Response to reviewers

Anonymous Referee #3

[Referee] This manuscript presents the distribution and fluxes of N2O in the Eastern Tropical South Pacific region during Oct. 2015, when a strong El Nino event occurred. Measurements of N2O and other related parameters along with its isotopomers were made in the water samples collected from six stations. These measurements have been used to study the variability and biogeochemistry of N2O in the ocean water as well as the effect of this event on the distribution and fluxes of N2O in this region. The manuscript presents important results during this major El Nino event and it is very well written.

However, I have the following clarifications/suggestions for its further improvement. Specific points:

[Referee] 1. The main focus of this manuscript is on the effect of El Nino of the distribution and fluxes of N2O. The three offshore stations show buildup of N2O in the water down to 1000m depth (Fig. 8). However, the comparison for these 3 stations is limited with previous one neutral year only (2012). Also there is large variability in the 0-200m depth. Please show error bars for each point. Measurements for the three coastal stations are compared with the measurements from three different years (2011, 2009 and 1985). All these three stations show very different comparisons. Hence, it is difficult to conclude for the coastal region.

[Response] The data availability allowed us to compare offshore water column N2O inventories during between 2015 and 2012. It is the scope of this paper to compare water column properties during El Nino vs. non-El Nino years. In coastal waters, the water column inventories were significantly higher (15 – 160% higher) during El Nino times. These apparent evidence led us to conclude that water column N2O inventories at lower latitudes during El Nino years were higher than those during non El Nino years. The analytical precision of N2O concentration measurement is < 2 nmol/L, and we will add the error bars for 2015 data on the plot. The precision of previous dataset was generally < 5%. The precision of our measurements are lower than El Nino variability and we think the conclusion of higher water column N2O inventories during El Nino will hold.

[Referee] 2. Fig. 9 shows depth integrated N2O concentrations and comparison with earlier measurements. However, the depth taken for each station is limited by earlier measurements and it is different for different stations except for stations B and C. This, in my view, is not correct and gives a wrong comparison. The X axis scale and even the depth for the coastal stations could have been same for all the three stations for a better visualization.

[Response] We compared the integrated N2O at the same depth range for each station; and in the revised manuscript, the depth range for offshore waters will be 0 – 800. For coastal waters, the range is shallower than 300 meters. The effects of El Nino are generally thought to be confined in the thermocline, and thus we don't expect significant changes below 1000 m at offshore waters. For coastal waters, the water depth is generally shallower than 300 m; in some cases, the entire water column was effected by El Nino. We will clarify this section in the revised draft.

[Referee] 3. Are these earlier measurements for the same respective stations? If not, please give their locations also.
[Response] All the location info for the data presented in Figure 9 are presented in the supplementary material Table S1. Although some measurements were not made at the exact location, data are comparable when measurements were made within 0.75 by 0.75 degree grid.

[Referee] 4. How the observed decrease in the N2O fluxes compare with earlier studies mentioned in the introduction (P2, L17)?
[Response] Observation from 2015 – 16 El Nino event showed 23 – 108 µmol/m2/d, 75 – 95 % reduction of fluxes of December 2012 (459 – 1825 µmol/m2/d). This is consistent with observation from Cline et al. (1987) who reported 80% reduction in fluxes.

[Referee] 5. P1, L25 : 'The depth-integrated N2O....were nearly twice....' is not correct except may be for the E and F stations. Please modify this sentence suitably and also give depth information related to integration.
[Response] We rewrite part of the sentence as follows: "Water-column inventories of N2O within the top 1000 m were 0 – 160% higher than those measured in non-El Niño years,"

[Referee] 6. How long this El Nino event has been there? The ONI shown in Fig. 1 for 2015 was >0.5 in January itself.
[Response] Given the definition of El Nino event being ONI > 0.5, the event started in November 2014 and lasted until May 2016. We will include this information in the Introduction section.

Minor corrections:
[Referee] P1, L16: '....was developing ..' or developed?
[Response] The El Nino event was still developing in Oct. 2015, as indicated by ONI in Figure 1

[Referee] P2, L17: Please change to – '...related to changes in...'
[Response] Done