Royal Netherlands
Meteorological Institute
Ministry of Infrastructure and the Environment

Product Description KNMI14 Daily Grids

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Contents

1 Introduction

The KNMI14 daily grids datasets contain interpolated daily maps of precipitation and Makkink evaporation observations for the reference period 1981-2010 and daily maps based on transformed data according to the KNMI14 climate scenarios.

The datasets cover the entire area of the Netherlands including the Wadden Sea, IJsselmeer and estuaries in Zeeland. The grid size is 1 km.

The datasets have been initially produced for the Netherlands Hydrological Instrument (NHI). The methods used induce some important dataset limitations which are addressed in section 4.

2 KNMI14 scenarios

The maps for the future scenarios have been produced by first transforming historical reference time series (1981-2010) to different scenarios for each observation and second by interpolating the transformed observations for each individual day.

The transformation methods are described in Van den Hurk et al. (2014), Bakker & Bessembinder (2012) and KNMI (2014). Transformations are executed for WH, WL, GH and GL scenarios for the climate around 2050 and 2085 resulting in time series from 01-01-2035 to 01-01-2065 and 01-01-2070 to 01-01-2100 respectively (see also section 4).

The following KNMI14 daily grid datasets are available in KNMI Data Centre:

RDREF
RD50WH
RD50WL
RD50GH
RD50GL
RD85WH
RD85WL
RD85GH
RD85GL

EVREF
EV50WH
EV50WL
EV50GH
EV50GL
EV85WH
EV85WL
EV85GH
EV85GL

Where:

- RD refers to precipitation.
- EV refers to Makkink evaporation.
- 50 and 85 refer to the scenario time horizon.
- REF refers to the untransformed reference dataset (1981-2010).
- WH,WL,GH,GL refer to the climate scenario.

All KNMI14 daily grid datasets have version 014, updates will have version 014x.

3 Dataset descriptions

3.1 Precipitation

3.1.1 Source data

The source data is cumulative precipitation over the time interval 08:00-08:00 UT measured by the KNMI precipitation stations network (voluntary network). Only observations with complete time series are used for transformation to KNMI14 scenarios. Therefore both reference and scenario source datasets contain a fixed number of 294 observations.

3.1.2 Interpolation method

The interpolation method is ordinary kriging. Observations are square root transformed and back-transformed after interpolation using quantiles calculation where a correction for the number of measurements with zero number is taken into account. For every day a spherical or exponential variogram is automatically fitted depending on the best fit. The nugget is zero which implies that the interpolation method is exact: the predictions on the measurement locations are identical with the measurement values. Minimum and maximum values are not lower or higher in the interpolated maps than in the source data. The method and quantitative validation is described in detail in Soenario, Sluiter et al. (2010).

3.1.3 File description

Each day is available as a separate NetCDF file. This file contains the following layers:

- precipitation_amount(prediction): the interpolated precipitation map (mm/day).
- stations(station): the location and station number of the precipitation stations.
- stationvalue(stationvalue): the measured precipitation at the precipitation station (mm/day).
- variance(variance): kriging variance (mm^2/day).

The datasets are available through the KDC[1] portal and KDC FTP server[2]. Each daily file is available in a separate folder, for example:

Folder: /download/RDREF/014/0014/1981/01/01
File: INTER_OPER_R___RD_REF__L3__19810101T080000_19810102T080000_0014.nc[3]

The dates in the filename refer to the end-time and start-time of the measurement. The measurement at 08:00 UT (end-time) is assigned to the file in the folder of the preceding day on the FTP server as 2/3 of the measurement period falls on the preceding day. In other words: the measurement with the end-time 19810102T080000 is assigned to the folder 1981/01/01 on the FTP server or in the tar-file.

1 https://data.knmi.nl/portal/KNMI-DataCentre.html#term=KNMI14
2 ftp://data.knmi.nl/download/
3 Files use the ADAGUC file name convention (KNMI 2008)

3.1.4 Differences with previous datasets

In KDC the operational daily rainfall dataset (Rd1, 1951-present) is available. Methodology is identical but the number of observations is not fixed and differs per day from 270-310.

In 2010-2011 KNMI'06 daily grids have been produced exclusively for NHI using the same methodology. In that dataset the fixed number of observations is 271 and the reference period is 1961-1995.

In 2011-2012 KNMI'06 daily grids have been produced exclusively for NMDC/Deltares using the same methodology (Bakker & Bessembinder, 2013). In that dataset the fixed number of observations is 273, the reference period is 1981-2010.

3.2 Makkink evapotranspiration

3.2.1 Source data

The source data is Makkink reference evaporation over the time interval 00:00-00:00 UT. Makkink evaporation is derived from incoming radiation and temperature measured by the KNMI Automatic Weather Station (AWS) network. Only observations with complete time series are used for transformation to KNMI14 scenarios. Therefore both reference and scenario source datasets contain a fixed number of 14 observations. A detailed description of the calculation of Makkink evaporation can be found in Hiemstra & Sluiter (2011) and Hooghart & Lablans (1988).

3.2.2 Interpolation method

The interpolation method is Thin Plate Spline (TPS) as described in detail by Hiemstra & Sluiter (2011). The smoothing parameter λ is fixed for every day on 0.004. TPS is not an exact interpolator: the predictions on the measurement locations may differ from the measurement values and minimum and maximum values may be lower or higher in the interpolated maps than in the source data. Theoretically TPS can produce negative values. In this dataset we correct this by assigning 0 to negative values.

3.2.3 File description

Each day is available as a separate NetCDF file. This file contains the following layers:

- evaporation(prediction): the interpolated evaporation map (mm/day).
- stations(station): the location and station number of the precipitation stations.
- stationvalue(stationvalue): the measured evaporation at AWS (mm).

The datasets are available through the KDC[4] portal and KDC FTP server[5]. Each daily file is available in a separate folder, for example:

Folder: /download/EVREF/014/0014/1981/01/01

4 https://data.knmi.nl/portal/KNMI-DataCentre.html#term=KNMI14
5 ftp://data.knmi.nl/download/

File: INTER_OPER_R___EVREF___L3__19810101T000000_19810102T000000_0014.nc[6]

The dates in the filename refer to the end-time and start-time of the measurement. The measurement with the end-time 19810102T000000 is assigned to the folder 1981/01/01 on the FTP server or in the tar-file.

3.2.4 Differences with previous datasets

In KDC the operational daily Makkink evaporation dataset (EV24, 1965-present) is available. Methodology is identical but the number of observations is not fixed and differs in time from 5-35.

In 2010-2011 KNMI'06 daily grids have been produced exclusively for NHI using the same methodology (version 005). In that dataset the fixed number of observations is 5 and the reference period is 1961-1995.

In 2011-2012 KNMI'06 daily grids have been produced exclusively for NMDC/Deltares using the same methodology (Bakker & Bessembinder, 2013). In that dataset the fixed number of observations is 14, the reference period is 1981-2010.

6 Files use the ADAGUC file name convention (KNMI 2008)

4 Dataset limitations

The methods used induce some important consequences for use which should be kept in mind when using the data:

- The values in between stations are interpolated, the maps are therefore an approximation of the real patterns which may be more irregular in nature and determined by local factors not taken into account in the interpolation methods.

- The spatial grid size is set at 1km by pragmatic reasons as most end-users use this resolution. The selected grid size is not a measure for the accuracy of the data.

- The assignment of "real" dates to the maps is pragmatic: values should not be interpreted as an exact prediction for a specific date. The datasets give a statistically based indication of the climate around 2050 and 2085 for different scenarios: the order of situations within years and between years will differ (Van den Hurk et al. 2014, Bakker & Bessembinder 2012).

- In an area of +- 4 km outside the Netherlands values are also predicted. In these areas and some areas within the Dutch border, the predicted values are the result of extrapolation which may decrease the accuracy.

- For the IJsselmeer, Wadden Sea and estuaries in Zeeland values are also predicted. In these areas no observations are present. As Makkink evaporation and precipitation both behave different above land and open water, the calculated values are less representative.

- For precipitation a consequence of the methodology is that extreme statistics derived from predicted locations on the map may be lower than statistics derived from the source data.

- The transformation methodology may in a limited number of cases cause that the spatial correlation between observations may decrease. This may influence the automatic variogram fitting procedure and cause spatial artefacts.

5 References

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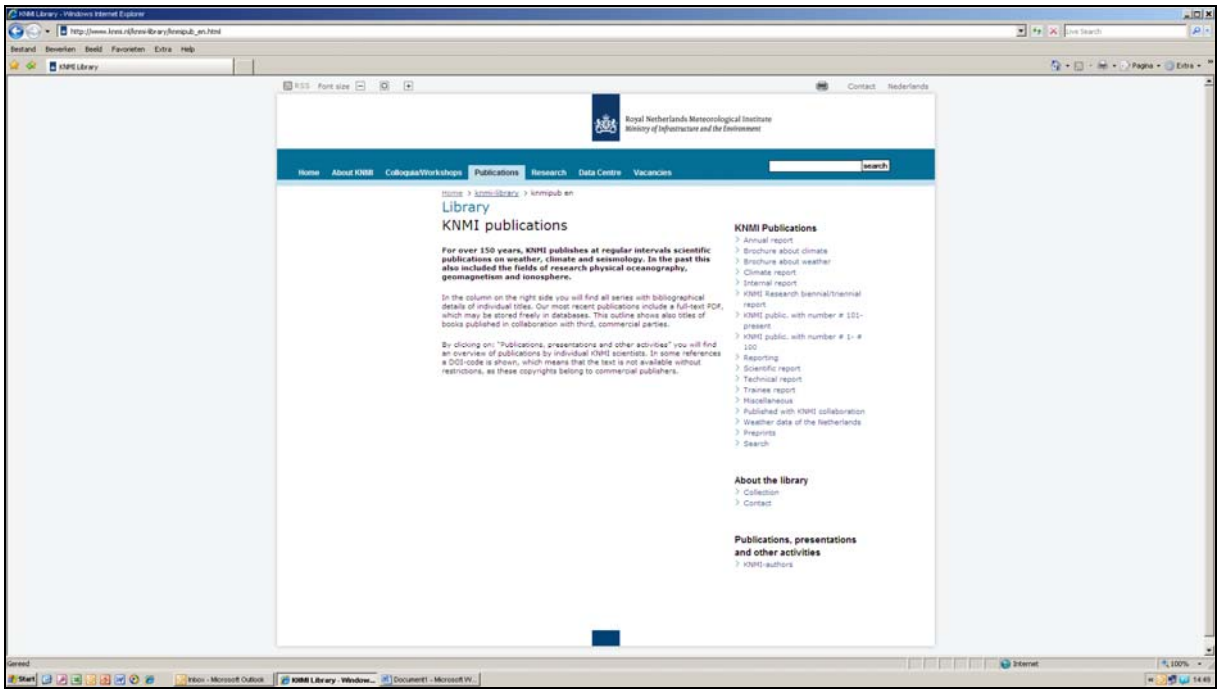
www.knmi.nl/knmi-library/knmipub_en.html



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