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Isotope derived cloud reconstructions; exploring the regional cloud-temperature feedback

Mary Gagen (1), Eduardo Zorita (2), Danny McCarroll (1), Giles Young (1), and Neil Loader (1)

(1) Swansea University, Department of Geography, Swansea, (m.h.gagen@swansea.ac.uk), (2) HZG - Helmholtz-Zentrum Geesthacht.

The long term relationship between cloud cover and temperature is one of the most important climate feedbacks contributing to determining the value of climate sensitivity. Climate models still reveal a large spread in the simulation of changes in cloud cover under future warming scenarios and clarity might be aided by a picture of the past variability of cloudiness. Stable carbon isotope ratios from tree ring records have been successfully piloted as a palaeocloud proxy in geographical areas traditionally producing strong dendroclimatological reconstructions (high northern latitudes in the Northern Hemisphere) and with some notable successes elsewhere too. An expansion of tree-ring based palaeocloud reconstructions might help to estimate past variations of cloud cover in periods colder or warmer than the 20th century, providing a way to test model test this specific aspect. Calibration with measured instrumental sunshine and cloud data reveals stable carbon isotope ratios from tree rings as an indicator of incoming short wave solar radiation (SWR) in non-moisture stressed sites, but the statistical identification of the SWR signal is hampered by its interannual co-variability with air temperature during the growing season. Here we present a spatio-temporal statistical analysis of a multivariate stable carbon isotope tree ring data set over Europe to assess its usefulness to reconstruct past solar radiation changes. The interannual co-variability of the tree ring records stronger covariation with SWR than with air temperature. The resulting spatial patterns of interannual co-variability are strongly linked to atmospheric circulation in a physically consistent manner. However, the multidecadal variations in the proxy records show a less physically coherent picture. We explore whether atmospheric corrections applied to the proxy series are contributing to differences in the multi decadal signal and investigate whether multidecadal variations in soil moisture perturb the SWR. Preliminary results of strategies to bypass these problems are explored.