

Identification and Intraseasonal Variability in The Surface Upwelling off Sumatra-Java

Gang Pan

South China Sea Institute of Oceanology, Chinese Academy of Sciences

Email: gpan@scsio.ac.cn

Abstract: Upwelling processes along the coast of Sumatra and Java is a largest upwelling system in the eastern Indian Ocean, which is a key process that modulates the upper-ocean conditions, affecting monsoons and other regional and global climate variations. Offshore transport of coastal upwelling and subsequent plankton enhancement and aggregation have important implications for coastal and offshore fisheries. Sea surface temperature (SST) is usually taken as the upwelling indicator. Forced by the Asian monsoon, the cool temperature signal of upwelling occurs east of Java in May. Then, it proceeds westward along the south Java coast, reaching the west coast of southern Sumatra in early August. However, the upwelling retreat in October is very rapid and simultaneous across the whole island chain. However, the upwelling region along Sumatra-Java is within the tropical convection center and exposed to the Indonesian Throughflow, which makes the SST mechanism very complex. In this study, we used two satellite data of SST to explore the short-term variations of surface upwelling off Sumatra-Java. In order to quantify the process, we developed a gradient-based edge detection algorithm to detect the surface upwelling. The evolution was analyzed in terms of an upwelling index measured via the temperature difference between upwelled and surrounding water and the area and shape of the surface upwelling. The results show that the short-term variations are ubiquitous and primarily occur in the summer. The resulting high-resolution field data from shipboard, moorings, and robotic platforms, together with concomitant high-resolution satellite data can be used to clarify the different contributions from upwelling, surface heat-flux and horizontal advection to the SST evolution. This study will strengthen our understanding of surface upwelling variations and improve current knowledge on understanding coupled ocean-atmosphere dynamics leading upwelling in the eastern Indian Ocean.

Keywords: Sea Surface Temperature; Upwelling; Sumatra; Variability; Monsoon