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Interactive comment on "Sea level trend and variability around the Peninsular Malaysia" *by* Q. H. Luu et al.

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Reviewer: The authors of this manuscript have presented an interesting results to quantify the temporal sea level trend variations around Peninsular Malaysia. Though this is a regional study, it gives clear picture of sea level trends around Peninsular Malaysia, which will be useful for further studies on sea level variations in the SCS. The following suggestions and comments may be incorporated by the authors before being accepted in Ocean Science Journal.

Answer: Authors would like to thank the reviewer for his comment. Below are our detailed responses.

Reviewer: (i) pp. 1527 l. 25, the authors said that magnitude of annual sea level

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variability is proportional to the intensity of ENSO events. But, annual sea level can be influenced by IOD also.

Answer: The interannual variability is driven by both ENSO and IOD. The influence of IOD and its co-occurrence with ENSO were described in the three remaining paragraphs of Section 3.2.

Reviewer: Volume transport between adjacent oceans can also play a significant role in annual sea level variations since SCS is embedded between Indian and Pacific Ocean and connected to adjacent Seas by Straits. Accordingly, write-up may be modified.

Answer: It is well known that the South China Sea (SCS) is an important passage for the Pacific Ocean water into the Indian Ocean, and also a SCS branch of the Pacific-to-Indian Ocean throughflow exists in the NE monsoon (e.g., Fang et al., 2009). Total flow through the Karimata Strait is estimated to about 1 Sv and it is directed towards north (Figure 2-6, Fang et al., 2009). The Makassar Strait, connecting the Celebes Sea and the Java Sea has usually a current to the south which is caused by the slope of the sea surface from the Pacific to the Indian Ocean. Meanwhile, through the Malacca Strait and Sunda Strait, water exchange is possible between the Sunda Shelf and the Indian Ocean. In both straits, the seasonal water movements are in general directed towards the Indian Ocean and are strongly related to the surface gradient of the sea level through these straits (Wyrtki 1961; Pang and Tkalich, 2003; Fang et al., 2009). In the Malacca Strait the period of strongest flow is from January to April, during the northeast monsoon, but it is mainly forced by the low sea level in the Andaman Sea in this season. The volume transport through the Malacca Strait is at minimum during the SW monsoon season (Pang and Tkalich, 2003). However, role of volume transport variability through the Malacca Strait to the local sea level variability at interannual timescale has not yet been identified. In fact, it is a part of our on-going project to study the dynamics of southern SCS using very high resolution numerical model (not included in this manuscript). Our initial results suggested that the volume transport through the Malacca Strait is highly correlated with the sea level gradient between

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Andaman Sea and SCS, which implies that the local interannual sea level variability is sensitive to the inter-ocean transport as suggested by the reviewer. However, such examination is beyond the scope of this study and thus will be addressed in detail in a separate publication.

Reference

Fang, G., Wang, Y., Wei, Z., Fang, Y., Qiao, F. and Hu, X. (2009): Interocean circulation and heat and freshwater budgets of the South China Sea based on a numerical model, Dyn. Atm. Ocea. 47, 55–72.

Pang W.C., Tkalich P. “Modeling tidal and monsoon driven currents in the Singapore Strait”. Singapore Maritime Port J., 2003, pp. 151-162.

Wyrtki, K. (1961): Physical oceanography of the Southeast Asian waters: Scientific results of maritime investigations of the South China Sea and Gulf of Thailand 1959–1961, NAGA Report 2, Scripps Institute of Oceanography, 195 pp.

Reviewer: (ii) IOD drives the sea level change, probably through the uniform south westerly winds in the SCS. Detailed analysis of sea level data along the Peninsular Malaysia is needed to get an idea of spatial variation of IOD induced interannual SLAs.

Answer: As shown in the manuscript, the IOD plays an important role in driving inter-annual sea level variability in the Malacca Strait. IOD spatial signature along the strait can be partly observed in Fig 6, where it gradually weakens toward the east, and disappears at the Singapore Strait. As already described (page 1528, line 8-10), the IOD probably drive the sea level change through the easterly zonal wind-induced equatorial Kelvin waves generated in the Indian Ocean during IOD events and propagating to Malacca Strait through the Andaman Sea (Vinaychandran et al., 1999; Mutrugudde et al., 2000).

Reviewer: PDO index can be used as one of the climate proxies for reconstruction for longer scale.

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Answer: In the revised manuscript, we use fill the gappy data by a more efficient technique, which eliminates the need for employing climate indices (inclusive of PDO) for reconstruction.

In summary, the authors thank the reviewer for his useful comments. Part of this discussion will be added into the revised manuscript.

Interactive comment on Ocean Sci. Discuss., 11, 1519, 2014.