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A spatial emergent constraint on the sensitivity of soil carbon turnover time to global warming

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Carbon cycle feedbacks represent large uncertainties on climate change projections, and the response
of soil carbon to climate change contributes the greatest uncertainty to this. Future changes in soil carbon depend on changes in litter and root inputs from plants, and especially on reductions in the
turnover time of soil carbon (τ_s) with warming. The latter represents the change in soil carbon due to the response of soil turnover time ($\Delta C_{s,\tau}$), and can be diagnosed from projections made with Earth System Models (ESMs). It is found to span a large range even at the Paris Agreement Target of 2°C global warming. We use the spatial variability of τ_s inferred from observations to obtain a constraint on $\Delta C_{s,\tau}$. This spatial emergent constraint allows us to greatly reduce the uncertainty in $\Delta C_{s,\tau}$ at 2°C global warming. We do likewise for other levels of global warming to derive a best estimate for the effective sensitivity of τ_s to global warming, and derive a q10 equivalent value for heterotrophic respiration.