

**"Regional variation in the effectiveness of methane-based
and land-based climate mitigation options"**

Hayman et al. (ESD-2020-24)

Editor Decision:

Publish as is (05 Mar 2021) by Steven Smith

Comments to the Author:

The revisions to the paper are well done and have significantly enhanced the readability and depth of analysis. I have only a few minor editorial comments that could probably be addressed in page proofs.

Line 114: "reflecting the different thermal sensitivities of existing climate models"

I assume the authors mean climate sensitivity? (thermal sensitivities is not a standard term). Suggest revision to make clear to reader.

Line 116: Some words appear to be missing here

"activity, and for scenarios taken from the IMAGE integrated assessment model"

Line 117: "for CH₄, we use an understanding of its atmospheric lifetime to translate methane emissions into their atmospheric concentrations"

"use an understanding" is a bit vague, but it would be sufficient to revise with a reference to section 2.2.1 that contains the new Equation 3 and text there that describes the methane calculations.)

Author Response:

We submit the version accepted for publication, with the following changes:

1. We amend lines 114-117 to address the Editor's comment above.

"Hence our Radiative Forcing (RF) trajectories have uncertainty bounds, reflecting the different ~~thermal-climate~~ sensitivities of existing climate models.

For each radiative forcing pathway, we subtract the individual RF components for non-CO₂ and non-CH₄ radiatively-active gases that are perturbed by human activity, ~~and for using baseline and mitigation~~ scenarios taken from the IMAGE integrated assessment model. Then, for CH₄, we ~~use an understanding of its represent its atmospheric chemistry by a single~~ atmospheric lifetime to translate ~~the~~ methane emissions into ~~their~~ atmospheric concentrations"

2. We correct the text where 'κ' or 'σ' is inadvertently shown as '□'.

3. We amend the data availability statement to give locations and doi's for:

- The IMOGEN-JULES source code and python processing scripts
- Datasets and relevant output from the study.
- The IMOGEN pattern scaling datasets and parameters for the IMOGEN Energy Balance model, for each of the 34 CMIP5 models emulated. We include the reference (Comyn-Platt et al., 2018) and doi for these data.

4. We abbreviate journal names in the list of references, using the accepted abbreviations. We add page numbers to those references, where these were either missing or incomplete.