Geophysical Research Abstracts
Vol. 21, EGU2019-5131, 2019
EGU General Assembly 2019

Air-sea coupling under Indian Ocean tropical cyclones

Neetu Suresh (1), Matthieu Lengaigne (2,3), Jerome Vialard (2), Guillaume Samson (2,4), Sebastien Masson (2), Krishnamohan Ks (2), and Suresh Iyyappan (1)

(1) (neetu@nio.org), CSIR-National Institute of Oceanography (NIO), Goa, India, (2) LOCEAN-IPSL, Sorbonne Universités (UPMC, Univ. Paris 06)-CNRS-IRD-MNHN, Paris, France, (3) Indo-French Cell for Water Sciences, IISc-NIO-IITM–IRD Joint International Laboratory, NIO, Goa, India, (4) Mercator Océan, Ramonville-Saint-Agne, France

The Bay of Bengal only accounts for 5% of the Tropical Cyclones (TC) globally, but witnesses 80% of their casualties. The influence of air-sea coupling on TCs intensity is one of the unaccounted factors that may contribute to the modest improvement of TC intensity relative to TC tracks forecasts. Yet, this effect has been assessed in other basins but not in the Indian Ocean (IO). This is the objective of this study. We have run a 20-years-long simulation with a $\frac{1}{4}^{\circ}$ regional coupled ocean-atmosphere general circulation model (NEMO-WRF) for the IO. This simulation simulates the IO spatial and seasonal TCs distributions and the TC-induced cooling reasonably well. We isolate the effect of coupling on IO TCs by comparing this reference coupled simulation to a uncoupled atmospheric experiment forced by the coupled simulation SST (from which cyclone colds wakes have been filtered out). Coupling does not influence the IO cyclogenesis spatial distribution, but reduces the number of TCs by $\sim$20% in both hemispheres. Coupling also yields a better-resolved bimodal distribution of northern IO TCs, with TCs before and after but not during the southwest monsoon. Air-sea coupling also reduces the percentage of intense TCs (Category 2 and more) in both hemisphere by a factor of $\sim$3. This impact of air-sea coupling on strongest TCs can be traced back to a 15% reduction of inner-core upward enthalpy fluxes in the coupled simulation, as a direct response to the TC-induced ocean cooling. Focussing on the Bay of Bengal, we also demonstrate that the effect of air-sea coupling on TCs is strongly reduced after the monsoon, owing to a deeper thermocline and stronger salinity stratification that inhibit the TC cold wakes. While this should favour stronger TCs after the monsoon, a more favourable large-scale background state (less vertical shear, larger maximum potential intensity) offsets the effect of air-sea coupling, and produces stronger pre-monsoon cyclones. The effect of air-sea coupling is however far from negligible, and contributes to diminish the contrast between pre- and post-monsoon BoB TCs intensity. Overall, our results demonstrate the key role of air-sea interactions for shaping up TCs properties in the Indian Ocean.