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Comment on gmd-2021-425

Heng Dai (Referee)

Referee comment on "How to perform global sensitivity analysis of a catchment-scale, distributed pesticide transfer model? Application to the PESHMELBA model" by Emilie Rouzies et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-425-RC2, 2022

Report on the manuscript “How to perform global sensitivity analysis of a catchment-scale, distributed pesticide transfer model? Application to the PESHMELBA model.” submitted to *Geoscientific Model Development*.

This paper explored how global sensitivity analysis can be applied to the PESHMELBA pesticide transfer model to quantify uncertainties on transfer simulations. Three different sensitivity analysis approaches (Sobol’ indices obtained from Polynomial Chaos Expansion, HSIC dependence measures and feature importance measures obtained from Random Forest surrogate model) have been implemented into a test case of virtual catchment to compare their performances.

I believe this paper is well written with high quality and good logic. However, some points of this paper need to be clarified and more discussions are needed, as listed below.

Major Comments:

- The novelty of this research needs more emphasis since the methods and algorithms are not new and the application of global sensitivity analysis in complex large-scale model is also not new (see Dai et al., 2017).
- The reasons of doing comparison for these three different sensitivity analysis methods need more discussions. Some conclusions for differences of these three methods are too obvious (e.g., the Sobol can consider the interactions).
- The screening procedure is unclear, what methods were used? The standard procedure is to use the Morris method or other low computational cost sensitivity analysis methods.
- The description of aggregated sensitivity indices is ambiguous, and the advantage of

using it is not convincing.