

Initial Observation of High Resolution Velocity Profile and Stratification in the Sunda Strait

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LONG-TERM GOALS

This pioneering work has main goal of observing and determining the dynamics of controlling circulation in the Sunda Strait – a strategic passage for marine safety and international shipping. (Figure 1).

OBJECTIVES

The main objectives are to:

- (1) measure the magnitude and variability of Sunda Strait flow by deploying one full Barny Sentinel ADCP to determine the volume transport and its associated heat-freshwater fluxes;
- (2) measure vertical stratification of the Sunda Strait and to study its effects due to rough topography/bathymetry, monsoon, and South Java Current.
- (3) test the hypothesis whether coastally trapped Kelvin waves could penetrate the Sunda Strait. If it does, how it affects the Strait stratification, mixing, and its interaction with water from the Java Sea.
- (4) determine effects of strait dynamics of fish distribution and abundance.

APPROACH

- ✓ Having international collaborative research among scientists from Lamont Doherty Earth Observatory (LDEO) United States, and Agency for Marine and Fisheries Research (BRKP) Indonesia and First Institute of Oceanography (FIO), China.
- ✓ Deploy two bottom mount ADCPs in the choked point of the Sunda Strait
- ✓ Take CTD casts and water samples at various locations within the straits and underway fishfinder as well as ADCP.

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WORK COMPLETED

- Two trawl-resistant bottom mounted (TRBM) moorings (one TRBM belongs to FIO and one TRBM belongs to LDEO) have been deployed in the north end of the Sunda Strait in early November 2008 using R/V Geomarin III (Figure 1).
- Twenty four CTD casts were taken during the November 2008 cruise.
- An attempt to recover and redeploy the moorings in August 2009 failed, therefore we plan to recover them in October 2009 using ROV and dredging.

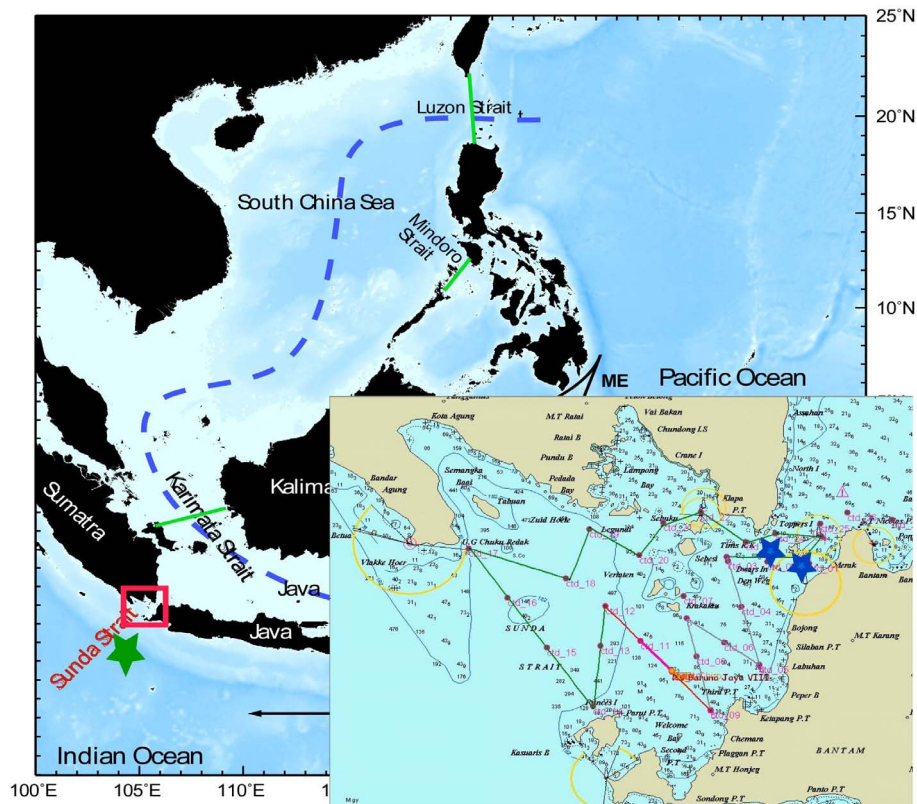


Figure 1. Indonesian throughflow pathways: Pacific-Makassar Strait-Indian Ocean and Pacific-Luzon Strait-South China Sea-Java Sea. Sunda Strait (red box and inset) connects the Java Sea and the Indian Ocean. Blue stars (inset) are mooring locations in the Sunda Strait. The grid line is the ship track in November 2008 and the red-dots are CTD stations (inset). The green star in the Indian Ocean is the Weidong (FIO-China) upwelling mooring in the Indian Ocean.

RESULTS

During the first cruise in November 2008, 24 CTD casts have been taken and preliminary results are presented in the Science, Technology and Policy Symposium as part of the World Ocean Conference, in Manado, Indonesia May 11-15, 2009 (Figure 2) and Ocean Obs09 Venice, Italy on 21-25 September 2009.

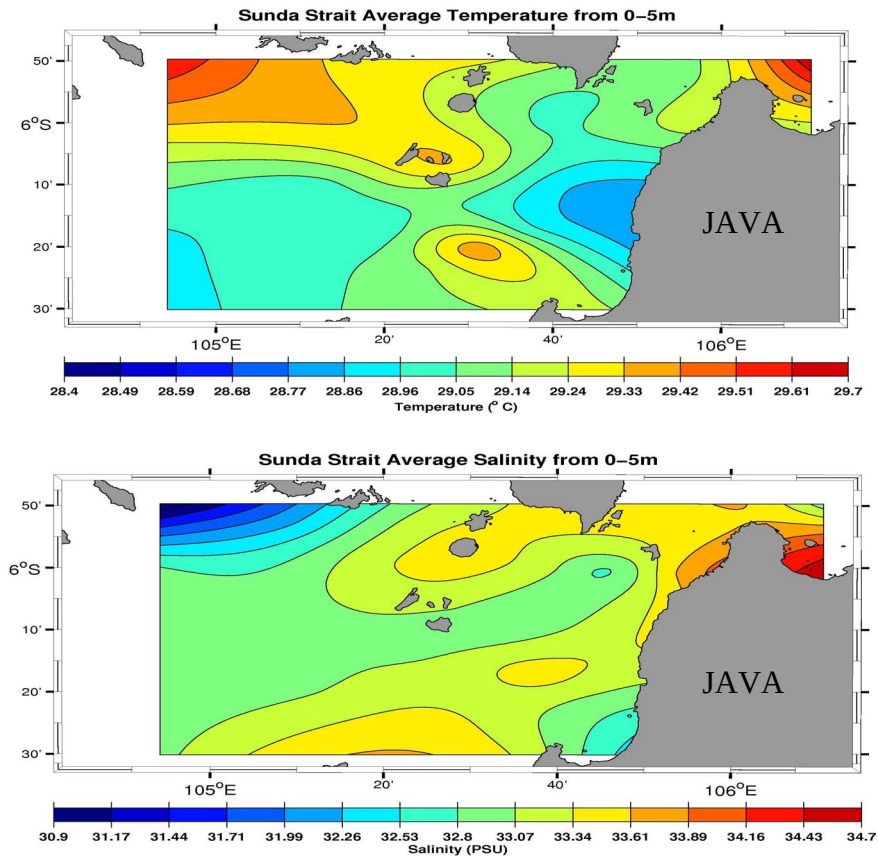


Figure 2. Average surface temperature (top), density (middle) and salinity(bottom) in the Sunda Strait.

IMPACT/IMPLICATIONS

Understanding dynamics of Sunda Strait has both scientific and economic benefits i.e. spatial and temporal variability of fish abundances, marine safety and environment and shipping. The Sunda Strait, which connects tropical Indian Ocean and Java Sea (Figure 1), is located between Java and Sumatra centered at 6.0°S and 105.0°E. An active growing volcano “*anak Kratatau*”, which is located in the middle of the Strait, adds to the complexity of the rough topography. The Strait provides the first gap of series of Indonesian islands from Sumatra to Timor, where equatorial Kelvin waves from the tropical Indian Ocean propagate eastward along southern coast of this island series and seasonal upwelling along the southern Java-Sumatra (Arief Murray, 1996; Sprintall *et al.*, 2000; Susanto *et al.*, 2001). Whether these waves could enter the Sunda Strait is still unknown. Southern Java-Sumatra is also center of interannual variability associated with Indian Ocean Dipole (IOD). Hence, dynamics of Sunda Strait is hypothesized to be affected not only by the complex coastline topography and bathymetry, but also interactions between intraseasonal associated with Madden Julian Oscillation, monsoon, South Java Current, and Indian Ocean Dipole.

RELATED PROJECT

- ✓ Ongoing project supported by NOAA to measure long-term ITF variability in the Makassar Strait as a continuation of the INSTANT program, which was supported by NSF (completed in 2007).
- ✓ Ongoing project supported by the Chinese NSF and led by Prof. Yao-chu Yuan of the Second Institute of Oceanography, China, by deployed moorings in the Luzon Strait in Spring 2008.
- ✓ Ongoing collaborative project (China-Indonesia) to deploy moorings in the Indian Ocean south of the Sunda Strait in November 2007. Chinese PIs led by Dr. Weidong Yu of the First Institute of Oceanography is supported by Chinese NSF and Indonesian PIs led Dr. Sugiarta (BRKP, Indonesia). Both of them have been my long-term collaborators.
- ✓ Ongoing collaborative project (Indonesia-China-USA) on South China Sea – Indonesian Seas Transport/Exchange (SITE) in the Karimata Strait has been funded by NSF starting Spring 2008. One mooring (supported by ONR DURIP N00014-06-1-0738) has been deployed in the Karimata Strait in December 2007 and will be recovered prior the Sunda cruise in the end of October 2008.

REFERENCES

- Arief, D., and S. P. Murray, 1996: Low-frequency fluctuations in the Indonesian throughflow through Lombok Strait, *J. Geophys. Res.*, 101, C5,12455-12,464.doi:10.1029/96JC00051.
- Sprintall, J., A.L. Gordon, R. Murtugudde, and R.D. Susanto, 2000: A semi-annual Indian Ocean forced Kelvin waves observed in the Indonesian Seas, May 1997, *J. Geophys. Res.*, 105, 17217-17230.
- Susanto, R. D. , A. L. Gordon Q. Zheng, 2001 : Upwelling along the coasts of Java and Sumatra and its relation to ENSO, *Geophys. Res. Lett.*, 28, 8, 1599-1602.
- Susanto, R. D. and J. Marra, 2005: The effect on 1997/98 El Nino on chlorophyll-a concentration along the southern coasts of Java and Sumatra, *Oceanography*, 18, 4, 124-127
- Susanto, R.D., T. Moore II and J. Marra, 2006: An ocean color variability in the Indonesian Seas during the SeaWiFS Era, *Geochemistry Geophysics Geosystems*, 7,5, doi:10.1029/2005GC001009
- Tozuka, T. T. Qu, and T. Yamagata, Dramatic impact of the South China Sea on the Indonesian Throughflow, *Geophys. Res. Lett.*, 34, doi: 10.1029/2007GL030420