Homogeneity of precipitation series in the Netherlands and their trends in the past century

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ABSTRACT

The historical daily precipitation observations before 1951 in the Netherlands were digitized recently, so that all data from 1850 onwards are available in computer readable form now. The homogeneity of the precipitation series was tested by pairwise comparisons of the monthly totals using an algorithm of Menne and Williams (*Journal of Climate*, 2009) that was originally applied to monthly temperature data. Forty percent of the precipitation series were indicated as inhomogeneous if the algoritm was applied to the untransformed monthly totals. The use of a square-root transformation to reduce the skewness was only successful in an application to the data for the 1951-2009 period. For older precipitation data such a transformation turned out to be inappropriate due to the lower quality of these data. Changes in the annual precipitation amounts, the precipitation amounts in the winter and summer halves of the year, the number of days per year with a precipitation amount greater than 20 mm or 30 mm, and the 5-day annual maximum precipitation amount were explored both for the period 1951-2009 using the data from 240 stations and the period 1910-2009 with the data from 102 stations. Significant increases were found for all six indices. The centennial increases in mean annual, winter and summer precipitation are 25%, 35%, and 16%, respectively. The exceedance frequency of the 30 mm threshold almost doubled during the 1910-2009 period. Much attention is given to the field significance of trends, the statistical significance of regional differences in trends and non-linearity of trends. In contrast to the increase in mean winter precipitation, which is statistically significant for the majority of the rainfall stations, the increase in mean summer precipitation is mainly restricted to coastal regions. The mean summer precipitation and the exceedance frequencies of the 20 mm and 30 mm thresholds show a relatively strong increase from the beginning of the 1980s.

Measurement and statistical modeling of the urban heat island of the city of Utrecht (the Netherlands)

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ABSTRACT

Mobile temperature and humidity measurements have been performed along on a 14 km transect through the city of Utrecht (300.000 inhabitants) in the period March 2006 - January 2009. The measurements took place on a bicycle during commuter traffic and resulted in 106 morning profiles (before sunrise) and 77 afternoon profiles. It is shown how the urban heat island depends on wind direction, cloudiness and windspeed. A statistical model is constructed that relates the magnitude of the urban heat island to the local area-averaged sky-view factor and land use. Sky-view-factors are calculated from a 0.5x0.5 m surface elevation database and land use is obtained from a 25x25 m land use database. The model is calibrated using the mobile measurements and provides an estimate of the areal distribution of the mean and maximum night time urban heat island in Utrecht. It explains more than 80% of the variance. The measurements are also used to obtain an estimate of the magnitude of night time urban heat advection to the meteorological station De Bilt, just east of Utrecht. It is shown that for night time conditions and westerly wind, advection causes a mean temperature rise of 0.5°C at that station.

Implementation of GCOS climate monitoring principles at KNMI (the Netherlands)

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ABSTRACT

Changes in the measurement network of meteorological institutes are sometimes inevitable. Often this concerns a forced relocation of a station (e.g. because of cancelation of the terrain) or a relocation because of abrupt or slow changes in the terrain around the measurement site. In the latter, measurements are mostly no longer representative for the neighbourhood of the site. Changes in measurement networks may also be meant to (a) improve the quality of the measurements, for instance by introducing improved sensors and/or covers, or (b) work more efficiently with respect to costs.

In principle changes in the measurement network or surroundings lead to inhomogeneities in climate time series. For climate research and applications these artificial jumps or trends are unwanted and should therefore be minimized.

KNMI recently developed and adopted a *Protocol Changes Measurement Infrastructure*. The protocol causes (a) a minimization of inhomogeneities in climate time series, (b) an adequate and timely assessment of the nature and magnitudes of inevitable inhomogeneities, and (c) adequate communication about changes in the measurement infractructure and their implications. The current protocol may serve as an example of how the GCOS principles for climate monitoring can be implemented in the daily practice of climate monitoring.