

## ***Interactive comment on “Seasonal variability of the Caspian Sea three-dimensional circulation, sea level and air-sea interaction” by R. A. Ibrayev et al.***

### **Anonymous Referee #1**

Received and published: 23 September 2009

#### General Remarks:

The paper is dealing with interesting aspects of the Caspian Sea circulation and sea level variations, and tries to disentangle also the relevance of the different external driving forces. In order to investigate this phenomenon, the three-dimensional circulation model MESH was employed, which has especially been developed for enclosed seas like the Caspian Sea.

This paper provides a good general overview over the hydrodynamics and its variability in the Caspian Sea. Such a comprehensive overview has not been given before, but it is definitively needed. Therefore, the paper is certainly worth to be published.

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However, the paper has one major shortcoming, which has to be discussed in much more detail. The entire discussion in the paper is based only on a model simulation, which has been performed for one single year, i.e., 1982. This selection was justified, because 1982 was a year with a nearly balanced water budget. But is this the correct measure to select a representative year? Moreover, for some of the forcing parameters like river runoff, the authors already state that values have been exceptional in 1982. Thus, the representativeness of the simulation results is not clear. I even miss a discussion about this problem. At least the possible uncertainties due to investigation of only one single year must be presented.

Overall, the paper will be suitable for publication after a moderate revision.

Specific Comments:

Page 1914, line 19: THE model successfully . . . . .

Page 1917, line 10: Please specify the recorded period.

Page 1917, line 18: Sentence: “The water budget depends on climate” must be clarified. It is mentioned that also anthropogenic effects such as water regulation schemes are of importance for the water budget. However, it is not clear whether these regulation schemes concern only the fresh water inflow into the Caspian Sea or also the water outflow is regulated. If the latter is true, it will not be possible to close the water budget just by accounting for the river runoff and evaporation minus precipitation. Possibly, the water regulation will dominate the entire system in this case.

Page 1919, line 21: We use THE kinematic boundary . . . . .

Page 1920, line 10: we use THE free-surface . . . . .

Page 1925, line 10: The northern part of the model domain looks extremely shallow. What is about drying and flooding in this area? As far as I understood, such an algorithm has not been implemented.

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Page 1926, line 4: The employment of ERA15 data is very questionable. Due to the coarseness of this data set, probably only  $3 \times 5 = 15$  ERA grid cells could be used for the Caspian Sea and I would assume that this number is even reduced when using a land sea mask. This problem should be discussed in particular since the Caspian Sea shows extremely high spatial gradients for the different meteorological parameters.

Page 1927, line 1-21: The use of monthly mean wind fields is extremely questionable, since it is known that short-term variability has a significant influence in particular on the depth of the thermocline. I cannot see any argument, why the authors should not make use of the available 6-hourly values.

Page 1929, line 7: Please explain why there was no outflow to the Kara-Bogaz-Gol Bay in 1982. What stopped evaporation in this bay? On page 1929, line 4 it is stated that this bay is an important sink for the water balance. This would mean 1982 is extremely exceptional.

Page 1930, line 4: of THE surface circulation ....

Page 1932, line 26: ... at first APPEAR totally ...

Page 1935, line 1: Please use SI units for salinity.

Page 1936, line 14: Please at least present a hypothesis, why Panin's estimates are much higher in the southern part of the SCB.

Page 1937, line 18: The statement that the good agreement between the observed and simulated sea level indicates the capability of the model to simulate the hydro- and thermo-dynamic processes correctly is questionable. If one specifies the river-runoff and precipitation and, moreover, tunes the radiation flux like the authors did, a simple box model would also be able to produce satisfactory results with respect to the sea level variations.

Page 1939, line 17: Please make clear what is meant by ECMWF estimated and observed sea level changes. Also Table 2 is unclear.

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Page 1940, line 18: How realistic is the 50% reduction of the river runoff? Please give an estimate how often such an event occurs.

Page 1940, line 19: The major focus of the sensitivity study is put on the consequences for the sea level. However, in some cases it is obvious that the heat content or the circulation would react much more towards the induced changes. Thus, I would strongly recommend the calculation of changes of the total heat content and of transport rates through specific sections.

Page 1941, line 21: ..... in A more unstable .....

Page 1942, line 18: ... to THE parameterization .....

Page 1943, line 4: From the values presented, the balance between sensible and latent heat flux has not changed very much. Please clarify this point.

Page 1944, line 11: ..... shows A persistent northward .....

Table 2: Please clarify what is meant by ECMWF data and observations presented in the last line.

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Interactive comment on Ocean Sci. Discuss., 6, 1913, 2009.

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