Evidence of intrinsic ocean variability in the Kuroshio Extension dynamics

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Abstract

The Kuroshio Extension (KE) low-frequency variability (LFV) is analyzed with the satellite altimeter data distributed by AVISO from January 1993 to November 2015 through an ad hoc composite index [1] that links the mean latitudinal position L of the KE jet and an integrated wavelet amplitude A measuring the high-frequency variability (HFV) of the KE path. This approach allows one to follow the KE evolution as an orbit in the (L,A) plane, as typically done in dynamical systems theory. Three intervals, I1 (1993-1998), I2 (1998-2006) and I3 (2006-November 2015) are separately analyzed also with sea surface height (SSH) maps. In I1 and I3, L and A are mostly anti-correlated and a recharging phase (characterized by a weak convoluted jet experiencing a rapid increase of the HFV) begins when negative SSH anomalies, remotely generated by the Pacific Decadal Oscillation, reach the KE region. On the other hand, in I2 the KE evolution is described by a hysteresis loop: this starts with a weak jet state followed by a recharging phase leading, in turn, to a persistent two-meander state, to its progressive and rapid erosion and, eventually, to the reestablishment of a weak jet state. This loop is found to correspond quite closely to the highly nonlinear intrinsic relaxation oscillation obtained in numerical process studies [2-4]. This supports the hypothesis that the KE LFV may have been controlled, during I2, by an intrinsic oceanic mode of variability.

(1) Pierini S., 2015. J. Climate, 28, 5873-5881.

(2) Pierini S., 2006. J. Phys. Oceanogr., 36, 1605-1625.

(3) Pierini S., H. A. Dijkstra, and A. Riccio. J. Phys. Oceanogr., 39, 2212-2229.
(4) Pierini S., 2014. J. Climate, 27, 448-454.

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