Site:

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Statistical DownScaling Model (SDSM-DC)

Step-by-step development of daily temperature and precipitation scenarios

Step	*Activity*	*Interface*	*Notes*
1	Verify that your meteorological data are in the correct format (i.e., single column, ASCII)	User supplied daily meteorological data within period 1948-2014	All data should begin on 1 Jan 1948, or be padded with -999 from this date
2	Note your site latitude and longitude, then download daily NCEP predictor variables from the SDSM portal	http://co-public.lboro.ac.uk/cocwd/SDSM/data.html	Enter the latitude and longitude of your site or the filename of the nearest grid cell (keeping in mind that the cell spacing is 2.5° x 2.5° and coordinates are for the centre of the cell)
3	Register at the SDSM portal, download and install the software (check version is 6 March 2015)	www.sdsm.org.uk	The preferred operating system is MS Windows XP or later
4	Confirm that the SDSM global settings match the intended data source(s) and application(s)	SDSM>Settings	Double check date ranges, year lengths and missing data codes
5	Check that your daily meteorological data have the expected number of days and value range(s)	SDSM>Quality Control	For example, data for 1961-2000 should have 14610 days
6	Explore seasonal variations in explained variance using physically sensible predictor variables	SDSM>Screen Variables>Analyse	Adjust the Fit Start and Fit End dates to match available data
7	Explore the form of the predictor-predictand relationship using (seasonal) scatter graphs	SDSM>Screen Variables>Scatter	There is no substitute for a visual check of the observed predictor-predictand relationships
8	Evaluate inter-variable correlations, and unique explanatory power of each predictor	SDSM>Screen Variables>Correlation	Short-list a parsimonious set of predictors that are physically sensible and have strongest explanatory power

9	Experiment with different combinations of predictor variables, model transformations and optimisation algorithms	SDSM>Calibrate Model>Settings>Advanced	Note the amounts of explained variance, and standard error for each model configuration
10	Cross-validate and build the preferred downscaling model	SDSM>Calibrate Model>Calibrate	Set **unconditional** (e.g., temperature) or **conditional** (e.g., rainfall) model. Select the number of *k*-folds for cross-validation (*k*=2 is split sample).
11	Load the calibrated model (PAR file from #10) and generate an ensemble of synthetic series	SDSM>Weather Generator>Synthesize	Don't forget to select the NCEP folder under "Select Predictor Directory"
12	Load the output file (from #11), and select diagnostic statistics appropriate to the intended application of the downscaled scenarios	SDSM>Summary Statistics>Statistics	SDSM in-fills missing data, so set the date range to match available observations for a fairer comparison
13	Repeat #12 using observed series from #1	SDSM>Summary Statistics>Statistics	Note results for key diagnostics
14	Produce graphs of monthly values for each diagnostic, comparing SDSM with observations	SDSM>Compare Results>Line	Perform visual assessment of model fit and return to step #9 if need be
15	Examine model skill at generating extreme events (assuming that this is relevant to the application)	SDSM>Frequency Analyses>FA Graphical	This can be a very severe test of SDSM given the fit to mean conditions
16	Examine skill at generating inter-annual variability	SDSM>Time Series Analysis>Plot	As above
17	Generate transient climate change scenarios using the calibrated model (PAR file from #10)	SDSM>Scenario Generator>Generate	Apply required treatments by adjusting the occurrence, mean, variance, and trend parameters[1]. Seasonality of wet-days can be set in Advanced Settings
18	Inspect daily and seasonal time series	SDSM>Time Series Analysis>Plot	Confirm required transient behaviours
19	Examine the synthetic climate change scenarios using diagnostics as in steps #12 and #13	SDSM>Summary Statistics>Delta Stats	Under "Delta Periods" select Percent Difference for precipitation and Absolute Difference for temperature. Use the *t*-test results to establish statistical significance of any changes
20	Return to #1 and repeat for next predictand or site		

[1] Note that SDSM-DC does not use climate model input. Generated scenarios are intended for stress-testing adaptation options. See: Wilby, R.L., Dawson, C.W., Murphy, C., O'Connor, P. and Hawkins, E. 2014. The Statistical DownScaling Model – Decision Centric (SDSM-DC): Conceptual basis and applications. *Climate Research*, **61**, 251-268.