Understanding the processes associated with the intraseasonal sea surface temperature variability in the Northern Indian Ocean during boreal summer

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1. Introduction
   The predictability of the Indian summer monsoon would depend on relative contribution of Intraseasonal Oscillations (ISOs) to the seasonal SST variability. These atmospheric ISOs classified into a broadband spectrum of scale between 10 and 90 days with two preferred bands of periods of 30-90 day and 10-30 day time scale. Formerly, Madden–Julian Oscillation (MJO) [e.g., Madden and Julian, 1971] having distinct character in summer from the boreal winter and later as submonthly when westward moving convectively coupled waves dominates [ Wheeler and Kiladis, 1999]. The local coupled Indian Ocean–air interaction basically governs the structure and the phase propagation of aforementioned ISOs. Tropical ocean affects the atmosphere via sea surface temperature (SST) through which mainly control the local coupled processes, hence investigating processes associated with the intraseasonal SST is key to understand. The different basin of the Indian Ocean for the summer season over NIO responds different.

2. Intraseasonal air-sea interaction associated with summer ISOs in NIO

The flux components are regressed on the intraseasonal SST in the selected regions (Figure 2). The peak-to-peak amplitude of net heat flux perturbation is 40 Wm⁻² in the NB00 and in phase relation with dominant contributors such as short wave and latent heat fluxes and a negligible amount from long wave and sensible heat flux. Around two-third of the net heat flux fluctuations is contributed by cloud radiation and remaining one-third is contributed by the lateral heat flux forced by the intraseasonal winds. The net heat flux contribution in the OMAN region is dominated by the latent heat flux and short wave radiation (the latent heat dominating the net heat flux in the active phase) and the long wave radiation contributes negatively to the net heat flux. Over the WAS, the latent heat flux primarily drives the SST variability and is dominant in both active and suppressed phase of ISO. This may be due to the perturbations in the surface winds associated with the LLJ variability, in contrast to the other SST variability is characterized by out of phase flux components.

Subsequently SST variability is weaker than that of MJO scale, whereas the heat flux and momentum fluxes are comparable to those of MJO. Hence, in the case of submonthly, the intensity is lessered by the short period of atmospheric forcing: SST in the sub monthly scale shows peak amplitude of about 0.6°C in BOB and STI, whereas it is about 0.4°C in WAS and 0.3°C in OMN (Figure not shown). Subsequently SST in the BoB has stronger amplitude than OMN, contrary to the MDO scale SST response. The net heat flux and its components in the BoB are in phase and the magnitudes are comparable with the MJO scale. Similar in phase relation can be seen in the WAS, except that the long wave flux and sensible flux contribute negatively to the net heat flux. In the OMN region, the latent heat flux is contributing more to the net heat flux in the warming phase. There is asymmetry in the flux perturbation especially in the latent heat flux. In STI, sub-monthly flux (net heat flux) components are higher (more than double the MJO scale) and due to the thermodynamic variability by longwave flux in this scale whereas in the MJO scale it has reduced the effect of short wave flux significantly.

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