What is bias correction?

Both Global and Regional Climate models (GCM, RCM) have systematic errors (biases) in their output. For example climate models often have too many rainy days and tend to underestimate rainfall extremes. There can be errors in the timing of the monsoon or the amount of seasonal rainfall, or temperatures can be consistently too high or too low.

Errors in climate models can be caused by a range of factors. Errors or biases are due to limited spatial resolution (large grid sizes), simplified thermodynamic processes and physics or incomplete understanding of the global climate system. Thus, the use of uncorrected outputs in impact models or climate impact assessments can often give unrealistic results.

To overcome the large biases in climate models, a range of bias correction methods have been developed. For all methods it is important to realize that the quality of the observational datasets determines the quality of the bias correction. To do a good bias correction, it is important to have a good dataset of observations. If correcting extreme precipitation, then long-term data sets are needed.

The simplest approach is the **Delta change method**, which is often used in climate impact research. This approach uses the GCM or RCM response to climate change to modify observations. E.g. if the climate model predicts 3°C higher temperatures, 3°C is added to all historic observations to construct a new time series for the future climate. For rainfall usually a percentage change is calculated. If the climate model predicts a 20% increase in rainfall, a new time-series will be made by multiplying the historic rainfall by 1.2. For different months or seasons different delta factors can be defined. **Note:** this method does not take into account changes in climate variability such as increasing extreme rainfall or longer dry spells.

Another popular method is **(Multiple) linear regressions**. A regression analysis is made, using historic observations and climate model output for the same period. Using the regression parameters, bias adjusted future time series are constructed. The regression can be made as simple or complex as needed based on the available data and relation between observed climate and climate model output.

Both the delta change and linear regression method are suitable to bias adjust relative humidity, humidity, wind speed and radiation.

Currently, the Quantile mapping approach is often used for the correction of climate data that are used as input for climate impact models. This method is also used (e.g. for hydrological or crop models) or some variant of it is perhaps the most widely accepted.

All these methods can also be applied to seasonal forecasts.

Bias correction can often be combined with statistical downscaling. An Excel tool to do this has been developed by Wageningen University and can be **downloaded here**.

NOTE: Bias correction is also referred to as bias adjustment. The use of the term correction can be misleading because no method is available which corrects for all the biases.