PRIMAVERA

PRocess-based climate sIMulation: AdVances in high-resolution modelling and European climate Risk Assessment

Dealing with uncertainties

There are different types of uncertainties (natural variability, model and scenario uncertainties) and consequently different ways of how to deal with them: providing more observation data, using model ensembles and concentration scenarios. In the case of model and scenario uncertainties (due to the lack of knowledge of a system) no likelihoods can be assigned to the various climate scenarios. For dealing with these uncertainties about our future climate, it is in most cases better to ask which climate scenario is most relevant for the user, and not which one is most probable.

Can uncertainties be reduced?

- **Uncertainty due to natural variability** cannot be reduced, but it can be quantified with statistics. If not enough data are available, collecting more observations may provide more information or ensembles of model runs can be used. With a larger amount of data more precise statistics can be generated.
- **Model and scenario uncertainties** can be reduced by doing more research to better understand the climate and societal systems. In the meantime, scenarios can be used (no probability assigned to the scenarios!) to study the effect of known uncertainties and the implications for impacts and adaptation options. Producing higher resolution data in PRIMAVERA may help to understand the climate system better (fact sheet “Types of uncertainties”).

Climate scenarios

Climate scenarios are plausible and consistent representations of potential future climates. They are often chosen in such a way to consider a significant range of possible future climates. When exploring the range of possible impacts and searching for robust adaptation measures (in impact, adaptation and vulnerability studies) it is advised to use a complete set of climate scenarios. By comparing the results of the various scenarios one can determine how robust different adaptation measures are.

Ideally, the results of the impact and adaptation studies mentioned above play a role in the formulation of policies and strategies. In this phase often a choice for one or more climate scenarios is made as the basis for policies. This choice depends also on many factors that are not related directly to climate science (e.g. relevance for society, financial aspects).

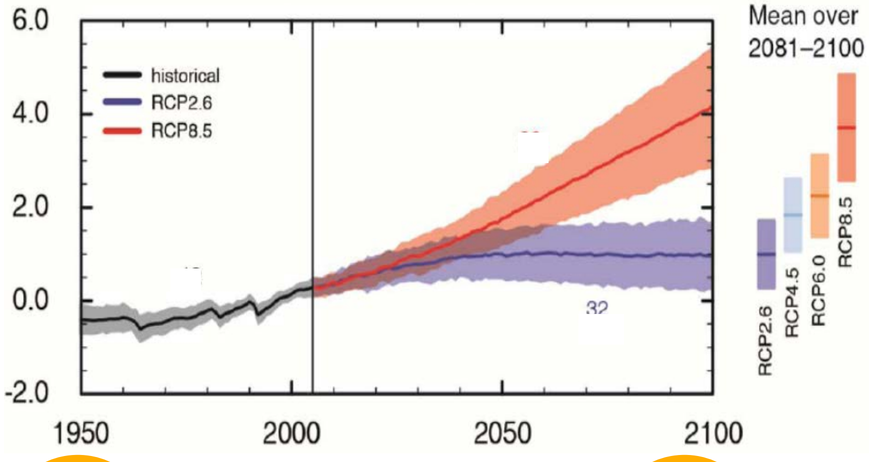

Figure 1 Multi-model ensemble for 1950 to 2100 for the global annual mean surface temperature relative to 1986–2005 for various Representative Concentration Pathways (RCP). Shading: measure of model uncertainty for RCP2.6 (blue), RCP8.5 (red) and modeled historical evolution (gray, natural variability). Vertical bars at right: mean and associated uncertainties averaged over 2081−2100 per RCP (IPCC, 2013).

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Info

Media

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PRIMAVERA is a collaboration between 19 leading European research and technology organisations with complementary expertise in climate science, climate change modelling, and high performance computing.

The project is led by the Met Office and the University of Reading.

www.primavera-h2020.eu

Watch the project video →

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Probability and relevance

No probabilities are assigned to individual emission scenarios or Representative Concentration Pathways (RCP). This is not possible, since it would require knowledge about which socio-economic developments pathways are more probable than others. Within an ensemble of climate model runs for one RCP the relative position of a model run can be indicated. When one assumes that the ensemble represents reality well, some kind of likelihood per RCP can be determined.

In most cases it is better to ask which climate scenario and time horizon is most relevant for the user, and not which is most probable.

Some examples:

- In cities flooding mainly occurs after heavy showers. The climate scenario with the largest increase in extreme showers is most relevant for assuring adaptation to the most extreme conditions;
- Agricultural production is influenced by the availability of water in the growing season. The scenario with the largest decrease in summer rainfall will probably give the largest impact and is, therefore, most relevant to make a system resilient under the most extreme situations;
- Sewerage tubes in the Netherlands often go into the ground for 40-80 years. A time horizon of up to 2060-2100 is relevant when one wants the sewerage system to function adequately until the end of its life cycle;
- The economic depreciation period of industrial installations or factories is often about 20 years, resulting in a time horizon of up to 2040-2045 (ROADAPT, 2015).

PRIMAVERA aims at providing better information for such risk assessments.


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Attitudes towards risks

Attitudes towards risks vary across people, cultures, time and experience. Some people have a risk-seeking attitude, whereas others are risk-averse (precautionary principle). Some people only start adapting when there is almost 100% certainty that something will happen, whereas others already want to adapt when there is some suspicion or indication of risky situation. Availability of resources and the magnitude of the impact of extreme events may also influence whether a more pro-active or prevention approach is used, or whether one focusses more on reducing the impact and recovering after extreme events (WATCH, 2018).

References

IPCC, 2013. Climate change: the physical science basis. WG1, Fifth assessment report

ROADAPT, 2015. Guideline on the use of data for the current and future climate for road infrastructure

WATCH, 2018. Climate and climate change: protocol for use and generation of statistics on rainfall extremes

PRIMAVERA factsheet on Types of uncertainties

Partners