Abstract View

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Annual and Interannual Variability in the Kuroshio Current System

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ABSTRACT

Individual, seasonal, 300 m temperature maps were constructed over the Kuroshio Current System from 130°E to 170°W, for a 4-year period from summer 1976 through spring 1980, using TRANSPAC XBT data and JODC temperature/depth data. Quasi-stationary meanders in the Kuroshic Current System occurred at 137°C (i.e., Kuroshio Meander), at 144°E and 150°E (i.e., lee-wave meanders), and near 160°E (i.e., meander over the Shatsky Rise). A composite of the paths of the Kuroshio (i.e., the 12°C isotherm) from the individual seasonal maps, and the total variance map, finds nodes (i.e., minima) and anti-nodes (i.e., maxima) of variability to have existed along the mean Kuroshio path. The anti-nodes coincided with the location of the quasi-stationary meanders, the nodes in between. Zonal propagation of temperature anomalies accounted for 20–30% of the total interannual variance. These temperature anomalies propagated eastward at 0.5–1.5 cm s^{-1} in the region 140°–155°E, and westward at −1 to −2 cm s^{-1} in the region 155°E–175°W. In addition to this wave propagation, 31% of the interannual variance in temperature could be explained by two empirical standing-wave modes. Within these two modes, spatial coherency in variability existed between the Kuroshio Meander, the two lee-wave meanders east of Japan and the meander over the Shatsky Rise. Both spatial patterns of variability fluctuated with a 1-year decorrelation time scale, with maximum interannual variability occurring in fall/winter and minimum interannual variability in spring/summer.

In the latter part of the 4-year period (1979–80), the Kuroshio Meander became weak and the Kuroshio Extension was displaced southward, from 36–37°N during the first 2 years to 34°N during the latter two years. Associated with these large scale changes, the quasi-stationary meander pattern in the Kuroshio Extension became unstable, associated with increased eddy activity and ring production. In fact, ring production doubled, i.e., from 5 per year to 10 rings per year, from what it was during the previous 3 years. Prior to this regimal change, the Kuroshio Extension bifurcated near the Shatsky Rise (160°E) with a secondary branch of the Kuroshio Extension extending

northeastward along the Shatsky Rise to 40°N, where it turned east, and with the main branch extending eastward along 36°N. After the regional change, this bifurcation occurred much farther to the west near 150°E.

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