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Ocean Science Discussions

Interactive comment on "Wind variability in the Canary Current during the last 70 years" *by* Nerea Marrero Betancort et al.

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1) Regarding the comparison of the databases, authors used PODAAC data which is limited from 1988 to 2011. There exists other database with similar resolution as, for example, CFSR which covers a temporal resolution from 1982 to nowadays. So author should explain why they chose PODAAC being able to choose other options.

Thanks for the comment. We selected the PODAAC database as the initial approach to the wind data in the region, but in order to cover a longer time-series we correlated the data with the NCEP/NCAR database, and we obtained statistically significant correlation results (r=0.949, r=0.923, wind direction and wind intensity, respectively). Thus, we decided to make the study with the NCEP database. The length of the NCEP/NCAR

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time-series allowed to conduct a study on wind patterns covering a temporal slot still not addressed in the scientific literature for the Canary Current, as far as we know. Certainly, CFSR is another data source and it is a reanalysis product that assimilates satellite radiances, but the most important aspect to our view was to cover the longest temporal coverage, and therefore the optimal choice was NCEP.

Action:

To clarify this issue, we included additional text in section "3. Results", line 92. In addition, we added the corresponding references in the References section (line 295).

2) The selection of the area under study raises some uncertainties. First, the selection of the point north of the Canary Islands in Figure 1b. It is well-known that upwelling in the area occurs mainly near the coast and that weakens away from the coast. If the study is focused in the upwelling area and on the Bakun hypothesis, perhaps it should be better to choose points closer to the coast. Second, the area under study was set between 27oN and 30oN, and 11oW to 20oW. However, the Canary upwelling system covers a larger area. In fact, Cropper et al., (2014) established 3 different areas of the Canary upwelling system. The present study was limited to the "weak permanente upwelling" area of that study. Figure 1a shows that the highest wind intensity reach 24 oN in the south, why the authors limited their study to a smaller region? Is the north of the Canary Island the best spot to conduct studies about upwelling in the area?

Thanks for your comments. Our study aimed to analyze the wind pattern in the Canary Current over the last 70 years. In particular, the study mainly addressed the analysis of the Trade Winds in the area. These prevailing regular winds decisively influence the climate of the region. However, as they blow from the North-East direction, we selected the most suitable location to analyze its effects over time. Locations to the south are quite disturbed by the islands all over hundreds of kilometers. On the other hand, sampling sites closer to the African continent were not chosen as winds near the coast behave differently as they are affected by the day-night cycle. Because of

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the difference in temperature between the ocean and the desert, the coastal zone is noisier than the proper ocean. An example is the study by Grall et al. (1982) who observed an important variability in daily wind intensity, also affecting primary production. Differences in wind intensity between the coastal zone (ICOADS data) and the ocean (WASWind data) were not statistically different but highly correlated in the study by Barton et al. (2013). Therefore, the area selected for the present study seemed to our view the most suitable to characterize wind patterns in the area. Moreover, the coincidence of our data with the European Oceanic Time-Series Station (ESTOC), where water column temperature exists from the 90s will allow a future comparison among both data sets. In any case, the upwelling intensity is related to the general pattern of wind direction and intensity in the area (Ekman transport), and not specifically related to the variable coastal phenomena mostly related to topography.

Action: To clarify this issue, we included additional text in section "2.1 Study Area", Line 57.

3) The comparison with AMO and NAO raise some questions. To what extent are such low values of r (for example 0.45 or 0.27) sufficient to assume a certain relationship between the variables (Line 126)? Moreover, those values refer to February when upwelling is weaker or inexistent. To what extent these results affect upwelling in the area? Is there any explanation to establish a lag of 10 years (even closer to 20 years according to figure 10) or is it totally arbitrary?

The reviewer is right. We found a significant relationship between the NAO index and wind direction and intensity, but it only reflects a general pattern related to the general atmospheric circulation, and not a close relationship as stated in the previous version. In relation to the lag observed between the AMO index and the wind intensity (but not direction), we cite in the manuscript the paper by Gulev et al. (2013) who found also a considerable lag between the Atlantic Multidecadal Variability and surface turbulent fluxes. They discuss the suggestion by Bjerknes (1964) that the atmosphere drives short-term (interannual) sea surface variability, and the ocean contribute to long-term

(multidecadal) sea surface temperature and potentially atmospheric variability. Gulev et al. (2013) observed surface turbulent heat fluxes driven by the ocean and forcing the atmosphere on times scales longer than 10 years. We think that there is no scope to this study to go in depth to this general problem but we show some agreement with the results of Gulev et al. (2013). We think it is worthy to discuss in brief.

Action: To clarify this issue, we included additional text in section "4. Discussion", line 154, and we edit the line 179. In addition, we added the corresponding references in the References section (line 231).

4) It would be interesting to add a figure with a compass rose to show the seasonal behavior of the wind in a much more intuitive way.

Thanks for your suggestion. As requested, we produced a wind rose for each season of the year and included it in the manuscript for better understanding and visualization; However, we decided to leave the time series of wind direction and intensity, as the trends are more visual in these figures.

Action: We added the new Figure 6 in the manuscript (Line 385) and we have referenced it in the main text accordingly.

Minor comments: 1) Line 29: “Currently, the research about the response of the EBCS and the associated impact under a global climate change scenario have motivated numerous studies over different time periods” This statement should be supported by some references

Agreed. Four references were included to support the statement.

2) The terminology “decrease or increase” of wind direction is controversial and more appropriated to wind intensity (for example in Line 94) . I recommend the authors to use other expressions as “change”

Agreed. Text amended accordingly.

3) Line 12: Delete “of the oceans”

Agreed. The text deleted.

4) Line 13: Change “word” to “world”

Agreed. Done

5) Lines 14-15: Change “Nearly 30 years ago, Bakun raised a hypothesis contend-ingthat coastal upwelling in eastern boundary upwelling systems (EBUS) might be inten-sified as the effect of global warming due to the enhancement of the Trade Winds asthe effect of increasing pressure differences between the ocean and the continent” to“Nearly 30 years ago, Bakun raised a hypothesis contending that coastal upwelling ineastern boundary upwelling systems (EBUS) might be intensified by global warming-due to the enhancement of the Trade Winds increasing pressure differences between-the ocean and the continent”.

Agreed. The paragraph is now replaced

6) Line 17: Change “theses” to “these”

Thanks. Done.

7) Line 26: Delete “of the world ocean”

Thanks. Words were deleted.

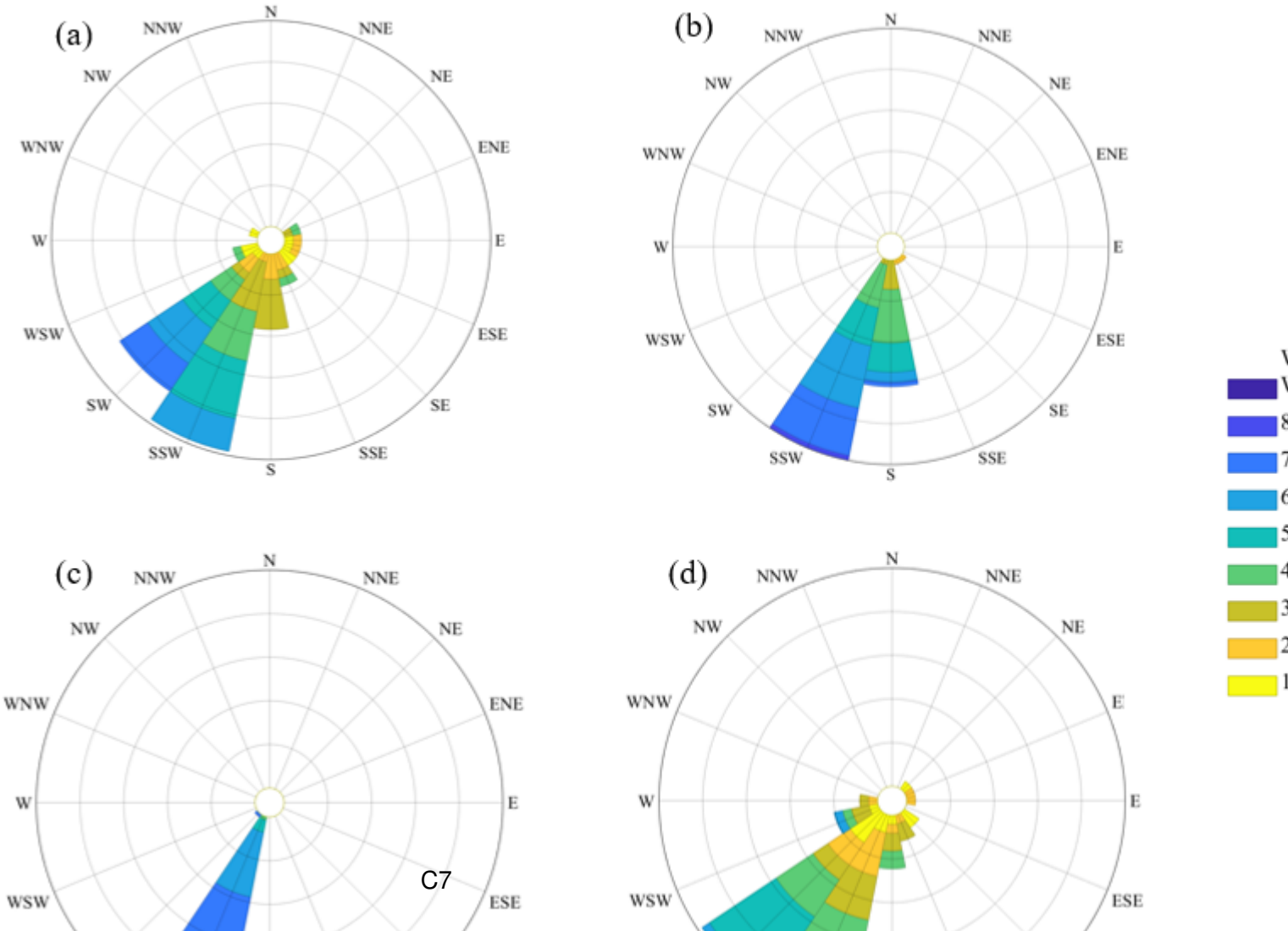
8) Figure 5, 8 and 9: Change “times” to “time” Agreed. Done.

9) References: - Some references are overlapped - Debernard and Roed, 2008 does not appear in the text - Hurrell (both references) are wrong in the text (Lines 153-154)

Thanks. References are now corrected.

Please also note the supplement to this comment:
https://www.ocean-sci-discuss.net/os-2020-18/os-2020-18-AC1-supplement.pdf

Interactive comment on Ocean Sci. Discuss., https://doi.org/10.5194/os-2020-18, 2020.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