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Interactive comment on "Spatial distribution of turbulent mixing in the upper ocean of the South China Sea" *by* Xiao-Dong Shang et al.

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The authors conducted an extensive field campaign to survey turbulence in the South China Sea and reported a spatial pattern of turbulent intensity from the observed data. They also compared the observed data against two theoretical models. The results are well known. I found no new information. I appreciate that the amount of work involved in the data collection, but as far as the science concerns the present manuscript reads like a data report. I found no new scientific finding and no new facts other than the survey was conducted in the South China Sea. Unless Ocean Science accept a manuscript aimed at a data report, I would not recommend this manuscript for an official scientific paper. For their revision purpose I will comment on this manuscript as followed: Responses: We thank the reviewer for the comment. In this paper, the turbulent mixing in the South China Sea (SCS) is analyzed from two aspects, not just a simple data

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Discussion paper

report. Firstly we explore the mixing features and mixing regimes in the SCS in great detail. Secondly we assess two parameterizations with the microstructure data. Many microstructure measurements have been conducted in the SCS. There is no doubt that these measurements have greatly aided our knowledge of turbulent mixing in the SCS. However, the microstructure measurements are localized and scattered with most of them focusing on the northern SCS. The mixing features and mixing regimes in different regions of the SCS are still not fully understood. With the microstructure data in 2010, we present the spatial distribution of turbulent mixing in the upper ocean of the SCS and explore the mixing features and mixing regimes in different regions of the SCS. In the revised text, we strengthened the discussion on energy sources for the turbulent mixing (lines 246-275 and 422-431). Our observation indicated that strong turbulent mixing mainly occurred in west of the Luzon Strait where there are strong shear and weak stratification, and internal waves made a dominant contribution to the elevated turbulent mixing in west of the Luzon Strait. Another work in this paper is the assessment of two parameterizations (GH and MG models). Though many microstructure measurements have been conducted in the SCS, none of the two models has been assessed against the dissipation in the SCS. It remains unknown which parameterization can successfully reproduce the dissipation in the SCS and why. In manuscript, we assess the two parameterizations with the dissipation data of the SCS, which would provide useful tools for ocean researchers. In fact, the microstructure measurements in the ocean are much fewer and more difficult than fine-structure measurements (i.e., CTD and ADCP measurements) in the ocean, especially in the deep sea. Thus to understand the spatial distribution and seasonal variation of the turbulent mixing in the ocean, researchers often turn to the parameterizations (Wu et al. 2011; Jing and Wu 2010). The assessment of parameterizations can also provide reference for modelers. Models often need to calibrate a background mixing level to correctly predict the physical phenomenon (Rippeth 2005). The requirement of calibration reduces the success of models on large scales since differing forcing mechanisms and mixing processes require specific methods and levels of tuning. Before the physical phenomenon

can be modeled realistically, the distribution of mixing must be established and the major mixing processes parameterized. Parameterizations can provide a reference of the background mixing for the modelers. According to reviewers' comments, we have strengthened the content of motivation (lines 52-74) and added discussion on the effect of surface winds and internal waves on turbulent mixing and shear (lines 246-275) in the revised text.

1. Material and methods should be explained in more detail. Also those mooring data outside the observation period should be removed from the text. The Luzon Strait is not well known to the audience. Indicate where LS is. Responses: We thank the reviewer for this suggestion. Mooring data were used to show the feature of wave field in the SCS. We think that it should be kept in the text. We have strengthened the description of the material and methods in the revised text (lines 76-123). The location of Luzon Strait has been indicated in Fig .1.

2. P.4 line83: "caused by instrument vibrations" If so, you can verify the vibration with accelerometer data. Those are mostly electronic noise. Responses: We apologize for this confusion due to our inaccurate statement in the original text. They are vibration noise caused by the strumming of the suspension wires in the flow (Wolk et al. 2002). We have clarified in the revised text, see lines 108-109.

3. You have to focus the science. What is deriving high turbulence in Region 1. Most likely internal tides are playing a major role in generation of turbulence. Responses: We thank the reviewer for this good question. There are a large amount of internal waves (tides) in the SCS, which has been reported in many literatures, such as Niwa and Hibiya (2004), Zhao et al. (2004), Klymak et al. (2006), Jan et al. (2007). Most of internal waves originate in the Luzon Strait and propagate northwestwards through the deep water zone near Luzon Strait to the continental shelf (Alford et al. 2015). Mooring data (Lien et al. 2014) indicate that internal waves would induce strong shear. A comparison of the spatial distributions of turbulent mixing, winds, and internal waves suggests that the elevated turbulent mixing and shear in west of the Luzon Strait (region

1) does not result from the effect of surface winds. The internal waves are expected to make a dominant contribution to elevated turbulent mixing and shear in west of Luzon Strait. We have strengthened the discussion on this in the revised text, see lines 246-275 and 422-431.

4. Discussion should be separated from Summary. The summary should summarize both results and a punch line of the discussion. Responses: We thank the reviewer for this good suggestion. We have separated the discussion from summary in the revised text.

Please also note the supplement to this comment:
http://www.ocean-sci-discuss.net/os-2016-80/os-2016-80-AC2-supplement.zip

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