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Global Temperature Assimilation using Artificial Neural Networks in SPEEDY Model: Satellite Observation

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An Artificial Neural Network (ANN) is designed to investigate a application for data assimilation. This procedure provides an appropriated initial condition to the atmosphere to numerical weather prediction (NWP). The NWP incorporates the equations of atmospheric dynamics with physical process and it can predict the future state of the atmosphere. Data assimilation procedure combines information from observations and from a prior short-term forecast producing an current state estimate. Operational satellite data are taken and processed in real-time and distributed around the world. The use of observations from the earth-orbiting satellites in operational NWP provides large data volumes and increases the computational effort. The goal here is to simulate the process for assimilating temperature data computed from satellite radiances and introduce new technique in analysis to Weather Forecasting and climate. This performance can be faster than conventional schemes for data assimilation. The numerical experiment is carried out with global model: the Simplified Parameterizations, primitivE-Equation DYnamics (SPEEDY) and the synthetic observations of temperatures from model plus a random noise. For the data assimilation technique was applied a Multilayer Perceptron (MLP-NN) with supervised training, which observation, local point observation and the Local Ensemble Transform Kalman Filter (LETKF) analysis are used as input vector. The global analysis is done in the activation MLP-NN with only, synthetic observation and its local point. In this experiment, the MLP-ANN was trained with the first six months considering the years 1982, 1983, and 1984 data. A hindcasting experiment for data assimilation performed a cycle for January of 1985 with MLP-NN and SPEEDY model. LETKF was performed at the same cycle. The results for MLP-NN analysis are very close with the results obtained from LETKF. The simulations show that the major advantage of using ANN is the better computational performance, with similar quality of analysis. The CPU-time assimilation with MLP-NN is 80% less than LETKF with the same observations.