Biogeosciences

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Supplement of

Carbon cycle feedbacks in an idealized simulation and a scenario simulation of negative emissions in CMIP6 Earth system models

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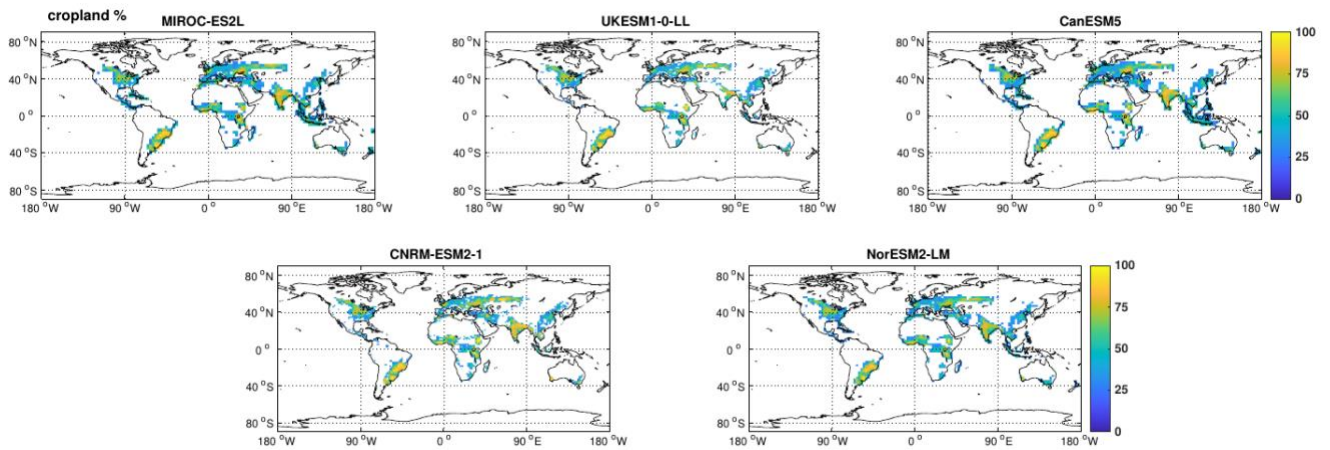*Correspondence to:* Jörg Schwinger (jrsc@norceresearch.no)

Figure S1: Global fractional cropland area distribution calculated as the maximum of the cropland area fraction between 2015 and 2100 for the ssp534-over scenario. Only fractions above 25% are shown.
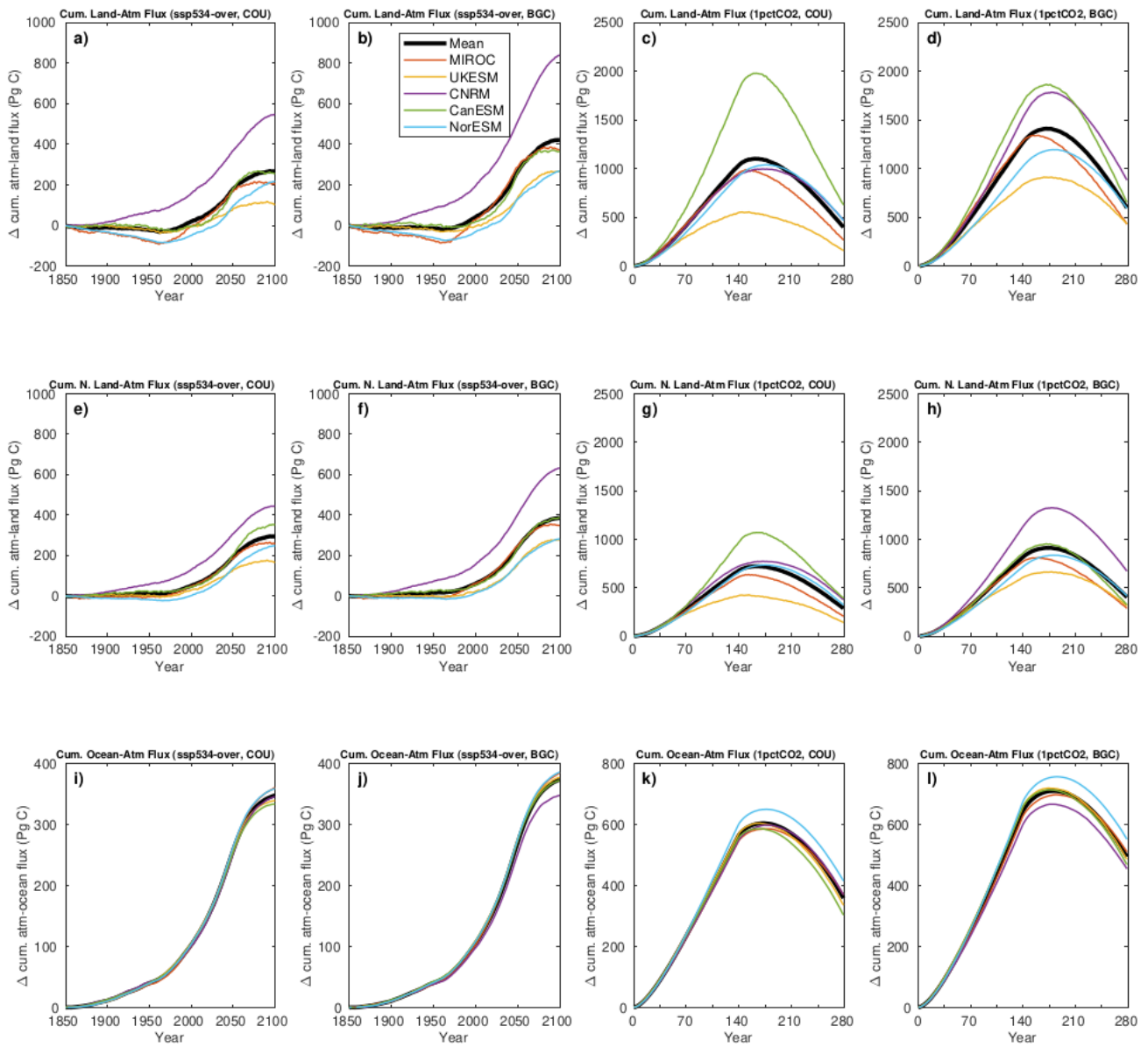
Figure S2: Annual time series of the global total (natural land plus cropland, and natural land only) cumulative land- and ocean-atmosphere carbon fluxes for the fully and biogeochemically coupled ssp534-over and 1pctCO2 experiments as indicated in the panel title.
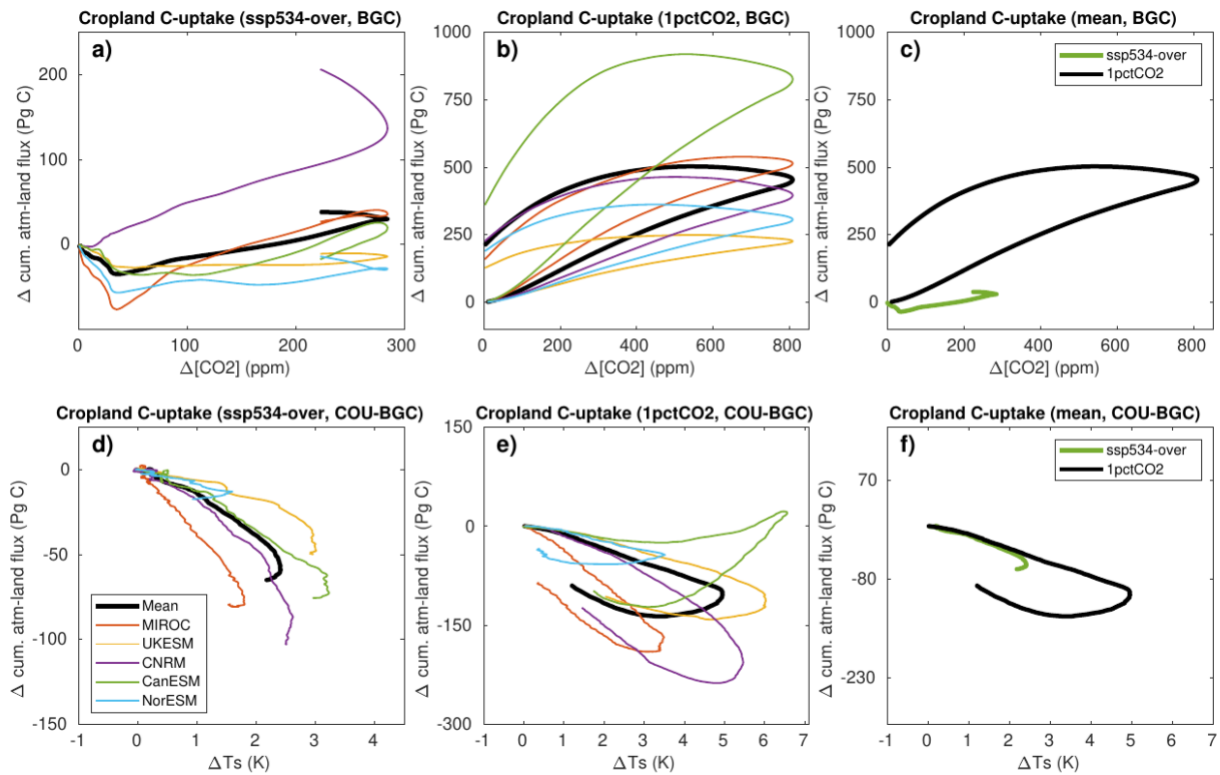
Figure S3: same as Fig. 4 but for grid-cells not dominated by natural vegetation in the ssp534-over simulation ("cropland", more than a maximum of 25% crop fraction over the period 2015-2100) . Note that, for this comparison, the same grid cells are considered in the 1pctCO2 simulation, even though land use stays at pre-industrial state.
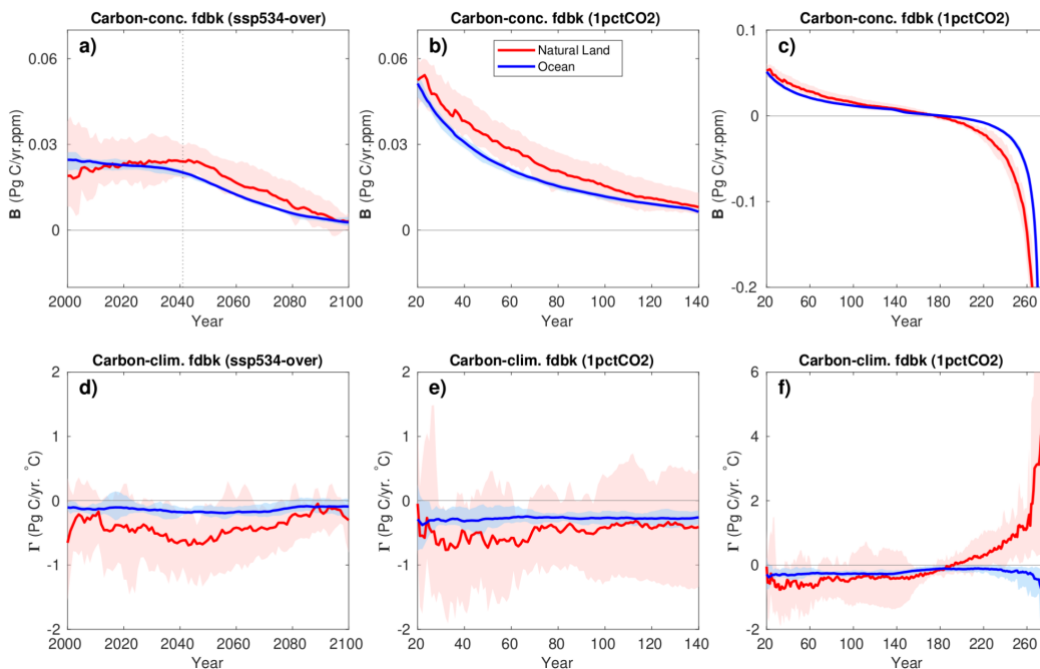

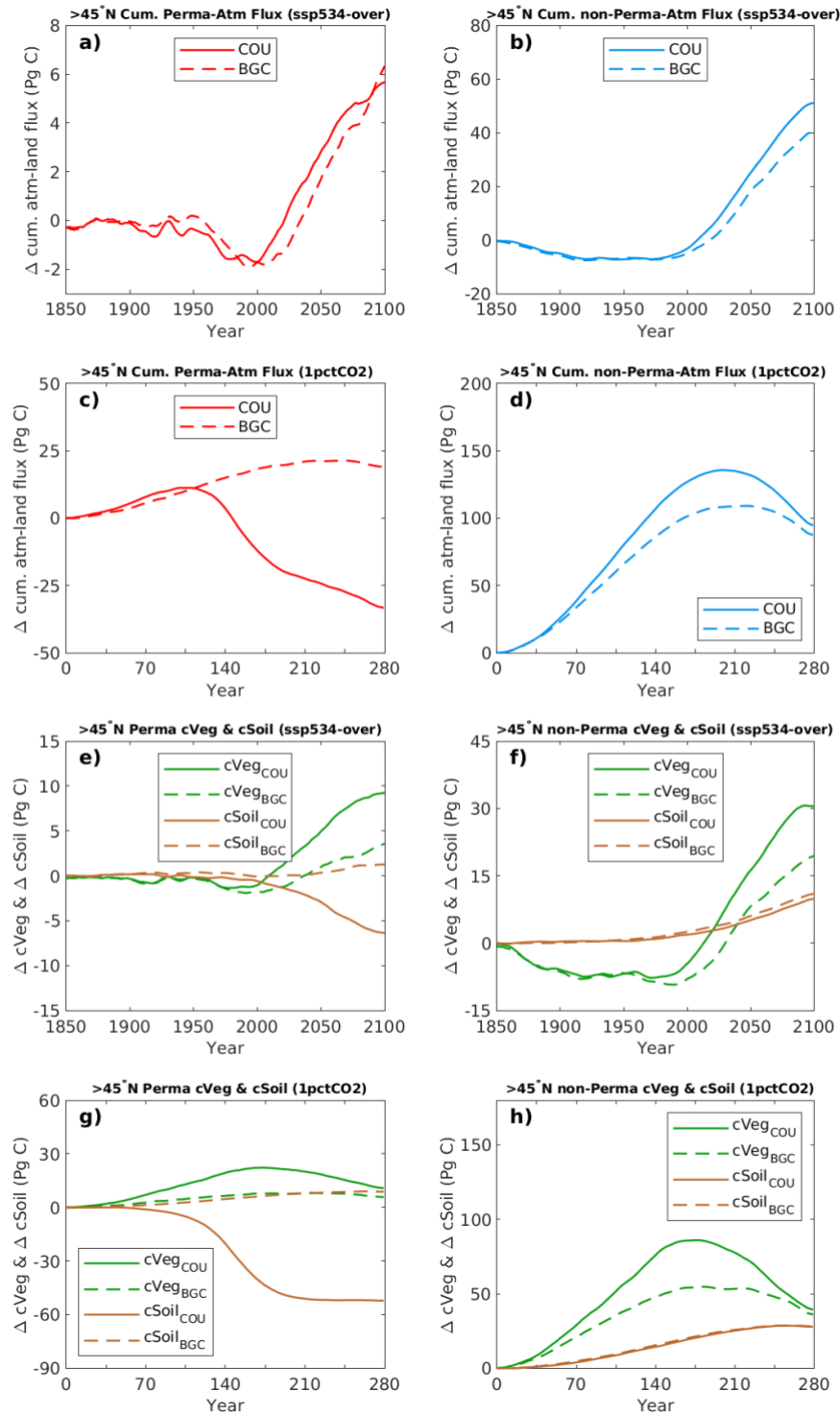**Figure S4:** same as Fig. 5 but for the instantaneous flux-based feedback metrics.

Figure S5: Annual time series of (a-d) the cumulative natural land-atmosphere carbon fluxes and (e-h) vegetation and soil carbon reservoirs over Northern Hemisphere high latitude natural permafrost and non-permafrost regions in the fully and biogeochemically coupled ssp534-over and 1pctCO$_2$ experiments using the NorESM model. An 11-year moving average has been used in all panels.
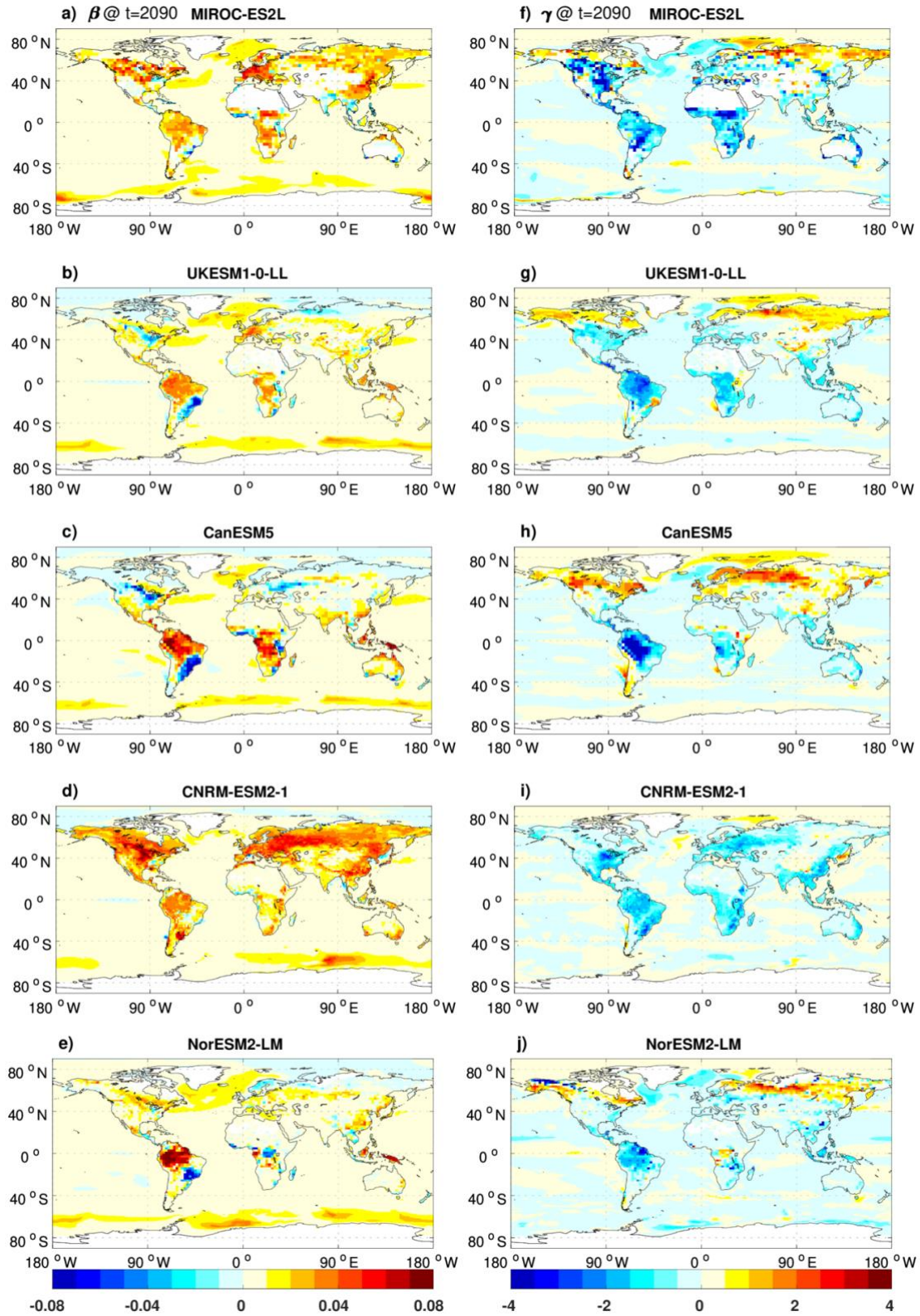
Figure S6: The spatial distribution of the integrated flux-based (a-e) carbon-concentration feedback (in kg C m^{-2} ppm^{-1}), and (f-j) carbon-climate feedback (in kg C m^{-2} °C^{-1}) at year 2090 on the decreasing side of the atmospheric CO_2 concentration in the ssp534-over simulation.
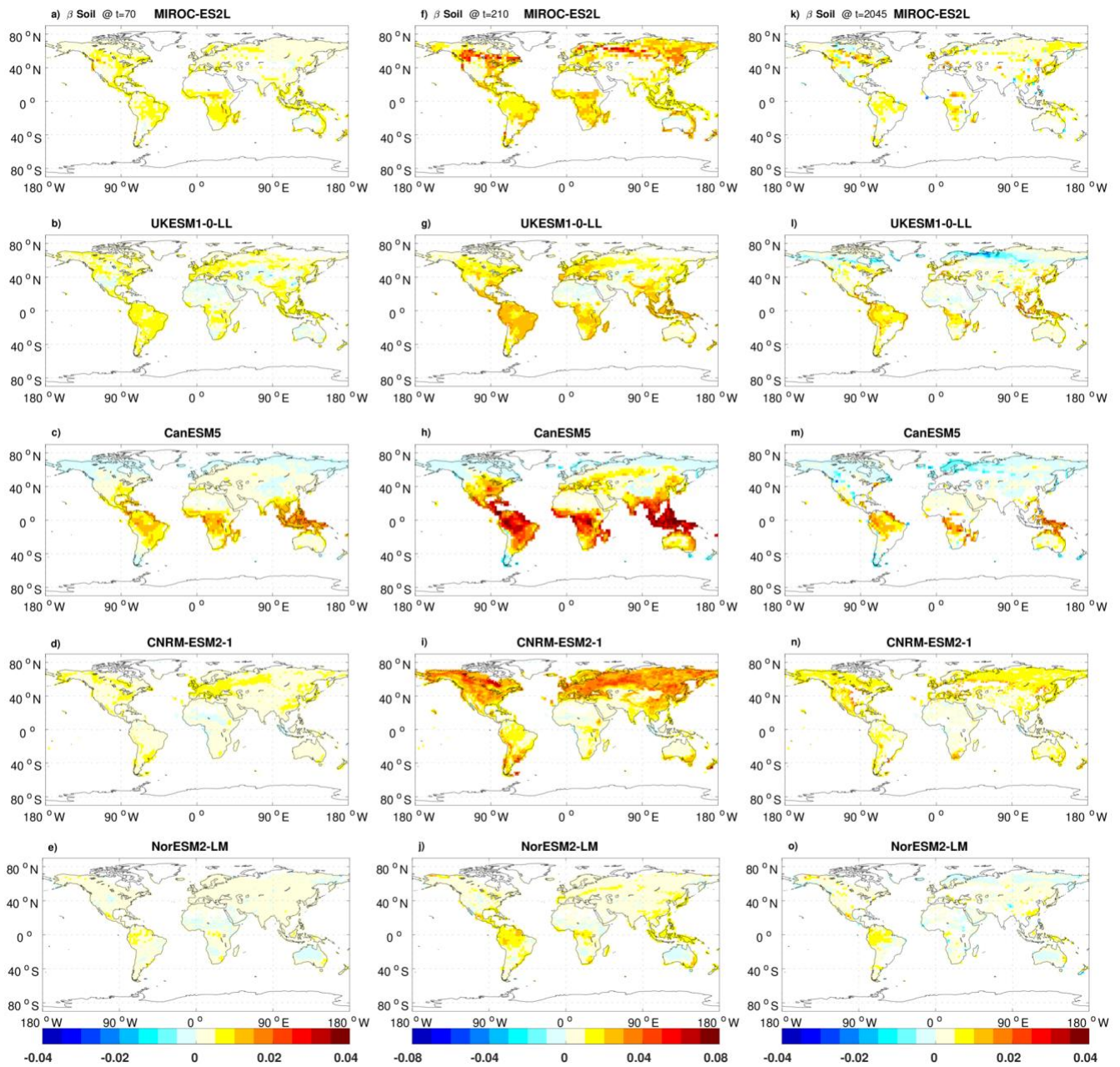
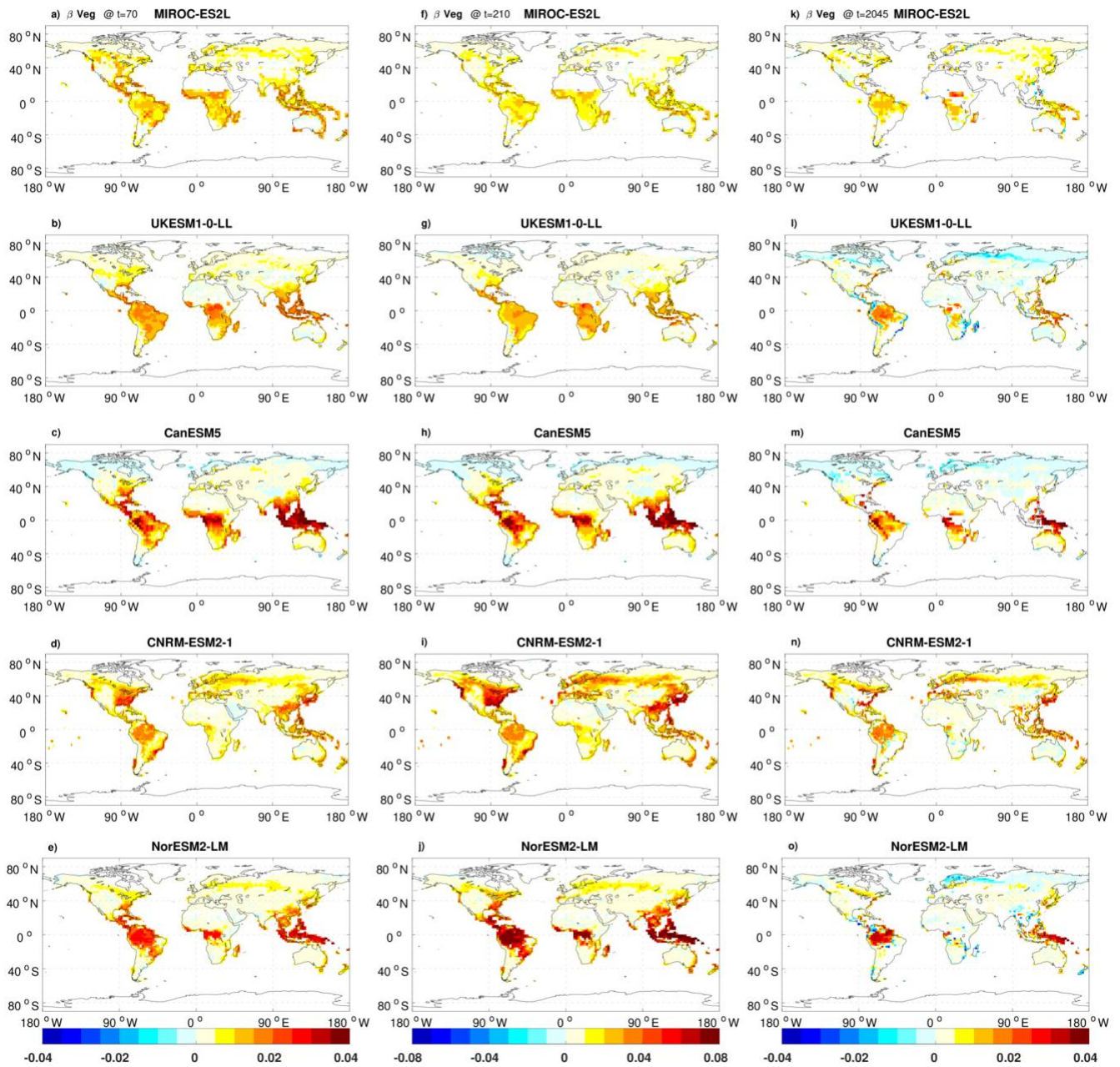**Figure S7:** same as Fig. 9 but using soil carbon pool instead of the cumulative atmosphere-land flux.

Figure S8: same as Fig. 9 but using vegetation carbon pool instead of the cumulative atmosphere-land flux.
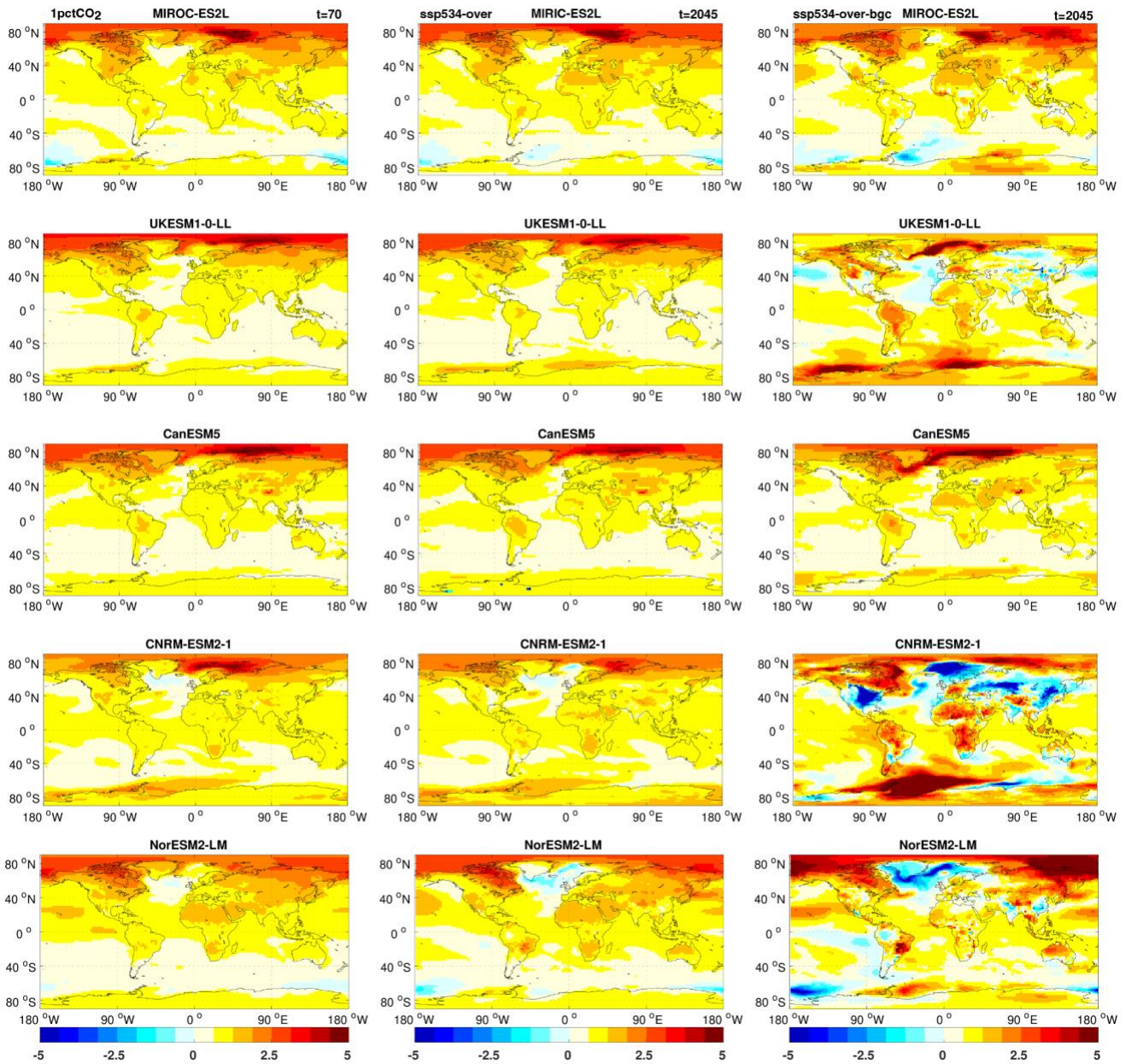
Figure S9: ΔT normalized by its global mean value for individual models. Temperature deviations are averaged over 21-year time intervals centered on the year 70 for the fully coupled 1pctCO$_2$ experiment and the year 2045 both for the fully and biogeochemically coupled versions of the ssp534-over scenario. The BGC version of the ssp534-over simulation represents non-CO$_2$ induced radiative forcing, along with the effects of land-use changes. The fully coupled 1pctCO$_2$ represents only CO$_2$ induced warming.
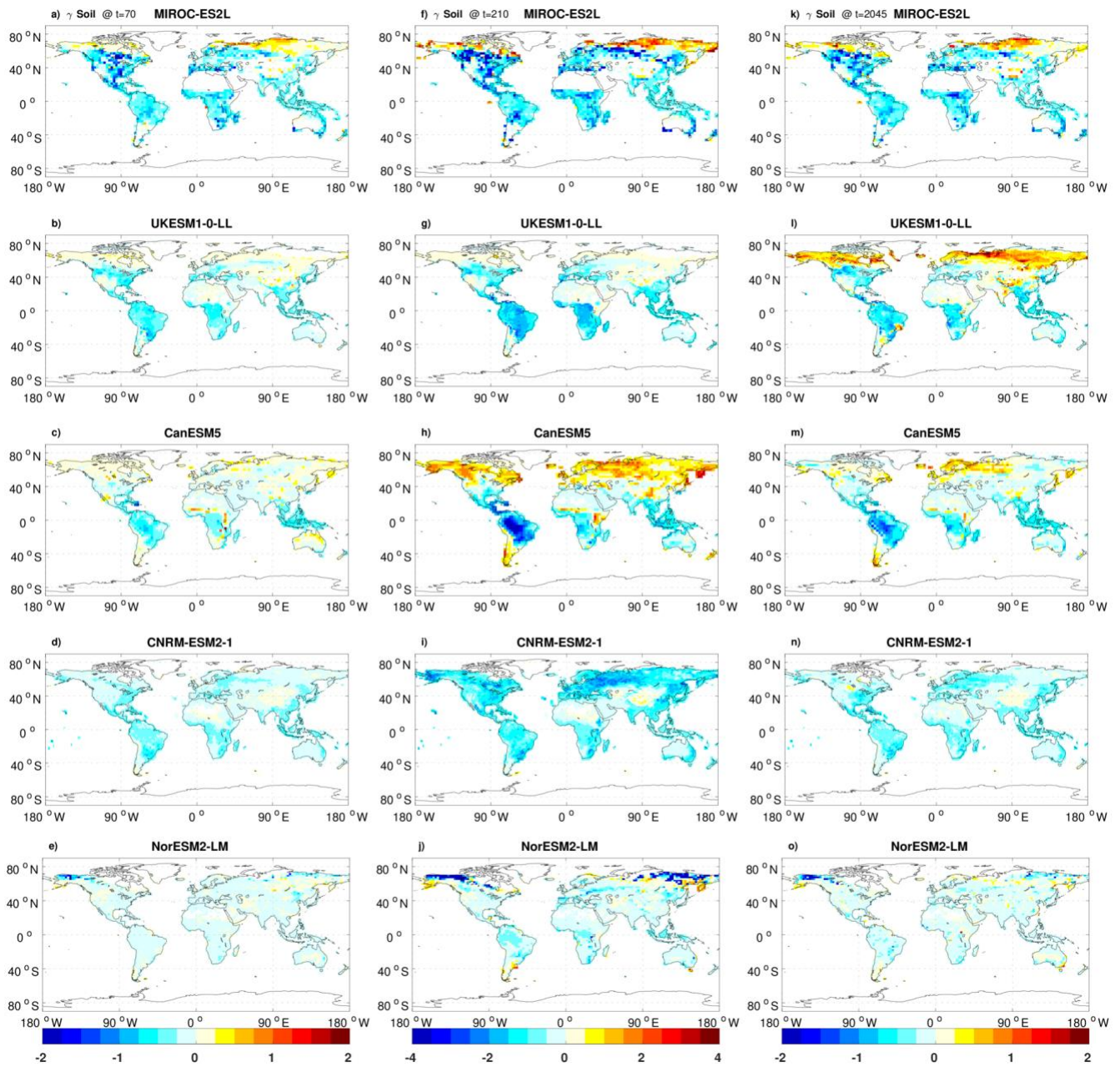
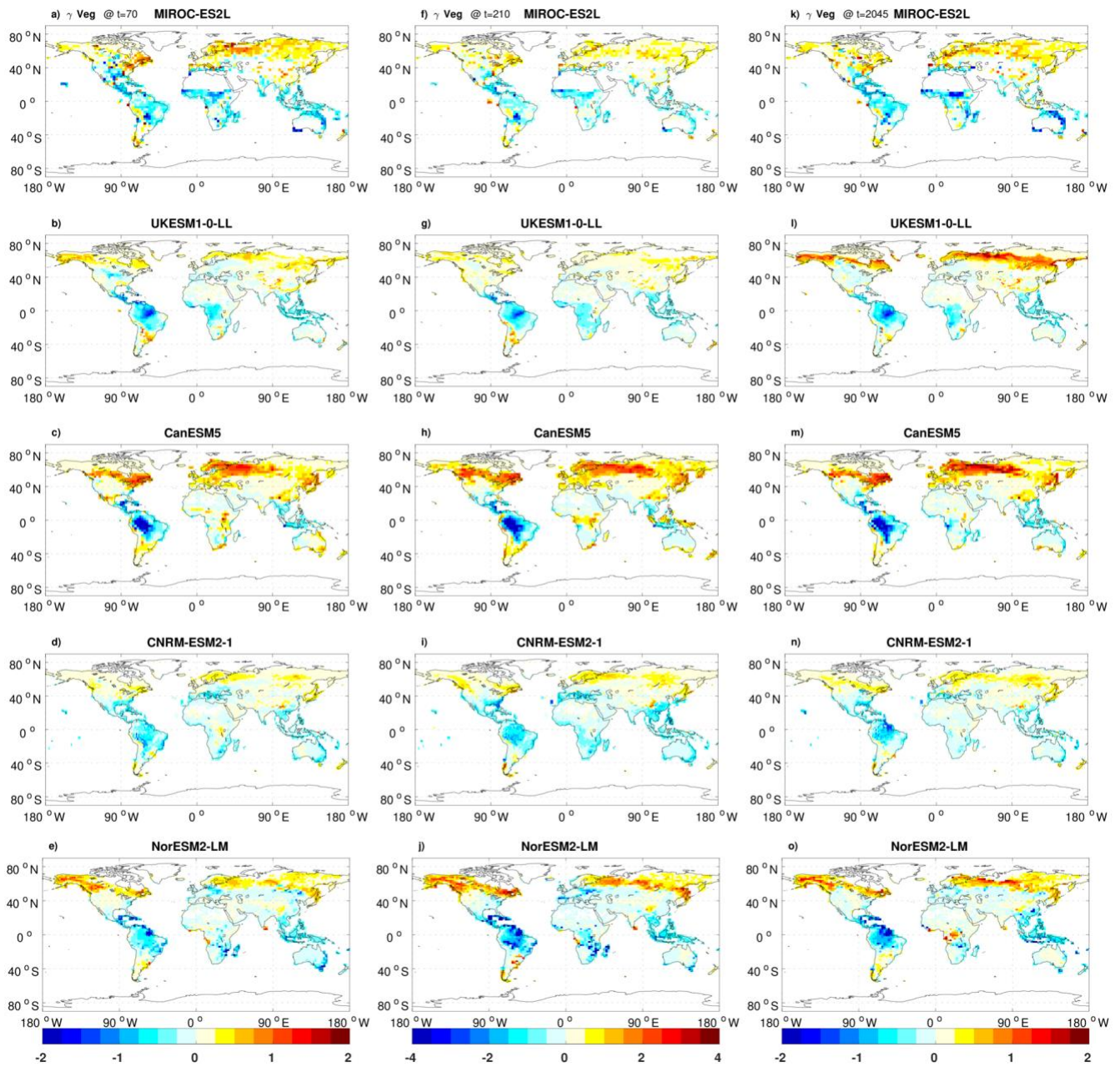**Figure S10:** same as Fig. 10 but using soil carbon pool instead of the cumulative atmosphere-land flux.

Figure S11: same as Fig. 10 but using vegetation carbon pool instead of the cumulative atmosphere-land flux.