

# ERA5-LAND: AN ENHANCEMENT OF THE ERA5 CLIMATE REANALYSIS LAND COMPONENT

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## ABSTRACT

We present the new ERA5-Land data set, as an improved version of the land surface component of the recently produced ERA5 climate reanalysis.

*Index Terms*— reanalysis, climate, land surface

## 1. BACKGROUND - ERA5

ERA5 [1] is the latest generation of global climate reanalysis, funded by the European Commission through the Climate Change Service (C3S, <https://climate.copernicus.eu>) of the operational Copernicus programme (<https://www.copernicus.eu>), and produced by the European Centre for Medium-Range Weather Forecasts (ECMWF). It will replace the widely used ERA-Interim reanalysis [2]. ERA5 provides a consistent hourly view of atmospheric, land

surface and wave variables from 1979 with timely updates close to Near-Real Time (NRT). Processing is underway to back extend the reanalysis from 1950. The core of ERA5 is the ECMWF Integrated Forecasting System in combination with an advanced 4D-VAR data assimilation system. Among others, ERA5 benefits of an enhanced use of observations and new reprocessed datasets that were not used in the previous ERA-Interim reanalysis. These make it possible to improve our knowledge of the processes and interactions between different components of the Earth System that characterizes the climate from 1950 until present.

## 2. AN ENHANCED LAND COMPONENT

As stated above, the description of the ERA5 land-surface component is also part of the ERA5 portfolio. However, with the objective of serving, primary, the climate community, few inconsistencies have been detected in the

temporal-spatial evolution of several variables of the water and energy cycle at Earth's surface level. For example, the production of land reanalysis in several temporal streams requires a well-defined spin-up strategy for long memory variables, such as the root-zone soil moisture. The lack of such strategy can lead to inconsistencies at the seam between two temporal streams. Another problem could be caused by the introduction of a new observation type. While ERA5 spatial resolution has been improved from 80 km to 31 km, the latter is still considered coarse to add significant value for communities working on water resources, such as hydrologists or agronomists. C3S has developed the ERA5-Land dataset, an unique dataset that will match the ERA5 latency, production period and temporal resolution, but with a global projected horizontal resolution of approximately 9 km (around 4 times finer resolution than ERA5). This resolution matches the currently ECMWF TCo1279 operational grid, and therefore providing consistent input for Numerical Weather Prediction, climate studies but also for accurate hydrological and agricultural modelling. The ERA5-Land dataset is being produced through a single simulation driven by near-surface atmospheric fields from ERA5, with thermodynamical orographic adjustment of temperature.

### 3. WAY FORWARD

Currently, ERA5-Land has completed the production from 2000-2018. A new stream is underway, covering the period 1979-1999 and projected to be finished by mid-June 2019. In the future, an ensemble of 10-members will also provide, for the first time, an estimation of key land-variables error based on meteorological forcing and model parameters uncertainties, thus providing vital information, frequently missing, to land-surface data assimilation systems.

Finally, the stand-alone nature of ERA5-Land allows to integrate forefront model developments without the prohibitive cost of climate reanalysis. For instance, the development at ECMWF of a multi-layer snow model could justify the production of a new version of ERA5-Land in a relative short time.

### 4. REFERENCES

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