



## **Stress-specific emission of biogenic volatile organic compounds in response to extreme heat, moderate drought and mortality in *Pinus halepensis* seedlings.**

Benjamin Birami (1), Ines Bamberger (2), Rüdiger Grote (1), Almut Arneth (1), and Nadine Ruehr (1)

(1) Karlsruhe Institute of Technology KIT, Institute of Meteorology and Climate Research – Atmospheric Environmental Research, 82467 Garmisch-Partenkirchen, Germany (benjamin.birami@kit.edu), (2) University of Freiburg, Institute of Forest Science – Ecosystemphysiology, 79110 Freiburg, Germany

Pine trees are among the plant species with highest biogenic volatile organic compound (BVOC) emission rates. In particular monoterpenes and, in certain pine species, acetone emissions have been shown to make up for the majority of BVOC fluxes. BVOCs are involved in ozone formation, methane degradation and cloud nucleation. Due to their impact on air chemistry and –quality they are thus important for human health. Furthermore, understanding emission patterns can aid to interpret plant metabolic changes during exposition of different stressor types.

In this study, we want to show, (i) the emission response of different BVOC groups to extreme heat and moderate drought, and (ii) reveal mortality-specific BVOC emissions, during seedling mortality. One-year-old *Pinus halepensis* seedlings were grown under controlled conditions in a greenhouse facility. Two 4-day heatwaves (with max air temperature of 43°C) were applied to seedlings under well-watered (heat treatment) and drought conditions (heat-drought treatment), while the control and drought treatment seedlings were kept under ambient temperature conditions. Shoot gas exchange and emissions of BVOCs were continuously monitored using automatically operating chambers (n=4 per treatment). BVOC emissions were quantified with online PTR mass spectrometry.

Our results indicate stress-specific BVOC emission patterns. For instance, we found high monoterpene and methanol fluxes, strongly correlating with temperature but not with stomatal conductance. Acetone emission was correlated with soil water content, while methyl-salicylate and hexenal emission increased during severe stress and with heatwave exposure time. Considering mortality which occurred in some seedlings in the heat and heat-drought treatment, hexenal emissions appeared correlated with lethal stress and monoterpene emissions remained slightly higher in dying seedlings after the heatwaves had ended.

However, even though increased hexenal emissions, we did not find clear connections between BVOC emission and death of the seedlings in the heat and heat-drought treatment. In summary we could show certain stress-specificity of BVOC emissions: High emissions of methanol, methyl-salicylate and monoterpenes occurred under heat stress, while a decrease in acetone emissions was found under drought and lethal stress was accompanied by large hexenal emissions. This confirms that BVOC emission rates are highly stress sensitive and differ largely between type of stress and stress severity.