

Modeling Economic and Climate Outcomes

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This is the introduction to MARGO, an climate-economic model that helps us understand possible pathways to limiting global warming [1].

The model is implemented in Julia, and the figures here were generated using MARGO's built-in plotting functions.

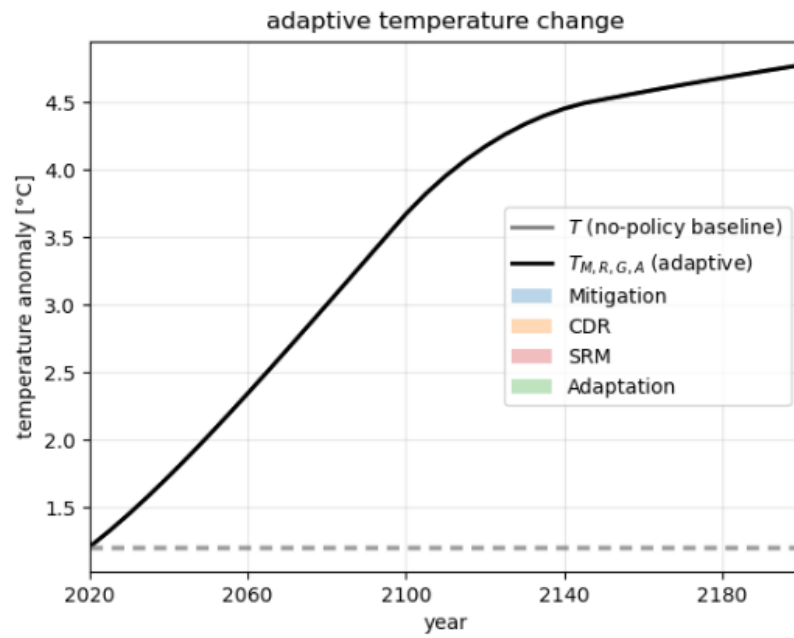
Margo models the future global temperature and carbon dioxide emissions and concentration in response to various control measures that can be deployed. The controls include: mitigation of greenhouse gas emissions, adaptation to climate impacts, removal of carbon dioxide (CDR), and Geoengineering by solar radiation modification (SRM).

The model optimizes the deployment of these controls given specific targets, such as keeping the global temperature to under 2.5 degrees of warming or budgetary requirements.

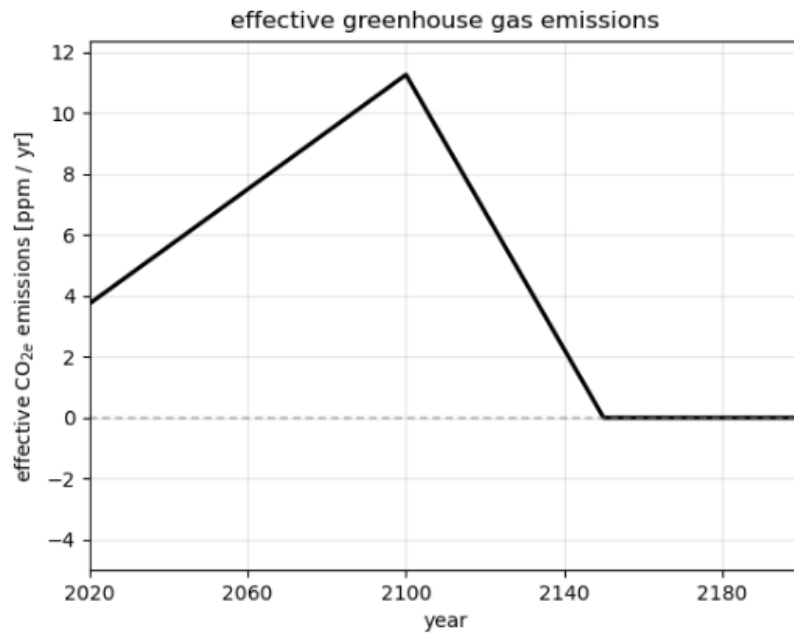
Here's an overview of MARGO's baseline scenario.

The temperature will continue to rise...

Margho Climate Model

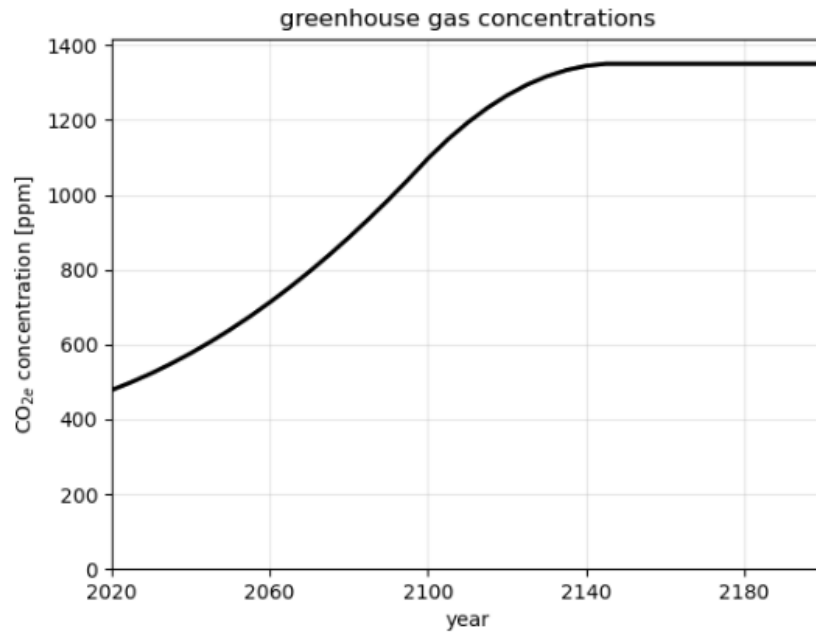


...and each year we emit more carbon until 2100 when the trend reverses.

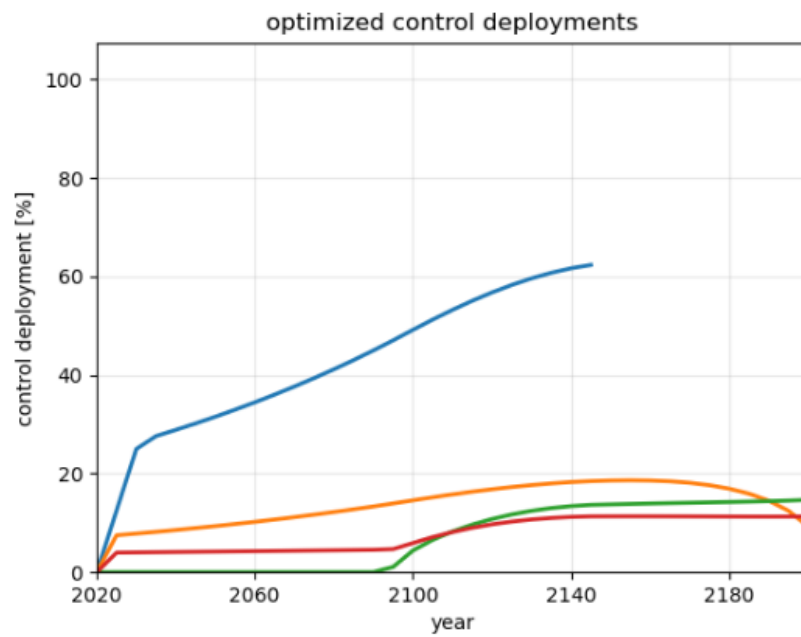


As that carbon dioxide is released into the atmosphere some of it will be drawn into natural CO₂ sinks, like the ocean, while the rest remains in the atmosphere.

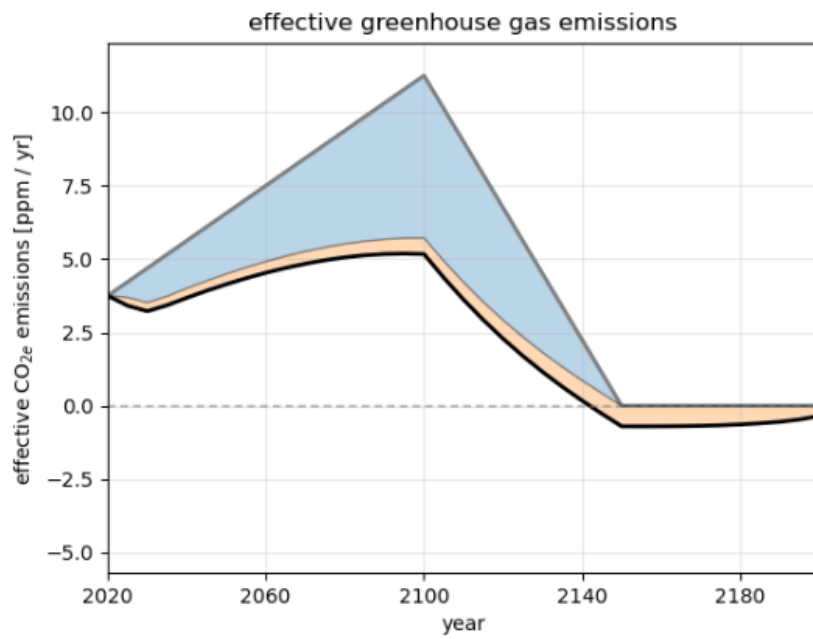
The overall concentration of CO₂ in the atmosphere is expected to continue growing.



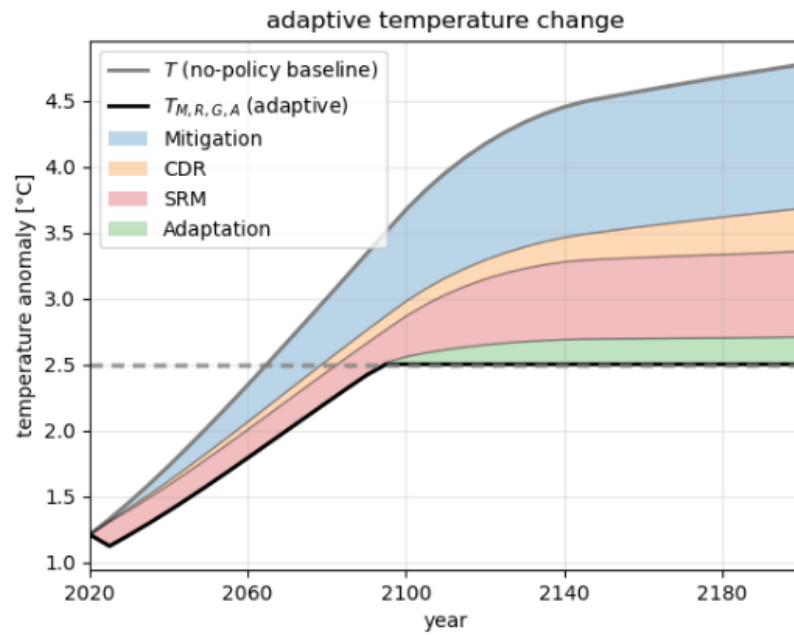
So what should we do? Margo suggests if we want to limit warming to under 2.5 degrees celsius we should deploy the mitigation strategies suggested in the visualization. Most notably, and intuitively, the model suggests our primary option should be mitigation, that is, not putting more CO₂ into the atmosphere.



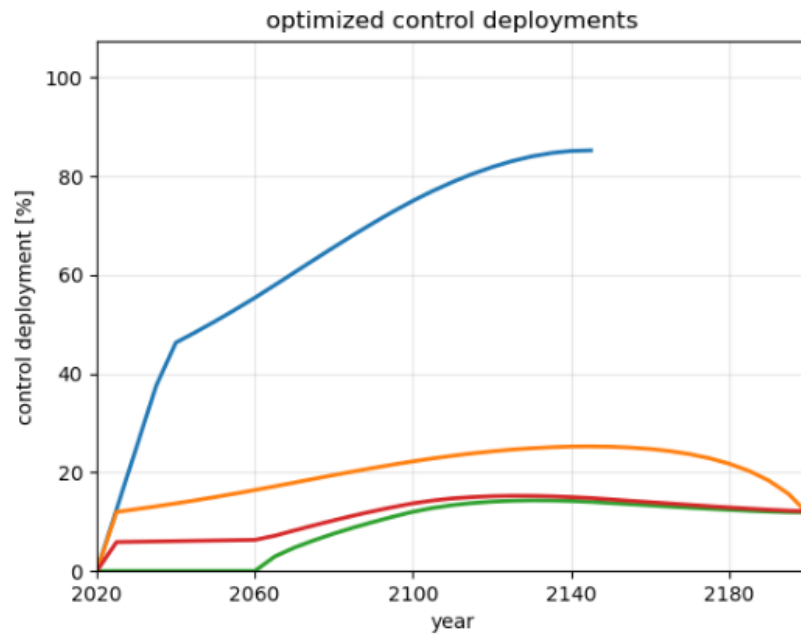
Here's what the emissions curve looks like with those controls in place.



And the effect that each would have on the overall temperature.

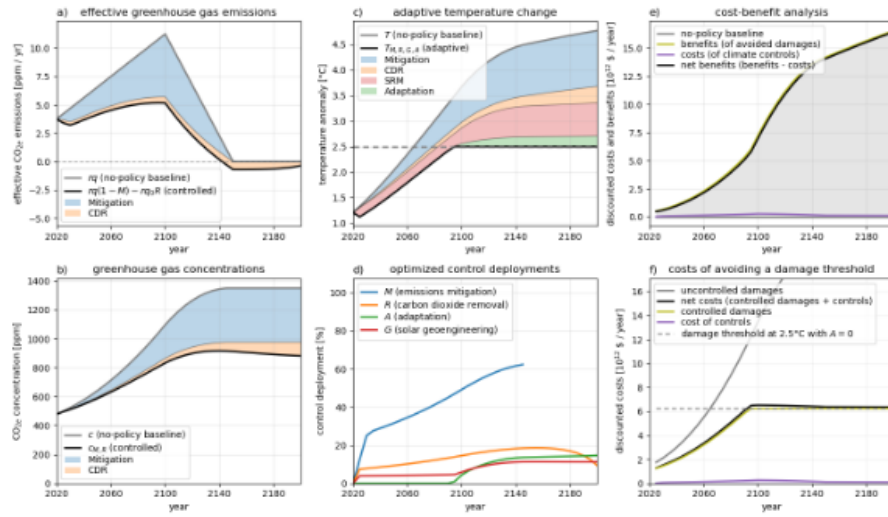


If we want to keep warming lower, say to 1.5 degrees, the amount of emissions reduction needs to increase sharply.



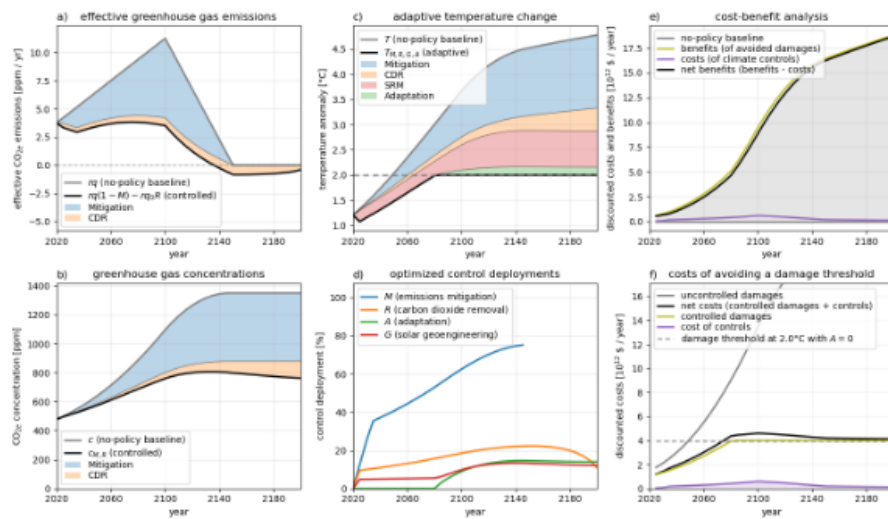
Now, you can see the entire model output. We'll sweep the optimized temperature goal from under 2.5 degrees of warming, to under 0.5 degrees of warming, and back.

Explore the Margo Climate Model 2.5 degrees

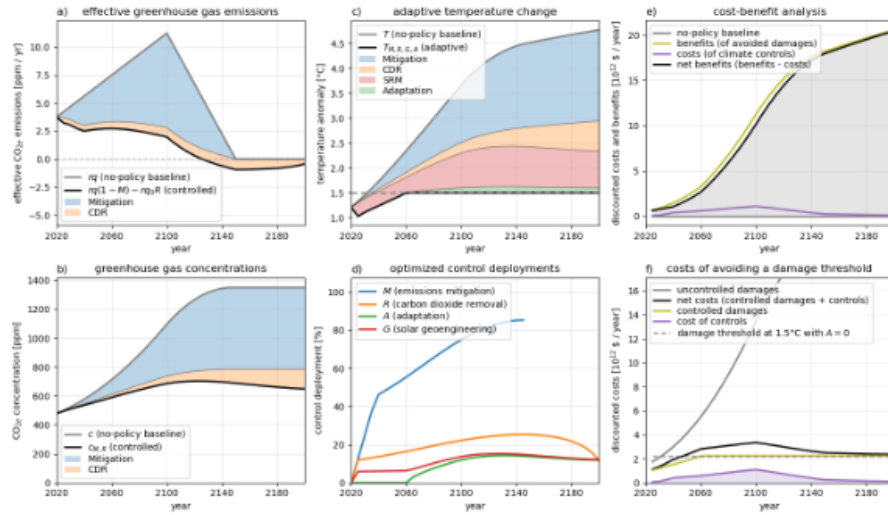


► Parameters

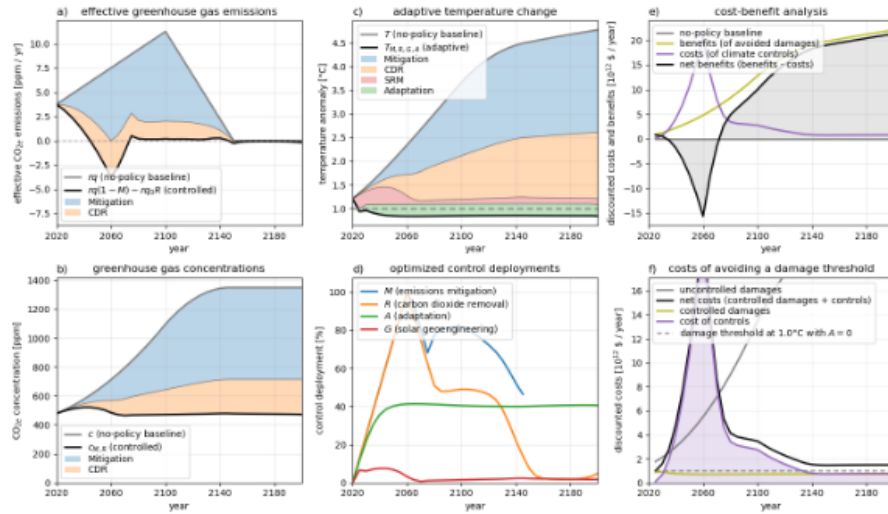
2.0 degrees



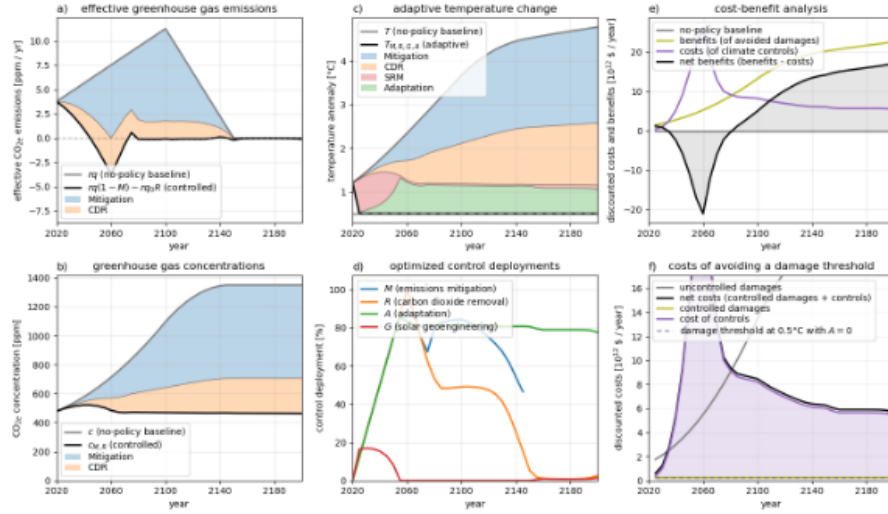
1.5 degrees



1.0 degrees



0.5 degrees



References

1. A multi-control climate policy process for a trusted decision maker, Drake, Henri F and Rivest, Ronald L and Deutch, John and Edelman, Alan. 2020.