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BVOC emission in Norway spruce: the effect of stand structure, high temperature and ozone levels.

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Norway spruce (Picea abies L.) is a widely distributed conifer species in the boreal zone and mountain areas of central Europe and is a moderate emitter of volatile organic compounds (BVOC). Although the vaporization and diffusion processes from resin ducts were generally considered to be the main processes for monoterpene emissions in conifers, recently it has been showed that a significant portion (up to one third) of monoterpene emissions of Norway spruce can originate from novel biosynthesis, thus depending on photosynthetic processes. For this reason, both biosynthesis and emission are strongly influenced by the environment and the stand structure. They increase with both increasing light and temperature during the warmer periods, although those are the periods with the higher ozone concentration that usually act as an inhibitor of both assimilation and isoprenoids synthesis and emission. On the other hand, stand structure can play an important role, because the photosynthetic capacity is influenced by temperature and light conditions through the canopy. In order to assess the effects of stand structure, temperature and ozone on isoprenoids emission of Norway spruce we carried out field and laboratory experiments. In the experimental field campaigns we measured: assimilation and BVOC emission from needles of sun and shade layers within the canopy of the spruce forest present at the Bily Kriz experimental research site (Moravian-Silesian Beskydy Mountains, 49° 33' N, 18° 32' E, NE of Czech Republic, 908 m a.s.l.). Moreover in the same layers we measured continuously concentration of BVOCs in the air using a PTR-TOF-MS. In laboratory we analyzed the effects of short-term exposure to high temperature and high ozone concentrations on branches of spruce trees collected at the Bily Kriz experimental research site. Preliminary results show that in Norway spruce both stand structure and environmental conditions influenced the gas exchange and BVOC emission rates. The exposure to high temperature and the position of the needles at the sun layer positively affect the BVOC emission, while the short-term exposure to high ozone concentration did not significantly affect BVOC emissions. The study contributes to increase our understanding about the environmental and structural controls of BVOC emission in response to both tropospheric ozone and global changes.