

# INTRODUCING 41R2: MOST ACCURATE AND HIGHEST- EVER RESOLUTION IN GLOBAL NUMERICAL WEATHER PREDICTION.

10 MARCH 2016

## FAQ

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### 1. Statement and key messages

#### What has been announced today?

We're announcing a significant set of upgrades launched by the European Centre for Medium Range Weather Forecasts (ECMWF). The changes nearly halve the distance between global weather prediction points, substantially increasing the effective resolution of the forecast. As a result, ECMWF's numerical weather predictions, which are widely used by Europe's meteorological services, are more accurate, contain three times as much detail and can predict the weather up to half a day further ahead.

#### Key messages

- Most accurate global weather predictions at record-breaking resolution.
- Number of grid points tripled to 900 million in the high-resolution forecast, evenly distributed around the globe.
- Gain in predictability of up to half a day at same level of quality.

### 2. Changes

#### What are the main changes?

- ECMWF has tripled the number of global points where a weather prediction is made to more than 900 million for the highest-resolution forecast. This reduces the distance between points from 16 km to 9 km, bringing a substantial increase in horizontal resolution.
- Ensemble forecasts describing the range of possible scenarios and the likelihood of occurrence are now at 18 km up to forecast day 15 and 36 km thereafter, down from 32 km up to forecast day 10 and 64 km thereafter.

- ECMWF has changed the way the grid points are laid out across the globe so they are distributed more uniformly. This is referred to as an 'octahedral grid' after the shape used to determine the grid's layout.
- ECMWF has improved the computation efficiency of the calculations used to determine the weather prediction at each grid point.
- The analysis and ensemble of analyses – which enable a flow-dependent estimation of the weights to be given to the observations – see their resolution increasing substantially too, contributing to the improvements of the high-resolution initial conditions and forecasts.

### **Further changes**

There are also a host of further upgrades, leading to a better analysis of the atmospheric state and to improved forecast quality. These include:

- More scales in predictions and a better description of land–sea contrasts and mountains.
- Changes to the observation error representation for GPS radio occultation and microwave data.
- Improved screening, such as a better identification of aerosol contamination in the infrared and an upgrade for the microwave part of the observation operator.
- Extended observation coverage, for example microwave data is being used in more challenging situations such as mountain areas and snow-covered land surfaces, and coverage of satellite-derived winds is being improved in the mid-latitudes.

### **Why are these changes significant?**

This is a major upgrade, and one of only a handful of horizontal resolution upgrades in 40 years of European cooperation on weather forecasting. It extends the range of forecasts at the same level of quality by several hours for many parameters. For example, ECMWF's high-resolution 10-metre wind speed forecast in Europe will see its range improved by as much as half a day up to forecast day 5. In particular, the changes promise significant improvements in the prediction of severe weather events.

### **Will vertical resolution also be increased?**

No, this will be maintained at 137 levels for the highest-resolution forecasts, and at 91 levels for the ensemble forecasts.

### 3. Benefits

#### **What difference will this make?**

This change means Europe's weather can now be predicted with improved accuracy, with three times as much detail and up to half a day further ahead. The upgrade will:

- Provide the potential for earlier warning of adverse conditions and extreme weather to help protect property and vital infrastructure.
- Allow our members to support improved long-term planning for weather-dependent industries.
- Make the calculations made by ECMWF's supercomputers to obtain predictions more efficient, saving energy and money to help make the task of continually improving the weather forecast more sustainable.

#### **Who will benefit from the improved resolution?**

ECMWF supplies forecasts and analyses to 34 Member and Co-operating States. The upgrade will give their National Meteorological Services access to higher-resolution products to help them deliver weather forecast services.

### 4. Explanation of terms

#### **What does higher resolution and more accuracy mean in practice?**

It means that in the highest-resolution forecasts each area where ECMWF predicts the weather across the globe is now a third of the size it was before – 77 km<sup>2</sup> rather than 238 km<sup>2</sup> – and ECMWF can make a longer-range high-quality weather prediction. This means that across any region we can now tell what the weather will be in three times as much detail, further into the future.

#### **What is an ensemble forecast?**

Since 1992, ECMWF has pioneered ensemble forecasts, which describe the range of scenarios and the likelihood of occurrence. Running the forecast 52 times starting from slightly different initial states generates a spread which describes the possible forecasts on that particular day. ECMWF believes that an ensemble approach is essential due to the inherent forecast uncertainty and the need to adequately capture the likelihood of extreme weather because of its potentially disastrous consequences.

## 5. ECMWF and partners – roles and responsibilities

### **What is ECMWF?**

The European Centre for Medium-Range Weather Forecasts (ECMWF) is an independent intergovernmental organisation supported by 34 states. ECMWF is both a research institute and a 24/7 operational service, producing and disseminating global numerical weather predictions to its Member States.

### **What is its role?**

ECMWF's role is to address the most difficult research problems in numerical weather prediction that no one country can tackle on its own, so that all can improve the range and accuracy of their forecasts. Introducing the new grid is one such example. ECMWF have been working with Member States for a number of years to introduce the change.