Geophysical Research Abstracts
Vol. 17, EGU2015-3126-1, 2015
EGU General Assembly 2015

Can Indian Ocean SST variability impact TC activity in the South Pacific? A Spatial Analysis

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Tropical Cyclones (TCs) represent a significant natural hazard to the 15 island nations and 2.7 million inhabitants of the South Pacific, accounting for 76% of reported disasters in the region since 1950. This vast area, dominated by the coupled ocean-atmosphere interactions of the South Pacific fuels the highly variable nature of TCs (both spatially and temporally), leading to difficulties in planning for and responding to these extreme events. While it is well known that the El Niño/Southern Oscillation (ENSO) plays a significant role in modulating the background state on which TCs form, there are other large-scale climate drivers operating on annual timescales or longer within the South Pacific (e.g. ENSO Modoki and the Interdecadal Pacific Oscillation) and outside the Pacific Basin (e.g. the Indian Ocean Dipole and the Southern Annular Mode) that may also influence TC formation. In response to this issue, the impact of these large-scale climate drivers upon the spatial characteristics of tropical cyclogenesis is assessed for the South Pacific region (5o-35oS, 145oE-130oW) over a 67-year period (1945-2011). It is shown, that in addition to the impact of 'Pacific-centric' climate drivers, eastern Indian Ocean sea surface temperatures significantly impact the spatial characteristics of tropical cyclogenesis in the South Pacific. In particular, warming (cooling) in the eastern Indian Ocean is found to result in an eastward (westward) shift in the average location of tropical cyclogenesis in the South Pacific (up to 712km between extreme phases). One mechanism that may account for this east/west modulation of TC activity in the South Pacific is the propagation of warmer water from the Timor Sea through the Coral Sea to the Pacific, resulting in a strengthening of the Pacific Warm Pool and associated meteorological characteristics connected with tropical cyclogenesis. Understanding how other large-scale climate modes interact with Indian Ocean processes is important in producing a 'real-life' climatology of TCs for the region. As such, when Indian Ocean SST variability is coupled with other drivers, for example, ENSO, significant amplification of TC activity is found; up to 1540km to the east of the overall mean centre of cyclogenesis. Given the extreme impacts of TCs, any improvements in the understanding of what causes the spatial variability of TC formation may help TC forecasting methods for the region, in turn improving disaster risk management and preparedness for the nations of the South Pacific.