



Exploring the driving factors of the triple oxygen isotope composition of water at the soil/plant/atmosphere interface in climate chamber

Clement Outrequin (1), Anne Alexandre (1), Christine Vallet-Coulomb (1), Amaelle Landais (2), Clement Piel (3), Sebastien Devidal (3), Martine Couapel (1), Corinne Sonzogni (1), Frederic Prie (2), and Monique Pierre (2)
(1) Aix Marseille University, CNRS, IRD, INRA, Coll France, CEREGE, Aix-en-Provence, France, (2) Laboratoire des Sciences du Climat et de l'Environnement (LSCE/IPSL/CEA/CNRS/UVSQ), Gif-sur-Yvette, France, (3) Ecotron Européen de Montpellier, UPS 3248, Centre National de la Recherche Scientifique (CNRS), Campus Baillarguet, Montferrier-sur-Lez, France

Atmospheric continental relative humidity is an important climate parameter poorly constrained in global climate models. A model-data comparison approach, applicable beyond the instrumental period, is essential to progress on this issue. However, there is a lack of proxies allowing quantitative reconstruction of past continental relative humidity.

Phytoliths are micrometric amorphous silica particles that form continuously in living plants, and their morphological assemblages recovered from soils and sediments are commonly used as past vegetation indicators. In addition, they precipitate in isotope equilibrium with the plant water, which offers the opportunity of reconstructing leaf water isotope composition. Recently, an experiment in climate chamber demonstrated that relative humidity is a major control on the triple oxygen isotope composition of grass leaf water and phytoliths. However, in order to assess the accuracy of the triple oxygen isotope composition of phytoliths as a humidity proxy, a quantitative understanding of fractionation processes at play in water, at the soil-plant-atmosphere interface, is required. For that purpose, there is a need of direct and continuous measurements of the triple oxygen isotope composition of the atmospheric water vapor surrounding the leaves, a key factor of the isotope ^{18}O and ^{17}O -enrichment in the leaf water due to evaporation (Craig-Gordon model).

Here, a new climate chamber was designed to monitor the triple oxygen isotope composition of the different water reservoirs at the soil/plant/atmosphere interface. The chamber allowed to control the oxygen isotope composition of the water vapor.

The grass species *Festuca arundinacea* was grown on soil under different conditions of relative humidity, temperature and partial pressure of CO_2 . The soil water evaporation was prevented. For each climate condition, leaf water and phytolith oxygen isotope compositions were analyzed by mass spectrometry. The constancy of isotope compositions that were set for irrigation water, soil water, and fogging water were checked by laser spectrometry analysis in liquid mode. Water vapor was continuously measured by laser spectrometry in vapor mode. The triple oxygen isotope composition evolution in the soil/plant/atmosphere continuum is presented and fractionation processes at play are discussed.