



ECMWF's ensemble prediction: A strategic and challenging choice

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On 24 November 1992, ECMWF started producing probabilistic or 'ensemble' forecasts. Since then, ensemble forecasting at the Centre has been going from strength to strength, incorporating more and more advanced estimates of the uncertainties in the initial conditions and the model.

The reason for the growing emphasis on probabilities is simple: weather predictions are inherently uncertain. This has led users to ask for a confidence estimate for each forecast, for some objective indication of how much they can trust the forecast. But ensemble prediction is actually providing much more than a confidence estimate or error bar, it provides a whole range of likely outcomes (or scenarios) of the future weather, together with their likelihood of occurrence.

Now a cornerstone of our Strategy to 2025, our ambition is to make the ensemble the primary forecast technique. The horizontal grid spacing of ECMWF's global ensemble forecasts is currently 18 km. The Centre's plans to 2025 is that it should have come down to 5 km. This will require multiple forecasts to be produced at a resolution nearly twice as high as the Centre's current high-resolution forecast.

This will clearly take us to the limit both in terms of what we can do scientifically and in terms of the computing capacity we envisage having in 2025. In parallel, we are investing a lot of effort in a Scalability programme which will deliver efficiency gains, allowing us to run a higher-resolution ensemble at a more affordable computing cost. Work has started to investigate potential configurations of our future ensemble and first results are being reviewed and analysed. For instance, for surface parameters, resolution seems the clear driving factor, whilst number of members could have more of an impact for other parameters and time ranges. As part of this work, we will investigate the benefits of a dual resolution ensemble, which can be seen as a generalisation of our current system, or possibly of time-lagged ensembles.

Choices that take into account the science and computing capability, whilst meeting our Member States' needs will need to be made in the very near future.