Geophysical Research Abstracts
Vol. 21, EGU2019-14501, 2019
EGU General Assembly 2019

Ocean surface warm layers: development and spatio-temporal variability in the Bay of Bengal during the 2016 summer monsoon

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Interactions between the atmosphere and the ocean play an important role in the development and evolution of the summer monsoon in the Bay of Bengal (BoB). Convective cloud systems that form over the BoB's warm waters bring rainfall to the Indian subcontinent during the summer monsoon season. The amount of energy available for development of the convective systems is highly dependent on the sea surface temperature (SST).
Surface warm layers in the ocean are relatively thin (∼5m) and short-lived (∼8h), and often develop at the ocean surface during the daytime through solar heating and increased SST. Persistent neglect of this layer in weather forecast models results in underestimation of the net energy flux from the ocean to the atmosphere, which may lead to biases in monsoon precipitation patterns. Although it plays an important role throughout many stages of convective development, diurnal warm layers are rarely directly measured and their spatial and temporal variability and dependence on the environmental conditions is poorly understood.
During the Bay of Bengal Boundary Layer Experiment (BoBBLE) 5 gliders were deployed to measure upper ocean properties at high resolution across the BoB in July 2016. This dataset provides a unique insight into warm layer development, evolution and decay as well as its spatial and temporal variability and dependence on varying environmental conditions. Time series from the 5 individual platforms show clear variability of warm layer characteristics. In this presentation, dependence on atmospheric (surface wind speed, solar insolation and precipitation) and oceanic (stratification and currents) conditions on warm layer evolution will be addressed based on observations from those platforms. Further insight into warm layer occurrence and its spatial and temporal variability is gained by high resolution simulations with KPP ocean model set up to represent conditions during BoBBLE experiment. Our results show that although warm layer formation is primarily forced by atmospheric conditions, its characteristics (e.g. amplitude of SST anomaly) depends on states of both atmosphere (wind speed and insolation) and ocean (stratification and currents).