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Quantifying uncertainty in documentary-data based climate reconstructions?

A. Moberg (1), P. Dobrovolny (2), R. Wilson (3), R. Brazdil (2), C. Pfister (4), R. Glaser (5), L. Leijonhufvud (1), and E. Zorita (6)

(1) Stockholm University, Department of Physical Geography and Quaternary Geology, Stockholm, Sweden (anders.moberg@natgeo.su.se), (2) Masaryk University, Institute of Geography, Brno, Czech Republic, (3) University of St Andrews, School of Geography & Geosciences, St Andrews, Scotland, UK, (4) Bern University, Institute of History, Bern, Switzerland, (5) University of Freiburg, Institute for Physical Geography, Freiburg, Germany, (6) GKSS Research Centre, Geesthacht, Germany

Past climate variations in the pre-instrumental period can be estimated from different kinds of proxy data. Apart from natural proxy archives, important information can be found in documentary non-instrumental man-made sources, primarily for Europe and a few other regions with a long tradition of keeping documentary records related to weather and climate. Unlike other proxy data types, documentary data can provide climate information for all seasons, with an accuracy down to monthly or even daily resolution. They are, however, rarely found as continuous complete time series for a particular location, and are mostly collected and compiled on a regional or national level. To develop a temperature or precipitation reconstruction, the raw descriptive information is generally first transcribed onto an ordinal seven-degree index scale, typically ranging from -3 (extremely cold or dry) to +3 (extremely warm or wet) for each individual month, where 0 indicates 'normal'. Seasonal and annual indices are calculated as the sum of the monthly values. Traditionally, documentary evidence was seldom collected to allow a period of overlap with instrumental data to facilitate statistical calibration and verification. Consequently, there are few statistically derived estimates of uncertainty in documentary based climate reconstructions. Moreover, as the raw information is often given with reference to the contemporary authors' perception of what 'normal' conditions were, there is a risk of losing low-frequency variability in the resulting climate reconstructions. In some cases, however, documentary climate data exist as more or less direct physical or biological quantitative time series that reflect climate changes, and which better preserve low-frequency variability. These series do not require any transcribing onto an index scale and may overlap with the instrumental records. This study describes some recent investigations which have extended index-type data well into the instrumental period and, additionally, developed a new record of the non-index type of data for the same period. In both cases, statistical calibration and verification was conducted in a similar way as in other paleoclimate disciplines, in particular dendroclimatology. Very strong relationships with monthly or seasonal temperatures are demonstrated, and attempts are made to quantify the combined uncertainty accounting for calibration statistics and changing signal strength back in time. These quantitative assessments make documentary data useful for constraining climate model simulations of past climate variability, but new questions also arise concerning how to best estimate the full range of reconstruction uncertainties.