The concept of downscaling

and the rationale of large-scale control in regional climate modeling.

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The derivation of regional and local information in climate modelling is based on the concept of downscaling: This concept describes the formation of a smaller scale climate (statistics of weather) as a result of a dynamical interplay of given large-scale climate states and the physiographic particularities at the smaller scale. Or, in other words, the small scale climate is a random process dependent upon the physiographic detail and conditioned upon the prevailing time-dependent large scale state.

Historically the concept is rooted in synoptic climatology; later it was extended to the problem of empirically specifying climate variations and changes at scales not resolved by global climate models. Only recently, the problem of regional climate modeling was formulated in this context as well.

The concept is discussed; examples of empirical downscaling exercises are presented, which feature the linkage of statistics which are not directly but indirectly (i.e., not causally) related – like intramonthy statistics of wave height and monthly mean air pressure fields; the method of spectral nudging in regional climate modeling is discussed, and its utility in forcing the known large-scale state without suppressing regional and local variability is demonstrated.

Large-scale control of regional climate modeling overcomes the fundamental problem of dealing with an ill-posed boundary value problem, but its usefulness depends on the specific application.