M.S.74-P.GOPALAKRISHNA MURTHY–Studies on Thermal Structure in the Seas Around India–1987–G.S.Sharma

To understand the influence of the regional particulars of north Indian Ocean on the subsurface thermal structure, the variability of thermal field in spatial and temporal domains is to be studied on a finer resolution. The thesis investigates on these aspects for the Eastern Arabian Sea and SW Bay of Bengal.

The available BT data (upto 1979) in the region 5-24°N, 65-90 E, after quality checks are averaged over 2 - degree spatial grids on a monthly basis separately for coastal and deep waters. This material is used to document the seasonal variability of thermal field in the upper 275 m. The time series data sets consist of temperature, salinity and surface marine meteorological parameters sampled at finer resolution (5 to 180 minutes) from anchored/drifting ships over a few places in the coastal and deep waters in the seas around India. They are utilised to study the short-term thermal variability at these positions. A larger data base, coastal and off shore thermal feature north of 16 N and internal wave characteristics form the improvements over earlier works.

The annual cycle of temperatures in the surface layer (30 m) exhibits a bimodal oscillation in the entire coastal region and deep waters in 8-16 N as a result of secondary warming during Oct./Nov. and unimodal in the remaining areas. A higher annual range of temperature in this layer over northern regions (5.5 C compared to 2-3 C south of 16 N) emerges out of winter cooling. The seasonal warming (Mar. - May & Oct. - Nov.) penetrates upto about 50m and the cooling under upwelling (5 C) surpasses monsoonal cooling (2 C).

The waters in the upper 150 m column are highly sensitive to periodically shifting upwelling and downwelling processes. The upwelling commences at subsurface levels during Feb./Mar. remains active during summer monsoon and ceases by Sept./Oct., while sinking prevails during winter monsoon. A time lag of 2-3 months is noticed for the onset of upwelling in northern regions. The upwelling in the coastal region is invariably accompanied by sinking in the deep waters and vice-versa. Relaxation of upwelling is observed at some coastal places during Aug./Sept. In southern regions the upwelling is more intensive as well as extensive (20–30m/month and 400 km compared to 17–20 m/month and 200 km north of 16oN). The thermocline region off Cape and Srilanka is characterised by Rossby/Kelvin waves with periods of 2–4 months.

The short-term variability of temperature reveals internal waves of following characteristics.

Parameter	Long period	Short period
Amplitude (m)	15–20	3.0–5.0
Period (hrs)	09–25	0.3–0.9
Speed (m/s)	0.8–1.3 (at depths of 50 & 70 m)	0.4–1.0 (at depths of 10 & 50 m)
Wave length (Km)	45–77	0.4–3.0
Brunt vaisala frequency (cph)	–	10.0–30.0
Mode	First order	Second order

The FFT analysis indicates harmonics of 4 hr multiples for long-period and 0.3 hr multiples for short-period internal waves with 15–50% energy concentrated at tidal frequencies. The long-period internal waves seems to be forced by tides and short-period internal waves by local wind field.

The results of this study are applicable in fishery exploration, weather prediction, underwater surveillance, ocean thermal energy, offshore drilling and pollutant dispersal.