Geophysical Research Abstracts, Vol. 7, 00763, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00763

Cross wavelet analysis of climatic and sunspot time series

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Long-term climatic time series (regional and spatially averaged air-surface temperature records, NAO, ENSO, and other climate proxies) are studied using wavelet transforms. Cross wavelet technique is applied to examine coherence and phase relationships between various climatic time series on interannual scale. We located time-frequency patterns of coherent climate oscillations revealing their global origin. Wavelet technique is applied also to the sunspot time series to find the solar signal in climatic data. Cross wavelet and coherence analysis display transient correlations and nonlinear impact of solar variability on climate. Regions and periods of significant solar influence can be spatially and temporally allocated. The last 60 years since 1940's demonstrate unusual hypersensitivity of climate response to solar output. This result is discussed in conjunction with the problem of unprecedented high level of sunspot activity and climate warmth in the late 20th century.