Reply to comments from Referee 3:

This paper presents nitrous oxide concentrations in the Yangtze estuary and its adjacent marine waters collected during five sampling campaigns conducted in 2002 and 2006. The authors also present monthly N₂O data obtained during 2007 and 2008 from an upstream site, covering a period of thirteen months, which they use to calculate the river N₂O contribution to adjacent coastal areas. Finally they also discuss benthic and air-water N₂O fluxes.

Current literature for coastal N₂O concentrations is rather limited and this type of study is significant for our scientific understanding. However, there are several issues that need to be addressed prior to publication.

Comment: P3128 L23-24. The authors say that they collected temperature, salinity and dissolved oxygen data from the CTD profiles, but they do not show those data in the manuscript. Please include.

Reply: The observed temperature, salinity and DO of the surface and bottom waters for all cruises were added in Table 1. A new figure (Fig. 3) was added to show surface N₂O concentrations versus salinity in the Changjiang Estuary. A new plot (Fig. 4) showing relationship between the apparent N₂O production (ΔN₂O) and apparent oxygen utilization (AOU) in the Changjiang Estuary was also added.

Comment: P3129 L25-28. Again the authors mention that they made nutrient measurements but they do not show the data. Please include.

Reply: The observed DIN and nitrate at Station Xuliujing in the Changjiang was added in Section 3.2. DIN data for the three cruises in 2006 was also shown in section 3.1 to discuss the relation of N₂O concentrations and DIN load.

Comment: P3130 Sediment-water N₂O fluxes section is insufficient. How many incubations were performed for each station? Was the decrease of DO and N₂O linear with time? Marine sediments often show high spatial variability, how did the authors deal with that (this goes back to the question of the number of cores taken in each site)? The authors should include a plot showing some examples of the evolution of DO and N₂O with time during the incubations.

Reply: All incubation experiments were performed in duplicate, and the results are reported as the mean values. A new plot (Fig. 7) was added to show the variation of DO and N₂O with time during the incubation at Station DB6.
Comment: P3132 L7-8. As the surveys were conducted in different years and there could be interannual variability in N\textsubscript{2}O data, the authors should refer here to the surveys instead of the season, and leave the seasonal assessment for the monthly data at Xuliujing station.

Reply: Since the surveys were conducted in different years, the variation of N\textsubscript{2}O data between cruises indicates temporal and spatial variation due to variations of environmental conditions. It’s difficult to distinguish the interannual variability due to the complex environmental conditions of the Changjiang estuary. Seasonal variation of N\textsubscript{2}O data at Xuliujing was discussed in Section 3.2. Text was revised accordingly.

Comment: P3132 L16-19. If the sampling sites just covered the outer estuary, the authors should point this out from the very beginning of the manuscript (and the title). In that case it would be more interesting to compare their results with published N\textsubscript{2}O data collected in estuarine plumes instead of in inner estuaries.

Reply: In table 2, most of the published data on N\textsubscript{2}O at various estuaries covered the full salinity range of 0-30. N\textsubscript{2}O in the Changjiang Estuary in this study mainly covered the area with high salinity (20-30) and represent the low N\textsubscript{2}O levels in the outer estuary. The text was revised to point out this in Section 3.1. Comparison of the observed N\textsubscript{2}O concentrations in this study with those collected in river plumes, e.g. Danube and Rhone River plume, was also added in Section 3.1.

Comment: P3133 L21-22. The negative relationship between dissolved N\textsubscript{2}O and water temperature is probably just due to higher N\textsubscript{2}O solubility at lower temperatures. It would be interesting to see how N\textsubscript{2}O saturation values correlate with temperature to check for any seasonal trend.

Reply: N\textsubscript{2}O concentrations correlate negatively with the in situ temperature ([N\textsubscript{2}O]= -0.48t +27.2, \(r^2=0.45\), n=11, July 2007 is not included), while N\textsubscript{2}O saturations showed weak positive correlation with the temperature (N\textsubscript{2}O(%)=5.3t+109.5, \(r^2=0.21\), n=12). This suggests that the high N\textsubscript{2}O concentrations in winter may partly due to higher N\textsubscript{2}O solubility at lower temperatures. The text was reworded accordingly.

Comment: P3134 L11-15. The authors estimate the input of N\textsubscript{2}O from the river to the estuary based on monthly averages of N\textsubscript{2}O measurements at Xuliujing station and river discharge rates, and they claim that the input is significant. In relation to what is this input significant? There are a few issues that need to be taken into account here.

First, as the authors mention in the manuscript, estuaries show maximum N\textsubscript{2}O
concentrations in the TMZ, where high N\textsubscript{2}O production rates occur. However, their study did not cover this region, and thus the authors may be underestimating the input from the river if the production in the TMZ is significant. Second, if the input from the river to the estuary is significant, one would expect N\textsubscript{2}O concentrations to be correlated with salinity. If this is not the case, the authors should discuss why. In any case, the authors should show the salinity data (and maybe N\textsubscript{2}O versus salinity plots). Third, a significant fraction of the N\textsubscript{2}O pool could ventilate to the atmosphere before reaching estuarine waters, leading to an overestimation of the river input.

Reply: These are good points and we agree with them. A new plot (Fig. 3) was added in Section 3.1 to show the N\textsubscript{2}O concentrations versus salinity in this study and indicated no significant trend. However, N\textsubscript{2}O concentrations were found to correlate well with salinity in a previous cruise in September 2003 (Zhang et al., 2008). This may because that only high salinity area was covered in this study and N\textsubscript{2}O data was scattered due to ventilation to the atmosphere and the influence of internal (i.e. nitrification and denitrification) and external processes (i.e. freshwater input and mixing of water masses). The text was accordingly revised in Section 3.1.

At the end of Section 3.2, N\textsubscript{2}O input via Changjiang was compared with N\textsubscript{2}O emission from the estuary and found to contribute about 7% to the latter, hence is only a minor source for dissolved N\textsubscript{2}O in the Changjiang Estuary. It’s unsuitable to use the word ‘significant’. The text was revised accordingly.

Comment: P3134 L16. ‘Sediment release of N\textsubscript{2}O’ should be replaced by ‘Sediment-water N\textsubscript{2}O fluxes’ or ‘N\textsubscript{2}O benthic fluxes’, as the sediments acted either as a source or a sink of N\textsubscript{2}O.

Reply: We agree with this and ‘Sediment release of N\textsubscript{2}O’ was replaced by ‘Sediment-water N\textsubscript{2}O fluxes’ throughout the text.

P3136 Given the large uncertainty associated with air-sea fluxes, the estuarine and marine areas showed fairly similar values, so I wonder if it makes sense to distinguish between them. Also, the authors affirm that N\textsubscript{2}O air-water fluxes were usually higher in estuarine than marine waters. However, mean annual N\textsubscript{2}O fluxes are higher in marine than in estuarine waters. Please clarify.

Reply: Since this study was mainly focused on the outer estuary of Changjiang and its adjacent marine area, which showed similar air-sea N\textsubscript{2}O fluxes, we agree with the
reviewer that it is unnecessary to distinguish between them. N\textsubscript{2}O fluxes and other parameters were given for the whole studied region in Table 4. The text has also been revised accordingly.

**Comment: P3138 L16-19.** One of the conclusions of this manuscript is that dissolved N\textsubscript{2}O concentrations in the study site fall in the low range of the values reported for other estuaries. This may be partly due to the fact that the authors are comparing their N\textsubscript{2}O data (obtained in the plume of the Yangtze Estuary) with data reported for inner estuaries. The authors should compare their data with values N\textsubscript{2}O concentrations reported for estuarine plumes.

**Reply:** Comparison of the observed N\textsubscript{2}O concentrations in this study with those collected in river plumes, e.g. Danube and Rhone River plume, was added in Section 3.1. In the Conclusion, the text was revised to emphasize that the observed low N\textsubscript{2}O concentration in this study were obtained for the outer estuary.

**Comment: Figure 1.** I would either use the same scale for both graphs or draw a box in the Fig 1b, indicating the area covered by Fig 1a.

**Reply:** A box was drawn in the Fig 1b to indicate the area covered by Fig 1a.

**Comment:** Figure 3 is too small and difficult to see. It could be separated into two figures. The graphs should be organized chronologically. Contour plots of salinity and temperature should also be included.

**Reply:** The graphs in this Figure were organized chronologically and the order of the figure has been changed to Fig. 2 to meet the change in text. The levels for the isolines and the size of the labels were adjusted to make the figures more clear. Plots of salinity and temperature were not included due to spatial limitation, but the corresponding data was added in Table 1.

**Comment: Table 2 &3.** The results from this study should also be presented in these tables for comparison.

**Reply:** The results from this study were added in Tables 2 and 3 for comparison.

**Comment: Table 4.** The surveys should be ordered chronologically.

**Reply:** The surveys were ordered chronologically in Table 4.