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

Sources of climate data: advantages and disadvantages for risk assessments

For climate-related risk assessments, climate information about extremes is typically required. There are many different sources of climate data, all with their advantages and disadvantages. Observations only provide data for the past, while using models allows simulated data for the future climate to be provided. Models can also be used to fill in gaps in observations (in time and space), using a technique called re-analysis. The possibility to create ensembles with models helps to quantify extremes and the uncertainties about extremes.

Sources of climate data

Climate data can be obtained from many different sources:

- Observations: e.g. weather stations, satellites, radar (Fig. 1)
- Weather and climate models: re-analysis, (sub)seasonal to decadal predictions, climate projections

By definition, observations only provide data for the past. Using models allows simulated data for the future climate to be provided (Fig. 2). The various data sources have other advantages and disadvantages, and this factsheet describes the main ones that relate to risk assessments.

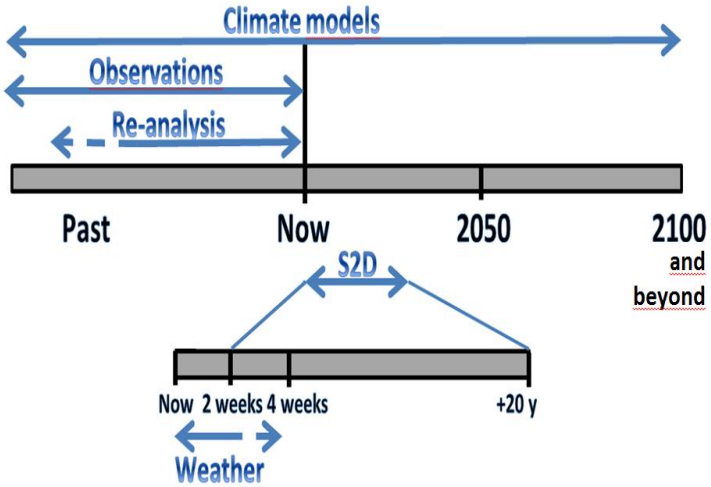

Figure 2. Schematic overview of data sources for atmospheric climate variables and the period for which they provide data (past – future). Although conventionally S2D indicates seasonal to decadal time scale, we are using S2D here to mean (sub)seasonal to decadal time scale.

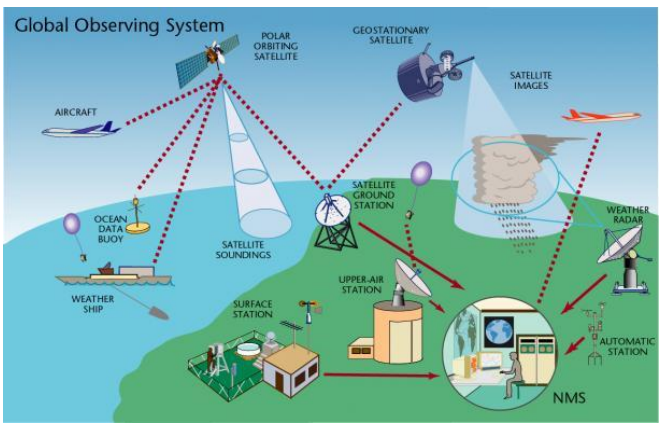

Figure 1. Various sources of climate observations (WMO1)

Requirements for risk assessments

For climate-related risk assessments, climate information about extremes is typically required. One would like to have a good and accurate estimation of the chance that extremes may occur. By definition, however, extreme events are rare – and so few observational data are available for extremes.

For risk assessments it may also be important to have information about specific locations, and at high temporal frequency. Often relatively high spatial and/or temporal resolutions are needed.

In many cases for risk assessments (e.g., for design of tunnels) one also needs information about potential changes in risks for the future. In PRIMAVERA the spatial and temporal resolution of climate models is increased, some projections for the future are provided and ensembles are created, that help quantify extremes better.

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Info

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.

Media

www.primavera-h2020.eu

Watch the project video →

PRIMAVERA

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Advantages and disadvantages of observations

The main advantages of data from **weather stations** are the direct measurements of many climate variables, and sometimes long time series. The main disadvantages are the unequal distribution of observations over the Earth and the presence of "inhomogeneities": apparent changes in climate due to e.g. the use of better instruments or changes in the environment.

The main advantage of **satellite and radar** data is the high spatial coverage (including data for regions without ground stations). Disadvantages are the limited length of the time series (from about the end of the 1990s onwards) and the data often has to be translated into the desired climate variable.

The main disadvantage of **all observations** is that they can only provide data for the past, and in a changing climate, the past may not be sufficiently representative of what could happen in future.

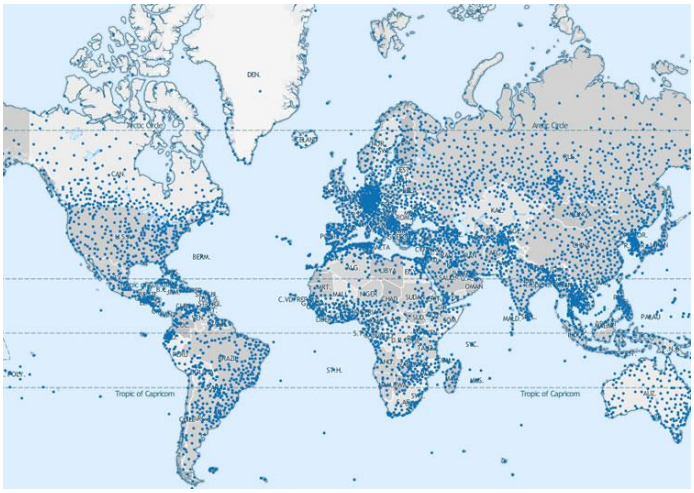

Figure 3. Surface observation stations (blue dots) in the Global Climate Observing System (GCOS) Surface Network (GSN) (WMO2)

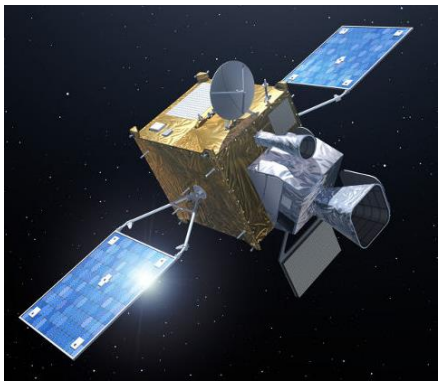

Figure 4. ESA's Meteosat third generation

Advantages and disadvantages of models

Advantages for **all types of climate models** are:

- they can provide simulated data for locations and periods in the past without observations
- several runs can be made for the same period (ensemble) which helps with a better characterisation of variability and the change of extremes, and the quantification of uncertainties.

Re-analyses use a combination of observations and models. They provide data for the past only. They may contain biases and the quality depends also on the (number) of observations used.

(Sub)seasonal to decadal predictions (S2D) provide information for the near future (weeks to decades ahead). Their main disadvantages are the limited skill for parts of the world (e.g. Europe) and they can also contain biases, especially when forecasting for a longer period ahead.

Climate projections provide estimates of climate change under various GHG emissions. They are the only source of data for the far future (until 2100 and beyond). The main disadvantage is the presence of biases.

References

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

WMO1: https://public.wmo.int/en/programmes/global-observing-system)

WMO2: http://www.wmo.int/pages/prog/www/OSY/Gos-components.html

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