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# *Interactive comment on* "Hydrological response in the Danube lower basin to some internal and external climate forcing factors" *by* I. Mares et al.

**I. Mares et al.**

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Dear Reviewer,

First of all we would like to express our gratitude for your very great support and constructive comments. In this stage, we have tried to improve our manuscript in according with all your comments and suggestions, except for the English, that I hope to improve it more in the next steps. Therefore we hope now, our manuscript to be improved in comparison with the initial form. Below you find details on our response to your comments/suggestions.

Many thanks for your support.

With best regards, Authors



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Discussion paper

" I am wondering, though, whether it would have been more appropriate to break down this paper in two distinct smaller ones: one dealing with finding predictors of Danube flow (provided this has not been realized before...), the other addressing the issue of solar and geomagnetic forcings + QBO potential impacts on weather regimes associated to hydrological variations. I have the feeling these two parts could have been better related to each other".

R.

We agree with your opinion, especially that we had a first tentative to do two contributions with these results. Now, I have asked the editor and she told me that this split is possible, but only when the decision for publication is taken.

"It also looks like the paper was not enough revised before submission, as lots of typo errors, missing (or sometimes extra-) words can be found in too many places throughout the text. This could have been avoided, whatever the english skills of the authors."

R. We are very sorry for this situation.

"As their approach is only statistical, the authors should moderate their interpretations in terms of "response" of a climate index to solar forcing, or "impact" of solar forcing on hydrology or climate indices.."

R. We have tried to replace "response" "impact", with some moderate words.

"Abstract would need one or two introductory sentences presenting the aims and hypotheses to be tested."

R. We have introduced these sentences.

"Data: more details should be given on the geomagnetic signal used (data, why it is important to take it into account, recall its physical influence expected on weather regimes and hydrological variables...). It should be explained more precisely why QBO

is used and why it is considered solar/geomagnetic data (as QBO is presented in this section)?"

R.

We have tried to give some details by citations of papers in which the physical explanations are found. The QBO is presented in section of solar/geomagnetic data, because its role is to modulate the possible link between these forcings and the climatic variables.

"It would have been interesting to show the geomagnetic and solar activity time-series."

R.

We have introduced the Figure 13, that present the geomagnetic and solar activity time-series vs. drought index (TPPI). The place of this figure might be changed in the next new version of the present manuscript.

"Spectral analysis: the authors need to provide information about the choice of reference background noise, it is not enough to cite the Mares et al. 2016 EGU abstract. For example, what AR(1) process was chosen as background noise? - Since there are many possibilities for smoothing data, it might be interesting to mention why Butterworth filters were preferred."

R.

Details were given, both on the AR(1) process chosen as background noise and why the Butterworth filters were preferred in our manuscript. New references were inserted.

"- Cross-correlation graphs in figures 9, 10 and 11: confidence levels should be represented as dashed lines (like on spectra graphs) instead of using small arrows. Cross-correlation functions should be represented over a longer period of lag time (e.g. 15 years or higher) instead of only 5 years, for instance between lag -1 or -5 and lag 15. Time units on figure 10b should be indicated (yr). From figure 10b it seems like either

Q_ORS lags solar flux or solar flux lags Q_ORS: as a result the links emphasized are certainly not straightforward, as well as the causal relationship (the "response"). What is the contribution (in terms of discharge amount) of the 9-15-yr component of Q_ORS (here the series are normalized)? Also, MTM spectra of Danube discharge should be shown and discussed."

R.

Now, in this version of the manuscript, the crosscorrelations are estimated over a longer period of the lag time between -1 and 15yr. In the figure 10b, the solar flux is taken before Q_ORS, and this is indicated in the respective legend. The time series are normalized. Also, in the figure 10c we have inserted MTM spectra of Danube discharge, for unfiltered data in order to avoid any problem induced by filtering.

"- In several places it is stated that the hydrological signal responds to geomagnetic or solar signals: I think this should be avoided as the study only deals with correlation, no matter the robustness of the statistical tests conducted. For instance, lines 472-485: I don't think it is correct to conclude to a response (i.e. physical and causal link, here) of a climate index to solar forcing just because 2 peaks arose surrounding the 11-yr solar activity periodicity. Again, it should be kept in mind that no physics is accounted for here, where all is just a matter of correlation."

R. As I mentioned before, we have tried to avoid word "response". You are right, we have not given any physics in this paper, but we wanted to validate the results obtained by other investigations for some regions. This is why, we have tried to do a robust statistical analysis of our results.

"Technical/minor comments: See annotated PDF."

R. Many thanks for your comments in the pdf file. We have given response to your comments and we have done all changes. For some of the comments (in the first part of the Methodology section) we did not able to confirm our modifications, may be due

to incompatibility pdf tools with our computers.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-304/hess-2016-304-AC1-supplement.pdf

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