

ERA5-Land: More than 7 decades of land surface consistency with timely updates

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Reanalysis is a key activity within the Copernicus Climate Change Service (C3S), which is funded by the European Union Copernicus programme and implemented by the European Centre for Medium-Range Weather Forecasts (ECMWF). Currently, the latest generation of European Reanalysis, ERA5 and ERA5-Land, are available through the C3S Climate Data Store (<https://cds.climate.copernicus.eu/>). ERA5 provides hourly snapshots of the Earth's atmosphere, land surface and ocean waves from 1950 to present, thus providing a global view of the evolution of the Earth's climate without temporal or spatial gaps for the last seven decades. The land surface component, although part of the ERA5 portfolio, contains few inconsistencies. For instance, significant regional steps between different production segments are present, compromising the reliability of long-term trends. In addition, ERA5 does not provide sufficient resolution for a large and growing number of land applications.

ERA5-Land was designed to overcome the above-mentioned shortcomings of the land branch of reanalysis. For instance, steps in the seam between production segments may be avoided by applying a long spin-up strategy for the initialization of each production segment. ERA5-Land is a unique dataset of its kind, providing a global scale description of the continental water and energy cycles through a series of 50 key surface variables, hourly at a spatial resolution of 9 km, from 1950 to present. ERA5-Land is driven by the near-surface meteorology of ERA5, and temperature is adjusted by considering the orographic differences between ERA5 and ERA5-Land numerical grids. The fidelity of ERA5-Land was assessed by comparing the main fields to a large number of available in-situ observations distributed along the world from 2000 onwards. The variables under analysis were soil moisture, snow depth, lake surface water temperature, river discharge, surface latent and sensible heat fluxes, and skin temperature. The results of the evaluation analysis suggested significant improvements of the ERA5-Land hydrological cycle in comparison to those of ERA5 and ERA-Interim.

The number of ERA5-Land users is counted in thousands. Very recently and similarly to ERA5T, the ERA5-Land-T facility was enabled, which means that preliminary updates are made available daily with only 5-days delay with respect to real time. The final quality-checked product is published with 2-3 month delay with respect to real time. ERA5-Land-T is the result of a requirement of users needing more recent data and opens the door to new applications such as flood forecasting or biomass monitoring.

In this paper the main characteristics of ERA5-Land dataset will be highlighted, its main strengths and weaknesses, as well as the current status.