Geophysical Research Abstracts
Vol. 15, EGU2013-7439, 2013
EGU General Assembly 2013

Long-range memory in Earth surface temperatures: spatial scale dependence and land-sea differences

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We present a study of how the long-range memory in temperature time series on scales from months to decades varies between land and sea, and with different degrees of spatial averaging.

Earlier analyses suggest that sea temperatures are more persistent than land temperatures, and that global temperatures are more persistent than regional temperatures. As a measure of the long-range memory we estimate the Hurst exponent H by parametric as well as non-parametric methods, and by performing spatial averaging of global gridded temperatures we make a systematic investigation of how the Hurst exponent varies on different spatial scales and between ocean/coastal and continental interior data records.

Increasing spatial scale from local records up to the global scale implies that for these data aggregation of relatively weakly persistent records produce records with strong long-range persistence ($H \approx 1$). We propose some statistical models that may give rise to this phenomenon and discuss their physical relevance.