

Interactive comment on “Extreme winter 2012 in the Adriatic: an example of climatic effect on the BiOS rhythm” by M. Gačić et al.

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Argo floats and altimetry data are used to investigate aspects of the circulation of the Adriatic and Ionian Seas. In particular, the consequences of the extremely strong winter in 2012, which caused the formation of very dense Adriatic waters, are discussed: in coincidence with the arrival of newly formed Adriatic dense waters the sea level lowered in the north-western flank inverting the surface pressure gradient. In the last months of the year 2012 the density gradient between the Adriatic flanks and centre vanished, which appeared together with a weakening of the anticyclonic circulation and then with a return cyclonic circulation. The Authors, based on these evidences, suggest that a reversal of Ionian surface circulation originated from spreading of highly dense bottom waters, which in turn were formed under extreme winter conditions. The paper

C306

seems to me well written and organized. In this sense I do not see elements which should undergo major revisions. The point I am more critical about is, indeed, more of "philosophical" or "epistemological" nature: shouldn't the evidence of the BiOS highly sensitivity to the climatic conditions (as the Authors express in the conclusions) lead to a reformulation of the paradigm according to which the oscillations are almost decadal? The data of the past are in my opinion not enough to support that statement and the present evidence supports, indeed, the possibility that these reversing paths of oscillations can involve substantially shorter time scales. I would also avoid to include in the discussion "previsions" based on results of climate model whose prediction skills, especially at regional level, are not firmly established. I thus suggest that the paper be accepted for publication provided that these two points are addressed in the discussion.

(Author Reply - AR) The conceptual model of BiOS is based on the salinity contrast between the AW and the Eastern Mediterranean waters (LIW and Levantine surface waters) which are brought into the Adriatic by the Ionian anticyclonic or cyclonic circulation, respectively. The density changes of the AdDW are in this conceptual model function of the salt input into the Adriatic dense water formation area assuming that the atmospheric forcing (air-sea winter heat fluxes) does not change to a large extent interannually. In that case, the BiOS time scale (the time needed for the pressure gradient between the basin borders and its center to cancel out and finally to invert due to the mixing between the newly arrived AdDW and the residing waters in the basin interior) is dictated by the geometry of the Ionian (dimensions, bathymetry and a total volume of the Ionian interior) and the AdDW production rate. The extreme atmospheric events (strong winter air-sea heat fluxes or extremely mild winters) can intervene by changing the Adriatic bottom water densities due to the thermal contribution and this then introduces the perturbation of the BiOS time scale. In this paper we show that this can largely affect the BiOS rhythm. As far as the "previsions" are concerned we simply said, citing other results that if predictions are realistic, the future climate change will have an important effect in changing the BiOS temporal scale (see the last paragraph

C307

of the revised ms.).

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C308