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Influence of the solar activity on the precipitation in the Northeastern Tibetan Plateau during the last millennium

LEI HUANG and XUEMEI SHAO

Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing, 100101, China

Introduction

The characterization of variations in solar activities has been considered as one element in efforts to understand climate change. In this study, we investigated the influences of the solar activities on the precipitation reconstructed from tree-ring width chronologies in the Northeastern Tibetan Plateau during the last millennium.

Material and Methods

Tree-ring width chronologies of Qilian juniper (*Sabina przewalskii* Kom.) obtained from northeastern region of the Tibetan Plateau were used to reconstruct annual precipitation from A.D. 1000 to A.D.2001. The complex Morlet wavelet analysis and the cross wavelet analysis were performed to examine the correlations between the precipitation variations and solar activities.

Results and discussion

The reconstructed precipitation series showed drastic changes in the last millennium, particularly in the Little Ice Age period. It was evident that the precipitation had decreased significantly during periods of the Oort, Wolf, Spörer, Maunder and Dalton Minimum of solar activities. The results of power spectral analysis for the last millennium demonstrated the presence of periods of 200, 150, 120, 50, 32, 21 and 11.5 years. These climatic cycles correlated well with the corresponding solar activities cycles. This spectral similarity together with pattern matching indicated a possible connection between precipitation fluctuations and solar forcing in the past millennium.

The results of correlation analysis showed that the precipitation was negatively correlated to the SCL and the sunspot cycle rising phase length since A.D.1610. The main cycles of the precipitation were similar to the cycles of SCL over last 400 years. The cross wavelet analysis showed that the SCL had effects on the long-term variations of the precipitation mainly in century-scale. Our work showed evidences for a strong relationship between the solar activities and the precipitation fluctuation in the Northeastern Tibetan Plateau in the last millennium.

Keywords: solar activity; precipitation; the Northeastern Tibetan Plateau