Reply to Anonymous Referee #2

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The manuscript addresses an interesting question, the glacial-time water ventilation in the South China Sea (SCS), and a 3-D modeling is used to quantify the glacial ventilation age for the first time in the region. In terms of geological data, the manuscript uses a well reported sediment core MD97-2142 (Lee, 2000; Chen et al., 2003; Wei et al. ,2003; Yu et al., 2006; Ku et al., 2008; Shiau et al., 2008; Löwemark et al 2009). Since the newly provided dataset consists only of Ti and Al curves with not-high time resolution (ca. 4 kyr), the focus of the manuscript is laid on the numerical modeling. However, the manuscript challenges some common views on the paleo-monsoon in the SCS, but failed to provide convincing arguments.

The doubled wind intensity and lowered sea level are the two backbones of the modeling experiments, but the most suspicious aspect in the modeling experiments is the hypothetical doubled wind intensity regardless which monsoon wind, winter or summer. Primary productivity in the SCS today is largely driven by the winter monsoon, and plenty of evidence indicate that the winter monsoon intensified in the SCS during the glacials resulting in enhanced productivity. By contrast, the summer monsoon was reduced during the glacial time. This notion is well supported by a variety of proxy data from marine sediments, including foraminifera (Huang et al., 1997, Marine Micropaleontology), grain size (Wang et al.,1999, Marine Geology), pollen (Sun et al., 1999, 2003, Marine Geology) and isotopes (Tian et al., 2005, Paleoceanography), just to name a few. In the terrestrial realm, the extensive records of speleotheme oxygen isotope convincingly show the weakening of summer monsoon in the glacials. Therefore, the assumed doubled summer and winter monsoon intensity is in a direct conflict with the geological data.

Reply: This question was also raised by Reviewer #1. As replied to Reviewer #1, we have carried out two new cases with reducing summer monsoon wind. The oxygenation state deduced from the new model runs would not alter our story at all. In the following revised version, we will add results from these two cases.

Actually, the authors should not ignore the difference between winter and summer monsoons. Previous authors have already noticed the different upwellings between the NE and SW coasts of the SCS: intensified upwelling off Eastern Vietnam during interglacials and off the northwestern Philippines during glacial (Jian et al., 2001, Quat. Res.; Wei et al., 2006, Paleoceanography). The paleo-records are well corresponding to the modern observations with summer-monsoon inducing upwelling off Vietnam, and winter-monsoon inducing upwelling off Luzon. Surprisingly, the authors "glacial model exhibits stronger upwellings at the west off Luzon Island and the east off Vietnam" together. To the reviewer's knowledge, it is hard to imagine a mechanism in climate dynamics that could intensify both winter and summer monsoons simultaneously during the glacial time.

Reply: Reviewer is correct about the upwelling center distribution in seasonal scale. However, the contour maps presented in Figure 2 are the annual average; thus, both

upwelling centers can be seen. The new model cases (with reducing summer wind) requested by reviewer indeed show weakened upwelling to the east of Vietnam as speculated by reviewer. The results of new cases will be added into old Figure 2. More descriptions will be made to clarify the differences in circulation pattern in annual basis.

Also, we will present the profile of monthly flow through the Luzon Strait to reveal the seasonality in water exchange.