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***Interactive comment on* “The shallow meridional overturning circulation of the South China Sea” by N. Zhang et al.**

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In the paper “The Shallow Meridional Overturning Circulation of the South China Sea”, the structure and formation of the meridional overturning in the South China Sea were discussed based on the SODA output. Overturning has been widely discussed in the general ocean. It also takes place in the South China Sea, one of the largest marginal sea, therefore this paper may be a useful supplement to the general overturning study. However, there are still some questions remaining in the manuscript. I recommend that this paper be published after revisions.

Major comments: The meridional overturning in the South China Sea has a three-dimensional structure, for example, the upwelling mainly occurs near the Vietnam coast. In Section 3, the authors only described the zonal mean structure. I under-

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stand that the purpose of this paper focuses on the meridional circulation. Since the SODA data can provide the three-dimensional information, it would be better to give a complete picture of the overturning in the South China Sea, for example the path of the subducted water. Does the west boundary current proposed by Stommel and Arons' (1959) exist?

What is the purpose to use the OFES output? The difference between the SODA and the OFES is apparent in Figure 1, but the authors did not explain it. If the OFES output is used for validation, it is not convincing to validate one model result with another.

The total upwelling near the Vietnam coast is $7.3-4.4=2.9$ Sv, doubled of the subducted water in the northern South China Sea. May the authors explain the reason?

The comparison between the South China Sea and the Indian Ocean is vague. I cannot get the direct connection between them. More descriptions are needed.

About the discussion of the upwelling near the Vietnam coast, there are two mechanisms: one is the Ekman transport caused by the alongshore wind, the other is the Ekman pumping caused by offshore increasing wind. The paper paid more attention on the latter one. The paper also pointed that the former one is dominant (Line 10 on page 1199). This confused me. Are they related?

Other comments:

- (1) In the abstract, the SODA data should be mentioned.
- (2) In Section 2, the model configuration should be clearly presented. Especially for the SODA data, what kind of wind forcing is used?
- (3) Line 24 on page 1196: Directly from Figure 6, the mixed layer is deep in the north while shallow in the South.
- (4) Line 7 on page 1198: "It should be noted that the estimate of annual subduction rate is subject to substantial error but it can be used to investigate the distribution pattern

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qualitatively.” This will confuse readers.

(5) Line 14-16 on page 1200: Be careful of the unit of density. And these two sentences are not clear to me.

(6) The language and writing styles needs to be improved.

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