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The changing global methane budget. NERC's MOYA, ZWAMPS and methane reduction projects, and the need for better tropical information and mitigation.

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The UK NERC MOYA Global Methane Budget consortium (2016-2020) tracks the changing methane burden, with time series measurement of methane and its isotopes at remote sites, field campaigns in the Arctic, Europe, and Tropics, and through modelling studies. The methane rise that began in 2007 and accelerated in 2014 has continued, as apparently has the isotopic shift to lighter, more C-12 rich values (Nisbet et al. 2019, GBC).

MOYA flight campaigns in S. America (Bolivian Amazonia) and Africa (including ZWAMPS, an aircraft campaign over Upper Congo wetlands around Lake Bangweulu, Zambia), have shown significant tropical emissions from wetlands, cattle and fires. Isotopic values of emissions from wetlands and cattle show strong C4 plant input. Fire is a major source, including biomass burning of seasonal C4 grassland and also of C3 leaf litter in wooded savanna. MOYA campaigns have also identified widespread and significant urban and rural air pollution in tropical Africa from crop waste and urban waste fires, including plastic burning.

MOYA's work has identified strong opportunities for reducing anthropogenic emissions, and highlights the need for better emissions quantification in tropical nations. Mitigation is feasible not only in northern nations, for example drastically cutting fossil fuel emissions, but also is urgently necessary in tropical nations, where much better inventory information is urgently needed. Natural sources such as wetlands are intractable to mitigation, and emissions are likely to increase, with climate warming feeding warming. Cost-effective low technology actions in tropical nations, such as covering landfills with soil, and reducing waste fires, would have significant impact on emissions. Emission reduction from landfills, sewage, and waste fires, especially around the rapidly growing tropical megacities would also bring significant health benefit by cutting air pollution.

Sharp near-future reductions in anthropogenic methane emissions are indeed possible (Nisbet et al. *Rev Geophys.* 2020), and are probably inexpensive compared to other ways of decarbonation, but cutting methane will need strong action, including determined effort from tropical nations.

