waves with landmass (e.g. maritime continent) and ocean boundaries, and air-sea interactions associated with such disturbances. During 2012-2015, field experimental programs were conducted in the northern Indian Ocean under the sponsorship of the Office of Naval Research to study, among other aspects, intraseasonal oscillations in tropics. These were dubbed ASIRI (Air Sea Interactions in the Northern Indian Ocean) and ASIRI-RAWI (Remote Sensing of Atmospheric Waves and Instabilities). An array of observing platforms was used by a bevy of investigators, partnering with multiple countries and covering several basins of the Indian Ocean. Observations and associated modeling conducted during these programs will be described in this presentation, paying particular attention to intriguing phenomena that were observed and explained using fundamentals of stratified and rotating flow dynamics.