Geophysical Research Abstracts
Vol. 14, EGU2012-8485, 2012
EGU General Assembly 2012

Isomap nonlinearity analysis and bimodality of the Asian summer monsoon

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Isomap nonlinear dimensionality reduction is applied to 1958-2001 ERA-40 SLP anomalies to study nonlinearity of the Asian summer monsoon intraseasonal variability. Using a two-dimensional Isomap space, the probability density function is shown to be bimodal. A bivariate Gaussian mixture model is then applied to identify the monsoon phases; the obtained regimes represent respectively the active and break phases. The relationship with the large-scale seasonal mean monsoon indicates that the frequency of monsoon regime occurrence is significantly perturbed in agreement with conceptual ideas. Trend analysis suggests that if the actual trend is to continue then we may witness a shift toward break conditions over India and more active conditions over east China.