

Upwelling Characteristics along the east coast of Peninsular Malaysia and its relationship with ENSO

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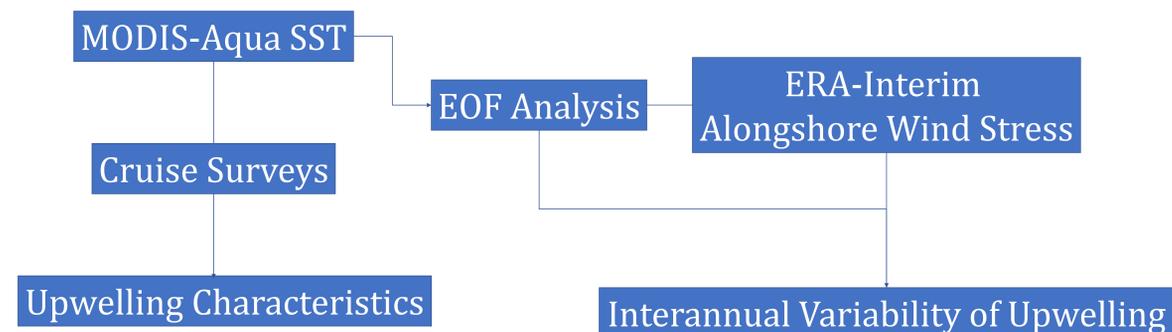
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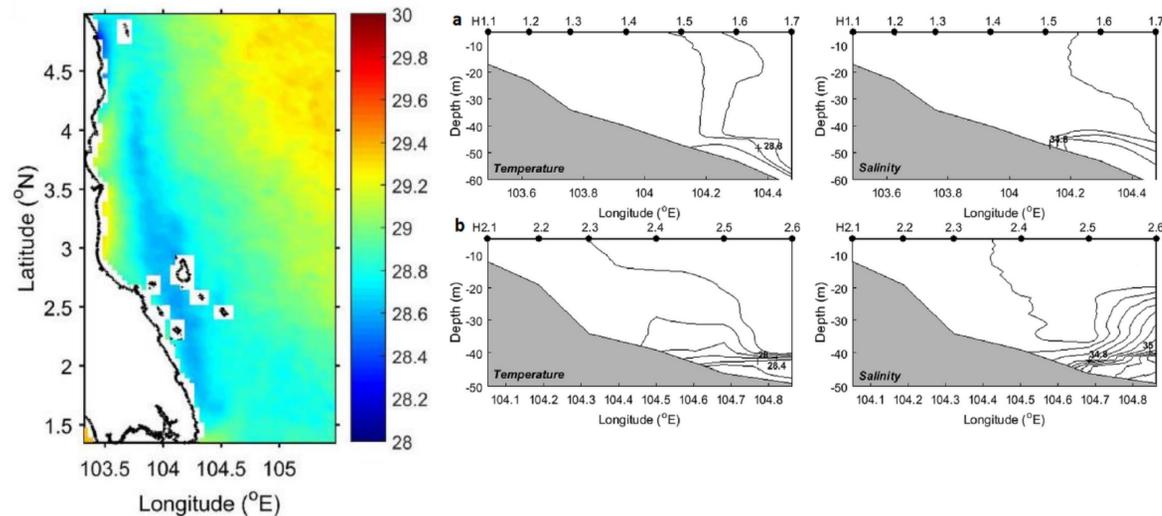
Introduction

- During the boreal summer, the north-south orientation of the coastline, along with southwesterly winds, causes upwelling throughout the majority of the SCS's western coast, including the ECPM.
- The upwelling studies along the ECPM are relatively new, thus lots of the important features are still ambiguous.
- The preceding researches revealed that the interannual variability of upwelling in the SCS is associated with El Niño Southern Oscillation (ENSO), but the question of what the interannual variability of upwelling along the ECPM is and if it reacts with ENSO remains equivocal.

Data and Methods



Upwelling Characteristics

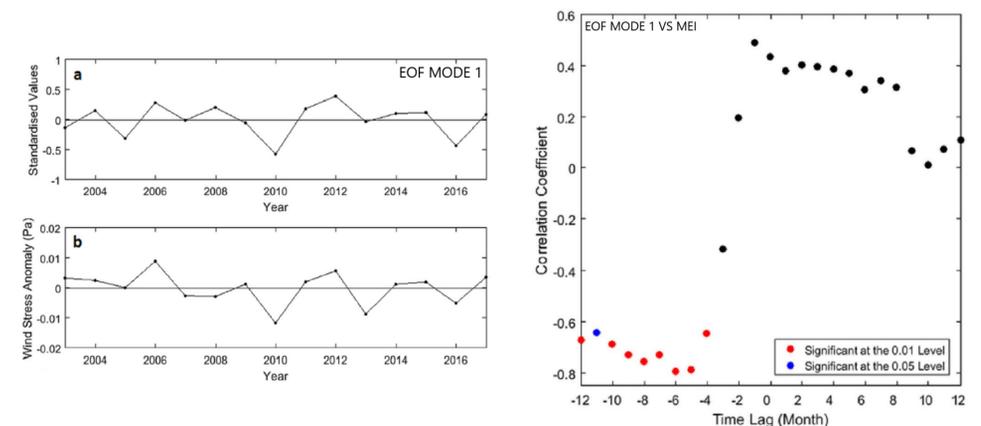


- Upwelling was characterised by an inshore cooler water band and thermohaline uplifting towards the coast and surface.

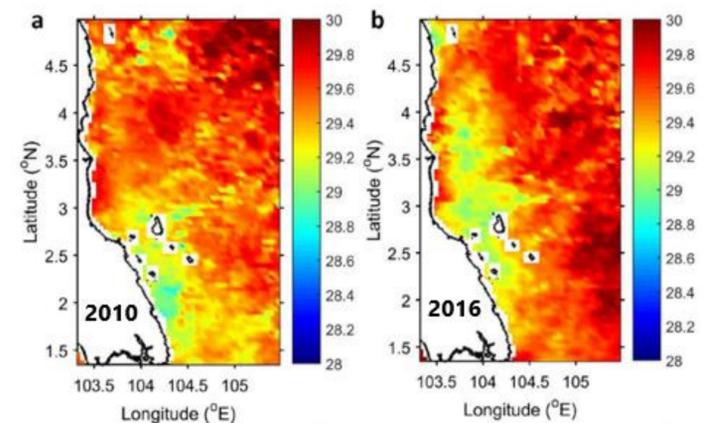
Conclusion

- Inshore cooler water and thermohaline uplifting were the upwelling characteristics along the ECPM.
- Ekman transport driven nature of upwelling interannual variability.
- The delayed ENSO effects as an important factor for the interannual variations of upwelling.
- The fluctuation in atmospheric conditions caused by 2009/10 and 2015/16 El Niño weakened upwelling in 2010 and 2016, respectively.

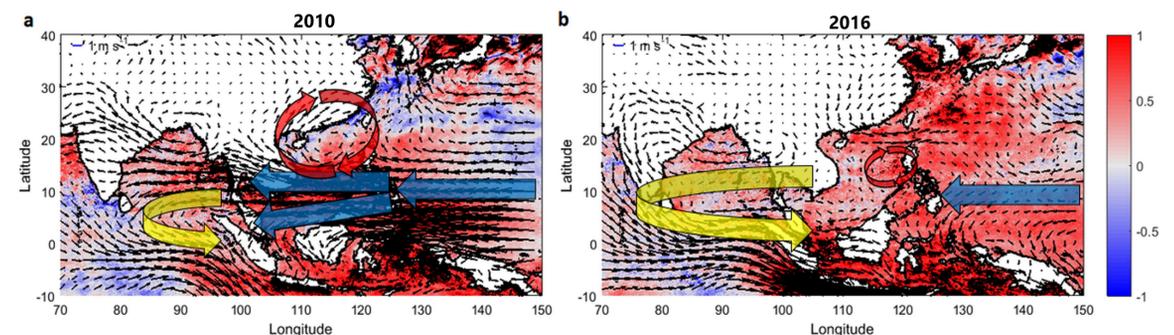
Interannual Variability of Upwelling



- EOF-1 was accountable for 80.99% of the total variance (highest) and was substantially correlated with alongshore wind stress anomalies, with a Pearson correlation coefficient (r) of 0.71, suggesting that fluctuation in Ekman transport caused interannual variability of upwelling.
- The EOF-1 was substantially correlated with the Multivariate ENSO Index (MEI) 6 months ahead of the EOF-1 ($r = 0.794$), indicating a delayed ENSO effect in generating upwelling variations.



- In 2010 and 2016, the inshore cooler water caused by upwelling nearly vanished.



- Intensive northwest Pacific anticyclone anomaly and the occurrence of northerly wind anomalies from the subtropical western Pacific generated by 2009/10 El Niño weakened the upwelling in 2010.
- The "C-shape" wind anomalies caused by the warming of the southwest tropical Indian Ocean through 2015/16 El Niño weakened the upwelling in 2016.