Novel, Speculative Highly-Scaled Carbon Removal Study on a Reduced Complexity Model, Showing a Return to Preindustrial Temperatures by 2100 and Opdates to Achieving Net Zero for Anthropocene Reversal. HOW MUCH CDR, AND FF PHASE OUT TO 0°C? WHAT DOES IT TAKE TO GET TO 0°C BY 2100?

Faster to Net Zero, 300 ppm by 2050, then 0°C by 2100 for Anthropocene Reversal? Simple Climate Modeling Experiment "RCP 0"?

B CDR Modeling Experiments

calibrates MAGICC 6.8, models 300x2050, SSP1-1.9 & SSP1-2.6

300x2050 Pathway

Achieved 0°C at 2100 by soonest Peak Emissions, fastest to Net Zero, then Negative Emissions of cumulative CO₂ (FF+LUC) emissions & FF GHG phaseout. CO₂ concentration drops significantly to 237.38 ppm at 2100 before recovering to mostly preindustrial by 2200, yet temperatures remain above 0°C likely from heat exchange and long-lived aerosols.

Linear CDR caused the least >, CO₂ conc., RF post-CDR perturbation after 2100. See Projected Climate Response: Surface Temp, RF, ATM. CO₂ Conc. Aerosols, & N₂O induced temperature rebound minimized by moving FF phaseout 1-2 decades before 2100 and completing CDR.

Magnitude of CDR to reach 0°C by 2100 requires full transition to fossil fuel phase out, thus **REDEFINES** HIGHLY SCALED SUSTAINABLE GREEN **GROWTH DEVELOPMENT** as: 'ZERO-CARBON INTENSITY ENERGY AND ECONOMIC SYSTEMS, ZERO-WASTE CIRCULAR GLOBAL ECONOMY, **ECOSYSTEMS REHABILITATION, PRESERVATION, AND EXPANSION, EXTENDING SUSTAINABLE DEVELOPMENT.**

Although highly-speculative, the model predicts an ocean upwelling recovery. Regional temperature splitting of the hemispheres and ocean and land results with the northern hemisphere land over 1.5°C, and over 2°C for a 4.5°C ECS. See: **POSSIBLE REGION DIFFERENCES:** Surface Temperature | 300 x 2050, 300 x 2050 Pathway with ECS....

Model Calibration

Heuristically set MAGICC 6.8 to 2015-2020°C means, 2020 CO₂, present emissions (2020) & return reasonable NE results. NE Equilibrium Climate calibration increased Sensitivity, lowered and raised other settings. Emissions were calibrated to the Global Carbon Budget, 2021. Temperature was set to HadCRUT5 means and regions via CRUTEM5 means, (min. >> compared to >>>> 1815-1817 est. high-uncertainty see CDRMEx () CO₂ conc. to the Keeling curve from NOAA/ GML. All settings and data are relative to calibration and are proportional but not highly reflective of present day conditions. Simulation & data normalized to 1720-1800 mean temperature. Results baseline 0.073°C warmer than 1850-1900. Simulated scaled NE & compared to CMIP6 members. Tests equilibrate over 2500 years. See NE & ECS/TCR/TCRE & NE Calibration Result, a-e. Inferred Ocean outgassing: all FF emissions were removed instead opposed to just atmospheric emissions. LUC also removed for NE.

Issues

Durable below-ground carbonation, Ice flow/ice coverage, Permafrost unsupported by model.

Land use change for SSP 1-1.9 differs from the others.

Calibration changed Ocean heat exchange, and speeds up Δ °C.

CO₂ conc. was about 8 ppm higher at 2020 than NOAA GML.

Aerosol/N₂O artifact at GHGs phaseout.

Calibration of fertilization, plant, terrestrial fluxes can change the liftoff from 0°C at 2100. Seeks guidance from soil/land use/forestry studies for more realistic calibration.

Unable to find higher certainty > for 1815-1817, for more accurate min > to lower uncertainty in ECS.

Originated from 2018, 300x2050 was constrained to have the fastest peak emissions, soonest Net Zero then deeply carbon negative, to impart the least global ecological damage, and avoid climate tipping points. Yet is implausible with present day ambition and clean industrial development.

Unable to run CDRMEx code to generate the experiments on MAGICC 7.x.

For the Future

Open for investigation: ESM studies with emissions forcing from 1.55x to 1.7x of preindustrial CO₂ conc., removing 600 GtC (2198.4 GtCO₂) to 775GtC (2839.6 GtCO₂), calibrating model to present-day temperature and CO₂, additionally projecting future temps. inc. region differences, holding below 1.5°C, below ground CO₂ mineralization, sea-level rise, and how AMOC, ENSO, and jet-stream turnover evolve.

Strongly recommends scenarios include a path to zero-carbon intensity energy and economic systems, to *bring* about a *highly scaled* sustainable green growth development within this century.

Notes additional advice to provide more ambitious energy modeling to allow businesses and others to build to net zero, and help play a more positive role to eventually reverse the Anthropocene.

Additional Info

MAGICC = Model for the Assessment of Greenhouse Gas Induced Climate Change Pymagicc = python management toolkit controlling MAGICC and other Reduced Complexity Model Color scale from AR6 WG1, Climate Stripes Fig 1.25: https://dx.doi.org/10.1017/9781009157896.003

IF IT'S NOT PLANNED, IT'S LIKELY TO REMAIN SCI FI.

POSSIBLE REGION DIFFERENCES















The experiment and cached data are at https://github.com/hsbay/CDRMEx. The preprint is at https://doi.org/10.31223/x5k37c.













TCR is 2.0882, ECS is 3.2376 kelvin and TCRE is 2.420048 K / 1000 GtC alculating ECS from abrupt-0p5xC02 Calculating TCR & TCRE from 1pctCO2-cdr

unmodified from MAGICC

2.3 default (per magicc6.8)

(1.000000e-001 per mag6.8)

(1.3 per magicc6.8)

default (per magicc6.8)

(1 per magicc6.8)

Default is NPP, 70

#3.5e-001 live.magicc

#6.0e-001 live.magicc

5.0e-002 live.magicc

.1 (live.magicc)

1.97 (live.magicc)

80.0 (live.magicc default

1 per magicc6.8

1200

2000

120

- TCR is 2.0882, ECS is 3.2555 kelvin and TCRE is 2.420048 K / 1000 GtC Pymagicc/MAGICC 6.8 Configuration Parameters
- core verticaldiffusivity : 2
- core verticaldiffusivity min : .1 core heatxchange landocean : 2.35, core amplify ocn2land heatxchng : .9,
- core_heatxchange_northsouth : 3.45,
- co2 plantpool initial : 450, co2 detrituspool initial : 85, co2_soilpool_initial : 1100,
- co2 respiration initial : 12, co2 fraction gpp 2 plant : 0.305, co2 fraction gpp 2 detritus : 0.3, co2 fraction plant 2 detritus : 0.35, # .21 co2 fraction detritus 2 soil : 0.3,
- co2 fraction deforest detritus : .4, # 0.05 co2 tempfeedback yrstart : 1750, co2 tempfeedback switch : 1, co2 feedbackfactor soil : 0.046,
- co2 fertilization method : 1.03, co2 fertilization factor : .63, co2 gifford_conc_for_zeronpp : 31,

