Biogeosciences Discuss., 11, C7437–C7440, 2014
www.biogeosciences-discuss.net/11/C7437/2014/

Biogeosciences
Discussions
Open Access

Interactive comment on "Trends and drivers in global surface ocean pH over the past three decades" *by* S. K. Lauvset et al.

Anonymous Referee #1

Received and published: 18 December 2014

I found the paper interesting and I believe it is suitable for publication in Biogeosciences following some revisions. The paper makes a significant and useful addition to the field as an observation-based estimate of global pH trends.

General comments

I found the paper very thorough but sometimes lacking clarity. I needed to repeatedly re-read several sentences and sections. This is partly due to the complexity of the methods but I still think the authors should consider simplifying/clarifying some parts of the manuscript for greater accessibility. As an example, I found section 3.4 (Recent changes in the Southern Ocean biomes) challenging: Page 15564 line 8: 'This study generally does not have statistically significant results in the SO. . .' clarification on timescale would be useful. Line 14: 'no change in what drives the pH trend for

this decade compared to the longer period' How is this evidenced? The numbers for SOSTSS do not increase from table 2 to table 3 by the same scaling. Line 15: 'the change in the observed pH trend (table 3) appears to be dominated by the change in DIC as this is approximately four times larger (more negative)..' The change due to DIC is indeed 4 times greater in table 3 than table 2 but the other drivers also increase or decrease by similar amounts. Please clarify. Also, the DIC component isn't negative.

There are quite a lot of figures with lots of subplots. I don't think it would be too detrimental to the message of the paper if only pH were shown in tables and figures. fCO2 tables and figures could perhaps go in appendix. This would also have the advantage of making the pH plots easier to read.

The authors write 'carbon chemistry' throughout the paper. In most instances I am confident that they are referring to inorganic carbon parameters. Personally I interpret 'carbon chemistry' to include organic components and would prefer 'carbonate chemistry' when only inorganic components are being discussed. This is just my personal opinion though and I don't feel it significantly affects the clarity of the paper.

Specific comments

Page 15552 Line 26: You mention that a spatially uniform and constant Revelle factor may be a good assumption for the global average but then state that Bates et al (2014) found the Revelle factor to be increasing at all time-series stations. Isn't this a contradiction?

Page 15555 Lines 1-2: I really like the use of biomes to make best use of the available data. Perhaps readers would find it useful to know how the Fay and McKinley biomes are defined? Perhaps: 'The dataset was divided into the 17 biomes defined (using mixed layer depth, sea surface temperature and chlorophyll a) by Fay and McKinley (2014) as shown in Fig 1'

Page 15556 Line 10: The sentence starting 'The spatial bias' would scan better if it

read ‘The spatial bias correction has no statistically significant impact on the long term trend in most biomes, but. . .’ Also, I’m a little unclear on the logic here. The ANOVAs were performed to see if the corrections corrupted the analysis. However, in some biomes the spatial bias correction has an effect on the trend and you use this as a reason to retain the correction rather than evidence of it corrupting the analysis.

Page 15558 Line 16: If I have understood correctly, you are excluding statistically insignificant trends from the area-weighted global average pH decrease because they have high RMSE and high decadal variability which is likely masking the long term trends. The global average is therefore, strictly, not a global average but an average of the areas you have found to have a significant trend. I think this should be made clearer in the text.

Page 15559 Lines 8-9: Any ideas why there is greater variability in the SA-STPS than the NA-STPS? From the map of the biomes it looks like the SA-STPS includes more coastal regions than the NA-STPS so perhaps the greater variability comes from upwelling or riverine influences? Lines 10-11: You find a significantly lower trend in the NA-STPS than observed at BATS. This is interesting. Do you know why?

Technical corrections

Page 15550 Line 8: I see a negative rate of decrease as an increase. I’d prefer ‘decrease of 0.0018. . .’

Page 15551 Line 1: Remove ‘But’

Page 15553 Line 14: ‘support’ should be ‘supports’ Lines 14-17: This sentence needs shortening/clarifying. Lines 24-27: This sentence could do with simplification. Perhaps: ‘Although pH is the main parameter of interest, fCO2 has been carried through all our analyses in order to determine how carbonate chemistry causes the evolution of pH to differ from that expected from fCO2 alone.’

Page 15554 Lines 12-13: a couple of commas would make it scan better: ‘but, for our

purpose of determining long-term trends, the. . .’ Line 24: ‘remains’ should be ‘remain’

Page 15555 Line 24: ‘do’ should be ‘does’.

Page 15557 Line 1: This sentence would read better as ‘To test the effect of the highly variable spatial and temporal coverage of the observational data on the results we have. . ..’

Page 15558 Line 12: delete the second ‘was’

Line 23: ‘everything’ sounds a bit vague. Consider replacing with ‘other carbonate system variables’ or something similar.

Page 15559 Line 2: remove ‘But’

Page 15560 Line 9: Use ‘Furthermore’ rather than ‘Further’ Line 10: remove ‘had’ Line 14: replace ‘against’ with ‘with’

Page 15561 Lines 5-7: This sentence scans better as ’. . .trends also significantly differ. . .5 of the 12 biomes (Fig 6.)’ ie. move ‘also’

Page 15562 Line 3: Remove either ‘thus’ or ‘therefore’.

Page 15563 Line 22: DIC supply rather than DIC support?

Page 15564 Line 15: should read either: ‘it is unlikely there are’ or ‘there are unlikely to be’ Line 16: I think it reads better with ‘too’ removed. Line 17: ‘in observations and the model’

Page 15565 Line 5: Very comparable sounds odd. ‘comparable’ or ‘very similar’ would be better.

Interactive comment on Biogeosciences Discuss., 11, 15549, 2014.