

## ***Interactive comment on “Using present-day observations to detect when anthropogenic change forces surface ocean carbonate chemistry outside pre-industrial bounds” by Adrienne J. Sutton et al.***

### **Anonymous Referee #1**

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The study is an attempt to constrain the variability of surface ocean carbonate chemistry via compiling 3-hourly moored observations for 12 open ocean, coastal, and coral reef locations. Further, these present-day conditions are compared to biologically relevant thresholds associated with ocean acidification.

These are very relevant topics in the context of anthropogenic climate change and definitely within the scope of BG. The paper is detailed and well-written. I would appreciate a more thorough evaluation of state-of-the-art ESMs against this new set of observations, which would be very valuable (as the authors correctly note, ESMs still

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have issues in capturing the full magnitude of variability), but that is perhaps beyond the scope of this paper.

Specific comments:

p 1 line 18: Looking at "long-term change" in the context of "natural variability", wouldn't be the challenge the detectability (and correct estimation) of these long-term trends in OA - which then in turn affect marine life?.

p 1 line 29: "Modes" refers to ENSO, NAO etc. - I would recommend the usage of "patterns" or something like that.

p 1 line 35: Although - While?

p 2 line 10: than in open..

p 2 line 19ff: Please also include more recent studies, e.g., Keller et al., 2014 and Rodgers et al., 2015.

p 3 line 15: "and to ground truth carbonate chemistry variability in earth system models." Quite strong wording for what is actually done later, also considering the small number of locations and (partly quite old) models. Rewrite.

p 5 line 1: "or variability" - delete. SD was introduced as variability just one sentence before.

p 5 line 34:  $Q3 + 1.5 \times IQR$

p 7 line +/-25: How exactly do you define overlap? At KEO/ $\Omega$ arag, the whisker in November seems also to be in the gray.

p 8 line 9ff: This paragraph is not really clear, please rephrase.

p 8 line 11: Chá bã is shown in Fig. 5, not 4.

p 9 line 2: see p 1 line 29

p 9 line 6: see p 1 line 29

p 12 line 3: see p 1 line 29

Tables & Figures:

The gray and blue features (cells, shades, grids) are hardly visible (printed out, the light gray in Tab. 4 is completely absent, as is the grid in Fig. 8). Please replace with

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stronger colors.

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K. M. Keller, F. Joos, C. C. Raible, Time of emergence of trends in ocean biogeochemistry. *Biogeosciences* 11, 3647–3659 (2014). doi: 10.5194/bg-11-3647-2014

K. B. Rodgers, J. Lin, T. L. Frölicher, Emergence of multiple ocean ecosystem drivers in a large ensemble suite with an Earth system model. *Biogeosciences*. 12, 3301–3320 (2015). doi: 10.5194/bg-12-3301-2015

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