No Significant Increase in Long-term CH_4 Emissions on North Slope of Alaska Despite Significant Increase in Air Temperature

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Continuous measurements of atmospheric methane (CH_4) mole fractions measured by NOAA's Global Greenhouse Gas Reference Network in Barrow, AK (BRW), show strong enhancements above background values when winds come from the land sector from July through December, indicating that emissions from arctic tundra continue through autumn and into early winter. Twenty-nine years of measurements show little change in seasonal mean land-sector CH_4 enhancements, despite an increase in annual mean temperatures of 1.2±0.8°C/decade (2s). The record does reveal small increases in CH_4 enhancements in November and December after 2010 due to increased late-season emissions. The lack of significant long-term trends suggests more complex biogeochemical processes are counteracting the observed short-term (monthly) temperature sensitivity of 5.0±3.6 ppb CH_4/°C. Our results suggest that even the observed short-term temperature sensitivity from the Arctic will have little impact on the global atmospheric CH_4 budget in the long-term if future trajectories evolve with the same temperature sensitivity.

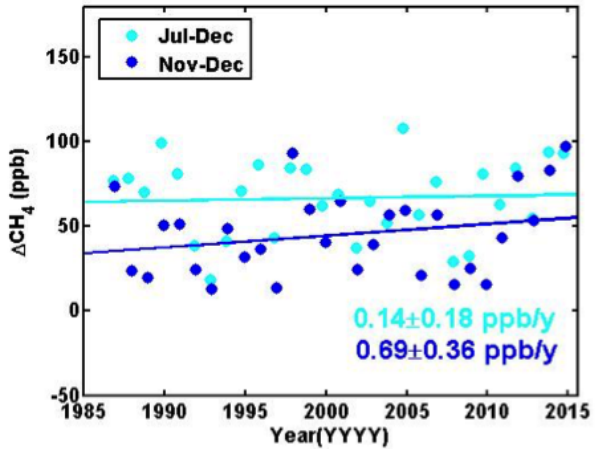

Figure 1. Trends in CH_4 enhancements and surface temperature from the North Slope 1986-2014. **Left)** Land sector CH_4 enhancements, July – December (cyan) and November - December (blue) during >3 m/s wind events coming between 150° and 210°.

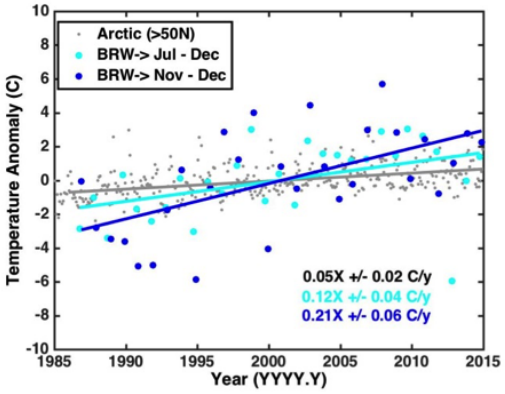

Figure 2. Air temperature anomalies, relative to the time series mean, at BRW and the entire Arctic. Grey points are monthly anomalies in Arctic (>50°N) temperature from the GISS Surface Temperature Analysis (GISTEMP, http://www.esrl.noaa.gov/psd/data/gridded/data.gistemp.html). Cyan and blue points show surface air temperature anomalies at 2 m made at the BRW tower for 1986-2014, July – December and November – December, respectively.