Q1 Forecast Q & A with Simon Mason*

WHY IS SEASONAL CLIMATE FORECASTING POSSIBLE?

A How can scientists presume to forecast the weather over the next few months, when forecasts for the next few days, or even hours, appear to be highly inaccurate? Surely it is much more difficult to forecast the more distant future than the near future. This paradox hinges upon a distinction between "weather" and "climate", and the fact that the reasons why scientists can predict each are very different. "Weather" is the state of the atmosphere as it is experienced at any given time, whereas "climate" is most simply understood as some kind of average of weather over a long period of time. In a weather forecast the state of the atmos-phere at specific times in the future is predicted, whereas in a seasonal climate forecast only the general state of the atmosphere over the next few months is predicted without having to worry about the precise weather at any time during those months.

Imagine trying to predict the outcome of a soccer match: when predicting the final score, no attempt is made to predict where the ball will be at any specific time during the match, only what the general run of play will be – it is much harder to forecast exactly when goals are going to be scored than what the final score will be. Similarly, with seasonal climate forecasting, it is only the general weather conditions throughout the season that are predicted; it is not possible to predict the exact weather on any given day within the season.

Notwithstanding this difference between weather and seasonal climate forecasts, the seasonal forecasts are only possible because in some parts of the world and at some times of the year certain weather patterns are forced to occur unusually frequently (or infrequently), or to persist for unusually long periods of time, or to be unusually intense. Specifically, if certain areas of the world's oceans are unusually hot or cold weather patterns can be affected. Because ocean temperatures over large areas tend to change fairly slowly (and can sometimes be predicted themselves) the effects on average weather conditions can be sufficiently strong to make predictions of seasonal climate possible. The best known example of this type of effect of the ocean on the atmos-phere is the El Niño phenomenon, which occurs when a large part of the Pacific Ocean near the equator becomes unusually hot. Unusual temperatures in other ocean areas can also be important for the seasonal climate, although the effect tends to be stronger in the tropics than in higher latitudes. For this reason seasonal forecasts tend to work best in tropical regions.

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Q2 Forecast Q & A with Simon Mason*

WHY ARE SEASONAL FORECASTS PROBABILISTIC?

A Although the oceans can affect the average weather conditions over a period of a few months, the effects of day-to-day weather variability still remain fairly strong so that it is not possible to predict with any high degree of accuracy exactly what the average weather conditions are like. Thus, although in theory an estimate of the average rainfall for the next three months, for example, could be made, the errors in this forecast are likely to be large. Instead, forecasters try to communicate the uncertainty along with the forecast. Imagine once more the prediction of the soccer game. One approach would be to predict the actual score, but this requires a high degree of accuracy, so we could imagine predicting one of the three possible outcomes: team A wins, team B wins, or the teams draw. So imagine that we predict that team A will win, now we want to know how confident we are that team A will win since we cannot be absolutely certain that they will do so. There is some uncertainty in the outcome, and we could communicate this uncertainty by providing a probability indicating the degree of confidence that we have in our belief that A will win. Similarly, with seasonal climate forecasts, the forecasters do not try to forecast an exact amount of rainfall, but instead try to indicate whether the seasonal will be unusually wet , dry, or close to average, and then specify how confident they are in the forecast.

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Q3 Forecast Q & A with Simon Mason*

WHAT EXACTLY DO CATEGORIES 'NORMAL', 'ABOVE' AND 'BELOW-NORMAL' MEAN?

A The most common format for a seasonal forecast is to define probabilities for the seasonal rainfall total or average temperature to be in each of three categories: "above-normal", "normal" or "below-normal". A simple interpretation of "above-normal" is "unusually wet" (or "unusually hot" if temperatures are being forecast); "below-normal" is the opposite, i.e. unusually "dry" or "cold"; while "normal" can often be interpreted as "close to average". However, these interpretations are still somewhat vague, and the interpretation of "normal" is a little over-simplified. A more exact definition of "above-normal" is the amount of rainfall (or the average temperature) that one would expect to exceed once in every three years, on average. It is, of course, quite possible to have "above-average" rainfall two, three, or even more years in a row, but over a longer period of time, only one in three years are defined as "above-normal". This rainfall amount, or temperature average, that has to be exceeded for rainfall/ temperature to be "above-normal" is typically calculated by considering the rainfalltotals temperature averages for the last 30 years. (To be more exact, the 30-year period is typically updated every 10 years, or even less. So currently seasonal forecasts use the period 1971-2000 or even 1961-1990.) This 30-year period is referred to as the "climatology" (although forecasters rather confusingly tend to use "climatology" with a number of different meanings, some of which are explained later).

Similarly, "below-normal" is defined as the amount of rainfall or average temperature that is not exceeded once in every three years, on average. If, on average, one in three years is "above-normal" and one in three years is "below-average", this leaves one other year that is neither: years that are neither above-nor below-normal are defined as "normal". In most cases "normal" will be close to average, although in some situations primarily in the context of seasonal rainfall in very dry areas and / or very dry seas-ons "average" can be above-normal. In these cases most of the years the season is fairly dry, but once in every few years quite a lot of rain may be received. These few wet years can pull up the average rainfall, so that most of the years receive less than aver-age.

There are a few dangers in these interpretations. Firstly, the fact that 10 of the 30 years (one in three years) were "above-normal" does not necessarily mean that 10 of the next 30 years will be "above-normal". If there are trends in the climate, because of global warming, for example, a disproportionately large number of the coming years may be "above-normal". Another potential misinterpretation relates to making false inferences about the weather and the impacts that may occur over the season. For example, if the forecast indicates a strong likelihood of above-normal rainfall, it cannot necessarily be concluded that there is a high risk of flooding. There are two problems here. Firstly, the seasonal forecast gives an indication only about the total rainfall over the season. Above-normal rainfall could occur because of excessive rainfall on only a few days, or because of moderately heavy rainfall over many days none of which may have particularly heavy rainfall. The second problem is related to the first in that the forecast relates only to the climate, and not to the impacts; the forecast is for seasonal total rainfall, not for flooding, and it is quite possible to have an unusually high seasonal rainfall total without any flooding occurring.

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