

## **Author´s response**

Dear Dr. Viviroli,

Please find in attached with this document the review version of our manuscript, which incorporates the changes proposed by the referees.

### **Major Changes:**

1. Following the suggestions of the referees, to better validate our ML pipeline, we first compared our data-driven models against existing benchmarks: Lees et al (2021) for CAMELS\_GB and Kratzert et al. (2019b) for CAMELS\_US. Once this step was completed, we moved forward with the study. We included in the manuscript a new section showing these results.
2. To increase the compatibility of our research with existing studies we modified the training, testing and validation periods to match Lees et al (2022). For this we had to retrain all the models, however it gave us more flexibility to make direct comparisons with their results. As we extended the training period, we were also able to increase the performance of all our models.
3. We included a comparison between the ability of our method to predict non-target variables and the probe method proposed by Lees et al (2022).
4. The codes accompanying the manuscript were modified to increase efficiency and be more user friendly.

### **Minor changes:**

5. The abstract was modified.
6. We incorporated the references suggested by both referees.
7. We included the alternative explanation to see hybrid models as head layers, together with a Table explaining the concept.
8. We modified the explanation on how the data-driven models and the hybrid model were trained.
9. We modified the explanation about the time-varying parameters.
10. We presented direct answers to the research questions.

Even with all these changes, the main points of the paper did not change. We believe the modifications made extensively cover the changes proposed by both referees. We would like to thank both, one who remained anonymous and Grey Nearing, as their input in the review process allowed us to produce a better manuscript.

Kind regards,  
Eduardo Acuña on behalf of the co-authors.