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Do oxygen isotopes record the dynamics of the ‘Sea of Clouds’ on La Palma (Canary Islands/Spain)?

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On the mountainous western Canary Islands, during summer, humid northeastern trade winds associated with the eastern branch of the Azores High cause a frequent windward orographic cloud belt at mid-altitudes. This cloud layer is locally named the ‘Sea of Clouds’, and is the source for fog water collection at some locations. The collected water is used for domestic purposes, for reforestation irrigation, for prevention of and fight against forest fires, and even as bottled drinking water. But fog water collection is also a natural phenomenon. Trees in fog-prone areas safeguard their existence even in water-scarce situations by capturing water droplets from the clouds, and let the condensation drop to the soil, where the water is then accessible for the roots. This naturally intercepted fog water is estimated to contribute to about 10% to the aquifer recharge of the western Canary Islands. The great awareness of the ‘Sea of Clouds’ as an important water resource is opposed by a huge gap of knowledge about how it will evolve in the future. Will it expand in space and time since warmer air can hold more water? Or will it shrink because the trade wind trajectory may change? In order to anticipate the future of these processes we need to know how they evolved in the past. We will present a multi-parameter data set of oxygen isotope measurements from water vapour, water and organics (i.e. water soluble compounds) extracted from soil, needle, twig and stem phloem and xylem samples and tree-ring cellulose together with measurements of stomatal conductance and chlorophyll production from Pinus canariensis sites along an 2000m elevational gradient on La Palma. These data will provide information on the isotopic signature of the water available for tree growth and the physiological response of the trees to different humidity conditions along the gradient. We hope that the combination of all these data will allow us to estimate if, when and where water was intercepted from the sea of clouds over the past decades and potentially centuries and at a later stage to develop quantitative tree-ring based reconstructions of its dynamics in time and space. If our approach was successful, it could also be applied to other cloud-water dependant forested regions with ring forming species in the world. Our research will also contribute to model predictions of future climate changes that may not only affect the natural environment of the archipelago but also local human populations.