

Experiments on the reconstruction methods and calibration of the climate series derived from REACHES historical database of China in 1644-1911

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Written historical records have been widely recognized as a valuable source for climate researchers to understand past climates and their variabilities in the last several hundreds to thousands of years. Use of documentary records to reconstruct temperature and humidity series has been done in China as well as in some European countries that possess historical documents for sufficiently long periods. A frequently used technique to evaluate the intensity of the cold-warm or dry-wet conditions is to construct an index system so as to quantify qualitative descriptions. However, different indexing methods may result in different reconstructed series of varying quality, and hence it is important to examine the pros and cons of these methods.

In this study, we report several methods performed to test the sensitivity of the temperature and precipitation index systems used for reconstructing historical temperature and humidity series. The data series were derived from REACHES database that consists of high spatio-temporal resolution data in China from 1644 to 1911. Temperature and humidity index series were constructed based on modified cold-warm index (CWI) and drought-flood index (DFI). Different sets of the indexing systems were developed to test their robustness and sensitivity by varying certain criteria. The statistical characteristics of the reconstructed series were compared.

In addition, we report on the statistical methods to determine the geographical areal mean as this is a new feature not reported previously in the reconstruction of historical climate series of China. Two aggregation methods for deriving geographical areal mean will be examined to determine their advantages/disadvantages. These experiments were designed to understand the benefits and caveats of the reconstruction methods as instrumental data of the time are not available.

To validate the reconstructed series, we use data series in Global Historical Climatology Network (GHCN) to calibrate the reconstructed temperature series in Beijing, Tianjin, Shanghai, and Hong Kong. Instrumental data are available for these locations dating back to the mid to late 19th century and thus provide partial overlaps with the reconstructed historical index series. Our preliminary result shows very high correlation ($r \sim 0.68$) between the instrumental and one reconstructed index series in Beijing but more tests as well as tests for other locations will be performed, and the results will be reported during the conference.