

ABSTRACT

Empirical temperature downscaling: Method and potential applications

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Most weather and climate product users are interested in information at fine spatial scales typically below that available from observational networks or dynamical weather/climate model output, or for locations affected by physical processes not captured by the model/observational data. Statistical methods exist that can interpolate to locations not directly represented on the data array, however they are based solely on information input from the available data and may not address the original representation problem.

One potential solution to this problem is to develop an empirical model that uses information about location to modify parameter estimates generated by observation or dynamical modeling. This is essentially a two-step process: start by securing additional information about the landscape at high spatial resolutions and then combine this with representations of scale-appropriate processes to improve parameter estimates. Typically a digital elevation model (DEM) provides the high resolution landscape basis. Processes of interest are then identified and captured within the empirical model. The output is a field of parameter estimates at the resolution of the DEM modified to reflect the action of small-scale processes. When applied to dynamical model output, this represents one approach to what is termed “downscaling”.

Empirical modification has been implemented in various ways – from as simple as forcing a dry adiabatic lapse rate onto elevation data to a comprehensive assessment of a suite of location parameters, as is conducted in the PRISM model. Almost exclusively, these approaches start with data from the surface observing network. A major stumbling block in arctic regions, however, is a lack of surface observational data with which to anchor the empirical modeling process. To address this problem an approach tailored the region, termed simply “Topoclimate Model” (TCM), was developed that does not utilize surface data in the initial generation of estimates. This has two advantages – the limitations and potential biases of a sparse network are not translated into the final estimates, and the surface data that do exist can be employed to help with error checking and nudging of final estimates.

This presentation will review development of the TCM model and consider potential end-user applications.

If time permits an ecological modeling platform based on cellular automata will also be discussed.