

## ***Interactive comment on “Investigating the effect of El Niño on nitrous oxide distribution in the Eastern Tropical South Pacific” by Qixing Ji et al.***

**Anonymous Referee #1**

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This manuscript discusses nitrous oxide in the ETSP and the impact that El Niño has on this important trace gas. The authors have a lot of experience on this topic and consequently a high quality is expected of this manuscript. At the moment, this manuscript needs improving in a number of areas that are outlined below.

The biggest technical issue with this manuscript is that it covers two topics. The first topic is an overall expedition report from 2015 including measurements of N<sub>2</sub>O concentrations, fluxes, inventories, and isotopes. The second topic is an evaluation on the impact that El Niño has on N<sub>2</sub>O dynamics which necessitates an in-depth comparison of previous datasets. Both of these topics are very worthy of publication and the authors have the intellect and experience to document the new insights and perspectives gained from both topics. However, at the moment, I feel that 75% of the manuscript is

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about the 2015 expedition and 25% is about an analysis of the effects of El Niño on N<sub>2</sub>O. For example, the comparison between 2015 and previous years is limited to the final section of the discussion. This is not consistent with the title of the manuscript which indicates to a reader that a more in-depth comparison will be provided. It's up to the authors whether they address this by providing a greater comparison with El Niño years or whether they save this for a later manuscript.

Another issue that I would like the authors to deal with is the absence of precision and accuracy values. The authors state that triplicate samples were collected, but no error bars are present on the vertical profiles and no values of analytical precision are provided. This is a problem when trying to compare measurements from separate years.

Specific comments

Line 16 – what region

Line 17. This sentence needs re-writing

Line 18. I am not sure why you include this single summary sentence when in the discussion you highlight four water parcels with different pathways.

Line 20 level of sea surface N<sub>2</sub>O supersaturation. I understand what you mean, but a quick glance indicates you are talking about sea levels.

Line 25 Depth-integrated concentrations, change to water-column inventories?

page 2

Line 1 This sentence is a lazy description of El Niño, La Niña, and neutral. A schematic diagram would be great here to orientate the reader

Line 15, But what were the results of the modeling? Higher or lower nitrous oxide? Do your observations match the modeled predictions? An evaluation of El Niño on N<sub>2</sub>O would benefit greatly from the use of model predictions and I am not sure why the

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authors did not leverage this information better

Page 3

Line 10 Here you say ODZ (and do not spell out), while on the previous page you say OMZ

Line 15-18. The method needs to contain values of analytical precision and accuracy. This is particularly important for this study as you are comparing data from separate cruises, conducted several years apart. For example, Figure 8 does not have any error bars and how is the reader supposed to make an informed decision about differences between the separate expeditions.

Page 5.

Line 15 Why are concentrations reported moles per liter rather than moles per kg?

Line 23 This should be in the methods section, close to Equation 1, which is the equivalent calculation for N<sub>2</sub>O

Figure 1. Its not clear to me why you do not show the El Nino index against time and indicate along the timeline when the cruises were conducted. This would be easier to read that the current figure?

Figure 2a is an anomaly yet Figure 2b isn't. If you wanted to compare 2015 with other years you should show how the water masses vary with El Nino.

Figure 3. This Figure needs improving.

- 1 The units should be in moles per kg.
2. I am not sure you need to show depths of 500-1000 m since this takes up half the plot and is not discussed much in the text.
3. Please highlight the stations better.
4. I suggest you start other programs to make contour plots in the future (e.g. R) as

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the ODV palette is not helpful for highlight the data trends that you have here.

Figure 4. I cannot see the individual points in the offshore stations so its hard to determine the extrapolation that has been applied

Figure 5. I am not sure this Figure adds value. Figure 5A and Figure5b are very similar to Figure 4 a and 4e (identical patterns, just different units. Figure 5c takes up a lot of space and only the bottom right hand section of the chart has any useful data.

Figure 6. You should connect this figure to the water masses identified in Table 1

Figure 8 With no error bars, it is not possible for the reader to know when there is a statistical difference between two depth profiles. On Page 3, Line 13 you say that triplicate measurements were taken, so they should be included

Table 1. This Table needs improving. 1. Please number the water parcels so they can be easily cross-referenced with the text. 2. Please report depth, O<sub>2</sub>, and nitrite concentrations for all four identified water parcels. 3. There is no column heading for the third column. 4 What is produced N<sub>2</sub>O?

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