Geophysical Research Abstracts
Vol. 19, EGU2017-19089-1, 2017
EGU General Assembly 2017

Towards the understanding of biogeochemical processes involved in the release of carbonyl sulfide (COS) from soil

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Carbonyl sulfide (COS) is present in the atmosphere in low mixing ratio (∼500ppt). It is relevant in climate change through the effect in aerosol formation. Soils can act as source of COS, e.g. by microbial degradation of thiocyanate from plant material. On the other side it is known that COS can be consumed via various enzymatic pathways. Assuming that biogenic processes dominate over chemical reactions we extracted nucleic acids and performed amplicon sequencing for bacteria (16S rRNA) and fungi (ITS region) from a mid-latitude agricultural maize soil which was previously incubated under ambient COS and COS fumigation (∼1000ppt). The mixing ratios of COS have been measured online from soil samples in a dynamic chamber system under laboratory conditions by an integrated cavity output spectroscopy (IOCS) analyzer (Los Gatos Research Inc., USA). Additionally stable carbon isotope values (δ13C values) of COS were measured using a pre-concentration method and stable isotope ratio mass spectrometry (IRMS). Under low COS mixing ratio (∼50ppt) δ13C +4.7 ‰ for spruce forest (∼23°C), and -24.4‰ for mid-latitude cornfield (∼22°C), respectively. Linking gas release rates of (COS, CO_2, CO, NO) to isotopic signatures of COS and molecular results might allow us to indicate bacterial s-compound degradation related to the higher activity of β-Proteobacteria and of the family Acetobacteraceae from the α-Proteobacteria phylum, potentially involved with the hydrolysis of thiocyanate in the soil releasing COS. Furthermore, our study reports the first COS data for rainforest and desert soils which are in the order of 0.5 pmol gdw-1 h-1 and 2 pmol gdw-1 h-1, respectively.