



Climate from a 1000-year multiproxy tree-ring record from Forfjordalen, North Norway

Andreas J. Kirchhefer (1), Giles H. F. Young (2), Björn E. Gunnarson (3), Håkan Grudd (3), Neil J. Loader (2), and Danny McCarroll (1)

(1) Department of Arctic and Marine Biology, University of Tromsø, Tromsø, Norway (andreas.kirchhefer@uit.no), (2) Department of Geography, Swansea University, Swansea, Wales, UK, (3) Department of Physical Geography and Quaternary Geology, Stockholm University, Stockholm, Sweden

The ring-width (RW) chronology of Scots pine (*Pinus sylvestris* L.) from Forfjordalen, Vesterålen archipelago (68°47.5'N, 15°43.5'E) extends back to AD 812. July-August temperatures are reconstructed back to AD 1100 based on a subset of the RCS-detrended RW series ($R^2_{adj} = 42.0\%$). This suggests warm summers persisted during: the Medieval period 1100-1250; from 1750-1850; and from 1915-1955. The latter period being warmer than the Medieval Warm Period. Cool summers apparently prevailed during 1375-1475 and 1600-1650.

From a subset of these trees we also analysed maximum latewood density (MXD) and stable carbon isotopes ($\delta^{13}\text{C}$), both also being strongly correlated with July-August temperatures ($r = 0.75$ and 0.58 , resp.). However, MXD tends to integrate temperatures over a broader time window than ring-widths, while $\delta^{13}\text{C}$ should more accurately reflect sunshine than temperature. These factors may help to explain divergences seen between these individual proxy records.

The three records run reasonably in parallel during 1100-1325 and since 1775. However, from 1325-1450, MXD values are high in contrast to RW and $\delta^{13}\text{C}$, indicating a prolonged Medieval Warm Period of more oceanic, cloudy character. During the period from (1525)1600-1700, $\delta^{13}\text{C}$ has consistently higher values than MXD and RW, respectively, indicating cool but sunny conditions during this period of the Little Ice Age. Low values of MXD and $\delta^{13}\text{C}$ suggest that at the coast of North Norway, the summers of 1000-1100 were as cool as during the late 19th century.