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The influence of soil moisture and temperature on the flux of nitric oxide from natural ecosystems

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Nitric oxide (NO) is an important compound in a number of environmental processes, such as controlling the concentrations of ozone and the hydroxyl radical in the troposphere, and in the production of nitric acid, an important component of acid precipitation. The total emissions of NO are thought to have more than tripled since the beginning of the industrial revolution. While most of this increase is due to anthropogenic activity, the biogenic production of NO from soils is known to be an important source of this gas, accounting for between 10% and 20% of the global total. The importance of soil moisture and temperature in controlling the emission of NO from the soil has long been recognised, however the exact form of this interaction is still under discussion, since it is often difficult to control these variables in field experiments. Our laboratory measurement technique, where the release of NO against the soil moisture content can be monitored and where the incubation temperature can be controlled, provides a unique opportunity to elucidate some of these relationships. Laboratory measurement of the NO emission were conducted on soils sampled from a wide range of different ecosystems, including: (1) temperate European pasture and forest, (2) semi-arid Central Asian steppe and cold desert, (3) hot desert from the Namib and Sahara, (4) arid and semi-arid savanna from southern Africa,(5) Mediterranean ecosystems from Israel, (6) tropical forest soils from Brazil and Surinam, and (7) wetland and

grassland soils from eastern China. The NO emission patterns, in relation to the soil moisture content, from all these ecosystems display a consistent pattern that can be described by a power increase in the emission until an optimal soil moisture content is reached, followed by an exponential decrease as the soil moisture content exceeds the optimum. The optimum soil moisture content for the emission of NO differs between ecosystems, such that it is lower in arid ecosystems than more mesic systems. The emission of NO shows an exponential relationship with temperature up to an optimum higher than which the release of NO decreases. This presentation will discuss the effects of soil moisture and temperature on the release of NO from seven different climatic regions world wide, the implications for further up-scaling and modelling work will be discussed.