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Biogenic NO production and consumption in natural and cultivated soils from a cold desert in northwest China

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Nitrogen oxides (NOx = NO+NO2) contribute substantially to the oxidative capacity of the troposphere by the catalytic behaviour of NOx in the photochemical formation of ozone (O3). NO is a precursor in the formation of tropospheric ozone which can directly impact public health and the environment. Biogenic production in the soil is an important source for NO; however the contribution from arid and semi-arid ecosystems is not quantified yet.

In our study we used a laboratory incubation technique to determine production and consumption rates of NO in soil samples, which have been taken from a natural Gobi desert site and from an nearby cultivated site in the extreme arid Tohsun depression of Northwest China. Both soil sampling sites are located in the extreme dry climatic region of China (annual mean temperature 14.2°C, annual main precipitation 7 mm).

We will report on NO production and consumption rates in the soil samples, as well as their dependence on soil moisture and soil temperature at a natural desert ecosystem site and which different when this ecosystem was cultivated. The NO production rate and consumption rate constant k in soils is dependent on soil temperature and soil water content, reported as gravimetric soil moisture. With regard to soil moisture, the NO production rates in both, the natural and the cultivated desert soil, follow an optimum curve. Maximum values (in terms of mass of N) are 2.05 ng kg/s and 1.21 ng kg/s at gravimetric soil moistures of 0.11 and 0.23 in natural and cultivated desert soil, respectively. The NO consumption rate in both soils decreases with soil moisture and increases with soil temperature.

Based on (a) our laboratory deduced parameterizations of NO production and consumption rates and (b) monitoring (long-term) data of soil moisture and temperature from the cold deserts of the Xinjiang we will give a first estimate of the seasonal and annual contributions to global biogenic NO emissions from the extreme cold deserts of northwest China.