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Coastal oceanography

Secular Change Of Semidiurnal Tide In The Ariake Sea, Japan

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The land reclamation of the Ariake Sea has long been conducted in western Kyushu, for the purpose of improving drainage and promoting agriculture. The sea surface area has consequently decreased. The National Isahaya Bay Reclamation Project, which was started in April 1997 and completed in 2007 and which completely closed approximately one third of Isahaya Bay (the Ariake Sea) with a sea dike of 7.05 km extension, was one such land reclamation. Changes in the geographical features caused by such land reclamation are expected to have considerable effects on the tidal amplitudes and tidal currents of both areas, and many studies, for example Tsukamoto and Yanagi(2002), have been conducted since recent damages in fisheries was attributed to the National Isahaya Bay Reclamation Project. But, these studies evidently produce inconsistent results, despite analyzing the same tidal data. The inconsistency results from different methods of analyzing the fluctuations in tides in the open sea. Furthermore, there have been no detailed studies about land reclamation projects implemented before the National Isahaya Bay Reclamation Project, although they may also have had a significant effect upon the Ariake Sea. A valuable case example is an analysis of changes in tidal currents since the 1940s by Manda and Matsuoka7) using numerical simulation, but unfortunately they did not discuss tidal amplitudes in detail. To solve these problems, it is necessary to analyze long-term tidal data, including the changes caused by land reclamation in the past. We conducted analyses of tidal data and numerical simulations on 4 patterns—1900s, 1960s, 1980s, and 2000s, to study the long-term changes in semidiurnal tide as well as their causes in the Ariake Sea. The findings of this study are outlined as follows: (1)The recent M2 tidal amplitude in the Ariake and Yatsushiro Seas was the smallest recorded since the 1930s. (2)The S2 tidal amplitude varied in reverse phase to the M2 tidal amplitude in the Ariake Sea, and it had a tendency to decrease in the open sea. (3)The tidal amplitude has decreased in the head of the bay and increased at the entrance of the bay due to the effects of drainage land reclamation implemented since 1900s. The effect of land reclamation projects that occurred prior to the National Isahaya Bay Reclamation Project and the effect of the National Isahaya Bay Reclamation Project itself were nearly equivalent. (4)Most of the decrease in M2 tidal amplitude occurring in the last 80 years was caused by the reduction in M2 tidal amplitude in the open sea,

instead of the changes in coast lines made by land reclamation.