

## ***Interactive comment on “Estimating temporal and spatial variation of ocean surface $p\text{CO}_2$ in the North Pacific using a Self Organizing Map neural network technique” by S. Nakaoka et al.***

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Overall this is a concise, well-written and interesting paper further refining the neural network technique as applied to the North Pacific, a relatively very well-sampled region with respect to carbon. The authors demonstrate that the inclusion of additional parameters (SSS) and oceanic  $p\text{CO}_2$  growth rate, provide additional constraints on calculating  $p\text{CO}_2$ . The authors then use this improved technique to reproduce maps and time series of  $p\text{CO}_2$  for the North Pacific. In my opinion the power of this technique is not so much to constrain the ocean carbon budget - such high resolution is not required, but in further refining and constrain ocean biogeochemical models through

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considering these results as a time-series at each point. I must admit I was a little disappointed in the results section; the authors contrast the response of the North Pacific under ENSO but take this no further. I had hoped that you would use the underlying information from the SOM, to say something about how the set of drivers i.e. MLD, SST, CHL and SSS change under ENSO or even seasonally (Fig2 – Mapping Process) – but I am aware that this is primarily a methods paper and this maybe beyond it's scope. Providing my concerns are addressed I would be happy to recommend publication of this paper.

### Major Comments

In this study the authors assume that the oceanic  $p\text{CO}_2$  growth rate is constant in time, a recent study Lenton et al (2012; GBC) calculated the oceanic  $p\text{CO}_2$  growth rates seasonally and annually. In this study they showed a strong seasonal decoupling in the Subpolar and Subtropical Gyres – driven by different processes. One of the key results of this new paper is that including the oceanic growth rate improves the statistical significance of the results. I am concerned that assuming a fixed annual oceanic  $p\text{CO}_2$  growth rate would be an a priori constraint on the magnitude of variability in  $p\text{CO}_2$ . Could the authors please comment on the sensitivity of their improved methodology to the observed changes in oceanic  $p\text{CO}_2$  growth rates in the North Pacific.

### Minor Comments:

Abstract- I would be a bit more explicit and state that this is a further improving and refining of the neural network technique

P4581 Line 25: Is this data available yet?

P 4585 Line 22: fourparameter should be four-parameter

P 4585 Line 29: Recommend adding “at these latitudes” at the end of the sentence.