

## Relevant changes in the manuscript

The following changes were performed in the manuscript to address the reviewers comments:

1. The largest addition to the updated manuscript consists of an additional application case of the validation tool, applying it to the NGFS scenarios as proposed by the reviewers. We use the new chapter 3.1 to shortly present the NGFS project before outlining multiple use cases which are covered by existing features of *piamValidation*. The newly included use cases are:
  - Multi-model, multi-variable overview
  - Model intercomparison
  - Scenario intercomparison
  - Period intercomparison

They are presented alongside 5 new figures, each consisting of a heat map for a general overview and a line plot demonstrating a focused analysis. The abstract, introduction and conclusions were adjusted accordingly to reflect the inclusion of the additional application case.

Furthermore, we chose to activate the *extraColors* feature for all heat maps in chapter 3, which uses blue and cyan to signal the exceedance of lower bounds, allowing a clearer distinction of which thresholds were surpassed.

With this additional application case we incorporate the following reviewer comments into the revised manuscript:

Reviewer 1: Response 1.1, Reviewer 2: Response 2.8, Reviewer 3: Response 3.1 and 3.2

2. We changed the structure in outlining the limitations of the tool by separating between the following areas:
  - Limitations indirectly related to the *piamValidation* tool,
  - tool limitations,
  - limitations regarding data management.

With this improvement we incorporate the following reviewers' comments into the revised manuscript:

Reviewer 1: Response 1.5, Reviewer 2: Response 2.8, Reviewer 3: Response 3.2

3. In addition to the limitations, we reworked the future developments and put special focus on the expansion and curation of reference data and thresholds.

This is in response to:

Reviewer 1: Response 1.2 and 1.4

4. To simplify the reproduction of the plots, a new vignette has been added to the R package and deployed to Github pages. The link to the vignette was added to the Code availability statement together with links to the newly created data and validation configuration files used in the new application case.

<https://pik-piam.github.io/piamValidation/articles/publication.html>

With this improvement we incorporate the following reviewers' comments into the revised manuscript:

Reviewer 1: Response 1.3

5. Overall, we clarified the language and explanations, harmonized formatting and fixed minor typos. Furthermore, we specified which REMIND versions were used exactly in application case 2.

With this improvement we incorporate the following reviewers' comments into the revised manuscript:

Reviewer 1: Response 1.6, Reviewer 2: Response 2.7, 2.8 and 2.9