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Earth System Dynamics
Discussions

Interactive comment on "ESD Reviews: mechanisms, evidence, and impacts of climate tipping elements" *by* Seaver Wang and Zeke Hausfather

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Line 610 to 615 There is a relationship of methane oxidation to soil moisture content. Rate of production of methane from organic sources is unlikely to be temperature dependant as most kinetic equations including those used by IPCC are kinetically temperature independent (though the Winden et al, 2012 temperature observation may be related to the latent heat of fusion -melting of the ice/frost post winter in boreal bogs where there would be rapid boost in methane generation from the saturation of soil). The key factor is moisture content. Organic degradation produces equal molar quantities of methane and CO2 from about 40% moisture (The water saturation point of each

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molecule of the simplest sugar glucose). Below 40% soil moisture the methane arising is increasingly oxidised to CO2, probably in logarithmic equation of the form [CH4] = aln[H20] +c (This is one of my modelling equations used to estimate landfill emissions and represents the non-constant moisture variable in a Fick Laws(1855) adaptation – the precursor of modern kinetics models used by IPCC – the moisture becomes constant over the lifetime of the landfill). Below 10% moisture the almost all of the methane is converted to CO2 ([CH4}=0%] when [H2O]<=10%] as shown in landfilled waste decomposition by Hartz and Ham 1978 (supported by other papers in text). Increased atmospheric temperature in post melting scenario may represent an evapotranspiration process, increasing moisture evaporation from the soil, introducing air (oxygen) to surface soils and thus increasing but variable methane oxidation as noted in Popp et al 2000).

Hartz KE and Ham RK (1983) Moisture level and movement effects on methane production rates in landfill samples. Waste Management & Research 1: 139-145, https://journals.sagepub.com/doi/pdf/10.1177/0734242X8300100116

Fick A (1855) On liquid diffusion. Annalen der Physik und Chemie. 94: 59. Reprinted in: Fick A (1995) On liquid diffusion. Journal of Membrane Science 100: 33–38. doi:10.1016/0376-7388(94)00230-v

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