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Interactive comment on "A global monthly climatology of total alkalinity: a neural network approach" *by* Daniel Broullón et al.

Anonymous Referee #1

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The authors of this study firstly extracted the relations between alkalinity and other variable (Salinity, DO, nutrients, depth, temperature and location), and adopted this relationship to generate a monthly climatology of total alkalinity. I am glad to see the a more precise alkalinity climatology dataset. However, the manuscript is poorly structured, inadequate illustrated with a lot of vague expression. There are tons of sloppy description, and the grammar is so poor that I have difficulty to understand the science. There are quite a few things that need clarification from the authors. They are listed from the most to least concerning:

1). I fail to see why "3.3 subsurface layer hypothesis" is included in this manuscript. This section plagued with serious issues: without enough background, it is very difficult for readers to understand the motivation: 1). What is the subsurface layer hypothesis? 2)

Whether your finding support or reject the hypothesis? 3) How this part related to the topic of monthly climatology at all? Figure 7 is also not well explained either. I have no idea how to read it. Can you add an autocorrelation figure to show the similarity between surface winter condition and subsurface layer?

2). Lines 315-390, The authors found that climatology of TA is highly dependent on the inputs. However, the logic can be improved. I would suggest re-organizing this session as this: 1). Explain the available TA climatologies, and what is the difference among them; 2) Why did authors choose WOA13 as input at last? 3). Show the monthly climatology of TA caluculate based on WOA13, discuss its variability, and compare yours and others. I also have a question related to input climatology choosing: the authors showed the difference between "AT NN WOA13"and "AT NNBATS inputs" in Fig. 10. Have the authors tried to use climatology reported by Lauvset et al 2016 as inputs? And what is the result?

3). There are a lot of unclear pronoun references across the manuscript, which make sentences very confusing and difficult to understand. There is no way to point out all of them. Please check through the Manuscript.

Specific and minor comments to the text: 1). The caption for tables should be put on the top. It is very confused with the current format.

2). Line 46, increase in temperature and ocean deoxygenation.

3). Lines 49-50, It should be five variables if including carbonate saturation state (Ω). I would also suggest adding alkalinity definition before discussing its physical meaning and processes that can impact its distribution.

4). There are a lot of upwelling studies in Californian Upwelling Systems, some references may be needed here.

5). Lines 62-63 "For example, phytoplankton blooms (i.e., primary production), and the seasonality in upwelling and river flows " is not a sentence.

6). What do you mean by the “Storage of the anthropogenic CO2”? You mean the TA’s seasonal cycle is important to the anthropogenic CO2 storage?

7). Lines 165-166, It is a very confused sentence. I still cannot figure out how the authors do the training.

8). Lines 192-193, again, it is a very wordy sentence, and I have no idea how the authors concluded the content after Thus.

9). Line 213. “They make up 6.5% of all the samples in this zone and 85% of them belong to the upper 100m of the water column (Table S2) ”. What does the “They” represent? How did you get 6.5% based on Table S1? Adding all the %relative over n is 5.35+6.90=12.25%. I would assume the second number should be 1317/(296+1289)=83.09%. By the way, the fifth column number was also miscalculated.

10). Line 214. “in this layer of this area. . .. . .14% of the total”. Please specify what “this layer of this area” represent. And what the “total” here is? The same problem with line 216 “in this area”.

11). Lines 219-220. Do not know what author want to say.

12). Lines 242-244. This sentence needs to be revised. The current description makes the reader think the Lee et al (2006) have the lowest RMSE comparing to other methods. Also, Line 245. It is not “We”, it should be the “NN approach”.

13). Line 251. “The zones defined in the Arctic have higher RMSEs in the two studies” I have no idea what the authors want to say.

14). Lines 256-257, is not related to this section. Monthly climatology should be discussed in next section.

15). Lines 257-264, this paragraph should be put after Line 275.

16). Line 278, the authors should list the three time-series first. The same as Line 360.

Have no idea what the “other climatologies” before jumping into figures. Line 279-280, why?

17). Line 284, “We obtained similar values of RMSE of 6 μmol kg-1 and 5.5 μmol kg-1 respectively ”. At which time series stations? Both values cannot be found in Table 4.

18). Lines 286-288, Too much repeat.

19). The way to mark panel is very confusing in Figure 6. Please assign each panel an ID. By the way, please explain how did you get the AT,residue without measured value in both time series stations.

20). Lines 350-359, the figure across this paragraph should be figure 10! This paragraph and following paragraph is very sloppy written. The authors should re-write it. For example, Line 355 can be simply written as “the comparisons are better (and show how better) when AT was obtained by NN with measured value as inputs”. Line 356. “The differences of the two comparisons show the differences in the input variables”. Have no idea what the second “differences” means. Line 360. Replace “similar” with “close”. What is the “one predictor” in Line 362? What does DIVA represent? Line 363. “Furthermore, the coarser grid in the Takahashi et al. (2014) climatology involves a change of grid for the comparisons which may enhance dissimilarities”. I have no idea what the authors want to say at all! Again, the above questions are only a few examples. the authors have to check through the entire MS and do the corresponding revision.

21). Line 370. “The spatial patterns of the differences between in annual mean surface AT between our and the three other climatologies under consideration are not correlated.” Get lost again.

22). Lines 374-375. “It shows how the different parametrizations of the AT diverge highly at low salinities.” How do the authors get this conclusion?

23). Again, what is the “the difference results”?! Add Figure 11 at end of Line 384 (. . .

of the WOA13 data. Line 387. Do you mean “below 250 m” by “in these layers” ?

24). Lines 389-390. “to be consistent, it is recommended to use the AT climatology corresponding with the other inputs used in the studies that arise from these products. ” Have difficulty to understand it too.

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