

Interactive comment on “The Carbon Dioxide Removal Model Intercomparison Project (CDR-MIP): Rationale and experimental design” by David P. Keller et al.

Anonymous Referee #3

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In the manuscript ‘The Carbon Dioxide Removal Model Intercomparison Project (CDR-MIP): Rationale and experimental design’ the authors document the experimental design for a suite of coordinated experiments, designed to explore potential, risks and uncertainties in Earth System response to carbon dioxide removal (CDR) from the atmosphere. The authors provide a sound and detailed motivation for this suite of coordinated experiments, emphasizing connection with other model intercomparison exercises.

I much appreciate this paper which is not only highly relevant in the context of UNFCCC COP21 objectives. IT is also relevant for some WCRP grand challenges topics such

C1

as reducing uncertainties in climate sensitivity and constraining climate-carbon cycle feedbacks. Therefore, I recommend acceptance of this manuscript after some minor revisions listed below.

General comments: 1) Some sections are really long to read. I would therefore recommend to bring upfront important message. 2) Some experiments seem to complement existing MIP coordinated simulation while some other don't. It would be convenient to clearly state why those later are independent (or new) from existing experiments. 3) There is no documentation or information on how this MIP will address the role of the internal climate variability. As I read the present ms, it seems that exp produce a sufficient signal-to-noise ratio. However, for some exp, especially those in emission-driven simulations recommendation and sensitivity relative to the ensemble size seems required. Specific comments:

L52: It could be nice somewhere to refer to the IPCC definition of mitigation.

L59: impacts= climate impacts?; efficacy refer to technological scalability here? I don't think CDR-MIP address this very specific point.

L81: please indicated what is the reference period used to defined the preindustrial level

L85: rather use attributed to anthropogenic. . . L91: limiting warming= limiting anthropogenic warming

L116: please indicate that these are all models(=IAMs) results and are hence speculative. . .

L135-141: help to mitigation and potential effectiveness are redundant. The last point need to be clearer. As I understand the various foci of CDR-MIP, there are: - Effectiveness - Risks and benefist including avoided impacts - Related carbon cycle –climate feedbacks

L235: issue of permanence has to be taken with cautious here. Indeed, CDR-MIP

C2

is designed for ESM, EMIC and boxmodel. Those models are not designed to address carbon storage leakage (fit for purpose). They can only document the response of the Earth system when a leakage occurs.

L273: Please refer to {Smith:2015hg}

L386: CMIP5, are you sure?

L654 doubtful = unrealistic

L663: Why C1 doesn't rely on abrupt 4xCO₂ rather than 1%CO₂.

L841: As I read it: there is a removal of 100Gt in one year. Are you expecting a pulse removal (1 model time-step) or a smoothed removal during one year? Besides, do you expect a spatial structure of the CO₂ removal?

L1043-1047: Why not relying on a constant afforestation? LUMIP T1 exp is a constant deforestation. It would have been a complementary model experiment here.

L1437 2.8° longitude by 1.6° latitude

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2017-168>, 2017.