NR> Vol.1 No.1, September 2010

OPEN ACCESS

Evaluation of Various Linear Regression Methods for Downscaling of Mean Monthly Precipitation in Arid Pichola Watershed

PDF (Size:567KB) PP. 11-18 DOI: 10.4236/nr.2010.11002

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ABSTRACT

In this paper, downscaling models are developed using various linear regression approaches namely direct, forward, backward and stepwise regression for downscaling of GCM output to predict mean monthly precipitation under IPCC SRES scenarios to watershed-basin scale in an arid region in India. The effectiveness of these regression approaches is evaluated through application to downscale the predictand for the Pichola lake region in Rajasthan state in India, which is considered to be a climatically sensitive region. The predictor variables are extracted from (1) the National Centers for Environmental Prediction (NCEP) reanalysis dataset for the period 1948–2000, and (2) the simulations from the third-generation Canadian Coupled Global Climate Model (CGCM3) for emission scenarios A1B, A2, B1 and COMMIT for the period 2001–2100. The selection of important predictor variables becomes a crucial issue for developing downscaling models since reanalysis data are based on wide range of meteorological measurements and observations. Direct regression was found to yield better performance among all other regression techniques explored in the present study. The results of downscaling models using both approaches show that precipitation is likely to increase in future for A1B, A2 and B1 scenarios, whereas no trend is discerned with the COMMIT.

KEYWORDS

Backward, Forward, Precipitation, Regression, Stepwise

Cite this paper

M. Goyal and C. Ojha, "Evaluation of Various Linear Regression Methods for Downscaling of Mean Monthly Precipitation in Arid Pichola Watershed," *Natural Resources*, Vol. 1 No. 1, 2010, pp. 11-18. doi: 10.4236/nr.2010.11002.

References

[1] A. Robock, R. P. Turco, M. A. Harwell, T. P. Ackerman, R. Andressen, H-S Chang and M. V. K. Sivakumar, "Use of General Circulation Model Output in the Creation of Climate Change Scenarios for Impact Analysis," Climatic Change, Vol. 23, No. 4, 1993, pp. 293-335.

[2] F. Giorgi and L. O. Mearns, "Approaches to the Simulation of Regional Climate Change: A Review," Review of Geophysics, Vol. 29, No. 2, 1999, pp. 191-216.

[3] S. Maxime, G. Hartmut , R. Lars, K. Nicole and O. Ricardo, "Statistical Downscaling of Precipitation and Temperature in North-Central Chile: An Assessment of Possible Climate Change Impacts in an Arid Andean Watershed," Hydrological Sciences Journal, Vol. 55, No. 1, 2010, pp. 41-57.

[4] R. L. Wilby, C. W. Dawson and E. M. Barrow, "SDSM– A Decision Support Tool for the Assessment of Climate Change Impacts," Environmental Modelling & Software, Vol. 17, No. 2, 2002, pp. 147-159.

[5] E. P. Salathe, "Comparison of Various Precipitation Downscaling Methods for the Simulation of Streamflow in a Rainshadow River Basin," International Journal of Climatology, Vol. 23, No. 8, 2003, pp. 887-901.

[6] M. K. Kim, I. S. Kang, C. K. Park and K. M. Kim, "Super Ensemble Prediction of Regional Precipitation over Korea," International Journal of Climatology, Vol. 24, No.6, 2004, pp. 777-790.

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[7] F. Wetterhall, S. Halldin and C. Y. Xu "Statistical Precipitation Downscaling in Central Sweden with the Analogue Method," Journal of Hydrology, Vol. 306, No. 1-4, 2005, pp. 136-174.

[8] S. Tripathi, V. V. Srinivas and R. S. Nanjundiah, "Downscaling of Precipitation for Climate Change Scenarios: A Support Vector Machine Approach," Journal of Hydrology, Vol. 330, No. 3-4, 2006, pp. 621-640.

[9] R. E. Benestad, "A Comparison between Two Empirical Downscaling Strategies," International Journal of Climatology, Vol. 21, No. 13, 2001, pp. 1645-1668.

[10] A. Anandhi, V. V. Srinivas, R. S. Nanjundiah and D. N. Kumar, "Downscaling Precipitation to River Basin for IPCC SRES Scenarios Using Support Vector Machines," International Journal of Climatology, Vol. 28, 2008, pp. 401-420.

[11] S. Zekai, "Precipitation Downscaling in Climate Modelling Using a Spatial Dependence Function," International Journal of Global Warming, Vol. 1, No. 1-3, pp. 29-42.

[12] S. D. Khobragade, "Studies on Evaporation from Open Water Surfaces in Tropical Climate," PhD Dissertation, Indian Institute of Technology, Roorkee, India, 2009.

[13] H. Linz, I. Shiklomanov and K. Mostefakara, "Chapter 4 Hydrology and Water Likely Impact of Climate Change IPCC WGII Report WMO/UNEP Geneva," 1990.

[14] C. R. Jessie, R. M. Antonio and S. P. Stahis, "Climate Variability, Climate Change and Social Vulnerability in the Semi-arid Tropics," Cambridge University Press, Cambridge, 1996.

[15] E. Kalnay, et al., "The NCEP/NCAR 40-Year Reanalysis Project," Bulletin of the American Meteorological Society, Vol. 77, No. 3, 1996, pp. 437-471.

[16] C. J. Willmott, C. M. Rowe and W. D. Philpot, "Small-scale Climate Map: A Sensitivity Analysis of Some Common Assumptions Associated with the Grid-Point Interpolation and Contouring," American Cartographer, Vol. 12, No. 2, 1985, pp. 5-16.

[17] D. A. Shannon and B. C. Hewitson, "Cross-scale Relationships Regarding Local Temperature Inversions at Cape Town and Global Climate Change Implications," South African Journal of Science, Vol. 92, No. 4, 1996, pp. 213-216.

[18] R. G. Crane and B. C. Hewitson, "Doubled CO2 Precipitation Changes for the Susquehanna Basin: Down-Scaling from the Genesis General Circulation Model," International Journal of Climatology, Vol. 18, No. 1, 1998, pp. 65-76.

[19] J. Neter, M. Kutner, C. Nachtsheim and W. Wasserman, "Applied Linear Statistical Models," McGraw-Hill Companies, Inc., New York, 1996.

[20] A. C. Rencher, "Methods of Multivariate Analysis," John Wiley & Sons Inc., New York, 1995.

[21] Novell Courseware Server, Acadia University, http:// plato.