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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Reservoir evaporation in a Mediterranean climate: Comparing direct methods in Alqueva Reservoir, Portugal" *by* Carlos Miranda Rodrigues et al.

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We would like to thank you, for your insightful comments, which unquestionably contributed to improve our manuscript. We believe that we were able to fully and adequately respond and address all your questions and recommendations. In the following pages are our point-by-point responses to each of your comments as well as your own

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Discussion paper

comments.

Revisions in the text are shown using green colour font for [example] additions , and strike through red font [example] for deletions.

Line 10-12 - What is the difference of EC evaporation and modeled evaporation? Same to Line 15.

The daily mean reservoir evaporation (EC) was measured in the lake, by the IRGASON, and the modelled evaporation (E_{Res}) was obtained by the pan evaporation method, where the K_{pan} was modelled as a function of the four meteorological parameters.

Line 28 and line 90, hm and ha are not common units.

We have changed hm^3 to m^3, and ha to km^2.

Line 70, Why the relationship between pan evaporation and lake evaporation must be a function of meteorological parameters? In fact, lake heat storage is also a main factor of the difference between pan evaporation and lake evaporation.

Yes, we agree that the sentence is not clear, thus we re-written as:

"It is expected that the relationship between pan evaporation and lake evaporation should must be a function of meteorological parameters, through the modelled Kpan."

Line 81, Can the pan coefficient function in June to September is be used to other months?

No, this study was developed for the summer months and cannot be used to other months. These months was chosen because they represent about 60% of the total reference evapotranspiration in a Mediterranean climate. This was already referred in line 46-49.

Line 144-145, What is the theoretical basis?

The theoretical basis is described by several authors. We added a reference in the end of the sentence:

It is proposed that the actual evaporation from the reservoir could be estimated using the relationship between the Class A pan evaporation measurements (at Alquilha station) and a pan coefficient multivariable function, as determined by Allen et al., (1998) but for reference evapotranspiration.

Also, the following sentence was added in the Section 1, Line 72:

"...the most commonly used instrument to quantify reservoir evaporation. The application of a pan coefficient to convert measured pan evaporation to reservoir evaporation is a method frequently applied in reservoir studies and this pan coefficient is often calculated as a function of meteorological parameters (Allen et al., 1998; Pereira et al., 1995; Pradhan et al., 2013)."

Line 150-156, The expression is not clear enough, please address it in more detail.

We agree with the reviewer. We have re-written a major part of Section 3:

"...First, relationships were determined between the EC measurements and meteorological parameters (air temperature, relative humidity, wind speed, and solar radiation) measured at Alqueva-Montante station. These four meteorological parameters were chosen mainly because, they are the factors governing evaporation usually describe in bibliography (see for instance Allen et al., 1998) and because they are the parameters measured in the Alquilha meteorological station. The daily cycle of evaporation and normalised meteorological parameters were analysed to assess their behaviour during the day. A sensitive analysis at the hourly scale was 160 also performed for the factors governing evaporation from Alqueva Reservoir. Second, the relationships were determined between pan evaporation measurements and the same meteorological parameters, but as measured at Alquilha station (at hourly and daily scales).

Third the correlation between EC evaporation and pan evaporation where determined and the daily cycles of the normalized pan evaporation and normalised EC evaporation are compared.

Forth a sensitivity analysis of pan evaporation and EC evaporation versus meteorological variables was performed.

Fifth, the daily multivariable pan coefficient series was calculated, by dividing the daily values of EC evaporation by the daily values of pan evaporation.

Sixth, a function was fitted to this series based on the physical relationship between the meteorological parameters measured at Alquilha station (at the daily scale). Several functions were attempted, and the one leading to a better determination coefficient (R2) was chosen. In order to find the optimal parameter estimates, the Generalized Reduced Gradient (GRG) method (Lasdon et al., 1974) was used with the aid of the Excel solver tool. The best parameter estimates were those that minimized the residual sum of squares."

Fig.8, it is difficult to differentiate the two curves.

Yes, we changed the colors to make it clearer.

Section 4.4 is two simple and should be addressed in more detailed.

Yes, we agree. We have re-written the entire section:

"**4.4 Sensitivity analysis of pan evaporation and EC evaporation versus meteoro-**

logical variables

A sensitivity analysis of the daily pan evaporation and daily EC evaporation with air temperature, relative humidity, wind speed, and solar radiation, was carried out and . T the results are presented in Fig.9 , . Fig. 9a show a non-linear correlation between evaporation (EC and pan evaporation) with wind speed. It can be seen that both evaporations have a positive linear correlation with air temperature, Fig. 9b, and radiation, Fig. 9d. In Fig 9c it can be seen a negative correlation between evaporation and air relative humidity. The value of R2 of pan evaporation with air temperature, air relative humidity and radiation is greater than the R2 of the EC evaporation with the same parameters. On the contrary the R2 of EC evaporation with wind speed is greater than the pan evaporation with the wind speed parameter. Based on this sensitivity analysis, the four parameters appear to cause influence in both EC evaporation and pan evaporation, and strengthen the ability to establish a relationship between the open EC evaporation and pan evaporation at the daily scale as discussed in Section 4.5."