

## **ERA5: STATE-OF-THE-ART GLOBAL ATMOSPHERIC REANALYSIS AT ECMWF**

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### **ABSTRACT**

At the European Centre for Medium-Range Weather Forecasts (ECMWF), reanalysis is a key contribution to the Copernicus Climate Service (C3S, <https://climate.copernicus.eu/>) that is implemented at ECMWF on behalf of the European Commission.

This presentation focuses on the latest ECMWF atmospheric reanalysis ERA5, which is now publicly available from 1979 via the C3S Climate Data Store and will soon replace the widely used ERA-Interim reanalysis [1].

*Index Terms*— reanalysis, climate

### **1. THE ERA5 REANALYSIS**

ERA5 [2, 3] 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.

ERA5 is based on a recent ECMWF model cycle which uses the 4D-Var assimilation method for the atmosphere, and includes coupling with ocean waves and a land model. Radiative forcing follows the evolution of greenhouse gases, volcanic eruptions, ozone and aerosols as recommended by CMIP5 and a consistent reconstruction is 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 been re-used before, and ERA5 is able to assimilate the latest instruments. Bias correction schemes have been extended and improved.

### **2. INNOVATE CHARACTERISTICS**

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.

ERA5 data products also include information about uncertainties which is provided by a lower-resolution 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. A database containing all ingested observations, together with detailed information about how they are used, will be made available to users.

In addition, a dedicated ERA5 land component delivers a land-surface product at an enhanced resolution.

### 3. DATA AVAILABILITY

The current availability of ERA5 data spans the period from 1979 to present. Timely updates are provided and consolidated in an official release about two months behind real time, while preliminary updates are available with a latency of two to three days. A second phase of ERA5, a pre-extension back to 1950, is currently in production and is to be available by the fall of 2019.

The data can be found through the Copernicus Climate Data Store (<https://cds.climate.copernicus.eu/#!/home>), and previous creation of a user account the data is freely available.

### 4. REFERENCES

- [1] D. P. Dee, et al., “The ERA-Interim Reanalysis: Configuration and Performance of the Data Assimilation System,” *Quarterly Journal of the Royal Meteorological Society*, Vol. 137, No. 656, 2011, pp. 553-597. doi:10.1002/qj.828
- [2] Hersbach H. et al., 2016: “ERA-5 reanalysis is in production”. *ECMWF newsletter*, number 147, Spring 2016, p.7.
- [3] Hersbach, H, et al. 2018, “Operational global reanalysis: progress, future directions and synergies with NWP”. ERA report series, Technical Report 27, ECMWF pp63.