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Identifying sources of methane sampled in the Arctic using δ13C in CH4 and Lagrangian particle dispersion modelling.

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An airmass of enhanced methane was sampled during a research flight at ~600 m to ~2000 m altitude between the North coast of Norway and Svalbard on 21 July 2012. The largest source of methane in the summertime Arctic is wetland emissions. Did this enhancement in methane come from wetland emissions?

The airmass was identified through continuous methane measurements using a Los Gatos fast greenhouse gas analyser on board the UK's BAe-146 Atmospheric Research Aircraft (ARA) as part of the MAMM (Methane in the Arctic: Measurements and Modelling) campaign.

A Lagrangian particle dispersion model (the UK Met Office's NAME model) was run backwards to identify potential methane source regions. This was combined with a methane emission inventory to create "pseudo observations" to compare with the aircraft observations. This modelling was used to constrain the δ13C CH4 wetland source signature (where δ13C CH4 is the ratio of 13C to 12C in methane), resulting in a most likely signature of -73‰ (±4‰‰. The NAME back trajectories suggest a methane source region of north-western Russian wetlands, and -73‰ is consistent with in situ measurements of wetland methane at similar latitudes in Scandinavia. This analysis has allowed us to study emissions from remote regions for which we do not have in situ observations, giving us an extra tool in the determination of the isotopic source variation of global methane emissions.