

### 3.006 Strong sesquiterpene emissions from Amazonian soils as product of microbial activity.

Presenting Author:

**Efstathios Bourtsoukidis**, Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128, Mainz, Germany., [e.bourtsoukidis@mpic.de](mailto:e.bourtsoukidis@mpic.de)

Co-Authors:

**Thomas Behrendt**, Max Planck Institute for Biogeochemistry, Hans-Knöll-Straße 10, 07745, Jena, Germany.

**Ana Maria Yañez-Serrano**, University of Freiburg, Georges-Köhler-Allee 53, 79110, Freiburg, Germany.

**Heidi Hellén**, Finnish Meteorological Institute, Erik Palménin aukio 1, FI-00560 Helsinki, Finland.

**Efstathios Diamantopoulos**, University of Copenhagen, Department of Plant and Environmental Science, Thorvaldsensvej 40, 1871, Frederiksberg C, Copenhagen, Denmark.

**Elisa Catão**, Max Planck Institute for Biogeochemistry, Hans-Knöll-Straße 10, 07745, Jena, Germany.

**Kirsti Ashworth**, Lancaster Environment Centre, Lancaster University, Lancaster LA1 4YQ, UK.

**Andrea Pozzer**, Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128, Mainz, Germany.

**Carlos Alberto Quesada**, National Institute of Amazonian Research, Av. André Araújo, 2936 - Petrópolis, Manaus - AM, 69067- 375, Brazil.

**Demétrius Martins**, Imperial College London, London SW7 2AZ, United Kingdom.

**Marta Sá**, National Institute of Amazonian Research, Av. André Araújo, 2936 - Petrópolis, Manaus - AM, 69067- 375, Brazil.

**Alessandro Araújo**, National Institute of Amazonian Research, Av. André Araújo, 2936 - Petrópolis, Manaus - AM, 69067- 375, Brazil.

**Joel Brito**, Laboratory of Atmospheric Physics (LaMP), University Blaise Pascal, Clermont-Ferrand, France.

**Paulo Artaxo**, University of Sao Paulo, Rua do Matão, Travessa R, 187, CEP 05508-900, São Paulo, SP, Brasil.

**Jürgen Kesselmeier**, Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128, Mainz, Germany.

**Jos Lelieveld**, Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128, Mainz, Germany.

**Jonathan Williams**, Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128, Mainz, Germany.

## Abstract:

The Amazon rainforest is the world's largest source of reactive volatile isoprenoids to the atmosphere. It is generally assumed that these emissions are products of photosynthetically driven secondary metabolism and released from the rainforest canopy from where they influence the oxidative capacity through reaction with hydroxyl radicals (OH) and ozone (O<sub>3</sub>). However, recent volatile organic compound (VOC) budgeting experiments (based on OH reactivity) show that further important sources remain to be discovered. Here we show that soil microorganisms are a strong, unaccounted source of highly reactive and previously unreported sesquiterpenes (C<sub>15</sub>H<sub>24</sub>; SQT). The emission rate and chemical speciation of soil SQTs were determined as a function of water and oxygen in the laboratory from soil samples. Based on these results a model was developed to predict soil-atmosphere SQT fluxes. Simulated results compared closely with SQT flux measurements in the field, so a two-year period (2014-2015) was modelled based on in-situ rainfall and soil moisture measurements. It was found that SQT emissions from a *Terra Firme* soil in the dry season were in comparable magnitude to current global model canopy emissions and that soil emissions dominated O<sub>3</sub> reactivity on the forest floor. SQT release and microbial activity were shown to be linked through 16S- and 18S-rRNA transcript abundances as a function of moisture in soils from a long-term forest fire experiment. Natural forest soil produces reproducible, strong emissions of SQTs, accompanied with a simultaneous increase in 16S-rRNA transcripts. In contrast, the burned forest soil generates minor SQT emissions accompanied by reduced microbial activity, establishing an important ecological connection between soil microbes and atmospherically relevant SQTs.