Supporting Information

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SI Text

Fig. S1 shows the warmings and the decays of warming following an abrupt cessation of all imposed radiative forcing for various test cases for the Bern 2.5CC Earth Model of Intermediate Complexity (EMIC) and the Geophysical Fluid Dynamics Laboratory (GFDL) Atmosphere-Ocean General Circulation Model (AOGCM), as in ref. 1; that study emphasized the partitioning of much of the climate system response into two components, "fast" and "slow," with the latter being particularly linked to ocean heat transport and the former being largely reflective of the atmosphere and ocean mixed-layer responses. It should be emphasized that an imposed immediate stop of radiative forcing as in ref. 1 is intended as a climate physics test. This behavior does not represent what would occur if *emissions* of genuine anthropogenic greenhouse gases were to cease, as in the main body of the paper. Indeed, a key point illustrated in Fig. 3 is that continued uptake of heat by the ocean while greenhouse gases decay substantially prolongs the persistence of climate change.

Fig. S1 shows that, if radiative forcing were to abruptly cease in 2100 after following the A1B forcing behavior to that point, the Bern 2.5CC model displays an initial fast adjustment timescale of about 5 y, similar to that obtained in ref. 2 using the GFDL AOGCM as shown. The subsequent slow decay of warming in the Bern 2.5CC model over the next few decades is somewhat slower than that obtained in the GFDL AOGCM (which may be linked in part to changes in the meridional overturning circulation in that model, as noted in ref. 1). The increase seen in warming in the Bern 2.5CC EMIC between about 2130 and 2200 after cessation of forcing is linked to changes in the computed ocean circulation. On timescales of the order of many decades in this test case, the Bern 2.5CC and GFDL models show continuing warming of similar magnitudes. The two models also display very similar behavior for a second test case in which A1B forcing is held constant at 2100 levels until 2300 and then abruptly stopped. These responses depend on details relating to the transient ocean heat uptake (3) and ocean carbon uptake (4), and should be considered illustrative.

1. Held IM, et al. (2010) Probing the fast and slow components of global warming by returning abruptly to pre-industrial forcing. *J Climate* 23:2418–2427.
2. Church JA, White NJ, Arblaster JM (2005) Significant decadal-scale impact of volcanic eruptions on sea level and ocean heat content. *Nature* 438:74–77.
3. Stouffer RJ (2004) Time scales of climate response. *J Climate* 17:209–214.
4. Hansen J, et al. (1984) Climate sensitivity: Analysis of feedback mechanisms. *Climate Processes and Climate Sensitivity*, Geophysical Monograph 29, Am Geophysical Union, pp 130–163.

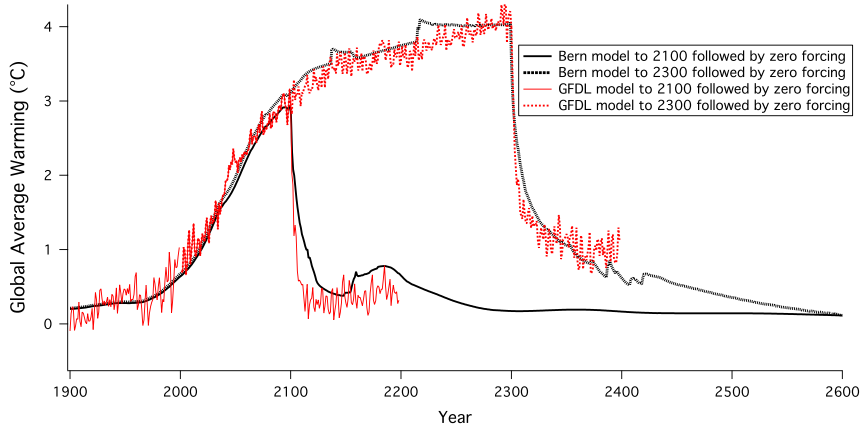

Fig. S1. Calculated warming in the GFDL AOGCM and Bern 2.5CC EMIC, using the A1B scenario to 2100 followed by constant radiative forcing to 2300, compared to instantaneous imposed zero radiative forcing at 2100 and 2300 for the purpose of illustration. The Bern 2.5CC model warming has been scaled (by 87%) to match the absolute magnitudes in the GFDL calculations at the peak prior to the forcing cuts.

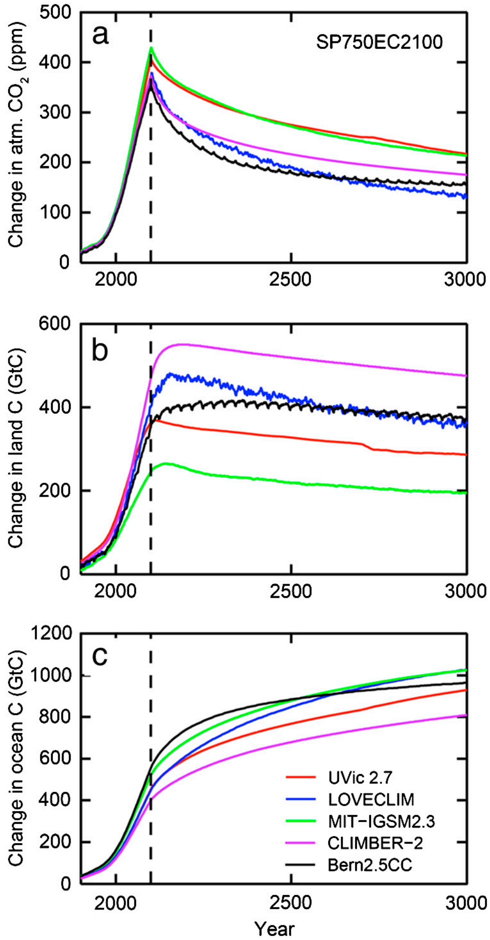

Fig. S2. Comparison of changes in carbon inventories since preindustrial times for five EMIC with an interactive carbon cycle, for a specific emission pathway leading to a peak total atmospheric CO_2 concentration near 750 ppmv followed by zero anthropogenic emissions thereafter. (*A*) Modeled change in atmospheric CO_2 (above the preindustrial concentration of about 280 ppmv), (*B*) change in the terrestrial carbon inventory, and (*C*) change in the ocean carbon inventory. Adapted from ref. 1.

1 Plattner GK, et al. (2008) Long-term climate commitments projected with climate–carbon cycle models. *J Climate* 21:2721–2751.

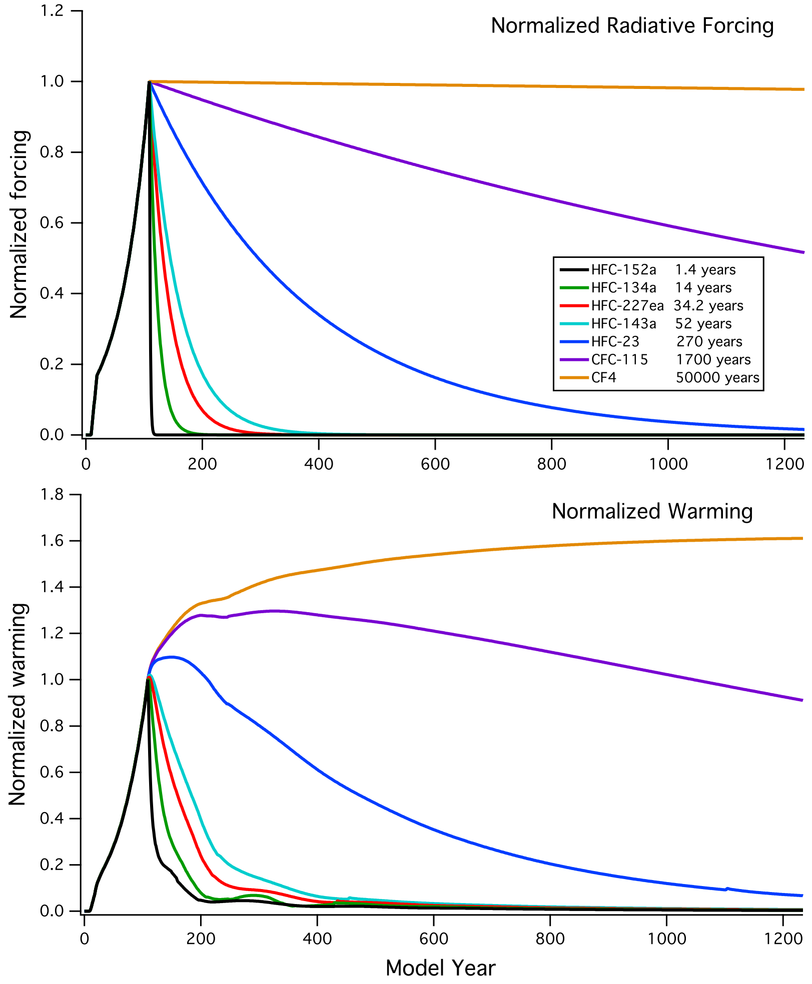

Fig. S3. Radiative forcing (*Upper*) and persistence of relative changes in warming (*Lower*) computed in the Bern 2.5CC model following an illustrative ramp of forcing from 0 to 1 W/m^2 over 100 y followed by an immediate stop of emissions for various halocarbon gases. The values are normalized to one at the time when emissions stop to examine relative changes, as in Fig. 4 of the main body of the paper.