

The Flow Features and the Forming Process of Tidal Flat in Ariake Sea

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The Ariake Sea is the long inner bay, which has 1,700km² of area, the extended 96 km of the bay axis, and 18 km of the average width. As for one of the major features of this bay, tidal range in Japan is the largest. The amplitude of tidal wave increases gradually from the mouth to the head of bay areas. This is due to two reasons. One is, when the natural oscillation period of the Ariake sea and the period of the tide, which propagate from the ocean approaches, resonate the bay, the tide increases in the bay head. The other one is, since the amplitude of tidal wave is inversed proportionally into 1/4 powers of water depth due to the water depth become shallow in the bay head area of Ariake Sea, the amplitude of tidal wave becomes bigger(Based on Green theorem). At the flood tide, the tidal range is about 3.0 m in the bay mouth area, and it becomes bigger in the bay head area with the tidal range of 4.5-5.0 m.

The tidal current of Ariake Sea forms a go and return style caused by neap and ebb tide. The velocities of these tidal currents in Ariake Sea, particularly in the mouth (in Hayasaki seto) and the head of bay areas, are in between 1.5-3.5 m/s and 0.3-0.5 m/s respectively. Generally, the mass of water, which moves gradually in the go and return style of tidal current, does not return back to its original position. This condition is occurred because there is the residual current exists in this sea area. According to the model tests conducted in Saga University, these residual currents, which move clockwise to north direction, branching from the main stream of the Chikugo River estuary, and moves counterclockwise to south direction in the bay head area of Ariake Sea, have been confirmed.

Another feature, which also belongs to the Ariake Sea is that the vast tidal flat has been developed mainly in the bay head area of Ariake Sea. Many rivers, such as the Chikugo River, flow into the eastern coast area of the Ariake Sea. The sediments, which are carried from these rivers into the bay, reach about 440,000 tons per year. These sediments are then become floating mud, in which its big grain diameter accumulates to the eastern coast area, and its minute grain diameter brought by the residual current in the bay head area is carried and accumulates to the west coast area. This accumulated floating mud is called Ariake clay, which forms this tidal flat.