European Climate Assessment

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Introduction

Climate extremes, such as flood-producing rains, droughts, and severe heat and cold, have major impacts for our living conditions and activities. The wish to anticipate changes in the occurrence of such extremes and the concern about anthropogenic climate change triggered the decision of the European network of meteorological services EUMETNET to start the European Climate Assessment (ECA) project. KNMI was appointed responsible member in 1998 and we immediately recognised that changes in extreme events could only be objectively identified by a thorough analysis of observations at meteorological stations.

Objective

ECA aimed at gathering of daily series of observations at meteorological stations in Europe and the Middle East (Region VI of the World Meteorological Organisation, WMO), analysing the data and subsequently disseminating the data and the analysis results. The daily station series needed rigorous quality control and tests for homogeneity before being submitted to trend analysis of extremes. The key questions addressed in the trend analysis were: 'how did the past warming affect the occurrence of temperature extremes' and 'was the past warming accompanied by a detectable change in precipitation extremes'.
These are questions that require an accurate, dense and consistent dataset with at least a daily resolution.

Results

Daily series of temperature and precipitation collated for stations from countries all over Europe (Figure 1) have been made freely available for scientific use at the project website[1)]. Most station series cover a period of 50 years or more. Metadata information on station history, data quality flags and homogeneity flags have been included. The homogeneity flags classify each series as "useful", "doubtful" or "suspect" on the basis of four tests (Figure 2). Only series classified as "useful" are subjected to further trend analysis.

The final report, which addresses the climatological and impact communities, policy makers and the general public, describes all results[2)].
With respect to trends in extremes it concludes that:

- The observed decreases in cold extremes and increases in warm extremes (e.g. Figure 3) are generally consistent with a mean warming for Europe. Remarkably, the cold and warm trends do not always match. For instance during the warm recent decades, the number of cold extremes has decreased at a lower rate than the rate of increase in the number of warm extremes.
- For precipitation, the dominant warming trend between 1946 and 1999 was generally accompanied by a slight increase in wet extremes. This is seen in particular at locations where the annual amount of rainfall has increased.

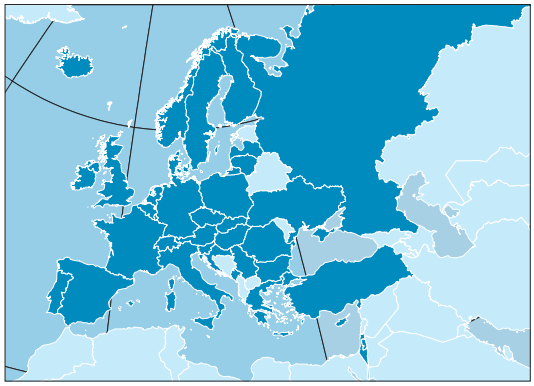

Figure 1. Participating countries in the ECA project (status May 2002).

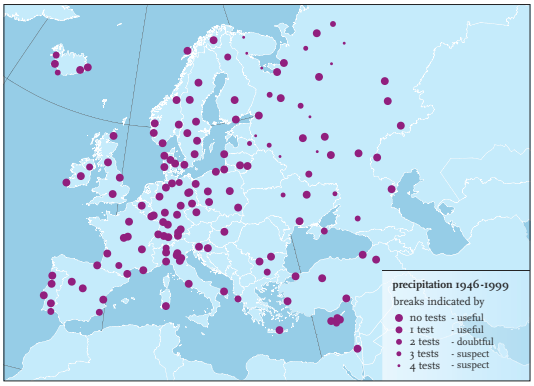

Figure 2. Number of homogeneity tests indicating a break in the series with associated classification for precipitation (period 1946-1999).

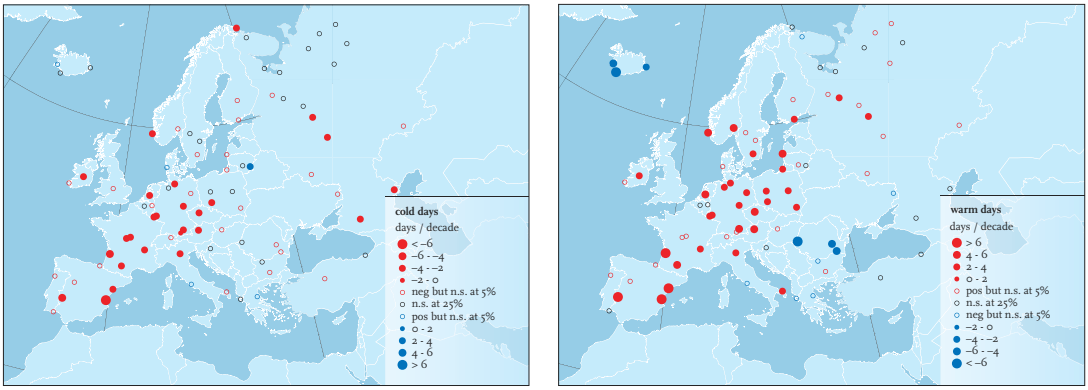

Figure 3. Trends in annual number of cold days and warm days in the 1946-1999 period. Cold days and warm days are defined as days with mean temperature crossing the seasonally varying 10th an 90th percentiles in the 1961-1990 baseline period.

The combination of data collection and dissemination with quality control, homogeneity testing and trend analysis proves to be essential for success

Apart from these deliverables, ECA participants produced a number of papers in peer-reviewed journals describing the analyses in more detail[3-5]. ECA is linked to working groups of the Intergovernmental Panel on Climate Change (IPCC), and its results are incorporated in IPCC's Third Assessment Report. For WMO's Commission for Climatology and the Research Programme on Climate Variability and predictability (CLIVAR), ECA maintains a comprehensive list of indices derived from daily surface data and providing insights into changes in climate extremes. There are also links to research and technical projects in the framework of the European Union. Through further matching with WMO requests for long daily station series, the project makes it possible to regard the daily dataset as Europe's contribution to the Global Climate Observing System (GCOS) Surface Network.

Outlook

As a follow-up, the European Climate Assessment & Dataset (ECA&D) project will build upon the unique co-operation of 36 institutions (meteorological services, universities and research centres). The project plans to extend the present dataset with more stations and meteorological elements, broaden the network of participating countries, and intensify the homogeneity analysis of daily series and the analysis of trends in climate extremes. Finally, it will be explored how the indices of extremes can be used by policymakers for impact assessment and the design of adaptation measures. ECA&D will continue the full range of ECA activities, as the combination of data collection and dissemination with quality control, homogeneity testing and trend analysis proves to be essential for success.

1) ECA project website: *www.knmi.nl/samenw/eca*
2) Klein Tank A., J. Wijngaard and A. van Engelen, 2002, *Climate of Europe; Assessment of observed daily temperature and precipitation extremes.* Final Project Report, De Bilt, the Netherlands, 36 pp.
3) Klein Tank A.M.G., et al. (including J.B. Wijngaard and A.F.V. van Engelen), 2002, *Daily dataset of 20th-century surface air temperature and precipitation series for the European Climate Assessment.* Int. J. of Climatol., 22, 1441-1453.
4) Wijngaard, J.B., A.M.G. Klein Tank and G.P. Können, 2003, *Homogeneity of 20th century European daily temperature and precipitation series.* Int. J. of Climatol., 23, 679-692.
5) Klein Tank, A.M.G. and G.P. Können, 2003, *Trends in indices of daily temperature and precipitation extremes in Europe,* 1946-1999. J. Climate, 16, 3665-3680.