Response to Anonymous Referee #1

We thank Referee #1 for his/her comments, which are addressed as explained below. The Referee's text is reported in Italic and our responses in roman.

The authors investigate salt dynamics in a lagoon, and the effects of climatic changes and water management on salt concentration. They present a clumped model for water and salt mass balance, that when constrained by environmental measurements (precipitation, evaporation) and measurements of water height and concentration, yield estimates of important fluxes between the lagoon and its surroundings (sea, ground-water, etc). The authors use this framework to investigate the fate of the lagoon under future scenarios (increased temperature, less rain), and what would be the required restoration strategies to maintain ecosystem functionality. The paper is well written and well argued. The methods are sound, and the results are interesting. I enjoyed reading this paper, and I would recommend its publication.

Thanks for these encouraging comments.

Here follow a few comments I would like the authors to address prior to publication. Specific comments:
Lines 125-126. The parenthesis (C_G) seems to be misplaced. "the salt mass is obtained as the product of salt concentration (C_G) and water depth (h) in the Gialova lagoon."

The suggested change was implemented.

Line 167-170. This is confusing. You must know the value of h for the first day of measurement, only then you can update h for every time step. From section 2.3.1 we learn that the Northern sensor measures water depth variation, not water depth, but that comes much later in the paper. Please restructure these sentences, convey first that you only measure Delta h/ Delta t, but since you know h from the first day, you can update its value at every time step.

Good point. We amended the text by adding the sentence: "This requires setting the initial value of water depth for this recursive calculation to start", just after presenting the recursive equation that updates water depths. In addition, the sentence below Eq. 11 was amended as follows "The two linked Eq. (10) and (11) do not need to be coupled through time because changes in water depth (though not water depth *per se*) and salt concentration in the lagoon are measured"

Avoid using "absolute value", since it can also mean the function abs(-3)=|-3|=3, it took me a while to realize that "absolute" is used here to contrast "relative", which would be "Delta h".

The term "absolute" was removed and the sentence now reads "Since the value of water depth h varies from one time step to the next, and it is not measured, h in Eq. (10) must be updated…"

Lines 175-182. I had to read a few times to understand that once you solve eqs 10 and 11 for the available data, you now use Qfresh (modified), dh/dt, and other data to solve eqs 5 and 6. Ultimately you want C_G from eq 6, and for that you need Qsalt from eq 5. At first I got the impression you were solving a differential equation ("solve in forward mode", line 176), but it seems to be an algebraic relation only. In short, you should restructure this paragraph, it is confusing.

The paragraph has been re-structured as suggested:
"To assess the effects of changing climatic conditions and water resource management on salinity in the Gialova lagoon, we use Eq. (5) and (6) in a forward mode – that is, to estimate salinity variations through time based on hydrologic fluxes. First, Eq. (5) is solved in discretized form to obtain Q_{salt}; second, Q_{salt} is inserted in Eq. (6), which is solved also in discretized form to calculate salinity C_G. The first step requires estimates of all hydrologic fluxes and the change in water storage except the unknown Q_{salt}. Measured precipitation and evaporation rates are modified to account for climatic changes, while the change in storage (dh/dt) is maintained from current conditions given the strong coupling of water levels in the lagoon and in the sea (Supplementary materials S1; Fig. S1). Sea level rise is not considered in these scenarios. The Q_{fresh} obtained under current conditions as described in Section 2.4 is modified to account for both climatic and water management changes. With these assumed *P*, *E*, Q_{fresh} and dh/dt values, Q_{salt} is calculated at each time step from the water balance Eq. (5), and salinity is then readily obtained with the salt mass balance Eq. (6)."

In section 3.2 you first refer to figures 6a and 7a (effects of reduced precipitation), and only then to figures 6b and 7b (managed freshwater). Consider regrouping these 4 panels in the same way you did in the text, figure 6 about the effects of reduced precipitation, and figure 7 about managed freshwater. Consider also labelling the different curves in figures 6 and 7 with C0 through C3 directly on the graphs. If the result is not too cluttered, this would enhance readability.

Good idea. This rearrangement makes the figure presentation easier. The new figures and captions are reported below. We have also included labels next to the curves of Fig. 7, but not Fig. 6 where curves in some cases include combinations of scenarios, making labelling ambiguous. Finally, we added some details on the imposed variation in precipitation and evaporation in the legend of Fig. 7.

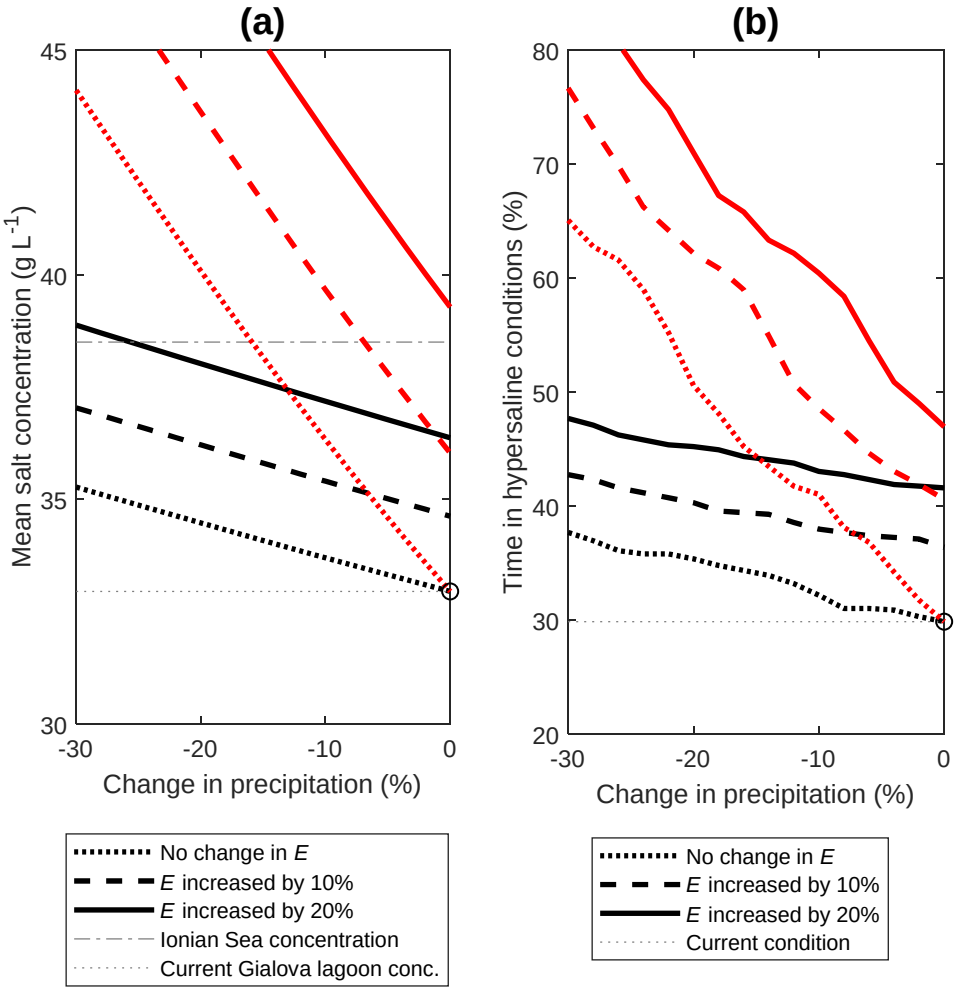

Fig. 6. Effect of climatic changes on a) the mean salt concentration in the Gialova lagoon and b) the percentage of time under hypersaline conditions. Different line styles refer to three scenarios for changes in evaporation rate; red lines refer to scenarios where freshwater fluxes are reduced as a result of climatic changes. Percentage time is calculated for the two simulation years; for visual reference, the grey horizontal dotted lines indicate current salinity and duration of hypersaline conditions in the Gialova lagoon, and the grey dot-dashed line in a) indicates salt concentration in the Ionian Sea as of today; current conditions are indicated by open circles.

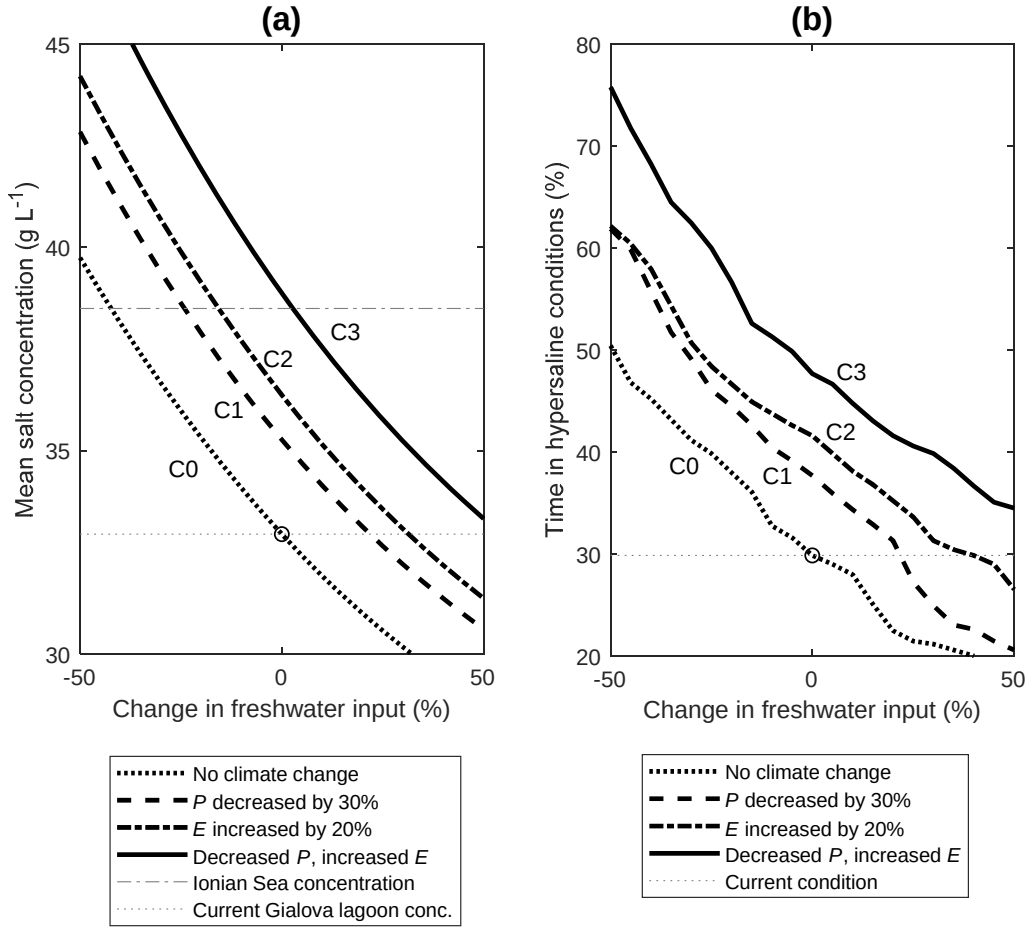

Fig. 7. Effect of changes in freshwater input on a) the mean salt concentration in the Gialova lagoon and b) the percentage of time under hypersaline conditions, under different climatic scenarios (different line styles; see details in Table 2). Percentage time is calculated for the two simulation years; for visual reference, the grey horizontal dotted lines indicate current salinity and duration of hypersaline conditions in the Gialova lagoon, and the grey dot-dashed line in a) indicates salt concentration in the Ionian Sea as of today; current conditions are indicated by open circles.