



## **A deeper look at the response of oxygenated and non oxygenated VOC to mid-term drought over the seasonal cycle: the case study of a drought-resistant species**

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At the end of this century, climatic models plan an intensification of summer drought in the Mediterranean area due to a 30% rain reduction and a temperature rise of 3.4 °C. Plants respond to drought by modifying their primary (growth) and their secondary metabolism, the later being partly represented by volatile organic compound (VOC) emissions, such as terpenes. With drought, oxygenated and non oxygenated terpene emissions have been observed to increase, decrease or remain unchanged according to drought severity and vegetal model. By contrast, the response of non-terpenic oxygenated compounds to drought has been poorly studied. The aim of this study is to determine the potential impact of a two-year drought period on the full screen of VOC released by *Q. pubescens*, with a focus on both isoprene and methanol, issued from plant anabolism, and the numerous highly volatile oxygenated VOC, issued from plant catabolism (i.e. issued from oxidation of isoprene or methanol).

A 70 years-old Downy oak forest (*Quercus pubescens*), highly resistant to drought stress, was selected as model ecosystem since it is well widespread in Southern France occupying 321 000 ha. Downy oak also represents the major source of isoprene emissions in the Mediterranean area and, unlike the other major *Quercus* sp. of the region (i.e. *Quercus ilex*, a monoterpene emitter) the impact of watering withholding over years has never been tackled. The study was performed at the experimental platform of O<sub>3</sub>HP (Oak Observatory at Observatoire de Haute Provence) in Southern France which is equipped with both a rain exclusion (by 30 %) and a rain addition structure (simulating the rainiest years of the region), allowing for comparison with naturally watered trees. Using dynamic enclosure chambers at the branch level and PTR-MS-Q-ToF, we screened the anabolic VOC (isoprene, methanol) and the catabolic VOC (e.g. methacrolein, methyl vinyl ketone, C<sub>6</sub> aldehydes and carboxylic acids) of trees located under the three watering treatments during the three seasons of the vegetation period (spring, summer and autumn). Concomitantly, water stress was characterized by monitoring the ecophysiological plant parameters such as predawn leaf water potential, photosynthesis, stomatal conductance as well as VOC<sub>anabolic</sub>/VOC<sub>catabolic</sub> ratios indicators of oxidation within the cell.

Differences among the three watering treatments were slight or absent depending on the season and the compound. This response was attributed to Downy Oak resistance to rain exclusion as reflected by the maintenance of the photosynthetic machinery activity and leaf water levels.