CHAPTER III
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VERTICAL SECTIONS OF POTENTIAL TEMPERATURE AND SALINITY

The water characteristics of the Arabian Sea are influenced by the presence of several sources of low and high salinity waters. An attempt is made in this chapter to study the cross-sectional flow pattern and water characteristics of the intermediate waters in the Arabian Sea by presenting vertical sections of potential temperature and salinity. The sections are presented in Figs. 16 to 29.

3.1.1. Section I - 48° to 79°E along 0°

The temperature distribution along the equator does not vary much horizontally at any depth below 300 m indicating a homogeneous nature, although the surface waters are warmer in the eastern region. The homogeneity may be because of mixing.

The salinity distribution also shows nearly homogeneous water in the intermediate layers. The vertical variation of salinity from 200 to 1,700 m depth is only 0.30%. Relatively homogeneous water in the equatorial region is shown in the meridional sections of the IIOE atlas (Wyrtki, 1971). Sharma (1976) reported homogeneous
water in the equatorial region, vertically extending from 100 to 1,000 m depth. He called it Equatorial Indian Ocean Water and suggested that it is an admixture of various water masses of the northern and southern hemispheres, and the water mass of the Pacific Ocean. However, Quadfasel and Schott (1982) referred it as Equatorial Water of the Indian Ocean.

A close examination of the salinity distribution reveals a weak salinity minimum in the depth range of 325 to 650 m with values less than 35.00%. The salinity minimum is more conspicuous in the western side. A comparison of the vertical sections of the IIOE atlas (Wyrtki, 1971) confirms that the salinity minimum is prominent only in the western region but not in the east. Probably the salinity minimum is caused in the west due to the influx of the Pacific Ocean Water which is carried to the west along with the South Equatorial Current that crosses the equator in the western region of the Indian Ocean (Sharma, 1972; Sharma et al., 1978).

3.1.2. Section II - 50° to 76°E along 5°N

The distribution of temperature on this section confirms that zonal variation of temperature in the intermediate depth is less. The temperature varies significantly on either side of the ridge situated along 60°E, particularly in the deeper layers.
Fig. 19: Distribution of Salinity Along Section II.
A conspicuous feature in the salinity distribution is the intrusion of relatively high salinity water around 600-800 m depth in the western side. This is due to the spreading of Red Sea Water (Rochford, 1964; Wyrtki, 1971; Quadfasel and Schott, 1982). Nearly homogeneous water is found in the depth interval of 250 to 600 m. The homogeneity may be because of lateral as well as vertical mixing. A weak salinity minimum is noticed around 400 m depth in the western side, probably, due to the influence of Pacific Ocean Water as discussed in the previous section. However, the value of salinity minimum is increased to 35.10% due to mixing with high salinity waters from the north. The other remarkable feature is the presence of low salinity water in the eastern part of the section in the depth range of 100 to 300 m. This is attributed to the influence of the Bay of Bengal Water. Below 900 m, the isohalines show an upward tilt towards the east.

3.1.3. Section III - 51° to 75°E along 10°N

The horizontal variation of temperature on this section is low in the intermediate depths except in the western side. In the eastern part, the isotherms exhibit an upward tilt towards the west coast of India indicating
FIG 21: DISTRIBUTION OF SALINITY ALONG SECTION III
the southerly flow as found on the acceleration potential maps. In the western part, a southerly flow west of $54^\circ$E between 200 and 1,000 m and a northerly flow east of $54^\circ$E in the depth interval of 200 to 500 m are evident. This is in agreement with the southward flow along the Somali Coast carrying the Red Sea Water and northward flowing low salinity water found on the distributions of properties on potential thermosteric anomaly surfaces of the present study. Below 1,000 m, weak northerly and southerly flows are indicated in the western side.

The influence of Red Sea Water which is limited to the western side of the previous section is more predominant and widely spread on this section. One branch of Red Sea Water spreads horizontally in the western side in the depth range of 600 to 1,000 m. It is interesting to note a low salinity layer around $54^\circ$E in the depth interval of 200 to 600 m. It indicates strong vertical mixing. The salinity minimum is probably due to the influence of water of Pacific origin from south as discussed in Section I.

Another branch of Red Sea Water, east of the salinity minimum, spreads vertically downward in the layer between 400 and 900 m around $56^\circ$ to $58^\circ$E again
spreads horizontally up to 70°E in the depth range of 500 to 800 m. The horizontal spreading of Red Sea Water in the intermediate depths noticed on this section is in confirmation with the predominant horizontal mixing found on the distribution of salinity on the potential thermosteric anomaly surfaces.

The homogeneous water noticed in Section II is also present in this section east of 59°E in the depth limits of 300 and 500 m, indicating an admixture of various waters. The influence of Bay of Bengal water is also felt in the upper layers on the eastern side. Below 1,000 m horizontal variation of salinity is less except in the eastern side, which agrees with the horizontal mixing found in the salinity distribution on the steric surfaces.

3.1.4. **Section IV - 52° to 73°E along 15°N**

The horizontal variation of temperature is less in the intermediate depths except in the east. The upward slope of isotherms towards the west coast of India suggests southerly flow as revealed on the distribution of acceleration potential.

Noticeable differences are found in the distribution of salinity on the section compared to the previous one. The Red Sea Water found as a predominant feature in Section III is restricted to western side around 400 to
800 m. The influence of Persian Gulf Water is observed around 55° to 59°E in the depth range of 200 to 400 m. As in the earlier sections east of 60°E, a homogeneous water is found between 200 and 800 m. Below 1,000 m, salinity does not vary much horizontally except in the east. The spreading of Persian Gulf Water is in agreement with the horizontal mixing found in the eastern Arabian Sea in the distribution of salinity on the steric surfaces.

3.1.5. Section V - 59° 30' to 68°E along 20°N

The temperature distribution indicates less horizontal variation in the intermediate depths below 500 m, although weak gradients are found around 300 to 400 m.

Remarkable differences are noticed in the distribution of salinity compared to the previous sections. The Red Sea Water found in the earlier three sections is totally absent.

Below the Arabian Sea Water, Persian Water is noticed in the depth range of 200 to 400 m. Premchand (1982) reported the spreading and mixing of Persian Gulf Water around the same depth interval in the northern Arabian Sea. Below 500 m, horizontal salinity gradients are low indicating the vertical mixing as found in the salinity distribution maps on the steric surfaces.
FIG. 24: DISTRIBUTION OF POTENTIAL TEMPERATURE ALONG SECTION V
3.1.6. Section VI – 0° to 15°N along 58°E

Compared to the zonal sections so far discussed, the distribution of temperature on meridional section shows significant horizontal variation in the intermediate depths except near the equator where a homogeneous nature is indicated. The upward trend of isotherms from north to south observed in the intermediate depths suggests the presence of westerly flow. This is in confirmation with the distribution of acceleration potential on 100, 80 and 60-cf1/t surfaces.

The prominent feature in the salinity distribution is the horizontal and vertical mixing of Red Sea Water in the intermediate depths. One branch of Red Sea Water around 13-15°N at 500 m mixes vertically downward to deeper regions while another branch around 10°N spreads horizontally towards south in the depth range of 400 to 900 m. This is in agreement with the horizontal mixing found in the distribution of properties on potential thermosteric anomaly surfaces.

Low salinity water from the south spreads towards north in the depth interval of 200 to 500 m and Persian Gulf Water is restricted to 15°N around 200-300 m along 58°E. The low salinity water from the south is trapped into a cell around 300 m at 11° 30'N surrounded by high salinity
FIG. 26. DISTRIBUTION OF POTENTIAL TEMPERATURE ALONG SECTION VI
FIG. 27: DISTRIBUTION OF SALINITY ALONG SECTION VI
waters. The presence of nearly homogeneous water is also found near the equator.

3.1.7. **Section VII - 1° 30' to 18° N along 70° E**

The temperature distribution on this section is nearly similar to the previous one showing significant horizontal variation in the intermediate depths and indicating the presence of westerly flow.

The distribution of salinity also reveals somewhat similar features as that of Section VI. Red Sea Water, found south of 15°N around 400-600 m spreads horizontally towards south upto 3°N and its influence is found to a depth of 900 m. The spreading of Red Sea Water is in confirmation with the horizontal mixing found in the salinity distribution maps on steric surfaces.

Above the southward spreading Red Sea Water, low salinity water from the south spreads horizontally towards north until the influence of highly saline Arabian Sea Water is encountered in the upper layers. The Arabian Sea Water is very well represented by tongue-like structure around 100 m from north to 6° N.
FIG. 29: DISTRIBUTION OF SALINITY ALONG SECTION VII