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Quantification of methane emissions from anthropogenic sources: A case study in Canada

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Anthropogenic methane emissions are generated in several economic sectors, including agriculture, waste management, oil and gas production, and others. Canada is one of the world's largest oil and gas producers, ranks in the top-25 for agricultural production, and is the world's largest waste producer per capita. As a result, the methane emission potential is high in parts of Canada where all these activities co-occur. To quantify emissions from multiple co-located sectors, we conducted a case study in Grande Prairie, a small city in Canada's west dominated by oil and gas production and agriculture. Our goal in this study was to produce a gridded dataset of emissions for the Grande Prairie region. In November 2021, we measured atmospheric mixing ratios of methane using a high-precision gas analyzer mounted in a truck, and estimated emission rates using an inverse Gaussian plume model. During our campaigns, we passed downwind of roughly 220 oil and gas sites and 20 farms with grazing cattle or bison present. We detected emissions at about one-quarter of the oil and gas sites and one-third of the farms, and we also observed emissions from waste management and power generation facilities. Methane emissions from oil and gas production sites were relatively low compared to others we have measured in Canada, but despite this we still found that oil and gas was the dominant methane-emitting sector in the Grande Prairie region. The results of this study feed into a long-term methane monitoring study, focused on multiple economic sectors, methane source types, and detection approaches.