Dynamics and Statistics of Weather and Climate

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Main focus:
This short *focus workshop* dealt with the accuracy of predictions in weather and climate. Numerical weather predictions and climate simulations rely on detailed models of the Earth's atmosphere (and also ocean currents in the case of climate), which are initialised using observational data and subsequently integrated numerically. All aspects of this approach inevitably contain inaccuracies and errors. On this workshop, the different error sources and their consequences were discussed, along with possible ways to reduce these errors or at least to assess their magnitude. In general terms, erroneous representation of the underlying physics and the initial condition lead to wrong model dynamics and deviations between the statistics of prediction and reality.
Senior participants:
The participants included leading experts working in the fields of weather forecasting, climate modelling, and predictability.
Young scientists:
10 out of the 30 talks of the workshop were presented by young scientists, typically senior PhD students or postdocs. The 20 posters were presented by younger participants. They had the chance to give a very brief overview of their poster (around 2 minutes) in a special session, which turned out to be very successful.
Scientific results:
The statement that atmospheric models are only an approximation of reality, and that their dynamics are therefore different from nature, is not new. However, the talks of this conference gave a detailed and quantitative impression of model errors and forecast accuracy. In terms of atmospheric modelling, the audience was rather broad: Different time scales (weather and climate), different physical (sub-)systems (clouds, the atmosphere, and full climate models), different intentions (precise weather forecasts, long run climate projections), different methodologies (statistical prediction and downscaling schemes, ensemble optimisation, data assimilation techniques). Therefore, this focus workshop stimulated the discussion between sub-communities. It reflected the state of the art and demonstrated which areas require strong and concerted efforts in the future. Several speakers expressed their concern regarding the validity and therefore the value of detailed global and regional climate predictions, as for example presented in the latest IPCC report and issued by local governments.
A number of topics emerged which, we believe, are of particular interest to the nonlinear dynamics community. Several new paradigms were suggested, such as covariant Lyapunov vectors, random attractors, and several new ideas for data assimilation. A deeper study and thorough assessment of these concepts could be an interesting subject of research for the nonlinear dynamics community, and several collaborations emerged during the workshop. Furthermore, the University of Hamburg presented their Portable University Model of the Atmosphere (PUMA). This model is well documented, simple compared to other

atmospheric models, and possible to handle even for the non–expert, yet it is a realistic model of atmospheric motion. This renders PUMA a very interesting testbed for new concepts of nonlinear dynamics methods.