Review of "The shallow meridional overturning circulation of the South China Sea" by N. Zhang, J. Lan, and F. Cui Overview: This paper investigates the Shallow Meridional Overturning Circulation (SMOC) in South China Sea (SCS). The SMOC in SCS might have potential importance on regional climate because it transport heat from Southern to northern SCS. The SMOC has been investigated by Wang et al. (2004) with a simplified GFDL GCM, and Wang et al. (2004) suggested that the water exchange through Luzon Strait plays an important role on the formation of SMOC. By using oceanic reanalysis data (SODA), this paper investigated the mass balance of the SMOC, but with a very confusing presentation. If I understand correctly, this paper suggests that the SCS monsoon drives the SMOC through its dynamic and thermal dynamic effect. It does require large amount of work to improve this paper to be published.

Major comments:
1. The introduction does not state clearly the state-of-the-art of the present study. What is new, and why the study of SMOC in SCS is important? And several paragraph in the main content of this paper should appear in the introduction (last paragraph in section 3, fist paragraph in section 4.1, some sentence in the first paragraph of section 4.3...).
Reply: There have been studies pointing out that the SCS receives great amounts of heat from the sun and atmosphere, and thus plays an important role in the climate system of the Southeast Asia. Fang et al. (2009) pointed out that there was a net downward heat flux through the SCS surface by examing the heat budgets through the straits around the SCS. And we believe the SMOC can play an important role in the heat redistribution in the SCS. What's more, importance of the SMOC has also been pointed out in papers of Wang et al. (2004) and Liu et al. (2008). The study of Wang (2004) showed that meridional overturning circulation existed in the upper layer of the SCS. The overturning demonstrated the possible movement route of the SCS upper waters, thus having a close relation with thermocline, upper circulation in the SCS. Heat in low altitude are transported to higher altitude by meridional overturning circulation, and this oceanic meridional thermohaline process sure has important impact on climate variability. The study of Liu (2008) showed that the seasonal variability of the intrusion of North Pacific Tropical Water (NPTW) and North Pacific Intermediate Water (NPIW) to the SCS was highly related to the seasonal variability of the SCS meridional overturning and this also demonstrated that the SMOC played an important role in water mass movement in the SCS. Since Wang's (2004) study is with a simplified GFDL GCM and Liu's study says nothing about the dynamics, we think we'd better first figure out the structure and dynamics of MOC in the SCS using a credible dataset, before we start calculating the related heat transport. And thank you about the suggestions that several paragraphs in the main content should appear in the introduction. These paragraphs are not directly about the state-of-the-art or the importance of the MOC in the SCS. The last paragraph in section 3 is about SODA data, the first paragraph in section 4.1 is about monsoon in the SCS and the first paragraph in section 4.3 is about summer upwelling in the SCS, we think it will make

the paper fluent to follow if they appear in the corresponding sections.
New Reference:
Fang, G., Wang, Y., Wei, Z., Fang, Y., Qiao, F., Hu, X.: Interocean circulation and heat and freshwater budgets of the South China Sea based on a numerical model, Dynamics of Atmospheres and Oceans, 47, 55-72, 2009.

2. "Although some investigations have been carried out ... little work has been done on the study of its dynamics (in the introduction)". That is not true. Wang et al. (2004) has investigated the dynamics of SMOC in their paper.
Reply: Maybe the sentence is a little arbitrary. In the paper of Wang et al. (2004), they discussed the impact of Kuroshio on the meridional overturning in the upper layer by carrying out simulations under the conditions of open or enclosed Luzon Strait. This implies that water exchange in Luzon Strait has an important impact on forming properly meridional overturning in the upper SCS. But since SMOC still exists when the Luzon Strait is closed in both winter and summer, we don't think the intrusion of Kuroshio is the direct driving force of the SMOC in the SCS. So we discussed the driving dynamics in more details in our paper.

3. " The OFES data are used here for validation, ..." . I do not think we can say OFES data is the truth because it has high resolution. If you take OFES as the truth, you should use OFES data to investigate the SMOC not SODA data. I suggest the author either use the OFES data or only use the oceanic reanalysis data SODA. It is also worthy to do the same calculation with other oceanic reanalysis data like ECCO or GECCO.
Reply: Thank you for your suggestion. The streamfunction values calculated from the OFES data may not be very correct because SODA data assimilate many observational data while OFES data are solely model output results. So it is understandable that the specific streamfunctions obtained from SODA and OFES data are different. But the OFES data are only used in section 3 to validate that SMOC dose exist, they are not used in the other sections of our paper.

4. The discussion on the seasonal and annual budgets should be separated. It is very confusing.
Reply: On annual mean scale, the SMOC consists of downwelling in the northern SCS, a southward subsurface branch supplying upwelling in the southern SCS and a northward return flow of surface water. But different processes dominant in different seasons when discussing the branches separately. Speaking to subduction, as we know, only fluid subducts from the mixed layer during the effective subduction period, late winter to early spring, that can penetrate into the main thermocline. So we first investigate the subduction process in the northern SCS to confirm that subduction phenomenon does exist. And in the equation (3) calculating the annual mean subduction rate, the second term on the right side is a rectification term referring to meridional transport within the mixed layer. The third term on the right side refers to the lateral transfer of fluid at the bottom of the winter mixed layer. So we discussed

the relevant winter mixed layer characteristics inevitably. When investigating the upwelling in the southern SCS, we found that it is summer upwelling off the Vietnam coast that dominate on annual mean scale. So we investigated summer upwelling off the Vietnam coast in more details.

5. The mass budget of the SMOC (the downwelling, subduction and upwelling) is not closed, what is the problem?

Reply: The annual-mean Ekman transport across 18° N is about 0.91 Sv. We think subduction is the main cause of downwelling branch of the SMOC in the northern SCS and the annual mean subduction rate in the northern SCS is 1.4 Sv. The values of Ekman transport and subduction rate are of the same magnitude. The total upwelling near the Vietnam coast is 7.3-4.4=2.9 Sv, we think it is because that we assume that all the Ekman pumping water will be upwelled into the mixed layer and becomes permanently transformed when estimating the upwelling rate, so this yields a high estimate. Another reason why the SMOC is unenclosed is that water intrusion especially via the Luzon Strait (the only deeper strait around the SCS) from the open Pacific has an important impact on the meridional overturning circulation, which has been pointed out by Wang et al. (2004).

New Reference:

Fang G. H. and Coauthors: Interocean circulation and heat and freshwater budgets of the South China Sea based on a numerical model, Dynamics of Atmospheres and Oceans, 47, 55-72, 2009.

6. Section 5 should be removed.

Reply: In fact, we add this section to increase interest of our paper, or our results are entirely confined to the SCS according to the Editor's kind suggestion. But some problems arise from this part perhaps because of the incoherence. The SMOC in the SCS and in the Indian Ocean have both similarities and differences. We made some comparisons between their strengths, characteristics of structures, and formation mechanisms. The strength in the Indian Ocean is stronger. They have similar structures and driving mechanisms. They are both in the monsoon area and have coastal upwelling, with subduction and Ekman transport playing important roles in their formations. Indian Ocean upwelling occurs off Somalia, Oman and off Indian, and only during the summer monsoon. SCS upwelling occurs off Vietnam coast and mainly in summer. They embrace similar structures and also different characteristics.