Session: B11 Oral presentation

When is the permafrost carbon tipping point?

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The thaw and release of carbon currently frozen in permafrost will increase atmospheric CO2 concentrations and amplify surface warming to initiate a positive Permafrost Carbon Feedback (PCF) on climate. We use surface weather from three Global Climate Models based on the moderate warming, A1B Intergovernmental Panel on Climate Change emissions scenario and the SiBCASA land surface model to estimate the strength and timing of the PCF and associated uncertainty. By 2200, we predict a 29-59% decrease in permafrost area and a 53-97 cm increase in active layer thickness. By 2200, the PCF strength in terms of cumulative permafrost carbon flux to the atmosphere is 190±64 Gt C. This estimate may be low because it does not account for amplified surface warming due to the PCF itself and excludes some discontinuous permafrost regions where SiBCASA did not simulate permafrost. The PCF is strong enough to cancel 42-88% of the total global land sink. The permafrost carbon tipping point marking the start of the PCF will occur sometime between 2020 and 2030 when thawing permafrost changes the Arctic from a carbon sink to a source. The thaw and decay of permafrost carbon is irreversible and accounting for the PCF will require larger reductions in fossil fuel emissions to reach a target atmospheric CO2 concentration.