Geophysical Research Abstracts, Vol. 7, 07172, 2005
SRef-ID: 1607-7962/gra/EGU05-A-07172

Synchronization Analysis of Atmospheric Indices by Means of Recurrences

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It is well accepted that different atmospheric oscillatory phenomena may interact with each other through different mechanisms. In particular, for El Nino and Monsoon, there is strong evidence from both geological and meteorological observations that there is certain coupling between both.

Recent analyses have shown that the concept of phase synchronization may be applied to these data and this coupling may lead to temporally "synchronization" of both phenomena. However, the corresponding results have not yet been verified as the standard approach for synchronization analysis may fail for very noisy and possibly instationary data as climate records and the atmospheric indices derived from.

To solve this problem, we apply recurrence-based methods for synchronization analysis. Performing the corresponding calculations separately for different time intervals allows for detecting epochs of synchronization. The method is particularly applied to the NINO 3 and All Indian Rainfall indices recorded over the last century.