Increasing Wetland Emissions of Methane from a Warmer Arctic: Do We See it Yet?

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Over the past several decades, the Arctic has experienced winter and spring warming that has accelerated during the 1990's. In addition to decreases in sea ice and snow cover, permafrost is also melting, especially in Russia and Alaska. Northern peatlands are thought to hold as much as 450 GtC, and the melting of permafrost has the potential to release significant amounts of methane, providing a positive feedback that will result in further warming. Using methane observations from the NOAA ESRL GMD Cooperative Air Sampling Network and the TM5 chemical transport model, we address the issues of whether Arctic methane emissions have already begun to increase, and whether the current air-sampling network is suitable for the detection of future changes. In particular, we consider changes in the inter-polar difference, CH_4 growth rates, and the seasonal cycle. Our results imply that no significant increase in Northern wetland emissions have occurred yet; however, simulations using a simple model of the temperature dependence of wetland emissions suggest that plausible increases in emissions will be readily observable with the air sampling network. We also investigate the network's ability to attribute changes in atmospheric methane to various anthropogenic and natural sources using optimal detection methods and projections of methane emission increases over the next half-century.

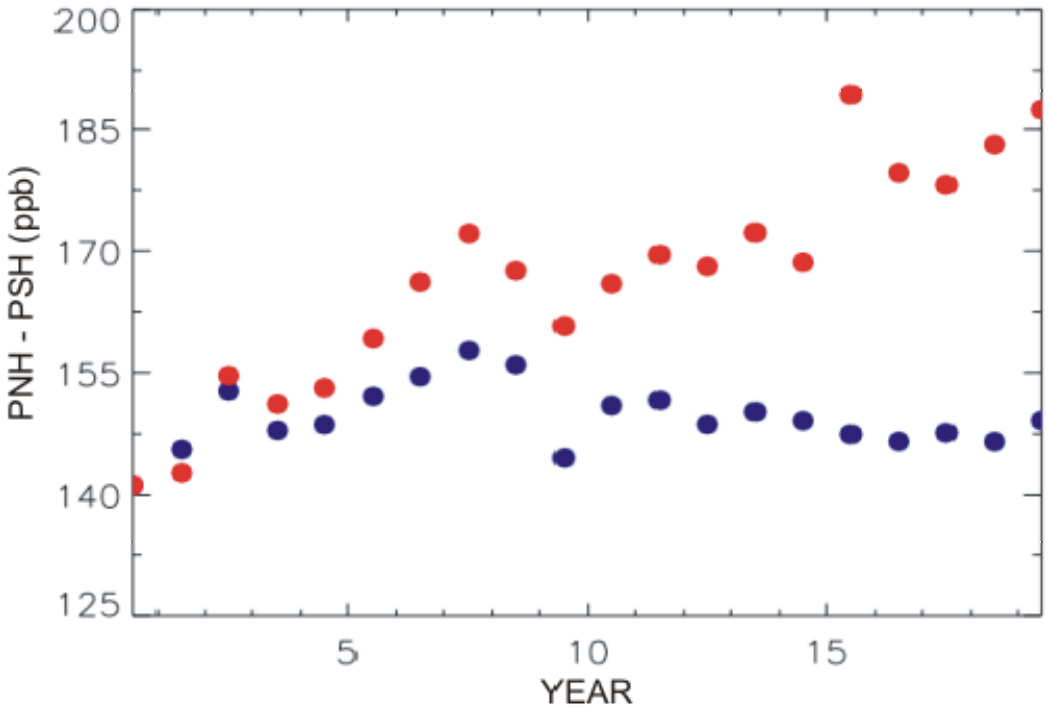

Figure 1. The predicted inter-polar CH_4 difference (polar northern hemisphere – polar southern hemisphere) calculated with (red) and without (blue) increasing emissions from warming Arctic wetlands.