

Title: Dataset associated with "Three flavors of radiative feedbacks and their implications for estimating Equilibrium Climate Sensitivity"

Abstract: The realization that atmospheric radiative feedbacks depend on the underlying patterns of surface warming and global temperature, and thus, change over time has led to an ignition of feedback definitions and methods to estimate equilibrium climate sensitivity. We contrast three flavors of radiative feedbacks -- equilibrium, effective, and differential feedback -- and discuss their physical interpretations and applications. We show that their values at any given time can differ more than $1\text{Wm}^{-2}\text{K}^{-1}$ and their implied equilibrium or effective climate sensitivity can differ several degrees. With ten (quasi) equilibrated climate models, we show that 400 years might be enough to estimate the true equilibrium climate sensitivity with a 5% error and a simple regression method utilizing the differential feedback parameter. We argue that a community-wide agreement on the interpretation of the different feedback definitions would advance the quest to narrow the estimate of climate sensitivity.

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Format of data files: .txt and .nc

File Information:

CESM104 data, annual means, behind Fig.1

cesm104/cesmtempfit.nc
cesm104/cesmtempout.nc
cesm104/netTOA_CESM104_1pct_250_anom.nc
cesm104/netTOA_CESM104_abrupt4x_5300_anom.nc
cesm104/netTOA_CESM104_abrupt4x_5300.nc
cesm104/netTOA_CESM104_control_1000.nc
cesm104/tas_CESM104_1pct_250_anom.nc
cesm104/tas_CESM104_abrupt4x_5300_anom.nc
cesm104/tas_CESM104_abrupt4x_5300.nc
cesm104/tas_CESM104_control_1000.nc

Various ECS estimates for ten models, behind Fig.2

ECSvalues/ECSvalues_Bayesianfit.txt
ECSvalues/ECSvalues.txt

Net TOA radiative imbalance and surface warming of the ten models, behind Fig.2 and Fig.3

Lmip/netTOA_CCSM3_abrupt2x_3000_anom.nc
Lmip/netTOA_CCSM3_abrupt4x_2120_anom.nc
Lmip/netTOA_CESM104_abrupt2x_2500_anom.nc
Lmip/netTOA_CESM104_abrupt4x_5300_anom.nc
Lmip/netTOA_CNRMCM61_abrupt2x_750_anom.nc
Lmip/netTOA_CNRMCM61_abrupt4x_1850_anom.nc
Lmip/netTOA_ECHAM5MPIOM_abrupt4x_1001_anom.nc

Lmip/netTOA_GISSE2R_abrupt4x_5001_anom.nc
 Lmip/netTOA_HadCM3L_abrupt2x_1000_anom.nc
 Lmip/netTOA_HadCM3L_abrupt4x_1000_anom.nc
 Lmip/netTOA_HadGEM2_abrupt4x_1299_anom.nc
 Lmip/netTOA_IPSLCM5A_abrupt4x_1000_anom.nc
 Lmip/netTOA_MPIESM11_abrupt4x_4459_anom.nc
 Lmip/netTOA_MPIESM12_abrupt2x_1000_anom.nc
 Lmip/netTOA_MPIESM12_abrupt4x_1000_anom.nc
 Lmip/tas_CCSM3_abrupt2x_3000_anom.nc Lmip/tas_CCSM3_abrupt4x_2120_anom.nc
 Lmip/tas_CESM104_abrupt2x_2500_anom.nc
 Lmip/tas_CESM104_abrupt4x_5300_anom.nc
 Lmip/tas_CNRMCM61_abrupt2x_750_anom.nc
 Lmip/tas_CNRMCM61_abrupt4x_1850_anom.nc
 Lmip/tas_ECHAM5MPIOM_abrupt4x_1001_anom.nc
 Lmip/tas_GISSE2R_abrupt4x_5001_anom.nc
 Lmip/tas_HadCM3L_abrupt2x_1000_anom.nc
 Lmip/tas_HadCM3L_abrupt4x_1000_anom.nc
 Lmip/tas_HadGEM2_abrupt4x_1299_anom.nc
 Lmip/tas_IPSLCM5A_abrupt4x_1000_anom.nc
 Lmip/tas_MPIESM11_abrupt4x_4459_anom.nc
 Lmip/tas_MPIESM12_abrupt2x_1000_anom.nc
 Lmip/tas_MPIESM12_abrupt4x_1000_anom.nc

Definitions of acronyms:

See Table 2 in Rugenstein et al. 2019: <https://doi.org/10.1175/BAMS-D-19-0068.1>

Calculation:

Anomaly of CCSM3 is done by subtracting annual means of year 1-20 of the simulations *abrupt4x*, and *abrupt2x* from year 1-20 from the control simulation (strong drift in all runs) after which the average of the remaining control run is used for calculating the anomalies (as in all other models).

Description:

- 1) The LongRunMIP output of global and annual mean “tas” and “netTOA” for the models CCSM3 (abrupt2x and abrupt4x), CESM (abrupt2x and abrupt4x), CNRMCM61 (abrupt2x and abrupt4x), ECHAM5MPIOM (abrupt4x), GISSE2R (abrupt4x), HadCM3L (abrupt2x and abrupt4x), HadGEM2 (abrupt4x), IPSLCM5A (abrupt4x), MPIESM11 (abrupt4x), MPIESM12 (abrupt2x and abrupt4x)
- 2) ECSvalues.txt contain the ECS estimates as shown in Fig. 2 in the paper.
ECSvalues_Bayesianfit.txt contain the ECS estimate with uncertainty ranges of the energy balance model as presented in Proistosescu et al. 2017.
- 3) Model output of global and annual mean “tas” and “netTOA” for the model CESM 1.0.4, as shown in Fig. 1. “cesmtempfit*.nc” are the splines fitted to the “tas” output for converting the differential feedback parameter from temperature to time, as detailed in Rugenstein et al. 2016.

Rugenstein et al. 2016: <https://doi.org/10.1175/JCLI-D-16-0312.1>

Proistosescu and Huybers, 2017: <https://doi.org/10.1126/sciadv.1602821>