**Biogeosciences
Discussions**

Interactive comment on "A comparative study of biological production in eastern boundary upwelling systems using an artificial neural network" by Z. Lachkar and N. Gruber

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The complex relationships between various environmental factors and marine biological production in four major eastern boundary upwelling systems of the world's coastal oceans are examined using a powerful tool, Self-Organizing Map (SOM), along with a Hierarchical Agglomerative Clustering method. Indeed, the authors have chosen a right data analysis technique to tackle such a complicated system. The SOM, as a non-linear mapping method, can effectively extract the dominant features from a complex data set. Over all, the paper is informative and within the scope of the journal. Some quite interesting results are reported. Thus, I would like to recommend it be accepted

for publication after some minor revisions, mostly in clarifications of SOM applications and discussion of coastal upwelling on a wide continental shelf.

Specific comments:

(1) The variable "shelf width" is not a time series. How was this variable manipulated to calculate the correlation coefficients with the other time series? Similarly, how was it arranged in the input data set for the SOM mapping? These should be clarified in the paper.

(2) P9906, L24, did "the offshore component of Ekman transport" take into account of the change of the offshore direction along the coastlines? Some people simply use the zonal component of the Ekman transport.

(3) P9907, L14-15, it seems that the authors define the offshore boundary lines of the 500 km coastal strip in Fig. 1 as a zonal extension of the coastlines to the west. It is not a line 500 km from the coast in the strict offshore direction. Even within the 500 km band, a portion of the ocean regions may not be "coastal" in nature. The definition of the coastal strip should be clarified. It would be good to see whether or not a change of this definition affects the main results of the study.

(4) P9908, L15-22, the description of SOM parameter choices should be in more details so that the work can be reproduced/followed by others. The authors have mentioned map size and lattice structure. What are the choices of neighborhood function, initialization, etc? Liu et al. (2006) tested a number of SOM parameter choices with known patterns, and made some recommendations on the SOM applications. For example, the ep neighborhood function is recommended for more accurate mapping, while the Gaussian neighborhood function is suggested for more smoothed patterns.

(5) PP9915, L7-17, there are relevant observational evidences for your statements. On a typical wide continental shelf, the coastal upwelling jet is located offshore (more offshore than the downwelling jet), as clearly seen from the SOM extraction of the

current structures that were observed with a moored ADCP array (Liu and Weisberg, 2007). The long-term mean current patterns also showed that there is a transition area offshore where the near surface currents tend to be convergent and the near bottom currents tend to be divergent (Weisberg et al., 2009). These observed current patterns favors the trapping of the nutrient within the inner shelf. It would be more convincing if the observational evidences are added to the discussion.

(6) P9905, L5-7, "SOMs . . . have a number of advantages over traditional statistical methods . . .". Here, a reference to EOF analysis should be added as " . . . Empirical Orthogonal Function (Liu et al., 2006) and Principal Component Analysis (Astel., 2007)."

(7) One color bar can be used for all the four panels, and the figure would be more compact.

(8) Fig. 10, the names of the coasts should be placed on top of the figure as "figure subtitles" instead of within the top panels. Also, one color bar can be used for all the panels to save space and for better clarity.

Technical corrections:

(1) P9902, L7, "The identification of NPP drivers is done with the aid of . . ." is better written as "The NPP drivers are identified with the aid of. . ."

(2) P9902, L17, "a weaker factors" should be "weaker factors".

(3) P9904, L3-5, the sentence should be rewritten for better clarity.

(4) P9907, L7-9, there should be a space between "N" and the next words. Same for "S".

(5) P9907, L25, the extra quotation mark after "neurons" should be removed.

(6) P9923, L4-5, the correct citation should be: Liu, Y. and Weisberg, R.: Patterns of ocean current variability on the West Florida Shelf using self-organizing map, J.

Geophys. Res, 110, C06003, doi:10.1029/2004JC002786, 2005.

(7) P9925, L19-21, the correct citation should be: Solidoro, C., Bandelj, V., Barbieri, P., Cossarini, G., and Umani, S. F.: Understanding dynamic of biogeochemical properties in the northern Adriatic Sea by using self-organizing maps and k-means clustering, J. Geophys. Res, 112, C07S90, doi:10.1029/2006JC003553, 2007.

(8) Fig. 3 caption, "the" is needed before "SOM".

(9) Fig. 4 caption, "Frequency of SOM patterns" should be revised as "Frequency of occurrence of the SOM patterns".

References:

Liu, Y., and Weisberg, R.H.: Ocean currents and sea surface heights estimated across the West Florida Shelf, J. Phys. Oceanogr., 37(6), 1697-1713, 2007.

Liu, Y., Weisberg, R., and Mooers, C. N. K.: Performance evaluation of the self-organizing map for feature extraction, J. Geophys. Res, 111, C05018, doi:10.1029/2005JC003117, 2006.

Weisberg, R.H., Liu, Y., and Mayer, D.A.: Mean circulation on the west Florida continental shelf observed with long-term moorings, Geophys. Res. Lett., 36, L19610, doi:10.1029/2009GL040028, 2009.

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