# What is a seasonal prediction?

A seasonal prediction aims to estimate the change in the likelihood of a climatic event happening in the coming months.

That is a concise definition but it is worth expanding on what this actually means, starting by addressing one of the most commonly asked questions when talking about seasonal forecasts: If weather forecasts get worse after only a few days … how is it possible to make any useful predictions months ahead? This is a very valid question and, luckily, a question that we can answer. There are two main reasons why we can make useful forecasts months ahead:

The first reason that makes seasonal forecasts possible is the fact that there are elements of the climate system (e.g. the oceans, the sea-ice, the water content in the soils or the snow) that evolve more slowly than the atmosphere yet have an influence on its behavior. An example of how ocean temperature changes more slowly than atmospheric temperature is shown in the figure on the right comparing the evolution of temperature during 15 days in London (red line, left y-axis) and in the mid-Pacific ocean (blue line, right y-axis).
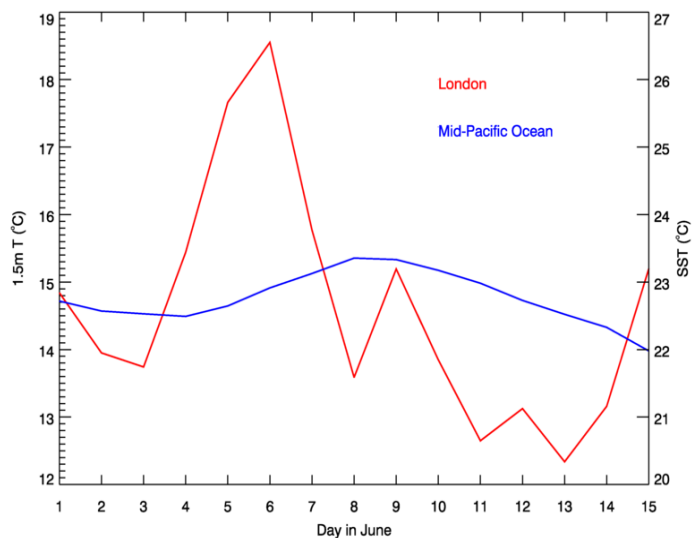
Think of what happens when you take a bath in winter. Imagine you close the bathroom door and fill the bath tub with hot water. The temperature of the water will normally be higher than the temperature of the air in the bathroom and the hot water will make the air temperature increase. If you then open the bathroom window the cold air from outside will come in and the temperature of the air in the bathroom will change rapidly. However, the temperature of the water in the bath tub will change more slowly and will remain hotter than the temperature of the air in the bathroom for a while longer.

The same process, but at a larger scale and with a higher degree of complexity, takes place on planet Earth. For example, the temperature of the North Atlantic Ocean influences the flow of the winds which, in turn, influence the temperature we experience over North America and Europe. Because of the complexity involved, we use computer models to represent all these processes.

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The second reason that seasonal forecasting is possible is that we are not trying to predict on the 1st May how much is going to rain in Paris on the 23rd August. Instead, the questions we can answer in seasonal forecasting are different to the questions we are trying to answer in weather forecasting

For example, in seasonal forecasting we try to address questions like:

• If the average temperature in Holland in January is 4 degree centigrade, what is the likelihood of having warmer or colder temperatures this year?

• If, on average, the first frost in South East England is on the 3rd November, what is the probability that this winter we will have frosts earlier than this?

• If, on average, we have 2 days of rain above 1 mm in Southern Spain during summer, what is the likelihood of having more than 5 days this year?

Courtesy of Thomas Wasilewski (University of Hamburg)

As you can see, in all these questions there is a comparison with an average value which is usually calculated from observations (typically from recent decades). This is the essence of what we are trying to do in seasonal forecasting: to estimate the change in the likelihood of a climatic event happening in the future compared to its average likelihood.

In addition, while we cannot be precise about the exact location and timing of a particular event (e.g. snow over Berlin or Hamburg) months in advance, we can calculate the change in the probability of a particular event happening over a region and period of time (e.g. the likelihood of snow over Czech Republic in December).

Of course, forecasting months ahead is difficult and we will be better at answering some questions than others. In order to estimate how useful our predictions are, we always make forecasts of recent years before completing forecasts of the future so we can compare our predictions against observations and learn how "good" or "bad" they are.

We explain more about the usefulness of seasonal-to-decadal forecasts in the factsheet "Is there useful information in seasonal-to-decadal predictions"?