Geophysical Research Abstracts
Vol. 19, EGU2017-8547, 2017
EGU General Assembly 2017

Reconstruction of climate in China during 17th-19th centuries using Chinese chronological records

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Chinese historical documents are an extremely useful source from which much climate information can be retrieved if treated carefully. This is especially relevant to the reconstruction of climate in East Asia in the last 2000 years as the Chinese has kept official chronicles since $\sim$ 500BC and China also represents a large portion of East Asia's land. In addition, there are also local records in many cities and counties. When available, such documentary sources are often superior to environmental proxy data, especially in the time resolution as they usually provide at least annual resolution and even as high as daily records in some cases.

This research will report on our recent advances on using a new REACHS dataset that collects primarily documented meteorological records from thousands of imperial and local chronicles in the Chinese history for more than 2000 years. The meteorological records were digitized and coded in the relational database management system in which accurate time (from yearly to daily), space (from province to city/county) and event (from meteorological to phonological and social) information is carefully reserved for analysis. We then formed digital climate series and performed time series and spatial analysis on them to obtain their temporal and spatial characteristics.

Our present research results on the annual and seasonal temperature reconstruction during 17th-19th indicates lower temperature in the 17th century. There were also strangely high occurrence frequency of summer snowfall records in the lower reaches of Yangtze River during the Maunder Minimum. Reconstructed precipitation series fluctuated with strong regional character in the Northeast, Central-east and Southeast China. Spectral analysis shows that precipitation series have significant periodicity of 3-5 and 8-12 years during the period, suggesting strong interannual variability and different regional signatures. Flood happened frequently but long lasting drought was more frequently occurred in the 17th than in the following century. Furthermore drought is highly correlated with locust records, especially in the 17th century. The temporal and spatial variability of the climate reconstruction implies hierarchical and multi-scaled climate variability and a likely changing regime of monsoon: its spatial distribution, pattern and intensity. More detailed spatial-temporal analysis will be applied to analyze the dynamism.