Reducing uncertainty in methane emission estimates from permafrost environments

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Depending on factors including temperature, snow duration and soil moisture conditions, emissions of the greenhouse gas methane from permafrost wetlands can vary by factors of 2-4 between years. This variability is clear in atmospheric measurements of the gas, but a lack of ground-based data is making it hard to locate the methane sources responsible. Methane monitoring in the Arctic is expensive, requiring sophisticated analysis equipment such as power requiring laser spectrometer analysis made in remote places. This also puts demands on the logistics where infrastructures and field stations that offer line-power in the field are in high demand but very rarely found. Research projects therefore typically focus on one site, and run for a year or two. Longer term monitoring programs, which document climate, hydrology, phenology and population dynamics of birds and mammals, rarely include carbon fluxes since it is technically challenging to measure. One that does is the Greenland Ecosystem Monitoring program that started at the Zackenberg research station, which has recorded substantial methane flux variations for almost a decade in North-east Greenland. Such multi-year studies show that, while there is some connection between the amounts of methane released from one year to the next, accurate forecasting is difficult. They also highlight the importance of extending monitoring beyond the growing period into the frozen season, both in spring and autumn. A spatially distributed network of long-term monitoring stations in the Arctic, with consistency between measurements, is badly needed to improve this situation. Productive methane ‘hot spots’, many sporadic, have also been identified in recent studies. By ventilating surface waters, storms trigger emissions in the East Siberian Sea Shelf. Shallow lakes formed when permafrost thaws can belch methane from decomposing old organic deposits, of which there are huge

amounts in the Arctic. All of these potentially important emissions are of a scale that still is in need of being reconciled with the atmospheric record. This presentation will give an overview of findings in relation to hot-spot emissions and will partly be based on a recent Expert Assessment on Arctic methane by the Arctic Monitoring and Assessment Program.