Reply on RC2

Marvin Höge et al.

Author comment on "Improving hydrologic models for predictions and process understanding using neural ODEs" by Marvin Höge et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-56-AC3, 2022

We thank the referee for constructive remarks and we appreciate the future recommendation to advance our research. Providing a modelling approach that allows to extrapolate to different climatic conditions is one of the motivations to use NeuralODES. We have collected all comments with corresponding lines from the pdf file that was attached and we have answered them below:

l.3 Replace the highlighted with "not yet fully understood"

- We agree, we change "given" to "understood".

l.9 Please mention the exact number (609?)

- We will replace "several hundred" by the exact number: 569

l.12 There is no need to divide the "Introduction" section through sub-sections. Hence you may remove 1.1, 1.2 sub sections.

- We introduction brings together several big topics that are important for the remainder of the article. Our intention to use sub-sections was to help structuring this. Referee 1 commented to like this setup. We see this as confirmation of our assumption that this structure helps to keep a red line throughout section 1. Therefore, our preference is to keep the sub-sections and we hope that the referee can follow our argument here.

l.16 (PUB)

- We think the referee refers to separating the abbreviation PUB from the references. We seek to avoid two parenthesis following one another. Yet, to provide a better distinction, we suggest that a ";" rather than only a "," might be more suitable.

l.18 You can start this sentence with "In this paper"

- Thank you for the suggestion. Since we did not refer to "this paper" anywhere else and in order to keep this style of writing, we suggest to start the sentence with "Here,…"

l.21 It would be better if you can support this sentence through literature

- We will add supporting literature.

l.22 «Although, the»

- We think there is no comma necessary here.

l.22-23 "Especially, when»

- After reading this sentence again, we suggest to drop "Especially" entirely, since it appears only to be a filling word here.

l.31 I suggest the authors to brief some of the internals whicj Nearing et al., & ... have explained (May be in 1 or 2 sentences)

- Thank you, we will add some details here, e.g. the referenced papers demonstrate linking hidden states in LSTM models to physical variables like soil moisture content.

l.41-46 Thank you for looking into the different words that are made from word combinations. We looked into the individual cases and learned the following:

- Timescales

- following https://www.collinsdictionary.com/dictionary/english/timescale : "timescale" and "time scale" both exist, but refer to different contexts. In our case, timescales seems to be appropriate

- Continuous-time

- Agreed, we will change it to "continuous time". Also, following this, we will delete the hyphen in "hidden-states"

- Step-wise

- Agreed, we will change it to "stepwise"

- Real-world

- following https://grammarhow.com/real-world-or-real-world/ : we keep real-world with a hyphen because it is used as adjective to a noun

- Time-continuous

- we will replace this by "continuous in time"

l.61 Provide some examples of certain bucket-type models? (HBV-light?)

- we will add examples like the mentioned HBV or GR4J

l.74 Spell out the acronymn «FUSE»

- Agreed, we will add "Framework for Understanding Structural Errors"

l.129 Material and Methods

- We see that "Material and Methods" is often the default header for this section. Since we do not specify any material as it is used, e.g., in a lab, we prefer keeping "Methods" only.

l.168 Spell out the abbreviation "CAMELS"

- Agreed, we will add "Catchment Attributes and Meteorology for Large-sample Studies"

l.188 Was there a specific reason to use NSE. What is the advantage of using NSE over Kling Gupta Efficiency?

- We purposely only used the metrics that were also employed in our reference study by Jiang et al. (2020), i.e. NSE, FHV and mNSE. Since NSE is a commonly used training and testing metric in hydrology, we did not see a need to switch to KGE. Yet, we know that KGE with its three different parts is generally a good option for hydrologic model rating.

L.215 This has been mistakenly written here ("FHV")

- It shall be in the parenthesis, but at the beginning, not the end. This is a TeX-based error, thank you for spotting it!

l.258-259 Give a basic description about these two catchments.

- We will add a short description providing some context information about the two

catchments.