GloFAS v2.0

Global Flood Awareness System service providers

Summary

The following were implemented in the major upgrade to v2.0:

- A GloFAS version numbering system
- Calibrated hydrological routing scheme
- GloFAS hydrological reanalysis update
- Improved real-time initialisation
- Long series of discharge forecast reforecasts
- Enhanced GloFAS documentation

Technical details

Release date	2018-11-14
In test suite	2018-10-14
GloFAS release	002
Archiving of data	ecfs
Reanalysis	1981-01-01 to 2017-12-31
Horizontal resolution	0.1 x 0.1°

GloFAS v2.0 reanalysis and initialisation run

GloFAS v2.0 has a common daily river discharge reanalysis and an initialisation run shared between GloFAS v2.0 30-day and GloFAS v2.0 Seasonal.

GloFAS v2.0 river discharge reanalysis was produced using the (pre-released) ERA5 ECMWF reanalysis (ERA5pr), the atmospheric reanalysis product of ECMWF available in June 2018. ERA5 has a horizontal resolution of ~32 km (see Hersbach et al., 2018 for further reading). ERA5pr contains preliminary estimates of atmospheric fields previous to January 2000. GloFAS v2.0 river discharge reanalysis covers 1981-2017, and was run at the model setup. This dataset is used to compute the GloFAS 30-day v2.0 river discharge thresholds.

GloFAS v2.0 river discharge initialisation run is used to provide initial conditions (atmosphere and land surface states from which to start the ensemble river discharge forecasts) for both the GloFAS v2.0 30-day and GloFAS v2.0 Seasonal. It is based on a near-real-time or 'timely' version of ERA5, called ERA5T , and for the remaining days prior to real time, based on day-1 ECMWF-ENS-CNTL forecast. Currently, ERA5T is available with a latency of 2-5 days (compared with real time) and does not include additional quality checks.

Available GloFAS v2.0 data is summarised in the table below. It contains the period covered, the production frequency, the number of ensemble members and the ECMWF IFS versions used for each dataset. Note that only daily river discharge time series are available to users.

GloFAS v2.0 30-day	Period	Freq.	Ens. memb.	ECMWF IFS version

GloFAS v2.0 30-day

GloFAS v2.0 30-day real-time river discharge forecasts are produced by the GloFAS v2 modelling chain initialised from the GloFAS v2.0 river discharge initialisation run and forced with data from the ECMWF ENS medium- and extended-range forecasting system. ECMWF ENS is ECMWF's ensemble forecast system and consists of 51 members at ~18 km resolution up to 15 days, increasing to ~36 km from days 16 to 30 in the monthly extension, which is available only for Monday and Thursday runs. In GLoFAS, the ECMWF ENS runoff forecasts are resampled to 0.1° spatial resolution (~10 km) before being used as daily input to the Lisflood model to produce river discharge. In the first 15 days the medium range runoff is used, while from day 16 the latest available extended-range forecast is used, with up to 3-day lag to real time (to the last Monday or Thursday run), to produce seamless river discharge forecasts out to 30 days. Results are presented as daily values.

GloFAS v2.0 30-day river discharge thresholds are generated by fitting an extreme value distribution (Gumbel using method of L-moments) to the annual maxima series, extracted from the river discharge reanalysis of 1981-2017, after filtering out the drier years from the time series. These thresholds are used to generate the 30-day flood forecasts.

GloFAS v2.0 30-day flood forecasts are generated by comparing the GloFAS v2.0 real-time forecasts to the thresholds. This provides flood signals as maps of probability of threshold exceedence and forecast hydrographs with the river discharge evolution in the next 30 days. GloFAS v2.0 30-day flood forecasts are available daily through the GloFAS map viewer from the launch date.

GloFAS v2.0 Seasonal

GloFAS v2.0 Seasonal real-time river discharge forecasts are produced by the GloFAS v2 modelling chain initialised from the GloFAS v2.0 river discharge initialisation run and forced with data from the ECMWF SEAS5 seasonal forecasting system. SEAS5 is ECMWF's ensemble seasonal forecast system and consists of 51 members at ~36 km horizontal resolution. SEAS5 runoff forecasts are resampled to 0.1° spatial resolution (~10 km) before being used as daily input to Lisflood to produce river discharge up to 16 weeks. GloFAS v2.0 seasonal real-time river discharge results are presented as weekly averages, starting every Monday, and are available on the 10th of each month.

GloFAS v2.0 Seasonal river discharge thresholds are river discharge magnitudes corresponding to fixed percentile values (20th and 80th percentiles for low flow and high flow, respectively), derived from the 37-year (1981-2017) GloFAS v2.0 Seasonal river discharge reforecasts. A set of thresholds are produced specifically for each week of the year and each forecast lead-time. This is different to GloFAS v2.0 30-day, where one threshold set is used for all the forecast ranges in the 30-day forecast horizon. The GloFAS v2.0 Seasonal river discharge thresholds are used to produce the hydrological extreme forecasts.

GloFAS v2.0 Seasonal hydrological extreme forecasts are generated by comparing the 51 scenarios of weekly-averaged river discharge forecasts to the thresholds. Both low flow (with 20th percentile) and high flow (80th percentile) probabilities are produced for each lead-time to 16 weeks ahead. This provides maps of probability of threshold exceedence/ non-exceedance and weekly forecast hydrographs for the next 16 calendar weeks. GloFAS v2.0 Seasonal hydrological extreme forecasts are available on the 10th of each month through the GloFAS map viewer from the launch month.

Reanalysis	1981-2017	Daily	1	41r2 (ERA5pr)
Initialisation run	2018 - 4 Nov 2019	Daily	1	41r2 (ERA5pr)

GloFAS v2.0 30-day river discharge reforecasts are forecast simulations generated for a set of past dates. For the 1997-2016 period, they are produced from the twice weekly, 20-year, 11-member ensemble ECMWF ENS re-forecasts. They are complemented by past forecasts obtained from 51-member ensemble ECMWF-ENS forecasts produced twice weekly from January 2017 to June 2018. After the GloFAS v2.0 implementation, the real-time forecasts are also added daily to the reforecasts from July 2018, until its last production date. The reforecasts use the operational settings of the real time forecasts and are initialised from the river discharge reanalysis. The river discharge reforecasts, together with the past real time forecasts, provide a long period for GloFAS v2.0 30-day skill assessment.

Available GloFAS v2.0 30-day data is summarised in the table below. It contains the period covered, the production frequency, the number of ensemble members and the ECMWF IFS versions used for each dataset. Note that GloFAS v2.0 30-day datasets only include river discharge time series.

GloFAS v2.0 30-day	Period	Frequency	Ensemble members	ECMWF IFS version
Thresholds	2-, 5-, and 20-year return periods	One set based on 1981-2017	-	41r2 (ERA5pr)
Reforecasts	Jan 1997 - Dec 2016 1 Jan 2017 - 30 Jun 2018 1 July 2018 - 13 Nov 2018	Twice per week Twice per week Daily	11 51 51	2017 NWP reforecasts : 43r1: 1 Jan 2017 - 10 July 2017 43r3: 11 Jul 2017 - 4 Jun 2018 Other data: 43r1: 1 - 10 Jul 2017 43r3: 11 Jul 2017 - 4 June 2018 45r1: 5 June 2018 - 13 Nov 2018
Real-time forecasts	14 Nov 2018 - 4 Nov 2019	Daily	51	45r1 from 14 Nov 2018 46r1 from 6 Jun 2019

GloFAS v2.0 Seasonal river discharge reforecasts are forecast simulations performed for a set of past dates, over January 1981 to October 2017, using ECMWF Seasonal forecasting system SEAS5. They use the operational configuration of the real-time forecasts and are initialised from the river discharge reanalysis. The reforecasts are used for producing the GloFAS v2.0 Seasonal river discharge thresholds and they also provide a long period for GloFAS v2.0 Seasonal skill assessment.

Available GloFAS v2.0 Seasonal data is summarised in the table below. It contains the period covered, the production frequency, the number of ensemble members and the ECMWF IFS versions used for each dataset. Note that GloFAS v2.0 Seasonal datasets only include weekly-averaged discharge time series.

GloFAS v2.0 Seasonal	Period	Frequency	Ensemble members	ECMWF IFS version
Thresholds	20th and 80th percentiles	One set based on 1981-2017	-	41r2 (ERA5pr)
Reforecasts	Jan 1981 - Oct 2018	Monthly	25	41r2 (ERA5pr)
Real-time forecasts	Nov 2018 - real-time	Monthly	51	41r2 (ERA5pr)