



## GloFAS-ERA5 operational global river discharge reanalysis 1979-present

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Estimating how much water is flowing through rivers at the global scale is challenging due to a lack of observations in space and time. A way forward is to optimally combine the global network of Earth system observations with advanced Numerical Weather Prediction (NWP) models to generate consistent spatio-temporal maps of land, ocean, and atmospheric variables of interest, known as a reanalysis. While the current generation of NWP output runoff at each grid cell, they currently do not produce river discharge at catchment scales directly, and thus have limited utility in hydrological applications such as flood and drought monitoring and forecasting. This is overcome in the Global Flood Awareness System (GloFAS; <http://www.globalfloods.eu/>) by coupling surface and sub-surface runoff from the HTESSEL land surface model used within ECMWF's latest global atmospheric reanalysis (ERA5) with the LISFLOOD hydrological and channel routing model.

This work presents the new GloFAS-ERA5 global river discharge reanalysis dataset launched on 5 November 2019 (version 2.1 release). The river discharge reanalysis is a global gridded dataset with a horizontal resolution of 0.1° at a daily time step. An innovative feature is that it is produced in an operational environment so is available to users from 1 January 1979 until near real time (2 to 5 days behind real time). The reanalysis was evaluated against a global network of 1801 river discharge observation stations. Results found that the GloFAS-ERA5 reanalysis was skilful against a mean flow benchmark in 86 % of catchments according to the modified Kling-Gupta Efficiency Skill Score, although the strength of skill varied considerably with location. The global median Pearson correlation coefficient was 0.61 with an interquartile range of 0.44 to 0.74. The long-term and operational nature of the GloFAS-ERA5 reanalysis dataset provides a valuable dataset to the user community for large scale hydrology applications ranging from monitoring global flood and drought conditions, understanding hydroclimatic variability and change, initialising hydrological forecasts, and as raw input to post-processing and machine learning methods that can add further

value.

**Data availability:** The dataset is openly available from the Copernicus Climate Change Service (C3S) Climate Data Store (CDS): <https://cds.climate.copernicus.eu/cdsapp#!/dataset/cems-glofas-historical?tab=overview> and further details and the evaluation of the dataset can be found in the accompanying data description paper:

**Data paper:** Harrigan, S., Zsoter, E., Alfieri, L., Prudhomme, C., Salamon, P., Wetterhall, F., Barnard, C., Cloke, H., and Pappenberger, F.: GloFAS-ERA5 operational global river discharge reanalysis 1979–present, *Earth Syst. Sci. Data Discuss.*, <https://doi.org/10.5194/essd-2019-232>, 2020.