



## The use of Meteonorm weather generator for climate change studies

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The global climatological database Meteonorm ([www.meteonorm.com](http://www.meteonorm.com)) is widely used as meteorological input for simulation of solar applications and buildings. It's a combination of a climate database, a spatial interpolation tool and a stochastic weather generator. Like this typical years with hourly or minute time resolution can be calculated for any site.

The input of Meteonorm for global radiation is the Global Energy Balance Archive (GEBA, <http://proto-geba.ethz.ch>). All other meteorological parameters are taken from databases of WMO and NCDC (periods 1961-90 and 1996-2005). The stochastic generation of global radiation is based on a Markov chain model for daily values and an autoregressive model for hourly and minute values (Aguiar and Collares-Pereira, 1988 and 1992). The generation of temperature is based on global radiation and measured distribution of daily temperature values of approx. 5000 sites. Meteonorm generates also additional parameters like precipitation, wind speed or radiation parameters like diffuse and direct normal irradiance.

Meteonorm can also be used for climate change studies. Instead of climate values, the results of IPCC AR4 results are used as input. From all 18 public models an average has been made at a resolution of 1°. The anomalies of the parameters temperature, precipitation and global radiation and the three scenarios B1, A1B and A2 have been included. With the combination of Meteonorm's current database 1961-90, the interpolation algorithms and the stochastic generation typical years can be calculated for any site, for different scenarios and for any period between 2010 and 2200. From the analysis of variations of year to year and month to month variations of temperature, precipitation and global radiation of the past ten years as well of climate model forecasts (from project prudence, <http://prudence.dmi.dk>) a simple autoregressive model has been formed which is used to generate realistic monthly time series of future periods.

Meteonorm can therefore be used as a relatively simple method to enhance the spatial and temporal resolution instead of using complicated and time consuming downscaling methods based on regional climate models.

The combination of Meteonorm, gridded historical (based on work of Luterbach et al.) and IPCC results has been used for studies of vegetation simulation between 1660 and 2600 (publication of first version based on IS92a scenario and limited time period 1950 - 2100: [http://www.pbl.nl/images/H5\\_Part2\\_van%20CCE\\_opmaak%28def%29\\_tcm61-46625.pdf](http://www.pbl.nl/images/H5_Part2_van%20CCE_opmaak%28def%29_tcm61-46625.pdf)). It's also applicable for other adaptation studies for e.g. road surfaces or building simulation.

In Meteonorm 6.1 one scenario (IS92a) and one climate model has been included (Hadley CM3). In the new Meteonorm 7 (coming spring 2011) the model averages of the three above mentioned scenarios of the IPCC AR4 will be included.