



# Newsletter

## climate scenarios



Issue 2, February 2012

The purpose of this newsletter is to inform users of climate and climate impact information about the progress of the consortium of [High-quality Climate Projections \(theme 6\)](#) and the process leading to the [KNMInext climate scenarios](#). These subjects are strongly related: research and user inventories performed in theme 6 will be used to improve the [KNMInext climate scenarios](#) and to provide more elaborate information.

### About KNMInext climate scenarios - background information -

Both new insights from climate research, periodically assessed by IPCC, and additional user requirements are a strong motivation for KNMI to develop actualised scenarios for climate change in the Netherlands. KNMI is working on the next generation of scenarios, with the temporary working title [KNMInext](#).

The [KNMInext scenarios](#) will succeed the [KNMI'06 scenarios](#): which included four plausible pictures of the future climate in the Netherlands, issued in 2006. They are frequently used in climate change impact and adaptation studies. [Supplements](#) to these scenarios were issued in 2009.

#### Time schedule KNMInext

The new KNMI scenarios will coincide with the publication of the [Fifth Assessment Report \(AR5\) of the IPCC Working Group I](#) (the physical scientific aspects of the climate system and climate change) due autumn 2013.

[Website klimaatscenario's \(Dutch\)](#)  
[Website climate scenarios \(English\)](#)

### About theme 6 - Climate Projections - background information -

[Theme 6 - Climate Projections](#) of the research programme [Knowledge for Climate](#) aims to provide high quality information on regional climate in The Netherlands, now and in the future, for developing national and regional adaptation strategies.

Researchers, including seven PhD students, work on mechanisms of local climate change, the generation of time series, information about extremes and probabilities. The coupling of climate projections to impact assessment models is also included.

A central theme addresses the uncertainty related to the pace and extent of climate change: specifically how to reduce, quantify and communicate these uncertainties.

#### Time schedule theme 6

November 2010 – December 2014

- [Theme 6 Website](#)
- [Theme 6 Flyer \(PDF\)](#)
- [Theme 6 Consortium partners](#)
- [Theme 6 Web portal: Climate Impact Guide \(Dutch\)](#): data and background information for climate impact analysis.



### More information at local and regional scale

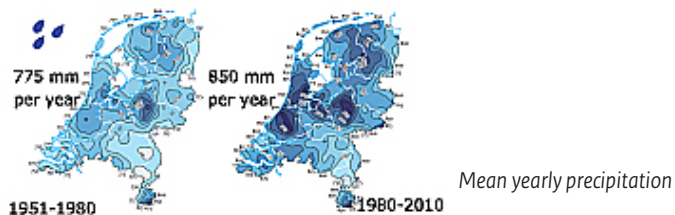
There is an increasing interest in information related to climate change at both local and regional scales. [KNMI'06](#) provided only limited information on these scales, mainly because of the limitations of the available (model) data and incomplete understanding. For instance, changes were provided as averages for the Nether-

lands as a whole. Yet, observations show that over the last 50 years a wetting trend of the coastal areas has occurred during summer and early autumn when compared to inland areas (see figures in right column at the next page of the change of mean yearly precipitation). Therefore an obvious question is whether this trend will continue in the future. Important information related to

variations on hourly timescales was also lacking (e.g. variations in shower intensity over the summer), which are of key importance to urban areas. As a proxy, KNMI'06 provided the change values for daily extremes. Since 2006 much research has been done on these issues, and the first results are now emerging.

One example is related to the fact that hourly shower intensities increase (much) faster with temperature compared to extreme daily precipitation events. The new climate scenarios will try to incorporate these new findings. We would like the reader to note that the research on local and regional characteristics of climate change is in a very early stage of development.

More information: [website of Future weather project](#) (which focused primarily on changes in precipitation extremes on different scales) or [lenderin@knmi.nl](mailto:lenderin@knmi.nl)



### The steering variables for KNMInext

The KNMI'06 climate change scenarios were defined by two different values for the assumed global mean temperature rise (1 and 2 °C in 2050), and the degree to which the regional atmospheric circulation would respond to this temperature increase (no changes or changes). In KNMInext a similar set of so-called steering variables will be used: namely the global mean temperature increase, and an indicator of changes in the atmospheric circulation.

A large number of climate model simulations have been completed recently in preparation for the 5th IPCC assessment report due to appear in 2013 (see article at the next page "Global model data available"). The following analysis is based on the first available 165 simulations. Note that these results are very recent and therefore unpublished and preliminary!

#### Global mean temperature

The spatial warming pattern is fairly uniform across the large ensemble of 165 simulations: land areas warm faster than sea, high latitudes warm faster in winter, and in summer the Mediterranean area shows pronounced warming, partly due to reduced surface evaporation. The range in global mean temperature rise in the analyzed global model runs (the first 165 CMIP 5 simulations) is rather similar to the range published in the last IPCC assessment in 2007. However, this similarity could change when accounting

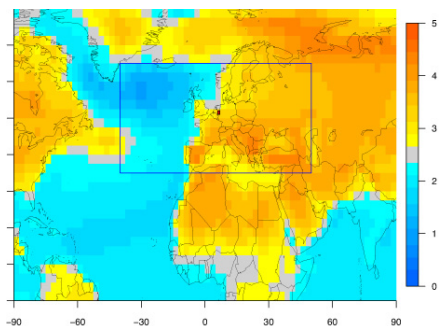
for the additional simulations currently underway. Based on the results up till now, it is expected that the values used for the first steering variable of KNMInext (global mean temperature change) can be similar to those in KNMI'06.

The figure in the left column shows the relative warming pattern in summer over the next century, averaged over all 165 model simulations now available. The colors show relative stronger or weaker warming, but note that the numbers should not be interpreted as the mean warming signal in degrees Celsius. Land is warming faster than sea, the North Atlantic sea warming is weak and the Mediterranean warming is relatively strong.

#### Indicator of atmospheric circulation

The circulation response to global warming varies widely across the model ensemble. Large differences in circulation changes between models were also found in the previous generation projections used for KNMI'06. For KNMInext we have chosen for a circulation index that is closely related to precipitation variations in the Netherlands and surrounding regions. The circulation index is based on sea level pressure, which correlates to wind direction as the position of high and low pressure areas determines the wind direction. A specific pattern of mean sea level pressure change - with low pressure change north of the Netherlands and high pressure change in the south - is found to correlate well with strong precipitation changes in winter. This distribution of pressure changes will bring relatively strong westerly winds with mild and moist air from the Atlantic area to our region, causing higher than average precipitation.

The second steering variable in KNMInext will be a measure of the strength of this pattern: models in which the circulation change resembles this pattern show a very different regional climate response than models with a small or different circulation change pattern. In KNMI'06 also a steering variable related to circulation was used, however a different one than will be used in KNMInext.



Relative warming pattern in summer, averaged over available 165 model simulations

More information: [hurkvd@knmi.nl](mailto:hurkvd@knmi.nl)

## Global model data available

Analysis of global model data is the first step in developing the KNMI<sup>next</sup> scenarios for the Netherlands. The global model data (CMIP5 data) for the [Fifth Assessment Report \(AR5\)](#) of the Intergovernmental Panel on Climate Change (IPCC) are, by now, for a large part available. Eventually the CMIP5 database will include simulations with 25 different climate models. Since half December 2011 the output of up to 18 models (with 165 scenario simulations between 1950 and 2100) are made available. This number includes some runs of EC-Earth, the global earth-system model of KNMI and European partners. The models perform simulations for four different emissions scenarios. It is the first time that the Netherlands submitted simulations for inclusion in the global climate model assessment of IPCC.

### *Purpose of CMIP5*

CMIP5 is a protocol to perform simulations of the earth's climate in such a way that the model output can be easily compared with the output of other models and with observations. The IPCC will use the combined knowledge gained from these climate models to assess the relative contributions of various climate processes and feedbacks to climate change in the last century, and to provide projections of possible climate change over the next century and beyond (and to quantify the uncertainty therein).

### *Analysis of CMIP5 data*

First assessment of the available CMIP5 data (18 of the 25 models) shows that there are no large differences with the model runs (CMIP3) used for the previous IPCC assessment report in 2007. The most important differences are: 1) The models have improved in their ability to represent the climate due to higher resolution and better parameterisation of small-scale processes. 2) The emission scenarios used in the IPCC assessment reports in 2001 and 2007 (SRES scenarios) have been replaced by the Relative Concentration Pathways (RCP) scenarios. The SRES scenarios prescribed greenhouse gas concentrations that resulted from various economic

development scenarios. In contrast, the RCP scenarios specify certain concentration pathways (for instance leading to no more than 50% chance of exceeding the 2°C criterion) and next leave it to the socio-economic community to find a way to reach this. 3) Many models now also include the effect of climate change on the ability of the earth to absorb part of the carbon emitted by humans.

The assessment of these model results will be published in the publication of IPCC Working Group 1. KNMI is involved in the writing and reviewing of the assessment report.

### *Time schedule IPCC*

The AR5 publication of Working Group 1 (the physical scientific aspects of the climate system and climate change) will be published mid September 2013 after three review rounds, the first of which is now underway. In 2014 the publications of Working Group II (Impacts, Adaptation and Vulnerability) and III (Mitigation of Climate Change) will appear. The AR5 Synthesis Report on results of all three working groups will be published in October 2014.

More information: [www.ipcc.ch](http://www.ipcc.ch)

### *Downloads*

All model output in the CMIP5 archive is available at the [CMIP5 project website](#) for non-commercial research and educational purposes. A subset (about half) of the data has also been released for "unrestricted" use. The monthly data of all models is available at the KNMI Climate Explorer, [climexp.knmi.nl](http://climexp.knmi.nl) (under "Monthly CMIP5 scenario runs"). This web analysis tool allows you to download, process and analyze the data.

### *More information*

For more information about the CMIP5 data at the Climate Explorer, you can contact [Oldenborgh@knmi.nl](mailto:Oldenborgh@knmi.nl). For information about the model runs of EC-Earth, you can contact [Richard.Bintanja@knmi.nl](mailto:Richard.Bintanja@knmi.nl).

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## Tailored data on climate (change) and impacts

The expert pool of theme 6 has budget to generate tailored data on climate(change) and the impacts on hydrology, nature, agriculture, land use and air quality (for KvK themes and hotspots only). Examples are: additional time series to the KNMI scenarios, estimation of crop production or water levels in the future.

- [Flyer about the expert pool and criteria for application](#) (PDF) (Dutch)
- [More examples of possible questions \(about climate or impacts\) for the expert pool](#) (PDF) (Dutch)
- [Folder about the possibilities of climate tailoring](#) (PDF) (Dutch)



## A new way to generate future time series for KNMI climate scenarios

For climate impact studies, often time series of climate variables for the future climate are needed. Time series for the future can be generated with different methods, each with its own advantages and disadvantages.

### Use of historical time series to generate future time series

For the KNMI'06 scenarios a program has been developed to transform historical time series into future time series (the Delta method) according to one of the four KNMI'06 scenarios. Disadvantages of this method are that the transformation reduces consistency between variables and that the succession of weather events is mostly the same as in the historical time series.

### Use of model runs to generate future time series

Another method to generate time series is to use the output of

model runs after bias correction (Direct method). This method will implicitly include (possible) changes in a succession of future weather events. This method also has disadvantages, such as the reduction of consistency between variables caused by bias correction.

For the KNMI'06 scenarios the Direct method could not be applied to generate time series for each of the four KNMI'06 scenarios.

As part of theme 6 we want to investigate the possibilities of other methods to generate time series further, such as the use of model runs.

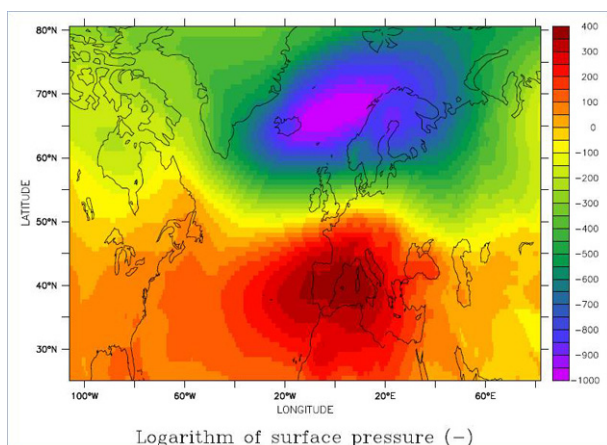
### New technique to deliver model runs for scenarios

For the KNMI $next$  scenarios we intend to apply a method to generate time series for future weather based on model runs, thanks to a new technique. With this technique we can force the mean climate state of a model to the specific atmospheric conditions of a scenario. Models, using this forcing, will give weather information which comes very close to these scenarios.

### PhD study on Future weather

The PhD study within theme 6 of Lucinda Rasmijn focuses on the weather conditions for the climate scenarios with changed atmospheric conditions with more than usual westerly winds in winter and more than usual easterly winds in summer. These winters and summers are warmer than usual because of the atmospheric circulation. A winter situation with more westerly winds is shown in the figure in the left column. The figure shows a low pressure area around Northern Europe and a high pressure area around Southern Europe, causing the westerly winds.

Lucinda uses the described new technique to force the mean climate state of the global climate model EC-Earth with the specific large scale atmospheric conditions that are characteristic to the climate scenarios with changed atmospheric conditions.



Surface pressure for a winter situation with more westerly winds

February 14 and March 8, 2012

## Workshops KNMI $next$ climate scenarios

Users of climate information are welcome to attend these workshops about the process to the KNMI $next$  climate scenarios. If you would like to think along with us about the presentation of the new scenarios, additional products (for example time series, presentation on maps) or the translation of the scenarios to several sectors (for example a summary for water management) and the required cooperation, then please attend these workshops.

Depending on your field of interest, you can choose one of the following days:

- Tuesday afternoon 14 February 2012: this day is more oriented at research [Program February 14th \(Dutch\)](#)
- Thursday morning 8 March 2012: this day is more oriented at policy [Program March 8th \(Dutch\)](#)

The workshops are a continuation of the workshops organized in spring 2010. As a result of those workshops a [report](#) (Dutch, English summary) was written, which is a compilation of user requirements.

The workshops are in Dutch. Free entry. Application via [klimaatdesk@knmi.nl](mailto:klimaatdesk@knmi.nl).

# Agenda

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May 23 - 25, 2012 (to be continued in autumn 2012)

## Course about climate change

The introduction course *Climate* (Dutch) for young researchers of KNMI is open to the public. You are welcome to follow this course about several aspects of the climate system, but also other geophysical research at KNMI is highlighted. The course is in Dutch, on request in English. Free entry. Application via [secrdks@knmi.nl](mailto:secrdks@knmi.nl).

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