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 N_2O data obtained during 2007 and 2008 from an upstream site, covering a period of thirteen months, which they use to calculate the river N_2O contribution to adjacent coastal areas. Finally they also discuss benthic and air-water N_2O fluxes.

Current literature for coastal N_2O 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 N_2O concentrations versus salinity in the Changjiang Estuary. A new plot (Fig. 4) showing relationship between the apparent N_2O production (ΔN_2O) 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 N_2O concentrations and DIN load.

Comment: P3130 Sediment-water N_2O fluxes section is insufficient. How many incubations were performed for each station? Was the decrease of DO and N_2O 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 N_2O 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 N_2O 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_2O 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_2O 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_2O 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_2O data collected in estuarine plumes instead of in inner estuaries.

Reply: In table 2, most of the published data on N_2O at various estuaries covered the full salinity range of 0-30. N_2O in the Changjiang Estuary in this study mainly covered the area with high salinity (20-30) and represent the low N_2O levels in the outer estuary. The text was revised to point out this in Section 3.1. Comparison of the observed N_2O 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_2O and water temperature is probably just due to higher N_2O solubility at lower temperatures. It would be interesting to see how N_2O saturation values correlate with temperature to check for any seasonal trend.

Reply: N_2O concentrations correlate negatively with the in situ temperature ($[N_2O]$=-0.48t+27.2, r^2=0.45, n=11, July 2007 is not included)，while N_2O saturations showed weak positive correlation with the temperature ($N_2O(\%)$=5.3t+109.5, r^2=0.21, n=12). This suggests that the high N_2O concentrations in winter may partly due to higher N_2O solubility at lower temperatures. The text was reworded accordingly.

Comment: P3134 L11-15. The authors estimate the input of N_2O from the river to the estuary based on monthly averages of N_2O 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_2O

concentrations in the TMZ, where high N_2O 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_2O 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_2O versus salinity plots).Third, a significant fraction of the N_2O 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_2O concentrations versus salinity in this study and indicated no significant trend. However, N_2O 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_2O 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_2O input via Changjiang was compared with N_2O emission from the estuary and found to contribute about 7% to the latter, hence is only a minor source for dissolved N_2O in the Changjiang Estuary. It's unsuitable to use the word 'significant'. The text was revised accordingly.

Comment: P3134 L16. 'Sediment release of N_2O' should be replaced by 'Sediment-water N_2O fluxes' or 'N_2O benthic fluxes', as the sediments acted either as a source or a sink of N_2O.

Reply: We agree with this and 'Sediment release of N_2O' was replaced by 'Sediment-water N_2O 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_2O air-water fluxes were usually higher in estuarine than marine waters. However, mean annual N_2O 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_2O fluxes, we agree with the

reviewer that it is unnecessary to distinguish between them. N_2O 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_2O 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_2O data (obtained in the plume of the Yangtze Estuary) with data reported for inner estuaries. The authors should compare their data with values N_2O concentrations reported for estuarine plumes.

Reply: Comparison of the observed N_2O 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_2O 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.