Is the current methane growth event comparable to a glacial/interglacial Termination event?

Euan Nisbet\textsuperscript{1}, Martin Manning\textsuperscript{2}, David Lowry\textsuperscript{1}, Rebecca Fisher\textsuperscript{1}, and James France\textsuperscript{1}

\textsuperscript{1}Royal Holloway, Univ. of London, Earth Science, Egham, United Kingdom of Great Britain – England, Scotland, Wales
(e.nisbet@rhul.ac.uk)

\textsuperscript{2}School of Geography Earth and Environment, Victoria Univ. of Wellington, New Zealand

Atmospheric methane shows very sharp growth since 2006. Growing evidence for methane's main sink, atmospheric OH, being relatively stable implies a major increase in methane emissions is occurring. Methane's synchronous isotopic shift to more negative $d^{13}\text{C}(\text{CH}_4)$ values means the increase is primarily driven by rapid growth in emissions from biogenic sources, such as natural wetlands and agriculture. Recent acceleration in the increase is also strong evidence that it is too large to be caused primarily by anthropogenic sources. Instead, much of the growth may come from large-scale climate-change feedbacks affecting the productivity and balance between methanogenic and methanotrophic processes in tropical and boreal wetlands. Emissions from tropical wetlands in particular may be larger and more influenced by climate shifts than hitherto realised. If so, even despite the Global Methane Pledge, achieving the goals of the UN Paris Agreement may be much harder than previously anticipated.

Modelling indicates that, for scale and speed, the biogenic feedback component of methane's growth and isotopic shift in the 16 years from 2006-2022 is comparable to (or greater than) phases of abrupt growth and isotopic shift during glacial/interglacial terminations, from Termination V (about 430 ka BP) to Termination I that initiated the Holocene. These were rapid global-scale climate shifts when the Earth system reorganised from cold glacial to warmer interglacial conditions. Methane's recent 2006-2022 growth in biogenic sources may be within Holocene variability, but it is also a possibility that methane may be providing the first indication that a very large-scale end-of-Holocene reorganisation of the climate system is already under way: Termination Zero.