This paper requires a very large amount of work in order to be of publishable quality. The authors diagnose various quantities related to the overturning of the South China Sea, and show that wind stress plays a major role in the shallow overturning in one ocean model. This is fine, as far as it goes. However, there are two major problems: A)The shallow MOC is of little interest in itself. The reason for the current level of interest in the North Atlantic MOC is that this reflects a large-scale ocean mode responsible for significant heat transport. The MOC in the South China Sea may or may not be a good proxy for some interesting aspects of its circulation, but it would make much more sense to first investigate the three-dimensional circulation of the sea and its role in cycling and exchanging water mass properties of interest. If the MOC plays a significant role in these processes, then it becomes an interesting diagnostic, but it is of little interest for its own sake in a relatively small, and partially open region of the Ocean.

Reply: Thank you for your suggestion to investigate the role of the shallow meridional overturning circulation in cycling and exchanging water first. By examing the heat budget in the SCS, Fang et al. (2002) pointed out that there was a net downward heat flux through the SCS surface on the annual mean scale. They also pointed out that there were overturning circulation existing in the subsurface layer of the SCS by examing the water budgets. We believe that the meridional overturning circulation plays an important role in the heat and water mass redistribution. Studies of Wang et al. (2004) and Liu et al. (2008) also implied that the meridional overturning circulation had an important impact on the water mass movement in the SCS. What we think is that we'd better figure out the two-dimensional structure of the meridional overturning circulation first, once its structure is clear, the related heat transport can be calculated. So we begin with the structure and dynamics first.

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.

B) The presentation suffers from many problems, as detailed below:

1) The authors initially consider diagnostics from two ocean models, but quickly discard one of them without looking at how and why the models differ.

Reply: SODA is a kind of reanalysis data which assimilates many observational data while OFES is a kind of model output data. The idea behind SODA is to use direct observations to correct model errors in order to improve the reanalysis of ocean variables with a straightforward assimilation algorithm. And actually we don't want to diagnose from both the ocean models, OFES data is used here only for validation of the existence of the shallow meridional overturning circulation in the SCS and Fig. 1b dose show a weaker meridional overturning structure limited to a shallower depth. Besides, SODA data have already been used in the study of the shallow meridional overturning circulation in the Indian Ocean (Schott et al., 2002) and the study of meridional overturning circulation in the SCS (Liu et al, 2008). We believe that the

SODA data can give credible results.

2) The primary diagnostic - the meridional overturning streamfunction - is of dubious value in an unbounded region, for which there is no meaning to the vertical component of the visualised "flow" at latitudes which are not closed. A better diagnostic would be the same, but integrated from the bottom up, rather than from top down, as this at least does represent a genuine streamfunction for the integrated flow below the depth of connections to the wider ocean. However, much more useful would be a clear description of the three-dimensional circulation. The authors make a good case for a northward Ekman flux accounting for much of the integrated flow in the mixed layer. A good question would be, how does that flow return to the south? Is it in boundary currents or throughout the interior? What is the role of any recirculation through connections to the wider ocean? Is there a net change of density (temperature, salinity) associated with that recirculation, and if so, where does it occur. Such questions should be straightforward to answer with the full ocean model fields.

Reply: The method to calculate meridional overturning streamfunction in our paper is according to Cabanes et al., (2008). Wang et al. (2004) also used this equation to calculate the meridional overturning streamfunction in the SCS. The stream function value at a latitude and a depth denotes the total volume transported across this zonal section above this depth. It is different from the calculation of the horizontal stream function, which needs boundary conditions. The stream function is enclosed at the northern SCS because of the transportation into the SCS via Luzon Strait from the open Pacific (Wang et al., 2004), so the openness of this region can be reflected in the stream function. Your question about the return flow is very good. The return flow is affected by the water intrusion via the Luzon Strait from the open Pacific, we need to investigate the three-dimensional structure to make clear its specific path. But since we focus on the two-dimensional structure and dynamics of the shallow meridional overturning circulation in this paper, so more work about the specific path will be done in the future.

3) The calculation of subduction rate (section 4.2.2) moves from the MOC in zcoordinates, to the water mass formation associated with flow through the mixed-layer base (which is not at constant z). However, the formulation in terms of a linear vorticity balance is dubious in the presence of bottom friction and nonlinear vorticity, and there is no need for such an idealised formulation when the full model fields are available -simply calculate the flow through the chosen surface. Incidentally, the v in (3) is supposed to represent the geostrophic velocity only, not any v associated with the Ekman layer. No attempt is made to account for the fact that the MOC in z-coordinates is not directly relevant to this quantity. I also find it strange that subduction into the interior is considered, but entrainment back into the mixed layer (negative subduction) is set to zero.

Reply: The reason why we chose the equation to calculate the subduction rate rather than calculate the flow through some chosen surfaces is because we want to

investigate the dynamics of the downwelling branch, not just to calculate the transportation volume related to the downwelling branch. Through the equation, we can compare the terms to see it is the Ekman pumping or the lateral transfer at the winter mixed layer that dominate. Using geostrophic velocity sure will make the result more convincing, thank you for this question. The subduction rate calculated should always be nonnegative because it is defined only for the effectively detrained water (Qiu et al., 1995). A negative rate of subduction implies that no effectively detrained trajectories exist. So we change all the negative values into zero.

4) The manuscript switches back and forth between annual mean budgets and seasonally varying components, occasionally using diagnostics from one to explain features of the other. This is very confusing. The two should be kept as separate as possible, with the seasonal variation only influencing the annual mean through explicitly calculated rectification of non-linear terms (in the transport within a particular density class, for example, where velocity and density may be correlated over a seasonal cycle). 5) The relative roles of Ekman pumping and coastal upwelling/downwelling are not made clear. How much of the upwelling and downwelling required to balance the northward Ekman transport is supplied by interior Ekman pumping, and how much by coastal upwelling and downwelling? This is a section in which the switching between annual mean and seasonal cycle is particularly confusing.

Reply: We actually used the budget in seasonal processes to explain the annual mean budgets when discussing the upwelling branch off the Vietnam coast. Because we think it is the summer upwelling process that dominates on the annual mean scale, to cause the upwelling branch off the Vietnam coast. Besides, the subduction rate based on the winter mixed layer properties, as first suggested by Stommel (1979, the Stommel demon), provides a good approximation to the annual mass flux from the mixed layer to the permanent pycnocline (Qiu et al., 1995), so we discussed about the winter mixed layer characteristics inevitably.

6) Section 5, comparing the results with the Indian Ocean, seems quite disconnected from the rest. The only real connection I can see is that the Indian Ocean also has a surface Ekman layer, and even that is more notable for its different behaviour than for its similarity, as the Indian Ocean Ekman layer straddles the equator.

Reply: This section seems to be a little disconnected from the rest. 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 difference. 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.

These problems, especially in the light of the central issue of why the MOC might be of interest in the first place, are great enough that any acceptable paper would effectively be a new paper on a different subject, hence my recommendation to reject for OS.

Reply: Thank you for your comments and suggestions. We will consider the questions you put forward carefully. We will really appreciate it if you read our paper following our ideas.