

## Comment on hess-2021-8

Anonymous Referee #1

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Referee comment on "A geostatistical spatially varying coefficient model for mean annual runoff that incorporates process-based simulations and short records" by Thea Roksvåg et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-8-RC1>, 2021

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The authors present a Bayesian geostatistical model for mean annual runoff that incorporates simulations from a process-based hydrological model (HBV model) by treating the simulations as a covariate in the statistical model. The article describes an interesting application of a geostatistical model. The scientific significance is fair/good and I think that this work can be considered as an extension of a previous work (<https://doi.org/10.5194/hess-24-4109-2020>). The methodology is sound and results are discussed in an appropriate and balanced way. However, some criticisms emerge. The major problem is that this article is more similar to a report than a scientific article. Some parts of the article are not clearly presented (here I am referring to the first part of the article, the second part - discussion and conclusions - are well structured). The document is too long and some parts are repeated several times in the text. The revision has been quite difficult due to the high number of pages and due to the fact that the authors repeated some information. Moreover, some key information is mentioned only in the second half of the article. I suggest performing a major revision of the text before publication.

Rows 14-15. I suggest removing from the abstract the sentence "It is not surprising that purely geostatistical methods perform well in areas where we have data". It is already expected and does not provide additional information to the reader. Moreover, it makes the article less robust.

Row 17 and following. The Introduction is too long and the description of the work performed in this study is split into several parts. I suggest removing some sentence (as rows 21-22, "The temporal variability of runoff can also be used to study runoff's sensitivity to climate change") that do not provide additional information related to this work. I also suggest to summarize the work and the main novelties at the end of the paragraph.

Row 35. Top-Kriging is used to model only discharge and not other referenced data, as mentioned. Please correct.

Row 55. The correct and most used name is "kriging with external drift" and not "external drift kriging".

Row 58. "Was estimated with a ...".

Row 59. Please explain what "g(.)" is.

Row 81. Please explain here what GRF is, considering that it is the first time that you mention this acronym.

Row 99. Please explain what INLA and SPDE are.

Row 121. You used a ratio equal to 0.2. Why? Please provide a reference or a motivation.

Rows 124-125. Please check these rows, I am not sure that the grammar is correct.  
Description of Figure 1. Please use "UTM" instead of "utm".

Row 133. Please mention the spatial interpolation that you used.

Rows 164 – 165. I suggest removing "However, most of the 141 calibration catchments probably coincide with the 127 fully gauged catchments in Figure 1a". If you are not sure about it, it is not advisable to mention it.

Rows 178-179. I suggest to remove them.

Row 206. Is the square bracket correct? Or is it a typo?

Row 209. I suggest to remove "will".

Row 224. Please insert the equation in a new line, by assigning number (3).

Row 226. Please explain what SPDE is.

Rows 231-233. I suggest to remove them.

Row 235. I suggest to shorten the sentence in "Kriging is used to ...".

Row 236. "x" is an estimated variable: please insert the "hat".

Row 246. Please add the brackets at the reference.

Row 249. Please correct with "According to Viglione et al. (2013) and Blöschl et al. (2013) ...".

Rows 279 – 284. I suggest to remove them.

Rows 307 – 310. You already mentioned this before. I suggest to remove this part.

Row 313. Why is "areas" in italics?

Row 329. Is the requirement of having positive runoff satisfied? If not, please provide additional information about how you managed this issue. If I am not wrong, you provide additional information about this only in row 713. I suggest to anticipate this statement.

Row 340. Please rewrite, removing "bear in mind".

Row 352. Please remove or rewrite "because Norway is a diverse country when it comes to runoff generation". For me, it is not clear what you meant.

Row 372. "Credibility interval" or "confidence interval"?

Row 409. I think you were referring to "confidence interval" and not to "credible interval".

Equation 14. I suggest to insert it as three separate equations. Please change the blue font to black font.

Rows 464 – 467. Please remove them or move them before. It is not advisable to mention the goals of the study after 18 pages of text. You already provided some information about the goals in several parts of Section 1. I suggest to merge everything, providing a more detailed and structured statement.

Rows 470 – 471. Please remove "These are observations from 127 fully gauged catchments from 1981-2010 and 284 partially gauged catchments from 1965-2010". You already mention it.

Row 491 and following rows. The bold font is not necessary.

Rows 561 – 563. I suggest to remove them.

Figure 6. Please remove the "[1]" above the first colorbar. Please insert the axis (with coordinates).

Figure 7. I suggest to use "UTM" instead of "utm".

Row 637. Is "do" necessary?

Row 671. Please remove the second brackets after x(y).

Row 702. Please remove the empty row.