

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2022-125

Anonymous Referee #2

Referee comment on "GCAM-CDR v1.0: enhancing the representation of carbon dioxide removal technologies and policies in an integrated assessment model" by David R. Morrow et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-125-RC2>, 2022

This manuscript introduces a modified version of the GCAM integrated assessment model which adds several new pathways for carbon dioxide removal, which are not yet available in the extant public release of the model (GCAM 5.4). It also allows users flexibility for representing policy options to induce CDR deployment beyond removal subsidies equal to a carbon price as in the extant GCAM 5.4. Both are welcome and policy-relevant developments which will advance the knowledge and modeling capability of the IAM community. The manuscript is well-written, but I have several important details that should be addressed before publication in Geoscientific Model Development.

I agree with the first referee that reporting of the numerical costs and performance in the main body of the manuscript would be useful. While I see this is done in the Supplementary Information, it would be helpful to have in the main manuscript and reported in units that are more intuitive (e.g., GJ/tCO₂), and include the levelized non-fuel cost assumptions as well (e.g., 2020 USD/tCO₂) as the model results are highly sensitive to both parameters.

- 4 L-121. GCAM 5.4 represents a sorbent-based DAC process wherein the low-temperature heat is assumed to be supplied by an electric heat pump with an assumed coefficient of performance and thus does not require any natural gas input. The model also includes representation of a high-temperature DAC process which again uses only electricity to provide the high-temperature heat requirement. This sentence should be clarified to avoid implying only the natural gas-based process is represented in the

model.

On a related note, in the "DAC.xml" input file, and in Figure 6, the naming "DAC_sorbent (oxy CCS)" seems to imply oxy-fuel combustion, which is not used in solid sorbent-based DAC processes.

In the waste_heat_endogenous.xml file, the source and derivation of the "output-ratio" parameter defining the amount of waste heat produced per unit of e.g., thermal power generation or industrial energy use should be provided for each of the technologies for which it is defined. Same for the 0.42 price at which 100% of the maximum waste heat available is provided.

- 4 L-125. TEW: The assumptions regarding rock comminution particle size and upper or lower bound estimate from Streffler et al., 2018 used to parametrize the electricity input parameter should be provided in the SI.

- 5 L-150. OEW: Why is the shipping input a by-product of international shipping, rather than having this service as a direct input? Distributing the limestone or other alkalinity over the ocean surface "consumes" some amount of tonne-km of international shipping capacity. This would seem to make direct rather than co-product consumption of this service a more appropriate modeling approach.