Investigation of tide-induced eddies in Nan-Wan Bay using Himawari-8 sea surface temperature data

*PoChun Hsu[1], ChungRu Ho[1]

1. National Taiwan Ocean University

Nan-Wan Bay is a semi-enclosed basin off southern Taiwan. Previous studies have indicated that the tidal flow induces sizable cyclonic eddy and upwelling of cold water around both spring and neap tides. To have a synoptic view of the eddy evolutions, the Himawari-8 SST data were used to investigate the influence of sea surface temperature (SST) by flood and ebb tides in "cloud-free" day from July 2015 to September 2017. Figure (a) shows the geographic location and depth of the seabed around of Nan-Wan Bay, points A to M are gridded points for Himawari-8 data, HTS and EB are Houbihu tidal station and Eluanbi buoy, respectively. Figure (b) shows an example of SST drop, change in the Nan-Wan Bay, and a time series of SST with sea level changes from tide gauge. June to September is defined as summer and December to next March is winter. In results, we found the sudden SST drops (> 1 degree Celsius) are usually occurred daily and last several hours in the period of diurnal tides. There is a higher daily highest SST and a lower daily lowest SST in the west and the south of Nan-Wan (points A and B) than that in the east side of Nan-Wan (points D and J). The average daily SST difference at point A and point B is about 2.5 degrees Celsius on average. In addition, the SST drop could occur in the Nan-Wan Bay in both spring tide and neap tide in summer as previous studies, but we found that during the winter, the SST drop in the Nan-Wan bay area was accompanied by the flood and ebb tides. There was still a significant temperature drop during spring tide and neap tide, which is different results from previous studies. Most days in winter showed that the daily SST drop could reach more than 2 degrees Celsius. To clarify the cooling mechanism of SST, a numerical model and observations from coastal radar system will further help us to understand this phenomenon.

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