Comparison of three statistical downscaling methods for simulating temperature and precipitation in Taiwan

Shu-Hua Lin[1], Chung-Ming Liu[1,2], Hua-Fu Wu[2], Katherine Chun-Min Lin[3]

1. Global Change Research Center, National Taiwan University
2. Department of Atmosphere Science, National Taiwan University
3. Department of Public Health, National Taiwan University

Abstract

Resolution inefficiency is one of the major problems for impact studies on climate change. The statistical downscaling (SD) offers a solution especially to small regions like Taiwan. These places are homogeneously simulated under climate model. However, SD can further estimate local-scale monthly precipitation and temperature by processing large-scale climate variables from General Circulation Model (GCM) outputs. Contrast to traditionally be used converting predictors generated from spatial patterns, such as Principle Component Analysis (PCA) and Singular Value Decomposition (SVD), a newly-built Pointwise Multivariate Regression (PMR) method was demonstrated. The results of monthly temperature and precipitation were then approached. In addition, PCA and SVD were also studied in this research. Those predictors (temperature, precipitation, humidity and pressure) and predictands (stations of observations) used in methods specified above were produced by National Centers for Environmental Prediction- National Center for Atmospheric Research reanalysis datasets and were offered by Central Weather Bureau respectively. In this study, datasets were divided temporally into two parts: the training period (1960-1989) and the verification period (1990-2005). To assess SD skills, correlation coefficient, standard deviation and root-mean-square error were proposed. Throughout the study, the authors found PMR not only distilled the advantages from PCA and SVD, but also simplified the downscaling procedure. More importantly, based on PMR, GCM precipitation output is now believed to be a proper and significant predictor under the SD.

Keywords: Statistical downscaling, General Circulation Model, Pointwise Multivariate Regression, Principle Component Analysis and Singular Value Decomposition