Hydrology and
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Interactive comment on "The AquiFR hydrometeorological modelling platform as a tool for improving groundwater resource monitoring over France: evaluation over a 60 year period" *by* Jean-Pierre Vergnes et al.

Anonymous Referee #1

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The manuscript presents a newly developed hydrometeorological modelling platform (AquiFR). AquiFR combines three groundwater flow models, one land surface model, and one meteorological model embedded in a coupling system. The modelling platform computes groundwater levels, river flow, and spring discharge. The presented work compares the output of the modelling platform with long-term measured time series from 11 aquifers and 22 karstic springs. Several quality criteria are applied in order to assess the model efficiency.

The implementation of a national-wide hydrometeorological modelling platform is an

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Discussion paper

important topic, especially for the assessment of future climate changes. The combination of multiple models having different model structures is an interesting approach. The manuscript gives a brief introduction of the incorporated models, but unfortunately, the model descriptions are not really detailed. This makes it difficult for the reader to understand how the newly developed modelling platform functions. However, the presentation of the result is sufficient for the aim of the manuscript. Overall, the model output is a good approximation of the measured time series. One negative aspect of the result section is the lack of structure. I recommend publication with minor revisions, including a thorough review to improve the language.

My detailed comments are listed below.

Main Comments

- The presentation of the AquiFR Hydrometeorological Modelling Platform is neither well described nor structured. Especially the first two paragraphs of Section 2, intended to be an introduction of the newly developed model, lacks a detailed description of the connection between different compartments. This part of the text should be closely connected to a meaningful (!) scheme of the AquiFR platform. I highly recommend replacing Figure 1 with a more detailed scheme and using this as a central theme guiding the reader through Section 2.

- "SURFEX is a modelling platform aiming to simulate the water and energy fluxes at the interface between the surface and the atmosphere" (Page 6, Line 5); "MARTHE embeds single to multilayer aquifers, hydrographic networks and the exchanges with the atmosphere (rainfall, snow and evapotranspiration) for the computation of the soil water balance" (Page 7, Line 24); "Snow accumulation, snow melting and pumping is taken into account" (EROS software; Page 7, Line 24) How do you deal with redundant parameters and processes which originally are elements in several of the models (e.g. evapotranspiration)?

- The SURFEX modelling platform: You are using the SURFEX model to calculate

groundwater recharge and surface runoff. How do you address the specific karstic features (e.g. Epikarst, fast recharge components) in your model?

- Why do you present the quality criteria in section 3 (Results)? I would like to have more information about the evaluation of the model quality: a) general descriptions of the applied criteria, b) information about the calculation (equations) and references: e.g. How do you define bias and how do you exclude the bias from the calculation of the normalized RMSE?

- The Numbering of the sections should be adapted. Section 4 is entirely missing.

Secondary Comments Introduction: The beginning of the Introduction has been kept general. I would like to have more information on "but is still poorly known" (Page 2, Line 2) and I do not understand what you mean by "Groundwater is indeed located at some depth below the soil" (Page 2, Line 2).

Page 2, Line 28: "[. . .] as separate layers discretized using a 5 km resolution grid [. . .]" – The word separate is confusing here. Please, rephrase this sentence and maybe the next one as well. Also point out that the different layers are not connected to each other but to the river network.

Page 3, Line 25: I do not understand how the AquiFR project can provide monitoring of groundwater resources. Please, elaborate this.

The SAFRAN meteorological reanalysis: I am not sure if "analyses eight variables" (Page 5, Line 26) and "analyses each atmospheric variables" (Page 5, Line 30) are suitable expressions. Although, Quintana-Seguí et al. (2008) uses the same expression. I think estimates or calculates would be more suitable here.

Page 6, Line 6: The sentence need to be rephrased.

Page 6, Line 9: "[. . .] SURFEX is used in offline mode [. . .]" If this part of the sentence is useful information for the reader, elaborate it. Otherwise, I would delete it.

Page 7, Line 18: "hydro-climatic rainfall-river flow-piezometric head distributed model" is the direct translation of the expression used in Thiéry (2018a). Don't you think "reservoir model" is also a correct description of the model?

Page 9, Line 22: Please, erase the brackets and use a different expression (e.g. wise versa) instead.

Page 12, Line 21: Please, consider rephrasing the sentence "They were kept [. . .]"

Page 13, Line 1: Please, consider splitting this sentence.

Page 13, Line 11: Why did you (re)calibrate a few of the catchment/karst models and others not? You are proposing an inverse calibration tool - How did you calibrate the models after connecting them to SURFEX?

Page 14, Line 18: What do you mean by "However, the SIM tool uses coarse hydrogeological modelling [. . .]"?

Figure 2/3: Karst springs or Karst instead of Karsts

MINOR COMMENTS AND TYPOGRAPHICAL ERRORS - Page 1, Line 27: to compute

- Page 1, Line 28: that is used

- Page 2, Line 1: on Earth

- Page 2, Line 15: research organizations (?)

- Page 2, Line 27: United Kingdom (UK)

- Page 3, Line 2: delete though

- Page 3, Line 13: on a global scale

- Page 3, Line 17: led by the

- Page 3, Line 18: delete Indeed

- Page 3, Line 25: the AquiFR project was initiated

- Page 3, Line 27: numerical modelling (?)

- Page 4, Line6: I am not sure if reported on the present study is a suitable expression: presented by?

- Page 4, Line 20: period. In

- Page 5, Line 26: eight variables: rainfall, snowfall

- Page 5, Line 26: air temperature and relative humidity 2 m (above ground) and wind speed 10 m above ground.

- Page 5, Line 29: two rain gauges. SAFRAN

- Page 6, Line 2: zone. Further

- Page 6, Line12: temporal

- Page 6, Line18: gathers numerical

- Page 6, Line 23: Horizontal groundwater flow (?)

- Page6, Line 24: leakage. Therefore

- Page6, Line 29: coupled to

- Page 7, Line 15: Thiéry et al, 2018 – a or b?

- Page 8, Line 25: Is there a number missing in the brackets?

- Page 9, Line 16: observations at

- Page 9, Line 26: 2m and 4 m, respectively.

- Page 10, Line 2: with at least

- Page 11, Line 19: model input instead of inputs of the model

- Page 11, Line 29: delete one of the two dots

- Page 12, Line 4: shows

- Page 12, Line 8: which refers to the extreme rainfall event at the end of May 2016.

- Page 12, Line 11: Better: Figure 12 shows two plots comparing. . .

- Page 12, Line 21: same here

- Page 13, Line 7: Nevertheless, some regions are

- Page 13, Line 9: than the other regions (cf. Fig. 5).

- Page 13, Line 25: It would also demand big resources of computational power.

- Page 13, Line 26: to simulate a

- Page 14, Line 8: into account the

- Page 15, Line 13: more regional models?

- Page 15, Line 18: in progress

- Figure 15: (b) Somme