

Indian Ocean Dipole modulated wave climate of eastern Arabian Sea

T. R. Anoop , V. Sanil Kumar , P. R. Shanas, J. Glejin, and M. M. Amrutha

- We investigate the influence of an inter-annual mode of variability, the Indian Ocean Dipole (IOD), on the wave climate of the eastern Arabian Sea (AS).
- Generally northerly wind observed over eastern AS in October.
- Dominant northeasterly wind during positive IOD years.
- Northwesterly in negative IOD years.
- Change in wind direction is more significant during IOD events associated with ENSO

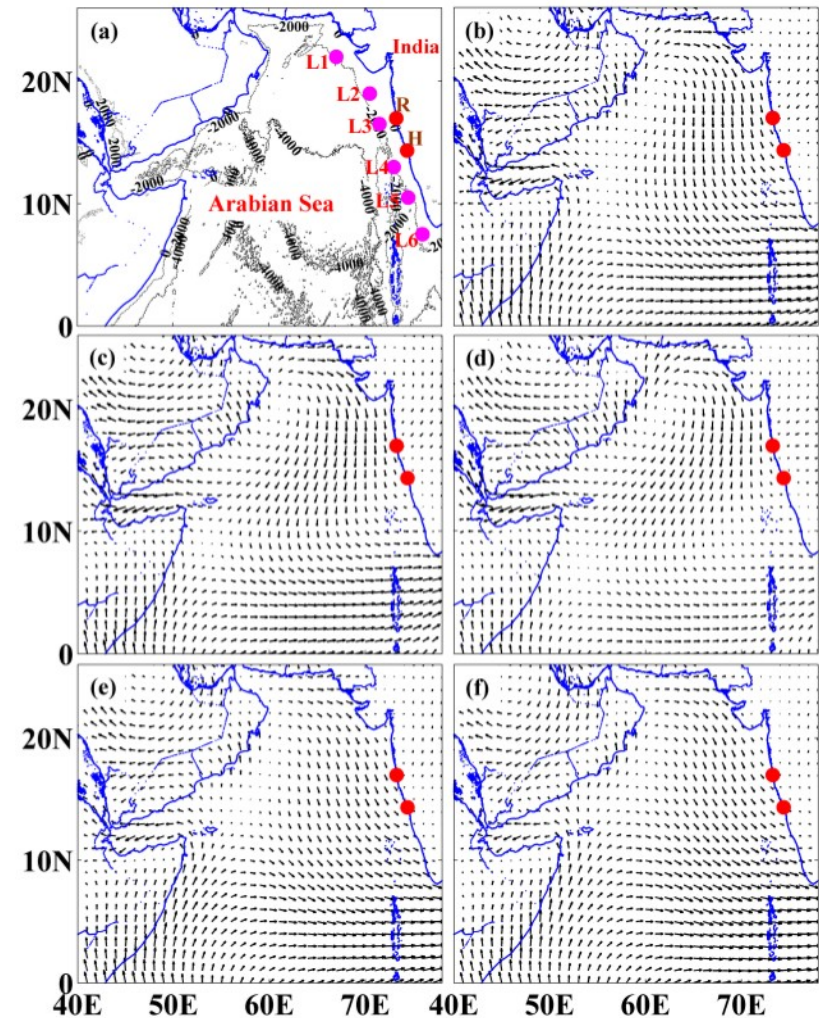
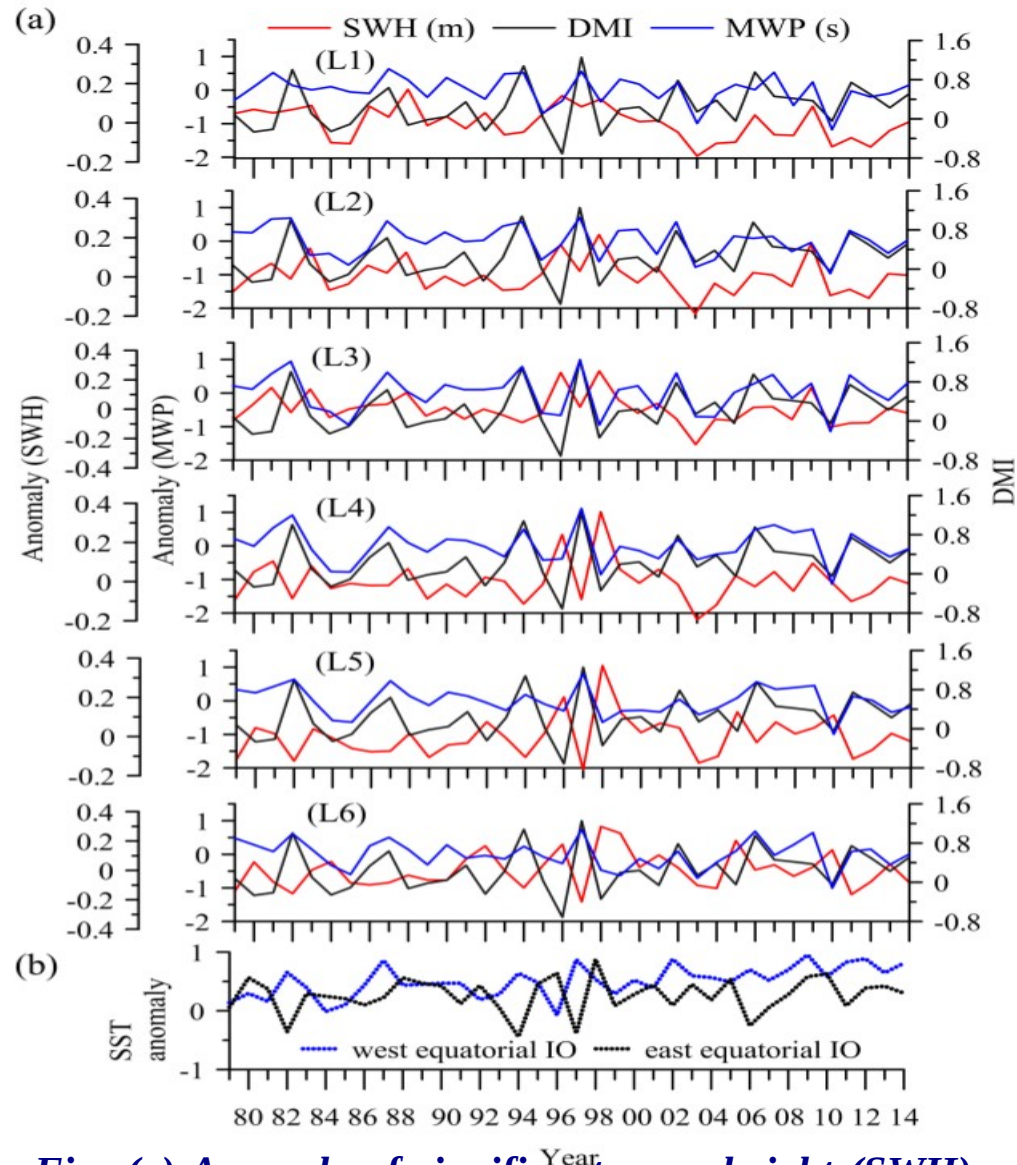


Fig: (a) Study area and buoy locations (b) Composite climatology of wind pattern during October. Averaged wind pattern during (c) pure positive IOD, (d) combined positive IOD, (e) pure negative IOD and (f) combined negative IOD.

Time series analysis of DMI, Era-interim SWH and MWP



	Correlation with DMI		Partial correlation with DMI (ENSO removed)		Correlation with ENSO		Partial correlation with ENSO (DMI removed)	
	SWH	MWP	SWH	MWP	SWH	MWP	SWH	MWP
L1 (22° N; 67° E)	-0.16	0.37	-0.19	0.23	-0.02	0.30	0.11	0.10
L2 (19° N; 70.5° E)	-0.27	0.48	-0.20	0.29	-0.19	0.45	0.03	0.20
L3 (16.5° N; 71.5° E)	-0.38	0.68	-0.31	0.51	-0.22	0.53	0.03	0.17
L4 (13° N; 73° E)	-0.56	0.69	-0.40	0.52	-0.46	0.59	-0.15	0.25
L5 (10.5° N; 74.5° E)	-0.59	0.57	-0.34	0.33	-0.59	0.60	-0.33	0.35
L6 (7.5° N; 76° E)	-0.59	0.55	-0.35	0.27	-0.56	0.61	-0.29	0.40

Table: Correlation and partial correlation of SWH and MWP with DMI and NINO3 time series during October, from 1979 to 2014.

- **Wave characteristics over central AS linked to indian ocean dipole.**
- **SWH decreases (increases) during positive (negative) IOD years.**
- **MWP increases (decreases) during positive (negative) IOD years.**

Fig: (a) Anomaly of significant wave height (SWH) and mean wave period (MWP) at six selected locations off the west coast of India during October from 1979 to 2014 along with DMI. The wave data are from ERA-I. Locations are shown in Fig. 1. (b) Plot of SST anomaly in the west and east equatorial IO.

Frequency directional wave spectrum

- Decrease of short period swells and wind waves from northwest AS during positive DMI years.
- Observed 2D wave spectra and corresponding wind patterns showed that this decrease mainly due to the IOD induced change in wind direction over eastern AS.
- Model simulate this pattern well.

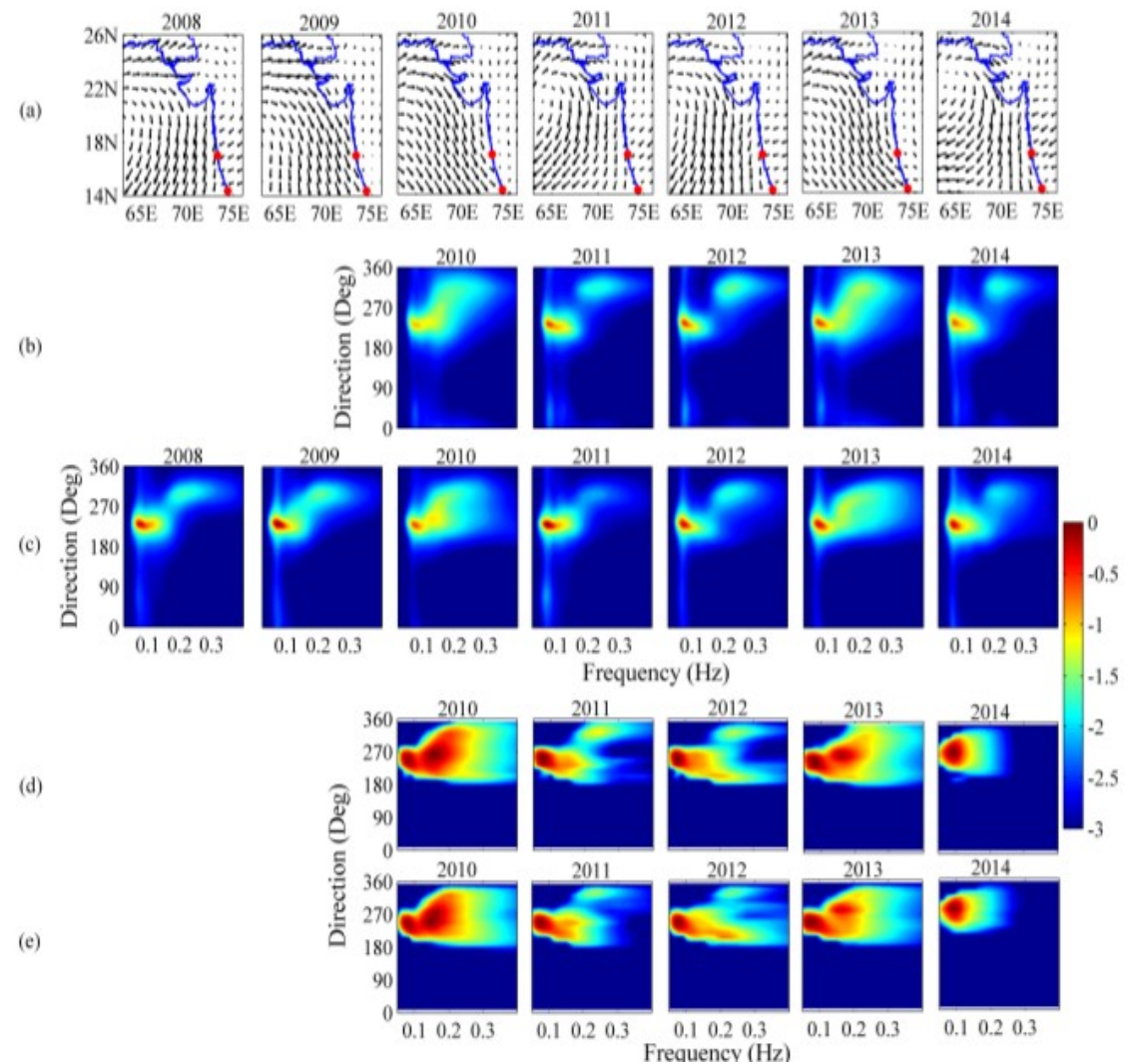


Fig: (a) Wind pattern of October (2008- 2014). Measured wave frequency-directional spectra off Ratnagiri (b) and off Honnavar (c). Color bar is for spectral energy ($m^2 Hz^{-1} Deg^{-1}$). (d) Modeled directional spectrum off Ratnagiri and (e) off Honnavar.

Conclusions

- **Due to the IOD-induced changes in equatorial sea surface temperature and sea level pressure, the winds from the northern AS gets modified and cause inter-annual variability in the wave climate over the eastern AS.**
- **The changes in wind field over the AS due to the IOD influence the generation or dissipation of the wave field and hence cause a decrease in northwest short-period waves during positive IOD and an increase during negative IOD.**

For more details: Anoop, T. R., Kumar, V. S., Shanas, P. R., Glejin, J., & Amrutha, M. M. (2016). Indian Ocean Dipole modulated wave climate of eastern Arabian Sea. Ocean Science, 12(2), 369.