Seasonal variability of MODIS chlorophyll-a and total suspended matter in the spring-neap tidal cycle in the Ariake Bay, Japan

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Red tide occurs more frequently in the Ariake Bay since 1990s, and it has greatly damaged the local fisheries, especially the nori farms. Increase of water transparency and reduction of tidal currents were also reported recently, and they may be related to the increase of the frequency of red tides. It is also reported that another cause of the red tide is the river discharge. Satellite remote sensing is suggested to be used to monitor the red tide. In this study, the newly developed MODIS-derived chlorophyll-a (Chl-a) and total suspended matter (TSM) was used to investigate the relationship between Chl-a and TSM and the seasonal variations of influences of spring-neap tides and river discharge. We observed that 1) high Chl-a (>5 mg m^{-3}) and high TSM (>5 g m^{-3}) were generally distributed in the areas off Saga, Kumamoto and Yatsushiro, and Isahaya Bay where the main river systems discharge the fresh water; 2) the magnitude of Chl-a was highest in summer, and decreased gradually from autumn to spring, which corresponded to the amount of river discharge which concentrates in summer and early autumn (June-September); 3) in the spring-neap tidal cycle, TSM was much higher in neap to spring (NS) and spring (S) tide than in spring to neap (SN) and neap (N) tide, which was consistent with the tidal suspension. On the other hand, Chl-a was often increased after high river discharge peak and the variation of Chl-a was small when the river discharge peak was small, indicating that the variation of Chl-a was mainly influenced by the river discharge. The variation of TSM in the spring-neap tidal cycle was mainly regulated by the tidal suspension, whereas the variation of Chl-a was more controlled by the river discharge than the tidal resuspension.

Keywords: MODIS, chlorophyll-a, total suspended matter, seasonal variability, spring-neap tides, river discharge

