

## M<sub>2</sub> Tidal Current in the Tokara Strait South of Kyushu, Japan

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### ABSTRACT

This paper describes the characteristics of the M<sub>2</sub> tidal current measured in the Tokara Strait with a moored ADCP for approximately 10 months. The measured M<sub>2</sub> tidal current was composed of surface and internal modes, which we separated and characterized. This investigation shows that the M<sub>2</sub> tidal current in the Tokara Strait is significantly affected by the internal tidal current. Moreover, the internal tidal current is shown to fluctuate according to the north-south movement of the Kuroshio's path.

**KEY WORDS:** M<sub>2</sub> tidal current, Tokara Strait, surface tidal current, internal tidal current, Kuroshio path

### INTRODUCTION

The Kuroshio, the western boundary current of the North Pacific, flows northeastward along the continental slope of the East China Sea and then passes through the Tokara Strait of southern Kyushu in Japan. After that it reaches to the region south of Honshu, alternating between two typical paths called the large-meander and non-large-meander paths (Taft, 1972) [Fig. 1(a)]. The meridional position, current velocity and volume transport of the Kuroshio in the Tokara Strait are considered to be important upstream factors that determine the current path of the Kuroshio south of Honshu (Kawabe, 1995).

To study this system, we collected current velocity data in the Tokara Strait during 1995-2000 using an ADCP (acoustic Doppler current profiler) mounted on a ferryboat. Current velocities measured at 29 m along a transect crossing the Tokara Strait on 17 February 2000 are shown in Fig. 2 as a typical example. In this figure a strong current, the Kuroshio, can be seen in the northern part of the strait. To separate the current velocity of the Kuroshio from the data, the contributions of the tidal currents must be determined. In particular, the M<sub>2</sub> tidal current with a period of 12.42 hours seems to be dominant around the Tokara Strait (Nishida, 1980). Therefore, we made additional direct current measurements with a moored ADCP from September 2000 to July 2001 to investigate the tidal currents in the Tokara Strait. In this paper, the

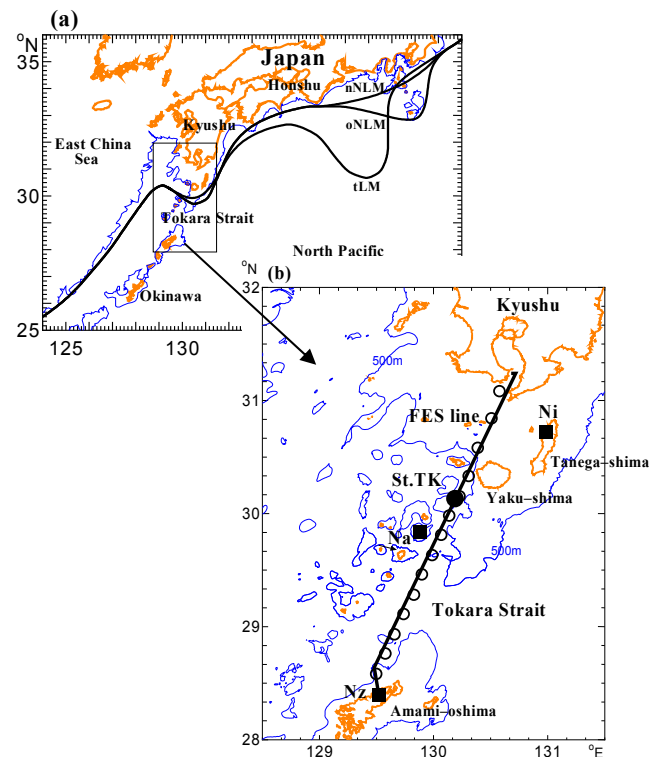


Fig. 1(a) Typical paths of the Kuroshio (Kawabe, 1985); nNLM is the nearshore non-large-meander path, oNLM is the offshore NLM path, and tLM is the typical large-meander path. The thin lines represent the isobaths of 500 m. (b) The solid circle indicates the location of current measurement (St.TK). The FES line crossing the Tokara Strait is the line along which CTD observations were made. The black squares labeled Nz, Na, and Ni indicate the tide stations at Naze, Nakano-shima and Nishino-omote, respectively.