



## Neurocomputing Approach to View The Possible Association Between Sunspot Numbers and Indian Summer Monsoon Rainfall

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The present study aims to investigate the temporal variability of the solar activity, which is typically measured by the sunspot number (SN). The time series of SN provides the longest existing record of solar activity, and is the best available data set for studying the long-term evolution of solar activity and, in particular, the 11-year activity cycle. The SN is correlated with the 10.7 cm solar flux, a quantity measured by remote sensing techniques. The study presented in the work reports an investigation on the temporal variability of the solar activity, which is conventionally measured by the Sunspot Number (SN), and the possible association between the mean annual SN and the rainfall of the summer monsoon over India. Initially we have analysed the autocorrelation structures, which has shown a wave pattern in the case of SN. However, in the case of the monsoon rainfall, no such pattern has been observed. Moreover, ACFs have shown that the time series of SNs shows persistence, which is absent in the case of the summer monsoon rainfall.

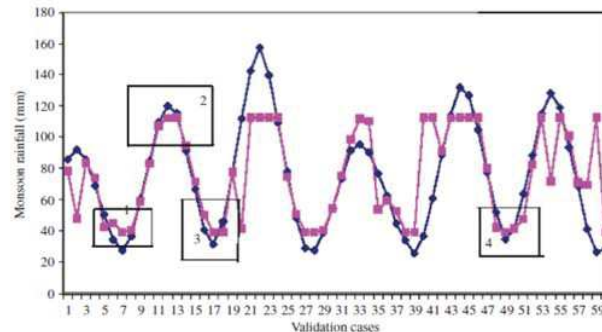


Fig.1 The actual and predicted summer monsoon rainfall using ANN with SN as predictor

Considering previous studies on the association between solar activities and climate, we tried to find some association despite the apparent non-linearity implied by the very low cross-correlation. Implementing spectral analysis we have obtained a common prominent harmonic between the two time series under consideration. The common harmonic was the fifth harmonic, which implies a common cycle of 12.8 years. We have then tried to determine whether there could be any regression relationship between the two time series. Considering the non-linearity implied by the statistical analysis, we have decided to implement an ANN in the form of multilayer perceptrons with sigmoid non-linearity. We have derived new time series by averaging the observations for 5 years. Finally, it was revealed that by the implementation of the ANN, an average of 5-year SNs can give a good estimate for the 5-year averaged summer monsoon rainfall over India. Although we could not give any year-wise forecast of the summer monsoon rainfall, a regression-like estimation has been possible.

1. M. Bzowski et al. *Astronomy & Astrophysics* 408,.3 (2003): 1165-1177.
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