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# *Interactive comment on* "ARIOS: An acidification ocean database for the Iberian Upwelling Ecosystem (1976–2018)" *by* Xosé Antonio Padin et al.

**Anonymous Referee #1**

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The paper by Padin et al. describes a detailed data base of carbon system parameters in the North Western Iberian Peninsula collected during 32 years. Not many of these datasets exist from upwelling areas and particularly in coastal regions, which makes this dataset very valuable. The authors performed an analysis to show seasonal cycles and long term trends of the biogeochemical parameters considered. Ocean acidification rates in surface waters of the Iberian Upwelling System are also provided. Finally, the study gives insights on the processes responsible for the temporal changes observed in the different parameters.

The manuscript is scientiïïňAcally sound. With regard to the presentation, the paper

is easily readable although some sentences are unclear, and there are a number of grammatical errors and typos in the text. If the authors have their text double checked, I only have some small remarks which need to be dealt with. Therefore, overall, I believe that the work is well suited for publication in ESSD.

Specific comments:

Title should be modified. I would suggest something like ARIOS: a database for ocean acidification assessment in the Iberian Upwelling System.

Introduction Line 41: change "fix" to "withdraw" Lines 42-45: please rephrase "In any case, the rapid increase of CO2 in the atmosphere decreases the ocean's pH". I would suggest: The gradual absorption of atmospheric CO2 by the oceans decreases seawater pH, causing ocean acidification, which conditions the buffering capacity of seawater and in turn the exchange of CO2 between the ocean and the atmosphere. Lines 52-53: Please rephrase. "observe and gather data about pH and other parameters of the marine carbon system to produce global and regional data products in order to help sustainably manage the ocean's resources. I would suggest: to conduct accurate measurements of pH and ancillary parameters and provide data products for a sustainable management of marine resources. Line 55: change of marine ecosystems to for marine ecosystems Lines 63-65: I know what you mean but I would recommend to rephrase the sentence. Line 67-72: remove the s at the end of effects for grammar consistency. I would also move this paragraph after line 53 for coherence with the text. Lines 72-75: I would modify the entire paragraph as: In the Iberian Upwelling System, accurate measurements of carbon system parameters commenced more than 30 years ago. Lines 75-80: which changes? Results have not been presented yet. I would therefore, continue the statement as: Researchers of the Instituto de Investigaciones Mariñas (IIM-CSIC) have been collecting pH and biogeochemical data along the Galicia coast (40°N and 45°N, 11°W) under the framework of different projects. This has allowed to generate a database, ARIOS (Acidification in the rias and the Iberian continental shelf), containing 17,653 discrete records gathered in 3,357 sampling sites.

Data provenance: I would remove provenance Line 86: I would replace Region by Data Coverage Line 115: change In addition to for Besides Line 119: delete the article before acidification and it would be convenient to specify the exact region/s where the mentioned acidification rate was estimated

Data sources: In general, I very much appreciated the comprehensive explanation of the projects that provided data for the dataset. However, considering that explanatory information of the cruises is given in Table 1 and each individual project is associated to a database included in a public repository, I do not find section 3.2 essential for the manuscript, as all those details can be mentioned (and possible are) in the repository. The authors might re-consider to shorten this section by keeping the first paragraph and refer subsequent info to Table 1.

Methods: Lines 337-338: Please rephrase. I would suggest: Except for the Galicia cruises (Table 1), in which nutrient samples were analysed on board, samples were kept in the dark and cold (4°C) after collection for further analyses in the shore based laboratory. Line 341: change is to was. Line 351: Same as above Line 371: remove the article before Table 1 Line 374: You possibly mean Table 1 instead? Line 377: by the high variability present in a system characterized by an intense biological activity Line 384: This section should be moved and either merged with 3.1 or placed right below it for the sake of consistency and for a better introduction of the sampling region.

Results: Line 424: vertical profile of what? Please indicate. Lines 420-445: why don't you show the standard deviations for T and S for all the depth ranges as you do for the water column comprised between 500m and 1100m? Line 443: add ...down to 1100m Line 447: change distribution to profile Line 448: replace at this depth by within this depth range Lines 452-454: Speculative as it is not demonstrated or shown in the graph. Therefore, I would just say: The highest pH values could be attributed to the biological $CO_2$ drawdown by phytoplankton activity, which brought the pH to a peak value of 8.13 at 40 metres deep during the spring bloom. Lines 454-457. Same as above. I would suggest to rephrase the paragraph as it is also confusing. Below 100

metres, respiration of organic matter possibly was responsible of lowering pH. ...but anyhow the text s counterintuitive To me, pH values between 200 and 500 m depth seem to be lower than those from 500 m down to 1100m, which were also constant and similar within the entire depth range regardless of the season. Lines 458-462: Please rewrite: I would propose: The influence of phytoplankton growth on biogeochemistry during spring can be also evidenced by the oxygen concentration pattern during this season. In the upper layer (depth range?) spring oxygen levels exceeded those in winter, whereas a decrease in oxygen concentration was found from 300 m depth down to 1000 m, possible due to enhanced respiration from cascading organic matter.

It would be helpful to add in this section a table with averaged concentrations and SD of each parameter within the different depth ranges and for each season.

Line 473: seasonal cycle of what? Please specify. I would recommend to rewrite the whole paragraph, as in Fig 4 what you actually show is the seasonal cycle of different biogeochemical parameters in surface waters of 5 regions and not the five regions themselves, as it can be deduced from the text the way it is right now.

Line 506: replace seasonable by seasonal.. you could also rewrite the following sentence as: with maximum and minimum pH values in spring and autumn, respectively, and in all regions (Fig. 4c).

Lines 541-549: considering change to past tense for consistency with the rest of the paragraph. Moreover, a reference could be well added at the end of the paragraph to reinforce your statement regarding the relevance of benthic and vertical fluxes in the Ria.

Line 551: please add a "s" to trend Line 552: long term trends of what? Please specify. I assume the temporal trends are estimated over parameters and they do not refer to surface waters themselves. Therefore, it needs to be re-written. Line 562: any suggestion why a warming trend is not found as it was previously reported? Line 563: ...consequence of climate change...I would add "in marine ecosystems".. and move

the reference by Cladeira and Wicket 2003 after ocean acidification. Line 565: What do you mean by pH number? Value? Number of measurements? Line 566: please replace . . .was about triple the change of. . .by. . ... was three fold higher than the trend observed in the open ocean zone, equivalent to 0.0012±0.0002 yr-1 Line 569-575: I would rephrase the paragraph as: These pH decrease rates found in both coastal and open ocean regions of the Iberian Upwelling System lie within the range of other acidification rates estimated in different sites of the North Atlantic Ocean (Lauvset and Gruber, 2014; Bates et al., 2014), being also coherent with the mean rates calculated for the global ocean and for the Eastern North Atlantic and equal to -0.018 and -0.0164 decade-1 , respectively (Lauvset et al., 2015; Rios et al 2001)

Line 575: just indicate: Salinity exhibited an increasing long-term trend (value?) that was dependent on the distance to the mouth of the Ria (de Vigo? All of them?). I do not see the salinity trend indicated anywhere. Line 581: Change So to Therefore. Line 586: add a "s" to nutrient and remove the previous article Line 587: same as above: delete the article before nitrate. But anyhow, it is not clear if the trends in nutrients level come from the previous study by Doval et al (2016) or are the result of your analysis. Please clarify. Lines 590-596: do you mean that your AOU temporal trend coincides with the deoxygenation rate calculated previously by Doval? It is not clear enough in the text. Lines 598-604: Speculative. Please support with references Line 614: correlation coefficient should be indicated even though it is contained in the Figure. Line 606-619: To me, the entire paragraph is the highlight of the paper, as it evidences the relevance of the dataset and gives insight on the processes responsible for the mean decreasing pH trend found in the area. In my opinion, this finding gets somehow diluted between the other results when it should be emphasized by the authors. Line 623: photosynthesis of organic matter??? Line 627: I would finish as: Hence, the analysis performed over the database presented here confirms that the future evolution of ocean acidification in this productive region is likely to depend on both the potential CO2 increase in the atmosphere and other long-term changes (of natural and/or anthropogenic origin) affecting the seawater's carbonate system.