Interactive comment on "Synoptic scale variability of surface winds and expected changes in the ocean–atmosphere dynamics of the eastern Austral Pacific Ocean" *by* Iván Pérez-Santos et al.

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Interactive comment on "Synoptic scale variability of surface winds and expected changes in the ocean–atmosphere dynamics of the eastern Austral Pacific Ocean" by Iván Pérez-Santos et al.

Anonymous Referee #1 Received and published: 9 January 2019

The presented study investigates the variability of southern hemisphere surface winds between 40_S and 56_S. As data basis two scatterometer datasets, Modis chlorophyll measurements, the ERA-Interim reanalysis dataset and observations from meteoro-

logical stations and buoys are used. A principal component analysis is applied on the scatterometer data to investigate the first three patterns. Up- and downwelling as well as nighttime heat wave events are investigated. The article is in principle well written. Jumping between the figures (e.g. line 214 fig. 4e than line 215 fig. 2c,f, line 217 fig.3g,p) in the text makes it harder to follow the argumentation. The topic of the study is interesting, and I suggest to publish the article after the following issues are addressed:

General comment to RC1: We appreciate the recommendation of the reviewer to add the ERA5 climate data set to the manuscript and also carried out the statistical analysis, e.g., EOF and wavelet. New figures were added to the manuscript contributing to an increase in the quality and strength of the results and discussion presented in the new manuscript version.

âẮc What are the investigated "expected changes" which are mentioned in the title?

We modified the title to, "Synoptic scale variability of surface winds and ocean response to atmospheric forcing in the eastern Austral Pacific Ocean".

âẮc Two different scatterometer datasets (QuickSCAT and ASCAT) are used, which have an overlap of only about two years. The raw satellite data are not gridded. Does the processing of the data can influence the results? Could you give some more details about the data?

The two scatterometers datasets overlap in the information on the surface winds from 2007 to 2009. We extracted three time series for the zonal and meridional wind components in areas close to coastal zone (e.g., 42.2° S, 47.2° S and 52.2° S, see the new figure 1 to the geographical position). The linear regression between both scatterometers was high with an r2 range from 0.65 to 0.73. The raw data for each dataset are now presented in the new figure 3, where the raw data from the ERA5 reanalysis is also presented.

âĂć For QuickSCAT, the institution is mentioned from which the data were retrieved (could you change the link to the webpage/ftp where the data are available instead of the institute's main page). It is not mentioned from where you get ASCAT. Are these data treated in the same way as the QuickSCAT data? If not, is there a potential impact on the results?

We added the ftp website for both satellite surface wind products: QuikSCAT (ftp.ifremer.fr/ifremer/cersat/products/gridded/mwf-quikscat/data/) and ASCAT (ftp.ifremer/cersat/products/gridded/MWF/L3/ASCAT/). The ASCAT database was treated similarly ro QuikSCAT. The only difference was in the spatial resolution.

âĂć In figure 6, a relatively strong difference in the Ekman pumping between both datasets can be seen. Is this because of the different periods of both data sets or are there differences in the observations?

We agree with this comment. The new calculation of Ekman pumping using the ERA5 data set (new figure) exhibited a similar behavior to the results of QuikSCAT. The Ekman pumping values are a good representationof the features in the three products (QuikSCAT, ASCAT, and ERA5 reanalysis), e.g., the area between 50°-54° S / 75°-80° W and the coastal zone between latitudes 40°-44° S. We added these new results and discussion to the manuscript.

âĂć In line 169, it is mentioned that for the overlapping period, R2 0.7. Why wasn't the EOF analysis done also with reanalysis data. This could help to identify the origin of the differences. ERAInterim assimilates QuickSCAT. There is also a newer reanalysis called ERA5 available, which assimilates also ASCAT. With a resolution of about 0.28_, its resolution is close to the one from the gridded ASCAT data you are using.

As was recommended, we added the ERA5 dataset to the manuscript. This new data was used in the EOF calculation and other analyses. New figures were generated, and in general, the results obtained with ERA5 agree with the results obtained with QuikSCAT and ASCAT.

C3

âĂć In figure 1, the long term mean for QuickSCAT is higher than for ASCAT. Is this because of the different periods, or has one instrument potentially a bias larger than the other? This could be checked by looking into a homogeneous data set like a reanalysis.

We calculated the long term mean using the ERA5 reanalysis data set over the period 1999-2015. The new result is presented in figure 2 and is similarto the ASCAT long term mean. We added a new description of figure 2 in the text.

âĂć In line 158 it is mentioned that long term means and linear trends were removed. How? Was it done for each scatterometer data set individually?

Yes, we eliminated the linear trends individually for QuikSCAT, ASCAT and ERA5.

âĂć In line 161 it is explained that wavelet spectra were calculated on the entire sampling period. For each data set individually? How are the different resolutions taken into account? In the same way, wouldn't it make sense to repeat the same investigation with a reanalysis?

The wavelet spectra analysis was applied individually for each scatterometers, e.g., for QuikSCAT over the period 1999-2009 and ASCAT over the period 2007-2015. We repeated the same analysis for the ERA5 reanalysis data. The new data set and results were added to the manuscript. The ERA5 covered the entire sampling period 1999-2015 and showed similar results to QuikSCAT and ASCAT. We clarified the sentence in line 161.

âĂć You found different cycle lengths for 1999-2008 and 2008-2015. This corresponds more or less to the periods covered by the two scatterometer products. Does the same investigation on reanalysis data would give you comparable results? Or in other words, are the differences related to the two different satellite products and potentially different treatment of the data?

The wavelet analysis carried out with the ERA5 reanalysis data set confirmed the different cycle lengths observed with the QuikSCAT and ASCAT data set.

C4

âĂć What are the criteria to identify nighttime heat wave events? The temperature range of the events is specified. Is the definition for example based on the difference between night- and daytime, a heating rate, an exceedance of a threshold or is it only the existence of a second temperature peak at night time?

We explored different statistic tools to automatically identified the "nighttime heat wave events," based on the spectral analysis, the dominance periods of 12 and 24 hours were extracted from the time series but the residual time series did not clearly show the events. Therefore, the best tool was selecting the daytime that we observed the occurrence of the process, and with a detailed manual validation, the nighttime heat wave events were quantified. In the future, the additional effort will be put into finding an efficient tool. We believe that the reports and publication of this new event will attract the attention of the scientific community and new tools will facilitate development.

âĂć The red dashed line in figure 3 (b,e,h,k,n,q) is the 95.

Yes, The red dashed line in figure 3 (b,e,h,k,n,q) is the 95

âĂć What do the flashes in figure 3 (c,f,l,o) mean ? This is not mentioned in the legend.

The arrows in figure 3 (c, f, l and o) indicated the normalized eigenvector patterns presented in figure 2 (a, b, d and e). We decided to eliminated the arrows from the figure.

âĂć Figure 4: Was ERA-Interim used for the EOF analysis? If this is the case, why are the results not compared to the ones from the observations? Both scatterometers data sets include the date which is shown in the figure.

As we mentioned before, a new data set for the ERA5 reanalysis was added to the manuscript covering the entire sampling period (1999-2015). The EOF result was added to a new figure and also to the text, showing similar variance and eigenvector behavior as QuikSCAT and ASCAT.

âĂć Figure 9: It is not explained what the error bars mean. Why is the lower bound not

shown?

In figure 9, the error bars denote the standard deviation. As the lower and upper bounds have the same values, we decided to plot the upper bound only. We clarified the figure 9 caption and new text was inserted in the new version of the manuscript.