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Possible changes in atmospheric chemistry due to increased methane fluxes in a future climate

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24 % of the land in the Northern Hemisphere is covered by permafrost. Permafrost is defined as an area where the soil temperature is below 0 degrees Celsius for 2 consecutive years or more. These areas are for a large part found north of 45 degrees. It is well established that a future warming will be greatest at high latitudes threatening the prevalence of permafrost. If the conditions are right, one of the consequences of this will be an increased methane emission from high northern latitudes. Besides being a potent greenhouse gas, methane starts a chain of reactions leading to ozone formation in the troposphere. Tropospheric methane mainly affects the background concentration of ozone, and not the episodes with high ozone levels that mostly are discussed in relation to human health. However, one could speculate that a higher background level of ozone might lead to increased amounts of incidents where ozone concentrations are in compliance with regulations, and hence hazardous to human health.

The Danish Eulerian Hemispheric Model (DEHM) - a long range chemical transport model is used for this study. As meteorological input for present day simulations the MM5 model is applied. The coupled atmosphere-oceans general circulations model ECHAM4-OPYC3 covering the northern hemisphere is used for future scenarios. A new addition to the DEHM system is the implementation of natural methane emissions from peatlands. These natural methane emissions are generated by the LPJ-WHyMe model both for present day conditions and for a future climate scenario. The many possible combinations of the model setup contribute to a sensitivity study that should give an answer to whether future increases in natural methane fluxes have an effect on background ozone concentration. An interesting aspect of this is, to examine if initiatives taken to decrease ozone formations from anthropogenic emissions, might be counteracted by increased natural methane emission.