Report on the "Ad-hoc meeting on 'Issues of Scale': comparing modelled and observed extremes", Royal Netherlands Meteorological Institute (KNMI), De Bilt, Netherlands, 16th May 2008

This meeting followed the WMO CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) meeting on 13th May 2008 and the EU FP-6 integrated project ENSEMBLES workshop "Extremes in a changing climate" on 14th -15th May 2008. The meeting was proposed following recommendations made to the World Climate Research Program (WCRP) in January detailing possible ways on how to move forward with WCRP's international coordinated extremes initiative. Since a 'pool of experts' was already present in De Bilt for the other workshops it was proposed that an additional day could be added to address scaling issues for extremes. This was kindly agreed to and hosted by KNMI.

Scaling issues for extremes refer to the mismatch between the spatial representativeness of observations on the one hand, which are generally collected at observation sites (points), and that of climate model output data on the other hand, for which grid point values are often assumed to represent area mean values. Scale mismatch is typically more of a problem for less continuous fields (e.g. precipitation) and for small temporal scales (e.g. daily or sub-daily data and extremes). It should be noted that the comparison between models and observations may also be affected by similar representativeness questions temporally, particularly at very short, sub-diurnual, durations. Temporal representativeness was not extensively discussed during the meeting.

While at present it may be difficult to produce observational datasets that are fully comparable with model output, our aim here was to provide a set of guidelines and suggestions for the modelling and observational communities that will hopefully make comparison easier in future, particularly with a view to the timeline of the IPCC's Fifth Assessment Report (AR5). The following recommendations were therefore proposed:

1) **Real time and continued monitoring of observations in combination with uncertainty estimates**

    a. Observed datasets of extremes should be produced with uncertainty estimates. In addition clear guidelines should be produced as to the appropriate uses of any datasets used e.g. reanalyses should not be used for trend analysis over certain time frames given inhomogeneities introduced by using satellite data for example.
    b. Testing of data and datasets should be performed rigorously and particularly in regions with good data and coverage to obtain optimal estimates of observational uncertainty.
    c. The workshop model adopted by the Asia Pacific Network (APN) and the WMO CCl/CLIVAR/JCOMM Expert Team Meeting on Climate Change Detection and Indices (ETCCDI) needs to be continued and particularly targeted in regions where workshops have already been held successfully. Repeated visits to a given region between now and AR5 and perhaps beyond are needed to develop an

ongoing capacity, and to ensure, in the interim, that the indices from these regions continue to be updated. This will help the regions to continue to develop a robust capacity to serve themselves and contribute to the global research and monitoring effort.

d. Information on extremes as they happen should be available. This could potentially happen through an automatically updated web site.
e. Analysis of observed extremes should be conducted in conjunction with process studies (see also recommendation 8).

2) Common extremes datasets for both observations and models

a. Ideally daily and/or sub-daily data for observations (stations and grids) and output from models should be accessible.
b. Model fields for various variables including temperature, rainfall, pressure, winds, humidity etc. should be saved and accessible to the wider research community.
c. Common CF-compliant (i.e. defined conventions for climate and forecast metadata) documented software for calculating extreme indices should be available for observation and modelling centres to use.
d. Guidance on what observational datasets represent and how they might differ from model output to avoid misinterpretation.

3) Extensively test indices in both observations and models, in different climate regions, before handing to end users or recommending additional indices

a. The choice of indices required/chosen should be informed by end users and this combined with issues of data homogeneity should be linked to questions asked by the impacts community (see also recommendation 4).
b. Any new indices proposed should be extensively tested in regions with good data and different climate zones before being included in ‘official’ lists (e.g. ETCCDI recommended indices). (see also recommendation 1b)

4) Use existing good practice from other fields to work better with impacts community

a. A joint workshop with many different end users is recommended. This will help to clarify what is wanted by one community and what is possible from the other.

5) Characteristics of observing networks required to look at extremes

a. These should be established taking account of multiple users’ different requirements on space and time scales e.g. the descriptive ETCCDI indices may not directly interest the impacts community who favour information on more rare extremes (see also recommendation 9).

6) Choice of modelling framework

a. Optimally a cascade of models is required i.e. regional/coupled/SST-forced models.
b. Experimental design needs to be explored and compared e.g. the effect of driving RCMs with different GCMs – are differences due to boundary conditions or model design?
c. Both perfect and imperfect model studies should be explored.
d. Better methods need to be explored to exploit existing model runs to obtain better estimates of natural variability from models.

7) Explore the potential for predicting changing risk of extremes at various timescales

a. Seasonal to decadal and beyond.

8) Understanding processes important for extremes

a. We need to identify what processes are important, how we test them and how they feed back into improving the models.
b. Observations can be used to inform the means of testing and weighting models.
c. Different scaling factors are required for different dynamical systems e.g. mid-latitude frontal systems, local convection, mesoscale convection.

9) Continued monitoring of developments in statistical science

a. New and improved methods for analysing extremes e.g. using existing data resources more efficiently.
b. Work to ensure that those methods appropriate and useful to climate issues become part of the regular toolset of climate scientists.
c. Recognition that staticticians can aid climate scientists to develop the best approaches to analyse extremes e.g. using non-stationary extreme value distributions.

Participants list

Lisa Alexander, Monash University, Australia
Julie Arblaster, NCAR/BoM, USA/Australia
Thomas Bosshard, ETH, Switzerland
Simon Brown, Met Office, UK
Erasmo Buonomo, Met Office, UK
John Caesar, Met Office, UK
Howard Cattle, International CLIVAR Project Office
Cheng-Ta Chen, National Taiwan Normal University
Paul Della Marta, MeteoSwiss, Switzerland
Erich Fischer, ETH, Switzerland
Hayley Fowler, Newcastle University, UK
Liz Good, Met Office, UK
Gabi Hegerl, University of Edinburgh, UK
Martin Hirschi, ETH, Switzerland
Nynke Hofstra, Oxford University, UK
Albert Klein Tank, KNMI, The Netherlands
Amanda Lynch, Monash University, Australia
Mark New, Oxford University, UK
Grigory Nikulin, SMHI, Sweden
David Parker, Met Office, UK
Gerard van der Schrier, KNMI, The Netherlands
Peter Stott, Met Office, UK
Simon Tett, University of Edinburgh, UK
Xuebin Zhang, Environment Canada
Francis Zwiers, Environment Canada