

# **A Particle Swarm Optimization - Neural Network Ensemble Prediction Model for Persistent Freezing Rain and Snow Storm**

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Based on daily minimum temperature, maximum temperature and precipitation data of 756 stations in China, the National Centers for Environmental Prediction (NCEP)/National Center for Atmospheric Research (NCAR) reanalysis data during 1951-2013 and the NCEP 24h forecast data, a nonlinear statistical ensemble prediction model based on the Particle Swarm Optimization-Neural Network (PSONN-EPM) has been developed for predicting and verifying the regional persistent freezing rain and snow storm process in southern China by analyzing and extracting the significant predictors. Results show that models are more accurate when dividing low-temperature processes into the general process and severe process which are constructed based on cold extents, humidity, and influence ranges for the freezing rain and snow storm processes. In the 10 days independent forecast test, the average relative errors for the general process and the severe process are 2.04 and 0.6, respectively, by using stepwise regression equation forecast method, while those are 1.33 and 0.30, by using PSONN-EPM technique. This means forecast errors are reduced by 0.71 and 0.3 as compared with to the stepwise regression method. In addition, the predication result for the severe freezing rain and snow storm process is better than that for the general process. The PSONN-EPM integrates predictions of N ensemble members, thus the prediction accuracy and stability is higher than that of the traditional linear regression method. Further, such method does not contain any tunable parameters, and is applicable for practical operational weather prediction.

Key words: particle swarm optimization algorithm, neural network, persistence, freezing rain and snow storm, ensemble prediction