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Spatiotemporal daily rainfall reconstruction via Artificial Neural Network. Target area: Brazil.

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One of the major problems in examining weather records for detecting changes in extremes is the lack of high-quality, long-term data (ground-based meteorological network does not operate over a common time period of adequate length). In general, the biggest drawback is that recorded data available must be gap-filled and quality controlled to provide a reliable continuous reference time series. It is important for time periods where no satisfactory reference series can be built due to an insufficient number of suitable nearby stations or large discontinuities in the time series. Good quality database undoubtedly provides a key source of historical meteorological information for detection and monitoring of climate variability. However, in general, the meteorological network was not designed to serve this function, and preliminary

evaluations indicate that few weather stations meet the criteria necessary for inclusion in a climatological sub-network. The question of the adequacy of the meteorological network to meet this need for information on climatic variability has been widely addressed, through a systematic process of network evaluation and planning. This process is intended to lead to the evolution of an appropriate network of meteorological stations. The precipitation is the climate attribute that assumes a relevant importance in respect to the climate studies of the tropical regions. Hence, this work outlines the strategy being used to reconstruct and evaluate rainfall time series, obeying a sequential strategy divided in the interpolation considering the time-memory method and the spatial integration procedure based upon the "optimum distance" between stations. From selected stations, the "reference series" were calculated as a weighted mean. It is well-known that the climate system has a very complex and non-linear behaviour for which consistent and robust mathematical models are needed, since they allow the modelling of non-linear dynamic problems. The selected series consist on daily total rainfall recorded in the period 1970–2000 in Brazil. Time series is a special case of symbolic regression and can be done using the artificial neural network (ANN) that explore the dependence of meteorological attributes as a function of time on inputs to the computer simulations. A common problem in numerical climate characterization is the spatiotemporal processing (integration or interpolation) of data from different types and different origins or accuracies (the space-time change of support problem). The basic idea is to import the entire posterior distribution from other locations allowing prediction of unsampled weather parameters using spatial related sampled information. To validate this work-algorithm, the diagnostic of homogenised rainfall time series was accomplished. The spatial distribution of rainfall is summarised by subjective descriptive four moment measures: mean, variance, skewness and kurtosis, giving support to spatial pattern recognition (clusterization). As expected, this reliable and robust reconstruction method has good performance, since more information can be introduced in the decision-making system. In particular, they were able to capture the intrinsic dynamics of atmospheric activities, producing good long-term forecasting for periods of at least a complete cycle of ENSO/PDO. It seems that the dynamics is essentially non-chaotic in this time scale, but perturbed by a fairly large amount of noise. In addition, the knowledge of phenomena connected to the precipitation variability is very important, particularly where the cases of extreme precipitation events affect negatively the life of the populations provoking flooding and dislodgement of families or droughts that deprive them of essentials means of subsistence. This work also consisted in analysing long-term observed rainfall series for localities of some Brazilian regions, corroborating the spatial consistency, apparent cycles and respective trends. The regional rainfall has been related to high-frequency atmospheric phenomena, such as El Niño and La Niña events; and low frequency phenomena, such

as the Pacific Decadal Oscillation (PDO). A complementary application was carried out correlating the “monitored” rainfall database with the National Center for Environmental Prediction (NCEP) – National Center for Atmospheric Research (NCAR) reanalysis dataset to verify possible divergences relative to the observed data.