ISSN: 2469-4134
Journal of Remote Sensing & GIS

OPEN ACCESS Freely available online

Commentary

Movements of Currents and Hydrography along the Equatorial Indian Ocean

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DESCRIPTION

Several features make the Indian Ocean unique. Unlike Pacific and Atlantic the Indian Ocean is land-locked at the north promoting differential heating that give rise a peculiar air sea interaction process that drives the strongest event on Earth called Indian Ocean monsoon which causes large scale seasonal variations in ocean currents including reversal of Somali current and Indian monsoon current. The Asian land mass at the north blocks heat export thereby preventing ventilation of the Indian Ocean thermocline. The seasonal reversal of monsoon current causes the reversal of cross equatorial heat and momentum transport that has tremendous implications on the regional climate variability. South of the equator the Indian Ocean is gaining heat during June-October during the austral winter and loosing heat during November-March during the austral summer. Another uniqueness of the equatorial Indian Ocean compared to other two major Oceans is the semi-annual appearance of eastward flowing jet during the monsoon transition periods (April-May and October-November) and the absence of equatorial upwelling in the annual scale.

It is also worth mentioning that the northern extent of the equatorial domain of the Indian Ocean is exposed to two contrasting water bodies called Arabian sea and Bay of Bengal. The saline Arabian Sea and its adjoining water bodies (Persian Gulf and Red Sea) are dominated by evaporation while the low saline Bay of Bengal is dominated by runoff from all major rivers of India, Bangladesh and Myanmar. The interaction of these two contrasting water bodies happens through the seasonally reversing circulation pattern. The surface and sub-surface zonal currents along the equator can easily be tracked by the east-west water masses of contrasting characteristics.

During boreal summer the Bay of Bengal contributes more than half of the runoff water (~2950 km^3) to the Indian Ocean and flows into the Arabian sea while part of it flows south across the equator and joins with low saline Pacific equatorial water seeping through the low latitude Indonesian archipelago often referred to as Indonesian Through Flow (ITF). This mixed fresh water feed the South Equatorial Current in the south-eastern tropical zone. Therefore, the Indian Ocean Equatorial Water is a conglomeration of all the three contrasting water masses originating from Arabian Sea, Bay of Bengal and from the equatorial Pacific through ITF.

Indian Ocean is the warmest Ocean in the world. The core of the world's largest warm pool lies in the equatorial Indian Ocean. The western cross equatorial flow both in ocean and in atmosphere dominate the south-west summer monsoon circulation. The Indo-Pacific warm pool extending right across the eastern equatorial Indian Ocean act as a source region for atmospheric convection often triggers the westerly wind bursts at the western equatorial Pacific modulating the surface ocean condition to the formation of El Niño at the equatorial Pacific. The ensuing dynamics are dominated by the propagation of low frequency planetary waves such as Kelvin and Rossby waves.

At interannual time scales an interesting feature appears to dominate the equatorial Indian Ocean with cold temperature anomalies off Sumatra coast in the eastern equatorial Indian Ocean and warm anomalies at the western equatorial Indian Ocean.

CONCLUSION

Recently Indian Ocean Dipole (IOD) has been categorized as one of the major ocean atmosphere coupled phenomena in the tropical Indo-Pacific and hence is natural to explore its possible influence on the Indian Summer Monsoon Rainfall (ISMR). The IOD as having a significant role as a modulator of ISMR and that it influences the correlation between El-Nino Southern Oscillation (ENSO) and ISMR. Their studies revealed that the anomalous summer monsoon circulation induced by ENSO over the South Asian continent is either complemented or opposed by the IOD induced circulation, depending upon the interaction of phase and amplitude of these two major climate modes in the Indo-Pacific equatorial belt. Recently it has been observed that the correlation between Indian Ocean Dipole Mode Index (IODMI) and ISMR is robust and appears to be increasing.

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Received: 02-Jan-2023, Manuscript No.JGRS-23-19888; **Editor assigned:** 04-Jan-2023, Pre QC No. JGRS-23-19888 (PQ); **Reviewed:** 18-Jan-2023, QC No JGRS-23-19888; **Revised:** 23-Jan-2023, Manuscript No. JGRS-23-19888 (R); **Published:** 03-Feb-2023, DOI: 10.35248/2469-4134.23.12.275

Citation: Nelson B (2023) Movements of Currents and Hydrography along the Equatorial Indian Ocean. J Remote Sens GIS. 12:275.