Geophysical Research Abstracts
Vol. 13, EGU2011-9216, 2011
EGU General Assembly 2011

Skill assessment of reanalysis data for local-scale, daily air temperature on a tropical, glaciated mountain range (Peru)

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This study asks how much information about daily air temperature variations in the tropical Cordillera Blanca can be gained from reanalysis data. The presented empirical-statistical downscaling (ESD) model is a MOS–technique (model-output-statistics), trained over the period when observations near glaciers are available (2006 to present), and applied for the entire reanalysis data period (1948 to present). In a previous study, double-cross validation was applied for automated predictor selection from a relatively broad pool of reanalysis data, leaving some ambiguity concerning the definite predictor choice for the ESD model input. Here we address this problem showing a systematic ESD method for predictor comparison and evaluation studies designed for short-term, daily time series of normally distributed target variables.

The method is based on simple linear least-squares regression between standardized predictors-predictands applied separately for each month of the year. The skill of the predictors is quantified based on a modification of leave-one-out cross-validation that accounts for autocorrelation in the predictand time series.

The results show considerable variations of the regression coefficients for different months of the year, emphasising the importance of using different ESD models for different months of the year. Similar to the regression coefficients also the ESD model skill varies throughout the year, from high skill in the wet season to almost no skill in the dry season. A not data-based (a priori) selected predictor (air temperature from the same pressure level as the observations) clearly shows higher skill than other potential predictors, such as e.g. surface air temperature, sea level pressure, or geo-potential height at the pressure level of the study site. The same predictor shows the highest skill in all months, thus suggesting that different predictors for different months (or seasons) do not necessarily increase the skill of ESD models. In a further experiment we stepwise decrease the time resolution of the ESD model from daily to five-daily averages and show that the ESD model skill increases with decreasing time resolution.

Finally, we use the presented method to compare the skill of different reanalysis data types from different institutions (NCEP, JMA, ECMWF, NASA) and different spatial resolutions.