

February/March 2022 - [Seminar series at Meteorological Institute](#) of **Hamburg** University;  
1 March 2022; 14:15, online

Hans von Storch

### *Concepts of downscaling*

The climate system is composed of many components, myriads of spatial and temporal scales, and very many if not infinitely many processes. Indeed, even if we are used to think of the basic thermodynamical and hydrodynamical differential equations as describing accurately the dynamics of the climate system, this is strictly speaking a misconception – when we increase the spatial resolution, which is an integral part of the theory of differential equations, then the system changes – more spatial scales enter the dynamics, more processes, and even the vector of states is growing; the difference equations change.

But we are nevertheless successful in modelling the state and variations of the climate system realistically. This is related to the conceptualization of the dynamics of the climate system as dominated by a driving core of dynamics, with a limited number of degrees of freedom, large spatial and temporal scales, and a limited number of active processes (which is, in a nutshell, Hasselmann's PIP concept). This core, which is in case of dynamical modelling, described by our "quasi-realistic models", treats the rest, the small scales and the many unresolved processes as being conditioned stochastic slaves of the core's dynamics. They feedback stochastically on the core's dynamics, an ansatz called "parametrization". Another aspect is that the conditional slaves-link can be used to predict statistically (or dynamically) the effects of large-states on small-scale states or processes. This approach is named "downscaling".