

Reply to anonymous referee 3

We would like to thank the anonymous referee 3 for his comments on the manuscript and we are glad he finds this work presents an interest for the hydrogeological community. We propose an answer for each specific comment hereafter.

Comment:

1. Although a previous reviewer requested information about the modeling packages be removed, I believe that they are necessary. A key concern of mine is that the comparison of model results across France are not done with one uniform modeling package, so how does the selection of modeling software impact the results? I would like to know what the key differences are and have some discussion about how they may impact the final results. Different modeling approaches will have different uncertainties, structural or otherwise, which will impact results and shouldn't be ignored.

- Reply: we understand the referee's position about the need to present the modelling packages. In response to the referee's concerns, the use of dedicated modelling packages for each studied area, all of them gathered in the Aquifer platform, is justified by the need to account for the heterogeneity of the sedimentary aquifers that the authors intend to represent. The EauDyssée and MARTHE modelling packages have different underlying assumptions that make them more suitable for specific applications. The referee is right about the fact that this choice may introduce uncertainty into the results, which would be interesting to analyse. However, setting up and running this type of model is time and energy consuming, and as mentioned in the manuscript (lines 361 – 365), the RexHySS project (Habets et al., 2013) has already demonstrated that results from the two hydrogeological software packages are similar. Then, the models that spatially overlap into Aquifer may also produce similar results, which limits the contribution of the hydrogeological components of the modelling chain to total uncertainty compared to the contribution of the climate components. Furthermore, the referee 1 requested to substantially reduce the description of the modelling packages to shorten the manuscript. In line with the referee 1's opinion and given that the modelling platform is described in an article published in the same journal (Vergnes et al., 2020), the authors do not intend to address this issue.

Comment:

2. Consistent to previous reviewers, and as indicated above, I do feel that the authors need to spend significant effort focusing this manuscript - a lot of work went into the simulations, but not all of them need to be presented to get to the main contributions of this work. The inclusion of all the simulations and the storylines makes it much harder for the reader to reach the same conclusions. I feel a careful evaluation of what is critical to supporting the conclusions, what is supportive (supplemental), and what is not necessary could help to improve this manuscript.

- Reply: the referee is right about the need to select relevant information to present in the main manuscript. However, the authors believe this effort was already made when the manuscript was revised based on the comments from the referees 1 and 2. In particular, the referee 3 mentions that "*The inclusion of all the simulations and the storylines makes it much harder for the reader to reach the same conclusions*". In the second version of the article, the manuscript focuses on the results from the storylines, and results with all the projections are given in the supplementary material. The authors believe that this proposed solution strikes a good balance between the referees' comments and the guidelines of the Explore2 project, of which this paper is a part, which state that both approaches are complementary and should be equally carried to. Therefore, the authors

are reluctant to modify this aspect again, especially because the 1st referee accepted the proposed solution.

Comment:

3. Through this process, I would also encourage the authors to carefully review the grammar, or request assistance as necessary - this would also improve the readability and communication of the work.

- Reply: in order to follow the referee 3's recommendation, the English from the manuscript has been revised.

References:

Habets, F., Boé, J., Déqué, M., Ducharne, A., Gascoin, S., Hachour, A., Martin, E., Pagé, C., Sauquet, E., Terray, L., Thiéry, D., Oudin, L., and Viennot, P.: Impact of climate change on the hydrogeology of two basins in northern France, *Climatic Change*, 121, 771–785, <https://doi.org/10.1007/s10584-013-0934-x>, 2013.

Vergnes, J.-P., Roux, N., Habets, F., Ackerer, P., Amraoui, N., Besson, F., Caballero, Y., Courtois, Q., de Dreuzay, J.-R., Etchevers, P., Gallois, N., Leroux, D. J., Longuevergne, L., Le Moigne, P., Morel, T., Munier, S., Regimbeau, F., Thiéry, D., and Viennot, P.: The AquiFR hydrometeorological modelling platform as a tool for improving groundwater resource monitoring over France: evaluation over a 60-year period, *Hydrology and Earth System Sciences*, 24, 633–654, <https://doi.org/10.5194/hess-24-633-2020>, 2020.