Response to reviewers

We would like to thank the two reviewers for their constructive comments to the manuscript. Here are our updates for the technical points that the editors concerned.

Reviewer 1:
I have found an improved paper based on a careful accounting of reviews. In particular I believe this paper may enhance spreading of useful performance metrics such as NSE and KGE, born and well established in the hydrological scientific literature into other fields such as signal processing, in this case.

Reviewer 2:
The revised version is ready for publication. It clearly has added value for the hydrological modelling community since it clearly shows the link between well-known metrics and the signal-to-noise ratio, sheds new light on the interpretation of the well-known metrics and thresholds for good models. Some of the findings have been known previously to the hydrologic model community but are rarely explicitly stated in papers. Many papers show e.g. scatter plots of NSE versus KGE that clearly show that both metrics identify the same best solution (e.g. Yassin et al., Fig. 5, https://hess.copernicus.org/articles/23/3735/2019/ or Knoben et al., Fig. 1, https://hess.copernicus.org/articles/23/4323/2019/) without in detail discussing this.
One point that is missing is the link to Bayesian inference, omni-present in hydrological modelling, with the long standing debate about GLUE, Generalized Likelihood Uncertainty Estimation (e.g. Mantonvan and Todini, 2006). In the Bayesian inference body of literature, there formal assumption about the error model whereas in GLUE, often NSE is used. This link would certainly be useful.

Reply: Thank you for pointing out the link between our study and Bayesian inference. We have added text to highlight this link in the revised manuscript in the beginning of Conclusion:
"This view underlines an important role of the error model between simulations and observations, which is usually implicit in our assumption. Thus, our approach follows Bayesian inference in which an error model is formally defined first, then a goodness-of-fit measure is derived (Mantovan and Todini, 2006; Vrugt et al., 2008). The rational is to avoid the use of NSE as a predefined measure without an explicit error model like in generalized likelihood uncertainty estimation (Beven and Binley, 1992) which has caused a long debate in hydrology community (Mantovan and Todini, 2006; Stedinger et al., 2008)."
Also, a citation to Yassin et al. (2019) has been added to demonstrate that the equivalence between NSE and KGE has been observed in practice.