3.1.2 Climate downscaling techniques

Statistical Downscaling

Description	Downscaling is a method for obtaining high-resolution climate or climate change information from relatively coarse-resolution global climate models (GCMs). Typically, GCMs have a resolution of 150-300 km by 150-300 km. Many impacts models require information at scales of 50 km or less, so some method is needed to estimate the smaller-scale information. Statistical downscaling first derives statistical relationships between observed small-scale (often station level) variables and larger (GCM) scale variables, using either analogue methods (circulation typing), regression analysis, or neural network methods. Future values of the large-scale variables obtained from GCM projections of future climate are then used to drive the statistical relationships and so estimate the smaller-scale details of future climate (see also weather generators).
Appropriate Use	Statistical downscaling may be used whenever impacts models require small-scale data, provide suitable observed data are available to derive the statistical relationships.
Scope	All locations, all sectors.
Key Output	Small scale information on future climate or climate change.
Key Input	Appropriate observed data to calibrate and validate the statistical model(s). GCM data for future climate to drive the model(s).
Ease of Use	Difficult to apply from first principles since it requires access to large data sets and considerable expertise to derive the statistical relationships. User-friendly software to facilitate use is available (see SDSM — Statistical DownScaling Model, on next table).
Training Required	Considerable knowledge and experience is required to work from first principles. Use of packages like SDSM, however, requires relatively little training.
Training Available	A training course for SDSM will be held in late 2002, but there are no plans currently for future courses.
Computer Requirements	Personal computer.
Documentation	Numerous publications in the scientific literature. The SDSM package provides a list of the most useful such publications arranged by category.
Applications	Widely applied in many regions and over a range of climate impact sectors. For a specific example, see Wilby et al. (1999) in References below.
Contacts for Framework, Documentation, Technical Assistance	SDSM may be obtained by registering at http://www.sdsm.org.uk/.
Cost	SDSM is free.

Statistical Downscaling (cont.)

References	Wilby, R.L. and T.M.L. Wigley. 1997. Downscaling general circulation model output: A review of methods and limitations. *Progress in Physical Geography* 21:530-548. Wilby, R.L., T.M.L. Wigley, D. Conway, P.D. Jones, B.C. Hewitson, J. Main, and D.S. Wilks. 1998. Statistical downscaling of general circulation model output: A comparison of methods. *Water Resources Research* 34:2995-3008. Wilby, R.L., L.E. Hay, and G.H. Leavesley. 1999. A comparison of downscaled and raw GCM output: Implications for climate change scenarios in the San Juan river basin, Colorado. *Journal of Hydrology* 225:67-91. Wilby, R.L. and T.M.L. Wigley. 2000. Downscaling general circulation model output: A reappraisal of methods and limitations. In *Climate Prediction and Agriculture*, M.V.K. Sivakumar (ed.). Proceedings of the START/WMO International Workshop, 27-29 September 1999, Geneva. International START Secretariat, Washington, DC, pp. 39-68.