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Hydrophysical processes in the vicinity of Ampere Seamount

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The description and interpretation of dynamic processes in the vicinity of Ampere bank(35°04’N,12°52’W) on the basis of in-situ shipboard measurements and modern high-resolution satellite SSHA and SST data are given.
The measurements consist of six moorings current and temperature time series(sampling rate 1 hour, rows length 10 days). Two buoys with four instruments were deployed atop of each flat of two-headed Ampere mountain. The other four moorings with instruments depths approximately 25, 50, 100, 200, 300, 500, 1000m were anchored on the deep plain around the Bank at roughly 20n.miles distance from it.
The CTD measurements(towed and vertical) were collected in the 30x25n.miles square (34°45’-35°15’N, 12°40’-13°05’W) over the Bank and along several longer towed CTD probe sections to the north and to the south from the Bank. Space resolution of towed CTD measurements was chosen experimentally, accounting for the complexity of field, and was 200-250m horizontally and 0,5m vertically. Vertical casts were taken down to 500 m during vessel stop.
There were two periods of measurements: November,1982 and February,1985.
On the basis of data analysis, we concluded about mean field and fluctuations, as follows.
In winter season, the dominant large-scale feature was a front, which stretched from Josefin Seamount to the Ampere Bank in meridional direction and bent round the Bank from west to south flank of it. It’s width was 1-1,5n.miles, horizontal temperature gradient - 0,3-0,4°C/km, mean current velocity along the front - 30cm/sec in the upper layer of the ocean and reduced to 7cm/sec at 350m depth. Frontal zone separated two different types of waters: relatively warm(17,0-16,3°C), saline(36,48-36,38psu) waters to the west, and colder(16,0-15,9°C), fresher(36,32-36,28psu) waters to the east. Over the Bank, intermediate waters were formed with temperatures in the range 16,2-16,0°C and salinities within 36,35-36,34psu limits. Using T-S analysis, it was shown, that intermediate waters were formed by semidiurnal tides, which give rise to upwelling of deeper waters along the seamount flanks and displace frontal zone to 4-6n.miles horizontally. Intermediate waters had specific mosaic pattern with water patches typical horizontal scale of the order of the Bank upper flat dimension(6-7n.miles).
In the autumn of 1982, there was no hint of such a front. Local near Bank low-frequency dynamics was characterized as complex eddy field with basic length scale 8-10n.miles. Eddy characteristic temperature drop in the thermocline(75 m) was 0,5-1,5°C, orbital eddy mean daily velocity - 15-20cm/sec. Averaged transfer was of the order of 10 cm/sec to the east.
Tidal advection of the front over lower summit of the Ampere seamount causes unusually great in comparison with the deep moorings semidiurnal temperature fluctuations(up to 2°C in the thermocline). Directly over the Bank, temperature jumps(0,3-0,2°C) in the upper mixed layer appeared at semidiurnal frequency, each time being followed by the high frequency wave packets of 6 hours duration.
In the deep part of the polygon, temperature fluctuations were determined by low-mode semidiurnal internal waves. But, temperature spectra of the south-east mooring had unusual appearance: spectral energy was distributed uniformly over background internal waves frequency range, with no common semidiurnal peak. Perhaps it’s an evidence, that at the place, semidiurnal tidal energy is converted to higher frequences.
Several noticeable features of the hydrology field spatial structure were encountered. In particular, both, to the north and to south from the Bank, specific temperature field patterns, which resembles “W” letter shape with temperature distinction 0,9°C and 21n.miles length scale, were found. We suggested, that such structures are rings, appeared due to instability of the along front current.Periodic horizontally, wave-like temperature disturbances with gradually reduced(10-3 n.miles) lengths, observed to the south of the Bank were interpreted as lee internal waves.
Using AVISO altimetry data(SSH anomalies and surface currents) and SST of AVHRR Pathfinder SST v5 array,

in the broader, than in-situ polygon, region and for various seasons, we calculated temporal and space spectra of the above variables and estimated variability partitions (dispersions) for low-frequency constituents with lower period and space scale limits: 2 days and 2/3° for SSHA; 2 days and 8 for SST, accordingly.