

## **State-of-the-art Atmospheric Reanalysis at ECMWF**

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At the European Centre for Medium-Range Weather Forecasts (ECMWF), reanalysis is a key contribution to the Copernicus Climate Change Service (C3S) that is implemented at ECMWF on behalf of the European Commission.

This presentation provides an overview of the latest ECMWF atmospheric reanalysis ERA5, which is currently in production and will replace the widely used ERA-Interim reanalysis.

ERA5 is the fifth generation of ECMWF atmospheric reanalyses of the global climate, which was pioneered with the FGGE reanalyses produced in the 1980s, followed by ERA-15, ERA-40 and most recently ERA-Interim.

Production is taking place in two phases. A first phase (to be completed early 2018) covers, like ERA-Interim, the satellite period from 1979 onwards. Monthly updates are provided and consolidated in an official release about two to three months behind real time, although preliminary data products will be made available within a week of production. In a second phase (production to start in 2018) a pre-extension back to 1950 is planned. ERA5 will provide a large number of essential climate variables within the C3S Climate Data Store (CDS).

Compared to ERA-Interim, ERA5 incorporates many important innovations that safeguard the provision of state-of-the-art climate reanalysis. ERA5 is based on a recent version of the ECMWF Integrated Forecast Model which includes numerous improvements to the 4D-Var assimilation method as well as the coupled atmosphere, ocean waves and land model. Radiative forcing data are used that represent the observed evolution of greenhouse gases, volcanic eruptions, ozone and aerosols, and consistent boundary conditions are used for sea-surface temperature and sea ice. A number of reprocessed data records are ingested as well as several data sets that have never before been used in reanalysis. ERA5 is able to assimilate data from the latest instruments. Observation bias correction schemes have been extended and improved.

ERA5 is produced at considerably higher resolution than ERA-interim: hourly analysis fields are available at a horizontal resolution of 31 km on 137 levels in the vertical. Data products include information about uncertainties generated by a lower-resolution (62 km) 10-member 4D-Var ensemble.

A number of new parameters, such as 100-metre wind speed and direction, are available as part of the output, based on user requirements and identified gaps in previous reanalysis productions. A database containing all ingested observations, together with detailed information about how they are used, is available to users. In addition, a dedicated ERA5 land component will deliver a land-surface reanalysis product at an enhanced resolution.

The presentation will conclude with an outlook on plans for the next ECMWF C3S reanalysis, ERA6.