Response to wind forcing around the Japanese coast represented by operational coastal system in JMA

Coastal seas are areas where socioeconomical activities such as fishery and marine transport is high. In Japan, coastal areas are sometimes damaged by storm surges and high waves caused by typhoons and extratropical cyclones. In addition, strong surface wind associated with the cyclones generates increase of sea level (SL) due to Ekman transport, induces coastal trapped waves, and decreases sea surface temperature due to coastal upwelling. The coastal response to surface winds is also important phenomena for coastal socioeconomical activities and therefore investigated by using a coastal assimilation system in JMA with 2-km horizontal resolution. Sensitivity experiments forced by long-term mean wind are conducted and compared with experiments using realistic wind forcing to reveal the impact of the wind forcing. In the middle of August 2022, strong northeastward wind continued to raise coastal SL in the Japan Sea. The increase of SL due to the Ekman transport affected the coastal branch of the Tsushima Warm Current (TWC) to be fixed near the mouth of the Wasaka Bay (WB) which is open to the north with 50 km width. At the same time, a small clockwise eddy less than 50km diameter is generated at the western part of WB, then advected eastward along the coastal branch of the TWC. When the smally eddy reached the eastern part of WB, the strong southward current destroyed the fishing set nets and the total damage exceeded several hundred million yen. In early September 1971, coastal flooding occurred along the southern coasts of Japan over the distance of 500 km within a few days, in spite of no severe weather conditions. High SL anomalies by 20-40 cm lasted longer than one week at the tide-gauge stations and could not be explained as storm surges and high waves. One factor of the high SL anomaly event is coastal trapped waves which occurred along the eastern coasts of Japan propagated westward along the southern coasts, and that the SL increased by about 15 cm toward 139E. In addition, the approach of the Kuroshio warm water toward the coasts caused the SL rise by about 30 cm from 139E to the west. Therefore, it is suggested that the event is caused by the superposition of the coastal trapped waves and the warm water intrusions by the Kuroshio. In the presentation, we will also demonstrate the impact of wind forcing for coastal upwelling.

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