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# Atmospheric convectively coupled Kelvin waves over Indian Ocean: initiation, propagation and interactions with the Maritime Continent

Dariusz Baranowski (1), Maria Flatau (2), and Piotr Flatau (3)

(1) University of Warsaw, Institute of Geophysics, Department of Atmospheric Physics, Warsaw, Poland (dabar@igf.fuw.edu.pl), (2) Naval Research Laboratory, Monterey, USA, (3) Scripps Institution of Oceanography, University of California San Diego, La Jolla, USA

Atmospheric convectively coupled Kelvin waves (CCKWs) propagate eastward in the equatorial belt and represent one of key modes of the intraseasonal variability in the topical atmosphere. CCKWs with other waves are building blocks of the Madden-Julian Oscillations (MJO), but their activity is not limited to the MJO itself.
In this study, we utilize Lagrangian analysis, which allows tracking individual CCKW events. Such an approach enables identification of initiation and decay of convective events as well as analysis of environmental conditions throughout the lifetime of a CCKW.
Analysis of 15-year-long global record of CCKW activity, derived from TRMM satellite data, shows that Indian Ocean basin is characterized by globally largest activity of CCKWs and that about 40% of events active in that region are sequential waves, which propagate in close proximity to each other. Analysis of environmental conditions identifies air-sea interaction, primarily development of the diurnal warm layers, to be an important contributor to the initiation of CCKW events over Indian Ocean basin. CCKWs events, which initiation over the same area within a few days of each other are proceeded by abnormally high diurnal SST due to warm layer development. Propagation of a CCKW across the Indian Ocean is characterized by coherent variability in air-sea fluxes: increase of wind speed and latent heat flux, and suppression of diurnal warm layer development, decrease in SST and lower tropospheric temperature and humidity. This typical variability last for about 5 days, after which time most of variables relax to their climatological levels. However, SST and lower tropospheric humidity rectify into longer, intraseasonal time scale. Magnitude of this variability increases monotonically across the Indian Ocean as CCKWs propagate eastward and achieves maximum west of the coast of Sumatra.
The Maritime Continent (MC), which bounds Indian Ocean from the east, is a net sink of CCKW activity, which means that more events terminate than initiate over that region. CCKWs bring excessive precipitation to the MC region. However, the amount of anomalous precipitation due to CCKW passage is strongly modified by interactions with the MC environment itself, primarily with vivid diurnal cycle of convection over Sumatra, Borneo and surrounding seas. Analysis of the time at which a CCKW approach Sumatra shows that events, which are in phase with local diurnal cycle bring 2.5 more anomalous precipitation than events that do not account for such favorable conditions. Furthermore, analysis of the terminal longitude reveals that events phase locked with local diurnal cycle of convection have 40% better change to propagate across the MC region into the Western Pacific.