International Networking for Young Scientists (INYS) on 'Climate change: a multidimensional challenge', Lund, 26-28 October 2005

Determining the added value of Regional Climate Modelling

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Limited area models of the atmosphere are used for describing the regional climate. To do so they are exposed along the lateral boundaries and, in some cases, on large scales in the interior, to a given sequence of coarser resolution dynamical states of the atmosphere. These coarser resolution states originate either from global re-analyses (in the case of reconstruction of past regional weather) or from global climate simulations (often scenarios of anthropogenic climate change).

Since both the global re-analyses and the global simulations provide also a description for the interior of the limited area model, albeit coarser, the question is which added value the limited area model is providing. An obvious answer is that stationary conditions related to the topography and other physiographic detail will be described better; however, this added value may possibly also be achieved by a much simpler and cheaper geo-statistical postprocessing.

We suggest that the added value is associated with those spatial scales, at which the coarse resolution re-analysis system or global simulation model (which operate often on grid with a mesh size of 200 km and more) has little skill – which is of the order of a few grid lengths (i.e., often less than 800 km or so). At these shorter spatial scales, many relevant (transient) weather phenomena take place.

We have developed a system of digital filters which allows us to separate the different scales – the large scales adequately described by the global systems, and the regional scales presumably better described by the limited area model. A comparison with regional re-analyses demonstrates that added value emerges only for the regional scales, while the description of the large scales suffers from some deterioration. The result is considerably improved if a large-scale constraint if introduced, while the conventional forcing only along the lateral provides little added value.

It is emphasized that this assessment may depend to some extent on the specific measure adopted. Other measures may identify other added values. Thus, more research on the added value is needed.