

Development of the Kuroshio large meander in 2017

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1. Introduction

From the end of August 2017 to September, a Kuroshio large meander started for the first time in 12 years since the 2004-2005 event. Using an ocean assimilation data JCOPE2M developed by Application Laboratory of Japan Agency for Marine-Earth Science (APL/JAMSTEC), we analyzed the development stage of the Kuroshio large meander in 2017.

2. Data

Under the JAMSTEC/APL's Japan Coastal Ocean Predictability Experiment (JCOPE), we update JCOPE2M twice a week for 2-month prediction (<http://www.jamstec.go.jp/jcope/>) by assimilating satellite and in-situ observational data into the Princeton Ocean Model (POM). JCOPE2M covers the western Northwest Pacific Ocean (108-180 °E, 10.5 - 62 °N) with a horizontal 1/12° grid resolution. In order to assimilate the high frequency/resolution data of sea surface temperature from the geostationary meteorological satellite Himawari-8, Miyazawa et al. (2017) adopted a method called Multi-scale 3D-VAR.

3. Development of a Trigger Meander

A small meander of the Kuroshio developed off southeast Kyushu by March 2017. This small meander was a trigger meander for the Kuroshio large meander in 2017. Merge with westward-propagating cyclonic eddies and interactions with downstream advection of anticyclonic eddies along the Kuroshio contributed to the development of the small meander. A similar development process was also found in the trigger meander for the Kuroshio large meander in 2004 (Miyazawa et al. 2008, Tsujino et al. 2013).

4. From the small meander to the large meander

The small meander was divided into two downstream propagations of small meanders of the Kuroshio. For convenience, we call them the small meander 1 and the small meander 2. The small meander 1 propagated downstream and became a large meander in early July. However, this meander kept propagating eastward, and did not stay as a stable large meander.

Meanwhile, the small meander 2 started moving downstream around July and reached Cape Shionomisaki of Kii Peninsula in the middle of August. The amplitude of the smaller meander 2 was larger than that of the small meander 1 when they passed Cape Shionomisaki. Endoh and Hibiya (2001, 2009), from the results of numerical models, suggested that baroclinic instability enhances a small meander if the amplitude of the small meander is large enough to excite abyssal anticyclonic circulation around the Koshu Seamount (located about 200 km to the south of Cape Shionomisaki). Comparison of the velocities at 3000 m depth shows that an anticyclonic circulation around the Koshu Seamount was only found when the small meander 2 passed Cape Shionomisaki. A suitable phase relationship between the anticyclone and the small meander 2 suggests that baroclinic instability contributed to the rapid development of the small meander 2. The small meander 2 grew into the Kuroshio large meander in 2017. The large meander continues as of February 2018 when this abstract is submitted.

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