

## ***Interactive comment on “A Bayesian framework for emergent constraints: case studies of climate sensitivity with PMIP” by Martin Renoult et al.***

**Anonymous Referee #1**

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In this paper the authors develop a novel technique to combine emergent constraints. Their main step forward is reconsidering the emergent constraint regression as a likelihood model so that it can be combined with a prior, allowing for Bayesian updating. This is particularly important for estimates of climate sensitivity, whose IPCC range has barely changed since 1990, even though independent lines of evidence have strengthened. The technique is elegant, transparent and I wish I'd come up with it. The accompanying code is also clear. I suggest the authors clarify some of their text and if available include more PMIP4 models.

Minor comments:

11: it's not a 100% clear whether this is a combination of the restricted ensemble of the nonrestricted ensemble. Either clarify, or remove the unrestricted estimate altogether.

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16: I don't quite understand the last half of the sentence: "higher bound by construction"

104: I didn't quite understand what "percentage of intervals to contain .." means. Please clarify.

126: typo: roles

139: "observation operator". Operator is unnecessary jargon.

169: A two line explanation of a (one step) Karman filter might benefit readers.

182: Phase 4 of PMIP are used in the study. Please replace explanation by saying not much data is available instead of none.

236-237: I don't think it's necessary to include this test any more.

337: merely → nearly or almost.

291: I'm quite surprised that OLS is more tight. Could you check code or provide an explanation?

349-350: a logical extension of the methodology is to apply it to CMIP, where we find many emergent constraint on the same models. It would be nice if the authors could comment on whether they see this as a problem, given that these models may have similar systematic biases.

374: add 'in a systematic way' or something similar. The principle behind emergent constraints relies on the fact that models deviate from reality, so that's not the problem.

386: pertinent → why not use simpler word such as relevant.

406: ordinary least squares doesn't require capitalization

Fig1 caption: what is a 'wide' ensemble proxy?

Fig2 – Fig9: in the pdf, the colour orange might imply to a tired reader that only PMIP3

C2

is used from the figure on the left. Purple or other dark colour might be more clear. I'm not convinced that all figures are necessary for the paper. The summary in the table may suffice for more regressions, such as the one in Fig 9.

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