Hydrology and Earth System Sciences Discussions

Interactive comment on **"Hydrochemical variability at the Upper Paraguay Basin and Pantanal wetland"** *by* **A. T. Rezende Filho et al.**

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We would like to thank the reviewers for time spent on our manuscript, and for the constructive comments, which allowed improving the treatment of the data and the overall quality of the paper.

Please find here the answers to the main comments:

RC: First, the variables used in the PCA (concentrations) are first classically standardized, and then "standardized" again using electrical conductivity (EC), this variable EC being also included in the PCA. I strongly suspect that this introduces bias in the results of the analyses.

AC: We agree with this comment, and an additional step in the result is given in the new version of the article, i.e. the result of the standard PCA based on the correlation matrix, without dividing the data by the electrical conductivity of each sample. It shows that the total concentration of the water samples has a major influence on the results of the PCA (axis 1, 57% and 66% for DS and WS, respectively). All the variables, including EC, are positively associated to the first axis of the PCA. This illustrates mainly a climatic effect due to the concentration by evaporation and dilution by rainfall prior to the sampling in the north of the Pantanal. Of course it is information, related to the seasonality of the climate, but it is not the information we are looking for. The discrimination of the chemical profile of the waters is partly hidden by the total mineralization of the solutions.

Therefore the second step of the PCA was maintained for a better discrimination of the residual variability, i.e. the chemical profile of the waters. However this treatment has been modified according to the comments. We agree that, one the one hand dividing the data by EC, and on the other hand, maintaining EC in the PCA, is not an "homogenous" standardization and it can introduce a biais in the PCA treatment. Therefore we remove this variable EC for the PCA/EC. The result barely changed, because the variable EC had a low weight in the initial PCA, presented in the previous version.

RC: Second, nothing is said on the distribution of the concentrations: very often, the distributions of this type of data are very skewed, which can lead to hazardous results of PCA, especially when used to identify end-members. The authors should consider performing the PCA on ranks to minimize these problems. Third, the underlying assumptions of the EMMA approach are not completely discussed, especially the fact that some variables (and particularly N species and Si, but also probably SO4) may not be conservative during the transfer in these large rivers where, very likely, instream biological processes are very active.

AC: Two dimensions have to be considered. The EMMA procedure is usually used as a tool for the quantification of the contribution of various reservoirs in a mixture. For

this purpose, the conservativity is absolutely required. Here we used EMMA as a tool for a qualitative characterization of the chemical profile. End-members are identified in order to spatialize the chemical variability. The conservativity of the constituents and the fact that the data are skewed are not crucial points for this application. In this new version we mentioned that the PCA based EMMA procedure is used as a tool for the mapping. In agreement with the suggestions, the maps in the new version have been established after removing the non conservative variables, i.e. the different forms of N, and EC. The results (the maps) did not change because the non conservative variables were usually associated to more conservative ones in the first version. Now, the weight of the factorial axis has increased, but the spatial distribution of the chemical profiles is almost similar to that in the initial map.

RC: The other weaknesses of the paper are linked to the writing : the introduction lacks general references on the hydrochemistry of large wetlands, and does not state clearly the scientiïïňĄc and applied implication of the work.

AC: The introduction has been re-written so as to better present the problem, namely the lack of data on water chemistry of one of the largest wetland in the world, highlighting, on the one hand, the high biogeochemical reactivity of a tropical wetland area, and on the other, its considerable size.

The other detailed comments, amendments proposed and suggestions have been incorporated in the new version, and we have checked the quality of the English on the whole document. In particular, we mentioned that the analyses were performed within 10 days after the collect, and the description of the calculation of chemical compositions by simply mixing has been simplified.

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