Intermittent displacement of the Kuroshio Extension front from the current axis revealed from simultaneous observations by three research vessels and OFES

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Intensive observations of the ocean and atmosphere were conducted in the Kuroshio Extension (KE) during 2-6 July in 2012, as parts of the research project “Hot Spot in Climate System” in Japan. Three research vessels were arranged along 143°E across the KE and conducted XCTD observations at about 9 locations every 0.25° in latitude once a day for 6 days in a row (Fig. 1). The present study analyzes the XCTD data and also the OFES hindcast simulation, to explore how the KE and its accompanying front vary on day-to-day timescales and what relationships there are between the changes in the KE and front.

The observations show that the mean axis of the density front is located to the north from the mean current axis above the main pycnocline by about 20-30 km, due to the KE-carrying warm water, indicating that the surface KE current is basically anchored by the fronts below the main pycnocline. The changes in the position of the current axis and the front are characterized by a vertically uniform displacement; they both moved northward from 2nd to 5th by about 35km, and then slightly turned back to the south. The front considerably deviated to the north from the current axis in the upper 200m depth from 5th to 6th when the KE started turning to the south, with warm Kuroshio water spread to the north across the current axis. The OFES shows the similar northward displacements of the front and the current axis. The displacements occur due to the passing of mesoscale frontal waves propagated from the upstream with a periodicity of about 7-15 days. The OFES suggests that the KE-carrying warm water may overshoot to the north and deviate from the current axis at the crest of frontal waves, causing the front to move northward above the main pycnocline.

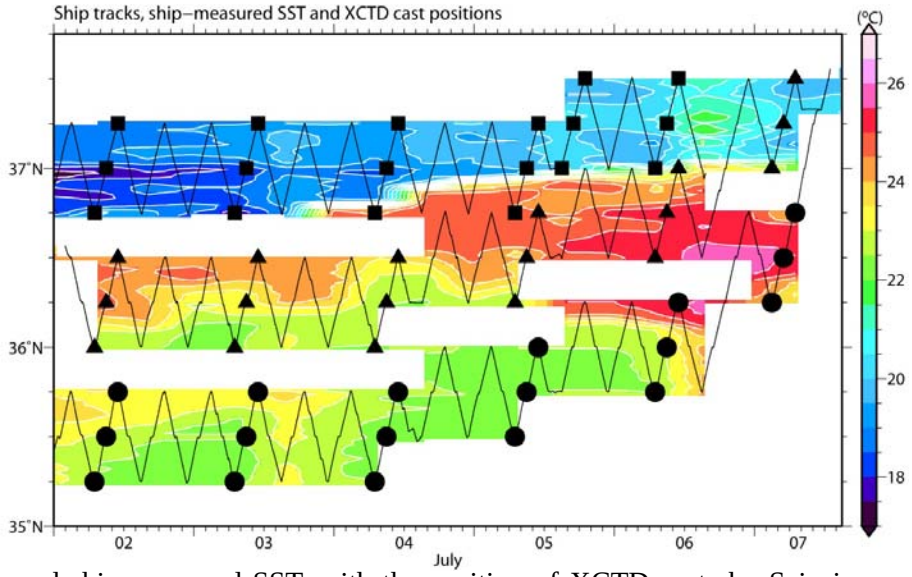

Figure 1. Ship tracks and ship-measured SST, with the position of XCTD casts by Seisui-maru (squares), Wakataka-maru (triangles) and Tansei-maru (circles).