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Improving downscaling in South America Sector

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The mathematical models used to simulate the present climate and project future climate with forcing by greenhouse gases and aerosols are generally referred to as General Circulation Models or Global Climate Models (GCMs). However, the spatial resolution of GCMs remains quite coarse, in the order of 300 x 300 km, and at scale, the regional and local details of the climate which are influenced by spatial heterogeneities in the regional physiography are lost. Therefore, there is the need to convert the GCM outputs into a reliable data set with higher spatial resolution, with daily rainfall and temperature time series at the scale of the watershed or a region to which the climate impact is going to be investigated. The methods used to convert GCM outputs into local meteorological variables required for reliable climate modeling are usually referred to as downscaling techniques. There are a variety of downscaling techniques in the literature, but two major approaches can be identified at the moment, namely, dynamic downscaling and empirical (statistical) downscaling. The most widely used empirical downscaling methods are the multiple linear regression and stochastic weather generation. However, the interest in nonlinear regression methods, namely, artificial neural network (ANN), is nowadays increasing because of their high potential for complex, nonlinear and time-varying input-output mapping.

The main aim of this work is to develop and test a novel type of statistical downscaling technique based on the Artificial Neural Network (ANN), applied of the climate change. This work analyses the performance of the IPCC models (CGCM3.1, CSIRO-MK3.5, ECHAM5-MPI, GFDL-CM2.1, and MIROC3.2-MEDRES) in simulate the present and future climate using ANN. The ANN used here are based on a feed forward configuration of the multilayer perception that has been used by a growing number of authors. To carry out statistical downscaling for each meteorological date (grid point), the predictors and predictands were supplied to the models (ANN). Two experiment using: 1) ANN1, using training monthly (JANuary, FEBruary, and MARch) between 1961 to 1990, testing (JAN-FEB-MAR) between 1991 to 2000, and predictors output models from IPCC AR4; ANN2 training idem ANN1, testing idem ANN1, and predictors output models and observation rainfall.