



## **Scenario dependency of the transient climate response to cumulative emissions**

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The transient climate response to emissions (TCRE), in relating surface temperature changes to cumulative carbon emissions, provides a means of estimating carbon budgets from global warming benchmarks. Current Earth System Model results indicate that the TCRE is linear and scenario-independent. We explore the sensitivity of the TCRE to scenario and model parameter uncertainties using 8 configurations of the UVic Earth System Model of Intermediate Complexity, forced by 2 twenty-first-century emissions scenarios (RCP 4.5 and 8.5). We find that the TCRE is higher under RCP 4.5 than 8.5 by 0.3-0.8 K/1000 Pg C and shows opposing nonlinear tendencies in these scenarios: an increase of 0.15-0.5 K/1000 Pg C over RCP 4.5 and a decrease of 0-0.7 K/1000 Pg C over RCP 8.5. These differences are robust across model configurations with perturbed land and ocean parametrizations and are the result of the decreased efficiency of heat transport into the deep ocean under decelerating emissions.