Anonymous Referee #1

The article analyses two transects in the South China Sea conducted with CTD, turbulence profiles and ship board ADCP measurements. The authors focus on the transport mechanisms of nutrients through vertical turbulent mixing. The main results are strong differences between the two transects: the transects nearer to the Luzon Strait exhibits a much more patchy but also stronger turbulence and subsequently stronger vertical nutrient flux compared to the transect further away. The authors finish the article with this conclusion, which I find a bit weak and would expect more discussion, in the current form it is more a technical document describing a measurement. Possible questions which arise automatically could be: What are the consequences on biogeochemistry of this spatial inhomogeneity? Do satellite picture show also inhomogeneities in chl-a? Is the part nearer to the Luzon strait more/less productive? Maybe less/more fish catch? The introduction is lacking a section explaining the mechanisms of the evolution of chl-a. What are the sources/sinks, where are they and why are the authors at all interested in chl-a? Also the methodology needs some improvements, the authors do not describe the dates of the measurements, nor the meteorological situation. Also the processing is somewhat unclear, were the devices calibrated? What software was used to derive the dissipation rate? The computation of the fluxes does as well need a second look: As it is unclear what the time difference between the CTD and the turbulence profiles is, it is unclear how much error is induced by the time difference between the sampling. Transect B suggests by its patchiness a strong temporal and or spatial inhomogeneity, which has possibly a huge impact on the fluxes. The authors need to discuss this issue. On the other hand transect A has low turbulence O(1e-9 W kg^{-1}), a quick glance at the Buoyancy Reynolds number (eps/(N^2nu)) at distance=150 km, depth 50 m with eps$\sim$1e^{-9}, N^2~4e^{-1} and nu$\sim$1e^{-6} gives a Reb = 2.5, suggesting values well below 10, in this region turbulent mixing is strongly damped or completely suppressed by stratification and fluxes are molecular. It is therefore necessary to compute Reb and to mark (or discard) regions of low Reb. Without being a natural English speaker, my impression is, that the English needs some improvement as well. Despite these criticisms, this is a very valuable dataset and is worth publishing.

Responses: Thank you for your comments. Turbulent mixing can redistribute the nutrients and phytoplankton in the ocean, which would affect the distribution of microzooplankton and fish catch. The satellite picture also shows inhomogeneities in chl-a. Figure R1 shows the sea surface chlorophyll a during the survey obtained from ERDDAP (https://coastwatch.pfeg.noaa.gov/erddap/index.html). The concentration of sea surface chlorophyll a in the region of transect B was higher than that of transect A. To show the spatial distribution of sea surface chlorophyll a, we have replaced Figure 1 in the text with Figure R1 (line 89). Nutrient fluxes from below the euphotic zone are essential for phytoplankton primary production in the surface ocean. Unfortunately, we cannot quantify phytoplankton growth and microzooplankton grazing rates due to the lack of data. We have added content about the evolution of chl-a to the introduction (lines 35-41).

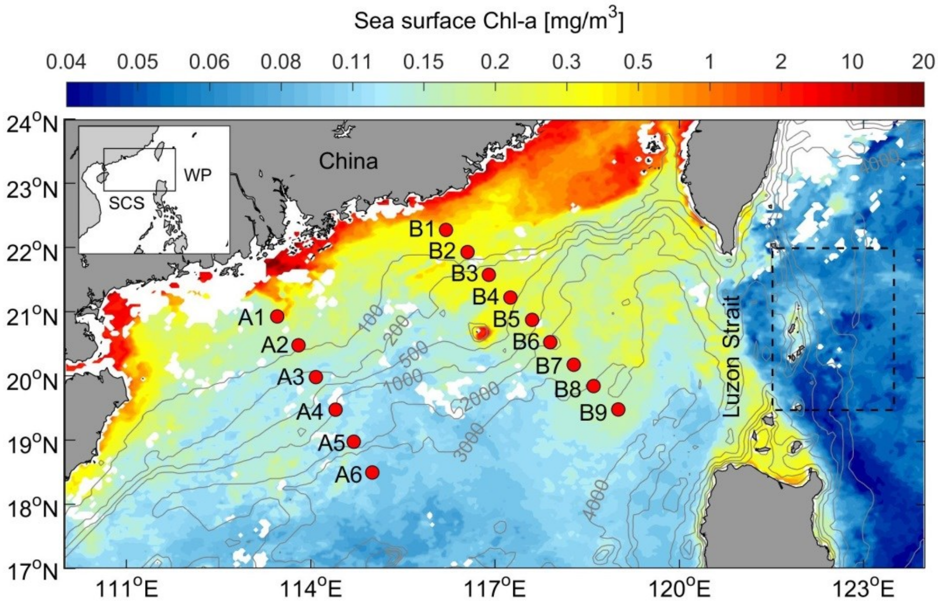

Figure R1: Spatial distribution of sea surface chlorophyll a with stations (circles) shown. The gray curves are the isobaths (unit in m). The dashed black box indicates the region where the temperature and salinity data of the western Pacific (19.5°N-22°N, 121.5°E-123.5°E) were obtained. Sea surface chlorophyll a is monthly MODIS-Aqua data (May 2010). The inset panel is a zoomed-out map with the South China Sea (SCS) and western Pacific (WP) shown. The black box in the inset panel indicates the observation area.

Transect A was conducted from 26 to 28 April 2010 and transect B was conducted from 22 to 23 May 2010. The weather was sunny and the wind was weak (<8 m s^{-1}) during the observation of the two transects (Figure R2). There was no storm during the observation. One CTD profile and one microstructure profile was conducted at each station. Microstructure profile was conducted right after the CTD profile. The observation time at each station is less than one hour over the continental shelf and less than two hours in deep sea. We believe that the turbulent field and the distribution of nutrients and chlorophyll have not changed greatly during this period. The devices had been calibrated before the cruise (January 2010). An integrated software application TMTools^{TM} developed by Alec Electronics Co., Ltd. was used to derive the dissipation rate. We have added these details to the revised text (lines 98-109, 115-117, 123-124, and 133-135).

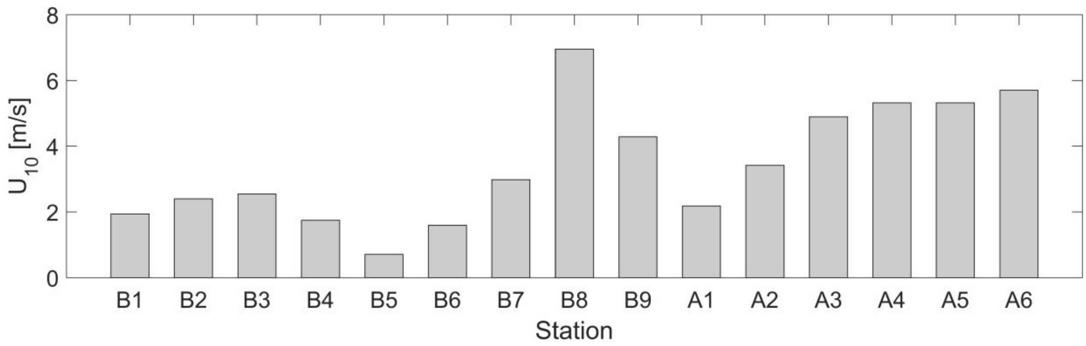

Figure R2: Wind amplitude for each station.

The formula of Buoyancy Reynolds number ($\varepsilon/(N^2 nu)$) is similar to that of diapycnal diffusivity ($\Gamma\varepsilon/N^2$). Diapycnal diffusivity is a variable to directly quantify the intensity of turbulent mixing. We have calculated the diapycnal diffusivity in the text. We believe that it is unnecessary to calculate the Buoyancy Reynolds number. Note that the colourmap of Figures 5-8 in the revised text was modified according to different variables, and a range more friendly colourmaps were used. The English has been improved by a natural English speaker (Figure R3).

Invoice

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Figure R3: Invoice of language editing.

Detailed comments.

Figure 1: Add a subplot showing the region on an overview map, include in the subplot also the location of the western pacific mentioned in line 129.

Responses: Thanks for your advice. We have expanded the map and selected another region (indicated by the dashed black box in Figure 1) for the temperature and salinity of the western Pacific (line 89).

Introduction: 30-51: Nutrient fluxes: where do the nutrients come from and are they mixed/consumed/transported

Responses: Nutrients in the ocean are usually distributed at deep layer and the seabed, while the nutrients in the upper ocean are relatively scarce due to consumption by phytoplankton. The role of nutrient flux is to transport nutrients from the deep and bottom layers to the upper layer, providing nutrients for the phytoplankton in the upper ocean. We have made this clear in the revised text (lines 35-41).

81: Add date of last calibration

Responses: We have added the date to the revised text (line 109).

88-89: Add ADCP frequency and sampling intervals of the ADCP

Responses: The frequency of ADCP is 38 kHz. The sampling intervals were set to 5 min and 16 m bin size. We have clarified this in the revised text (lines 115-117).

100: Include a description of the software package used to calculate the dissipation rate.

Responses: Thanks for your advice. We have added a description of the software package in the revised text (lines 133-135).

Figure 2: Include the station number and date of measurement into the figure label

Responses: Thanks for your advice. We have added station number and date of measurement to the Figure label (line 156).

118: Detail in more detail how the interpolation of the high resolution T, S to eps was done

Responses: The CTD data were processed according to standard procedures as recommended by the manufacturer and bin averaged to 1-m resolution, corresponding to the resolution of the dissipation rate. We have added this to the revised text (lines 146-148).

Data & Methods: It does not become clear when and how many profiles were taken. Was i.e. only one turbulence profile taken at the stations A1-A6 and B1-B9 or several? How were the meteorological conditions? Do tides play a role, was it spring/neap tide?

Responses: One CTD profile and one microstructure profile were collected at each station. The weather was sunny and the wind was weak (<8 m s^{-1}) during the observation of the two transects. Figure R4 shows the barotropic tides obtained from the global inverse tide model (TPXO) at (20^{o}N, 116^{o}E) (Egbert and Erofeeva, 2002). Both transects are conducted in period of neap tide. The difference of turbulent mixing between transects A and B does not result from spring or neap tide. We have added these details in the revised text (lines 98-108 and 123-124).

Egbert, G. D. and Erofeeva, S. Y.: Efficient inverse modeling of barotropic ocean tides, J. Atmos. Ocean. Tech., 19, 183–204, 2002.

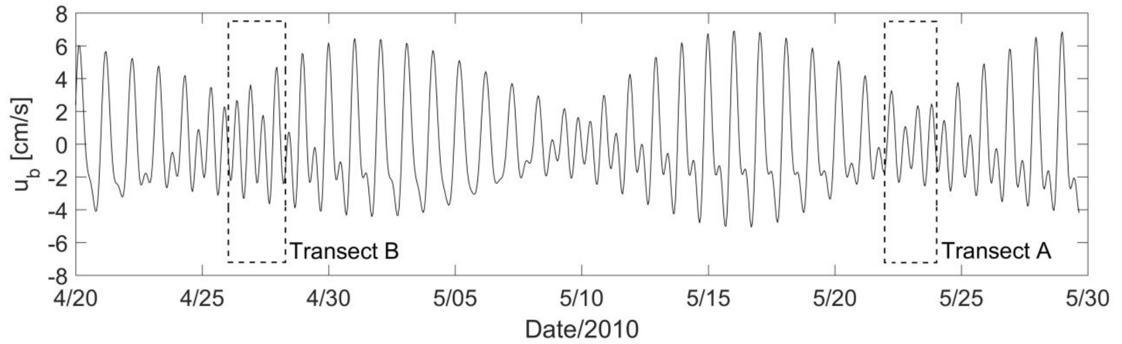

Figure R4: Time series of the barotropic tidal velocity predicted from TPXO 7.1. The two dashed red boxes indicate the periods of transects A and B.

Figure 4: Add markers of the CTD/TurbMAP profiles

Responses: Thanks for your advice. We have added station labels to the Figure (line 217).

161-162: "Internal waves might play an important role in mixing the local and invasive waters (Alford et al., 2015).": This is not an result and better belongs into the introduction.

Responses: Thanks for your advice. We have moved it to the introduction (line 62).

171-172: What about local wind conditions? It could be argued that transect B was measured after a storm event, mixing the whole upper water column.

Responses: There was no storm during the observation. The weather was sunny and the wind was weak (<8 m s^{-1}) during the observation of the two transects. We have described the local wind conditions in the revised text (lines 103-106).

192: Figure 5 suggests $O(10^{-7})$

Responses: Most of values were less than 10^{-7} W/kg, so $O(10^{-8})$ W/kg is reasonable.

193-194: Transect B compared to transect B?

Responses: Thank you for your reminding. We have corrected the error in the revised text (line 229).

194-195: Is there evidence in measured data (i.e. ADCP) that internal waves are the main process, otherwise this is speculation (a reasonable though) and the sentence should be rephrased.

Responses: Thanks for your comment and advice. No evidence can be found from the ADCP data due to the short-term observation. We have rephrased the sentence in the revised text (lines 229-231).

Figure 5b: One could argue that the profiles were taken with/without internal wave activity and thus creating the strong variability and patchiness of the data. Is there a way to estimate the internal wave activity during the profile? Add also markers for the locations of the profiles.

Responses: Thanks for your comment and advice. We cannot estimate the internal wave activity due to the limit of velocity data. However, we can roughly determine whether the internal wave is active from the shear and stratification. Generally, the shear is relatively strong in region where the internal wave is active, and strong shear is likely to cause shear instability and weaken the stratification. As one can see from Figure 5 in the revised text that shear in transect B was evidently stronger than that of transect A, and stratification in transect B was weaker than that of transect A. We have added station labels to the Figure 6 in the revised text.

Figure 6: How do the oxygen profiles look like? Do they show similar patterns? 267: Fluxes can be directed upwards/downwards, in the figure it is log10 (flux). Add description of calculation

Responses: Sorry, we have no oxygen data. The flux is calculated from Eq. 3 and then the absolute value is taken. We have explained this in the revised text (lines 299-300).

306: What does "maintaining" mean? The nutrient flux causes a growth of chl-a containing organisms, what processes cause a decay?

Responses: "maintaining" means “Provide nutrients for phytoplankton”. We have replaced "maintaining" with “support” in the revised text. Chl-a generally decays in the absence of nutrients or at high microzooplankton grazing rates.