



PROGRAMME OF
THE EUROPEAN UNION



Implemented by



European
Commission



Emergency
Management

#EUSpace

An introduction to CEMS GloFAS

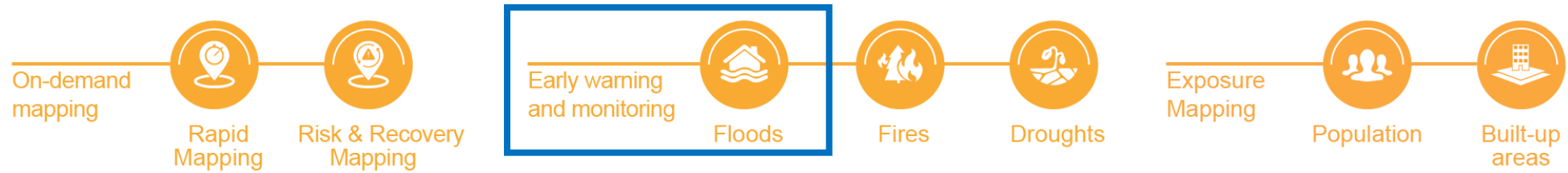
**3rd CEMS Global Flood Forecasting and
Monitoring Meeting, March 5th-6th v2024**

Peter Salamon(1), Christel Prudhomme(2),
Giuseppe Baiamonte (1), Chirs Barnard (2), Calum Baugh (2),
Jesus Casado Rodriguez (1), Antonio Casino (1), Corentin Canton De Wiart(2),
Margarita Choulga(2), Claudia D'Angelo (1), Damien Decremer(2),
Juliana Disperati (1), Francesco Dottori (1), Stefania Grimaldi(1),
Eleanor Hansford (2), Shaun Harrigan (2), Milan Kalas(1), Valerio Lorini(1),
Gabriele Mantovani (1), Cinzia Mazzetti(2), Francesca Moschini(2),
Arthur Ramos (2), Carlo Russo(1), Dobri Stoilov(1),
Vera Thiemig(1), Michel Wortmann (2), Ervin Zsoter(2), Nina Bosshard (3),
Svea Bertolatus (3), Paulina Hellgren (3), Ilias Pechlivanidis (3),
Alejandro Serratos Marquez (4), Antonio Jimenez Molina (4),
Tomas Jacobson (4), Rafael Garcia Sanchez (4).

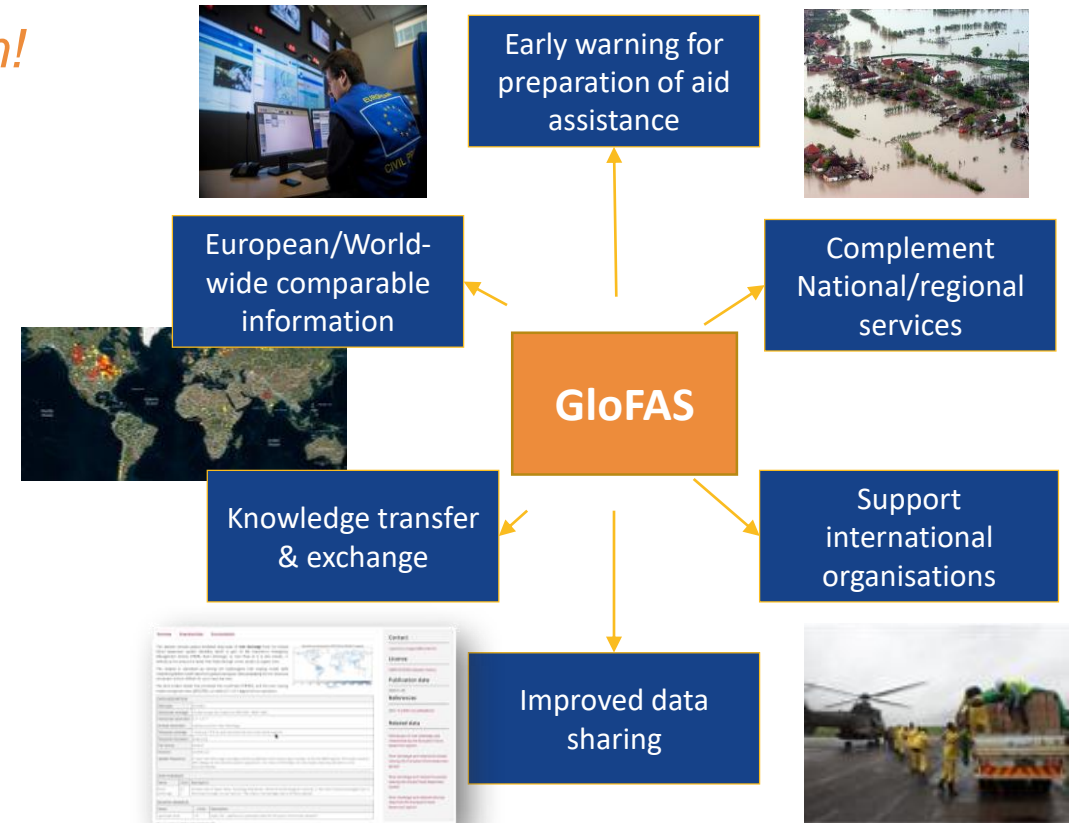
- (1) European Commission, Joint Research Centre, Ispra, Italy,
- (2) European Centre for Medium-Range Weather Forecasts, Reading, UK
- (3) Swedish Meteorological and Hydrological Institute, Norrköping, Sweden
- (4) GHENOVA Digital, Sevilla, Spain



THE COPERNICUS EMERGENCY MANAGEMENT SERVICE



- Operational since 2018 and *in constant evolution!*
- **Early warning system**
- **Complementary** information to National and Regional Hydrological and Meteorological Services
- **Support** to international organisations and local decision makers
- Global forecast products and data, hydrological model set-up are all **freely available.**
- Frequent interactions with the users.





CEMS GloFAS operational set-up

EC JRC

Entrusted entity responsible for CEMS GloFAS in terms of management, technical implementation, and evolution.

CEMS HYDROLOGICAL DATA COLLECTION CENTRE

Collection and quality control of historic discharge data for model calibration and validation.

CEMS HYDROLOGICAL FORECAST CENTRE – COMPUTATION

Operational generation and storage of GloFAS forecasts, management of the GloFAS Web Interface.

CEMS HYDROLOGICAL FORECAST CENTRE – ANALYTICS AND DISSEMINATION

Users support and feedback collection, analysis of GloFAS forecasts.



Global Flood Awareness System service providers

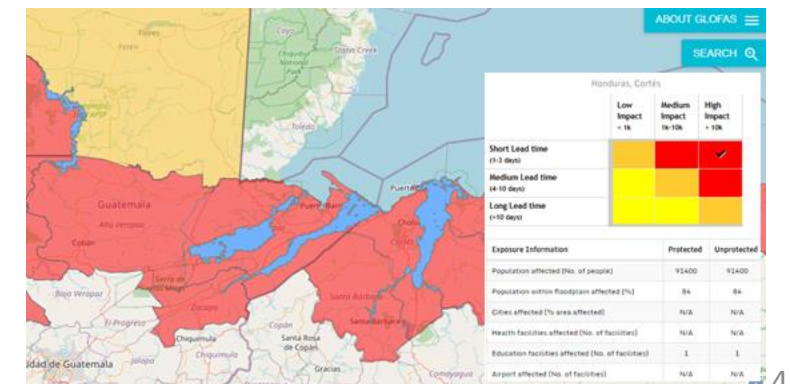
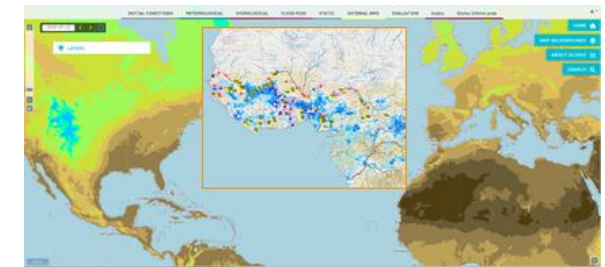
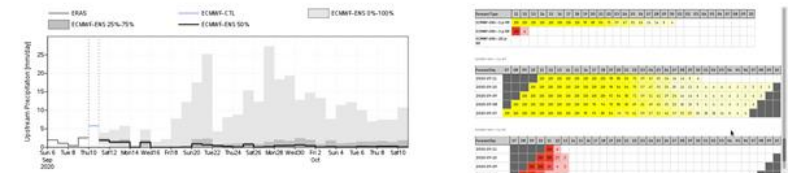
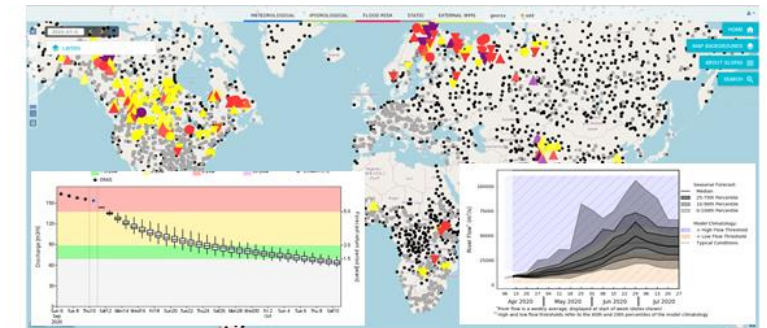


Rijksoverheid
Ministerie van Infrastructuur en Waterbouw



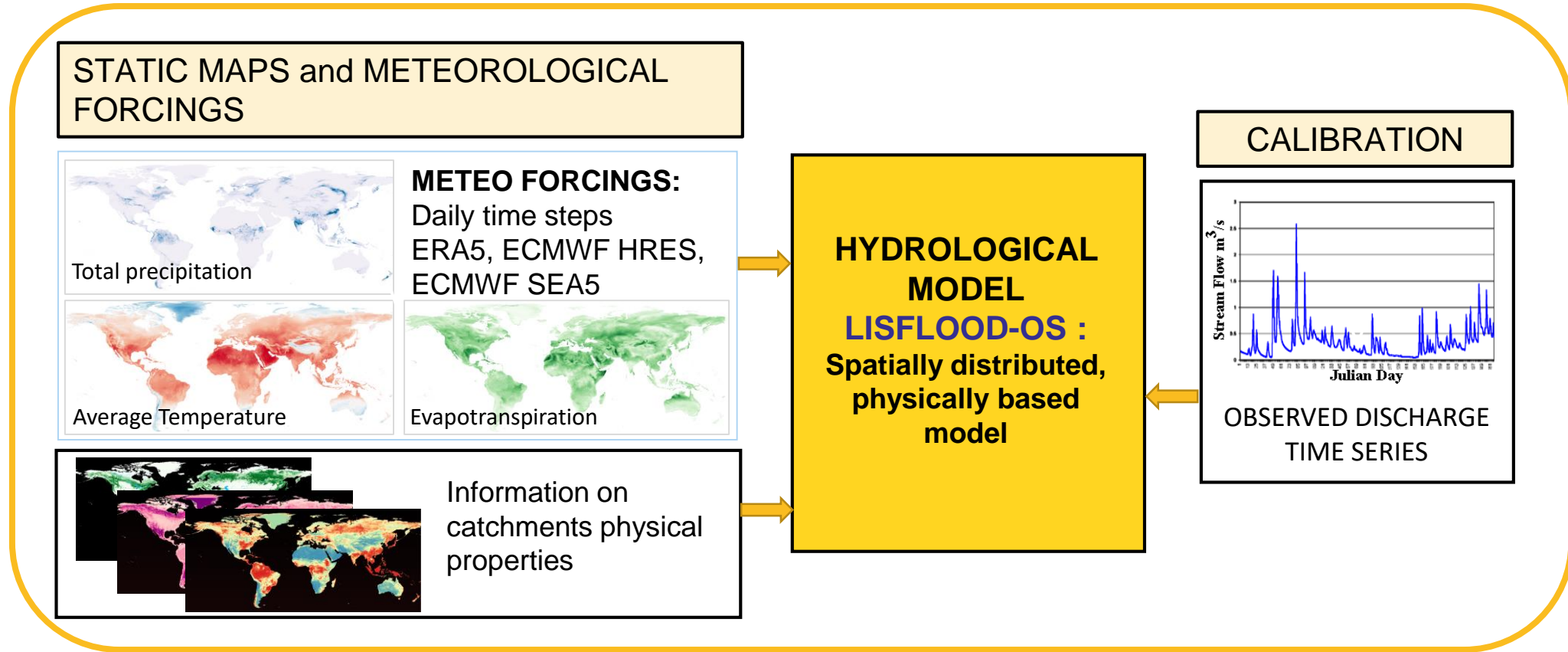
What does GloFAS provide?

- Global **hydrological ensemble** (probabilistic) forecasts updated daily, for **each land pixel**.
- **Highlights** of expected flooding over next 30 days.
- Rapid flood mapping and rapid flood **impact assessment**.
- **Seasonal hydrological outlook** showing wet/dry anomalies over next 16 weeks.
- **Additional information** as hydrographs, initial condition maps: precipitation, *soil moisture*, *snow water content* anomalies, forecast consistency tables, performance.
- Complementary **Global Flood Monitoring**.



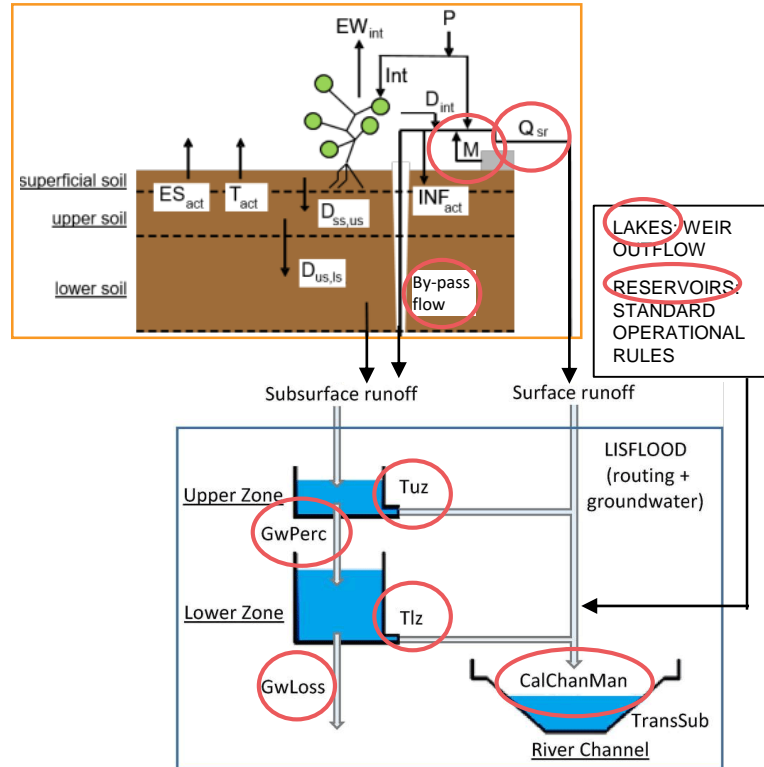


How are GloFAS forecasts generated?





Open Source Hydrological Model



Open Source LISFLOOD

physically based and spatially distributed

- 6 land cover fractions within a pixel;
- 3 soil layers;
- 2 groundwater storages;
- kinematic wave routing in channels and floodplains;
- lakes and dams;
- water abstraction for anthropogenic use.

OUTPUT: all fluxes and states

IGNITE TALK!

Open Source code and ancillary tools; comprehensive documentation.

<https://github.com/ec-jrc/lisflood-code>

<https://github.com/ec-jrc/lisflood-calibration>

Open Source Implementation maps

<https://data.jrc.ec.europa.eu/dataset/68050d73-9c06-499c-a441-dc5053cb0c86>

<https://egusphere.copernicus.org/preprints/2023/egusphere-2023-1306/>

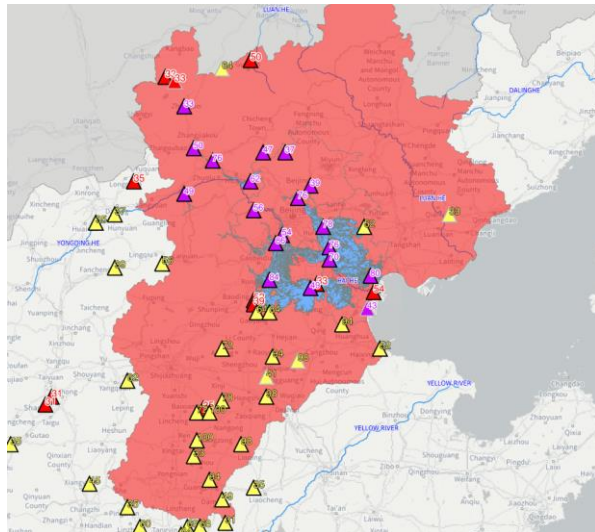
Join us in Gather.Town to discuss OS LISFLOOD modelling approach, and implementation!



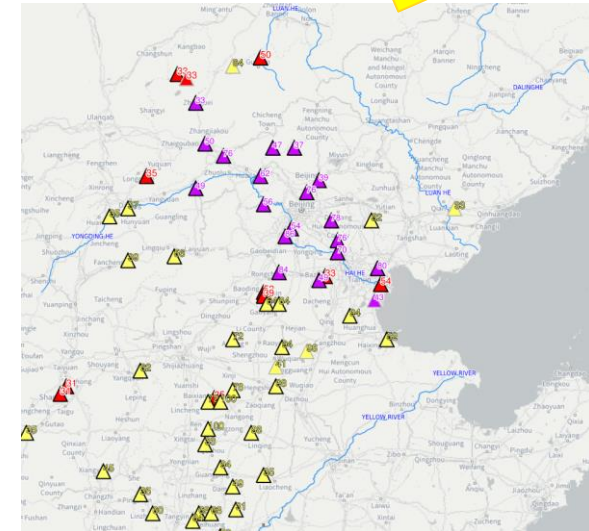
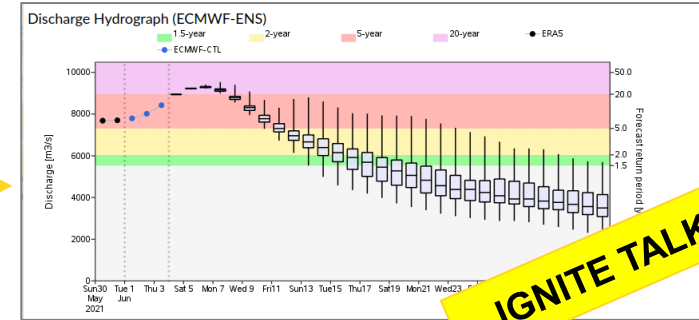
GloFAS Medium Range Forecasts



RAPID IMPACT ASSESSMENT



HYDRODYNAMIC MODEL
Flood HAZARD maps





#EUSpace



How to access GloFAS: <https://www.globalfloods.eu/>

High Alert Level
Flood early detection up to 30 days in advance

27	28	29	30	1	2	3
27/23/2025	10	71	82	80	75	73

Implemented by the European Commission as part of the Copernicus Programme

ONLINE DOCUMENTATION

GloFAS User guide: hands-on instructions on how to use the map viewer
<https://confluence.ecmwf.int/display/CEMS/GloFAS+User+Guide>

GloFAS wiki: detailed description of models and products
<https://confluence.ecmwf.int/display/CEMS/Global+Flood+Awareness+System>

CEMS Data User guide: instructions to download GloFAS data
<https://confluence.ecmwf.int/display/CEMS/CEMS-Flood+Data+User+Guide>

Global Flood Awareness System (GloFAS) is to support preparatory measures as well as emergency response to predicted and ongoing major flood events at global scale

Services

- Map viewer
- Data Access
- Training

Services

Map viewer

Twitter | View @CopernicusEMS on Twitter

Threats from @CopernicusEMS

European Disaster Resilience Goals

Contact

Copernicus Services

Implemented by the European Commission as part of the Copernicus Programme

Emergency Management Service

All your feedback and comments are really important to us as they help us develop the best service we possibly can

Email *

Subject *
 Select an option

Content *

Recaptcha

Send Message

Twitter | View @CopernicusEMS on Twitter

Tweets from @CopernicusEMS

Follow on Twitter

#EMSR647 #Chile 🇨🇱

Desde el inicio de la activación, nuestro equipo de Mapeo Rápido ha entregado mapas para monitorear la evolución de los incendios forestales 🔥

Producto de Delimitación para el area de #Peniquillo (13 de Febrero a las 14:31 UTC)

Latest News | News Archive

Feb. 14, 2024, 5:15 p.m.

Annoucement of GloFAS v4.1 release; launch of the GloFAS and GFM Annual Survey

GloFAS v4.1 operational release

A minor release of the Copernicus Emergency Management Service (CEMS) Global Flood Awareness System (GloFAS), version 4.1, will be launched operationally on Wednesday 28 February 2024.



GloFAS Map Viewer: medium range forecasts



LAYERS

Reporting Points



Reporting points where more forecast information is available. Purple/red/yellow points denote expected...
+ show more

Flood summary for days 11-30



The flood summary map combines the 2- (yellow), 5- (red) and 20-year (purple) exceedance probabilities...
+ show more

LISFLOOD Drainage Network



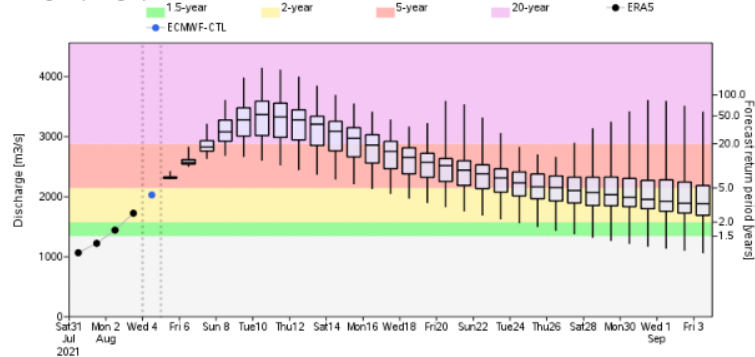
Drainage network of the LISFLOOD model. Rivers are shown as they are represented in the model. Lines...
+ show more

Rapid Impact



Potential impact (agriculture, urban)...
+ show more

Discharge Hydrograph (ECMWF-ENS)



- Static
- Dynamic

MAP BACKGROUNDS

ABOUT GLOFAS

FLOOD MONITORING

SEARCH

GloFAS risk matrix. Table showing the flood likelihood level and impact categories and associated combined impact. Results are aggregated over NUTS administration units.

	Low Impact	Medium Impact	High Impact
Short Lead time (1-3 days)	Yellow	Red	Red with checkmark
Medium Lead time (4-10 days)	Yellow	Yellow	Red
Long Lead time (>10 days)	Yellow	Yellow	Yellow

Impact levels. Defined according to the total population exposure

Flood likelihood levels. Based on the maximum median forecast over the next 30 days.

GloFAS impact tables. Tables showing exposure information and the maximum forecast flood characteristics over the next 30 days and expected associated impacts. Results are aggregated over NUTS administration units.

Exposure Information	Protected	Unprotected
Population affected (No. of people)	70100	70100
Population within floodplain affected (%)	69	69
Cities affected (% area affected)	N/A	N/A
Health facilities affected (No. of facilities)	3	3
Education facilities affected (No. of facilities)	3	3
Airport affected (No. of facilities)	N/A	N/A
Artificial surfaces affected (ha)	N/A	N/A
Agricultural surfaces affected (ha)	258	258
Forest and semi-matural surfaces affected (ha)	3063	3063

Flood Event Information	Protected	Unprotected
Estimated mean return period (yr)	200	200
Estimated protection levels (yr)	6	6
Estimated peak time (d)	1	1
Estimated flooding duration (day)	13	13
Estimated flooded area (km2)	4024	4024
Mean probability of exceeding 2-years threshold	100	100
Mean probability of exceeding 5-years threshold	100	100
Mean probability of exceeding 20-years threshold	100	100

Flood characteristics. Based on the maximum forecast median over the next 30 days.

Impact estimates. Defined by overlaying the inundation area with exposure data, aggregated over NUTS admin units.

Exposure information. Potential impact of floods on population and land use (e.g. agriculture, urban).

Protected. Flood defenses accounted for in inundation extent estimates.

Unprotected. Inundation extent estimates assuming no flood defense.



GloFAS Map Viewer: complementary data and variables



Hydrological Model Performance

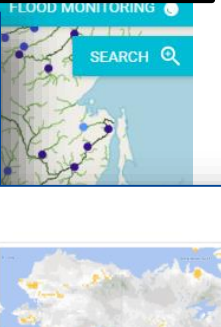
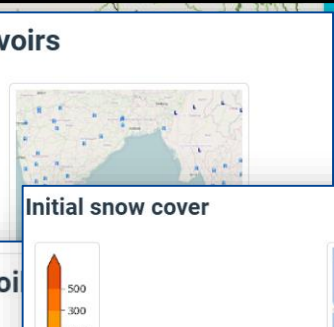
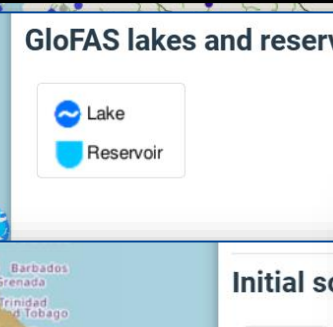
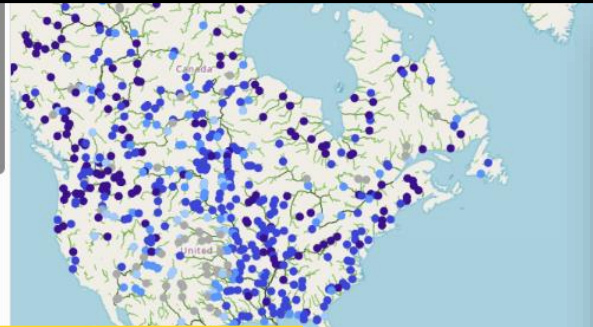
Modified Kling-Gupta Efficiency (KGE) for calibration stations. The KGE ranges from -Inf to 1, with ...

LISFLOOD Drainage Network

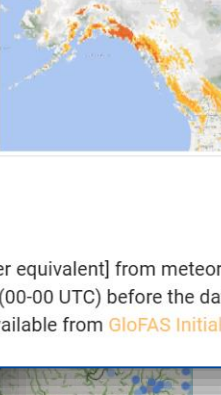
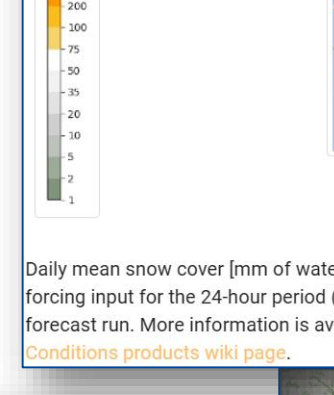
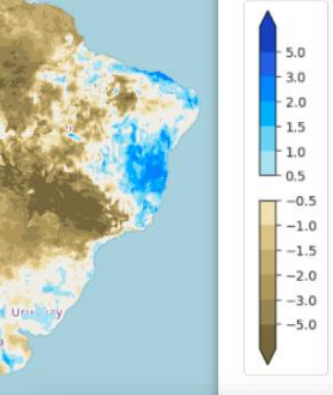
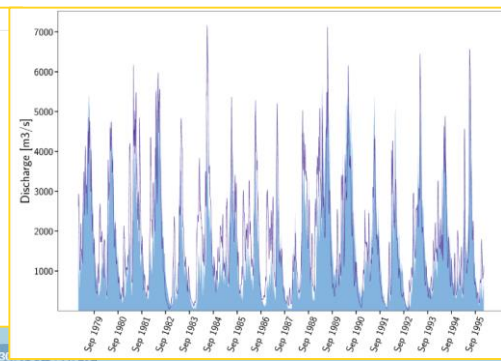
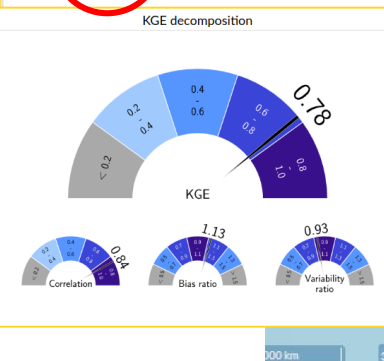
Drainage network of the LISFLOOD model. Rivers are shown as they are represented in the model. Lines...

Major Rivers

Layer showing the major rivers. More information is



Calibrated	KGE	Correlation	Bias	Spread	NSE
Yes	0.78	0.84	1.13	0.93	0.63



Soil moisture anomaly (unitless) from meteorological forcing input at initial time (00 UTC) on the day of the forecast run. The deviation from the ERA5 climate mean is normalised by the standard deviation. More information is available from [GloFAS Initial Conditions products wiki page](#).

Daily mean snow cover [mm of water equivalent] from meteorological forcing input for the 24-hour period (00-00 UTC) before the date of the forecast run. More information is available from [GloFAS Initial Conditions products wiki page](#).



GloFAS Map Viewer: Seasonal Forecasts Products



Seasonal Outlook - Reporting Points

Reporting points where ensemble hydrographs, displaying the river flow forecast out to 4 months, are...

[+ show more](#)

Seasonal Outlook - River Network

Maximum probability [%] of high (> 80th percentile) or low (< 20th percentile) river flow during the...

[+ show more](#)

Seasonal Outlook - Basin Overview

Maximum probability [%] of high (> 80th percentile) or low (< 20th percentile) river flow during the...

GFM

Layers Date

2024-02-29

Observed flood extent

Layer Date 2024-02-29

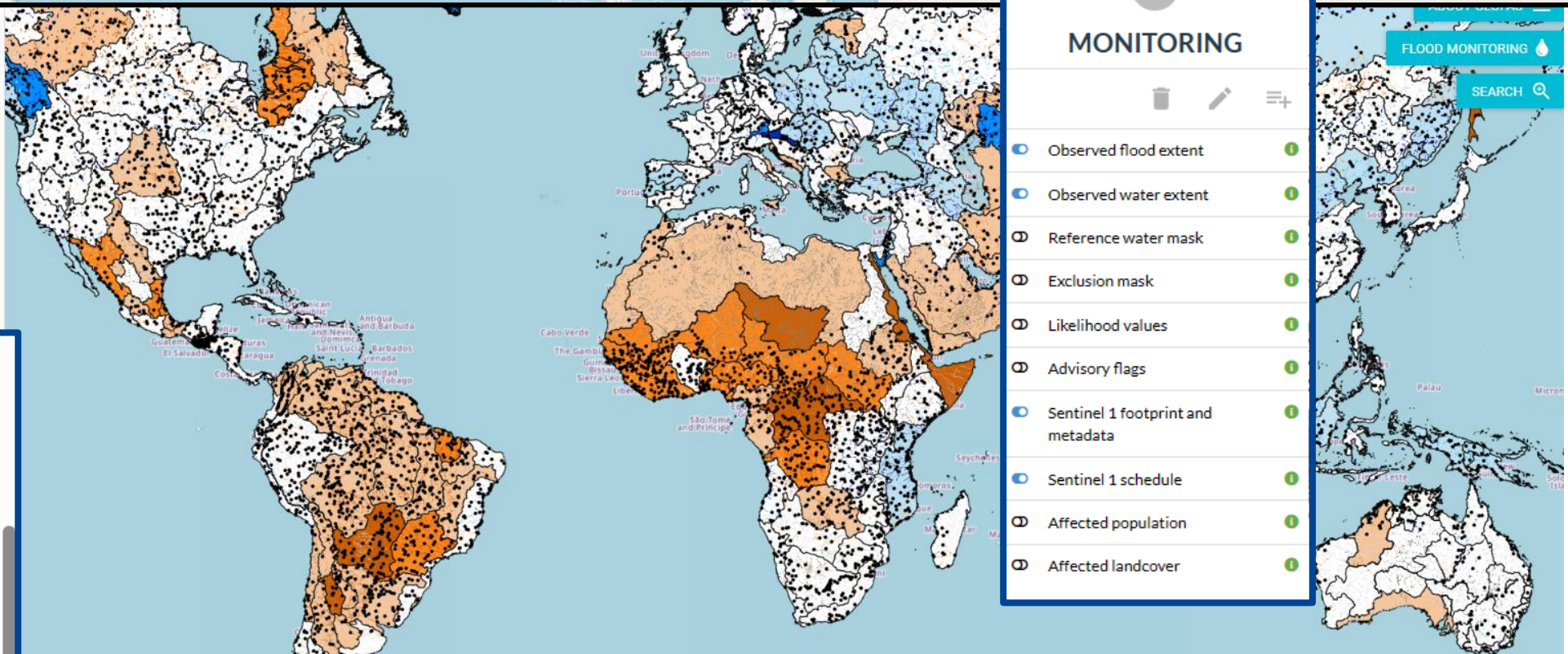
Sentinel 1 footprint and metadata

Layer Date 2024-02-29

Sentinel 1 schedule

Layer Date 2024-02-29

Observed water extent



MONITORING

- Observed flood extent
- Observed water extent
- Reference water mask
- Exclusion mask
- Likelihood values
- Advisory flags
- Sentinel 1 footprint and metadata
- Sentinel 1 schedule
- Affected population
- Affected landcover

and Global Flood Monitoring Product



GloFAS Data Access

<https://confluence.ecmwf.int/display/CEMS/CEMS-Flood+Data+User+Guide>

Copernicus Emergency Management Service - CEMS

Pages

PAGE TREE

- > CEMS-Fire
- 1 **> CEMS-Flood**
 - > European Flood Awareness System
 - > Global Flood Awareness System
 - > CEMS-Flood User Guide Corner
 - > Background on Copernicus Emergency Management Services - CEMS
 - > EFAS User Guide
 - > GloFAS User Guide
 - 2 **> CEMS-Flood Data User Guide**
 - CEMS-Flood Terminology
 - > Data Catalogue
 - Data Structure and Formats
 - > Data Access
 - > Working with CEMS-Flood Data
 - > FAQs
 - CEMS-Flood Data Support
 - > CEMS-Flood Development and Outreach
 - > UTCI

GloFAS Available Data

Presented here is a brief overview of the GloFAS data made available to the public. For a full overview of the GloFAS system, please go to the [dedicated wiki pages](#). You will find information on the latest releases here: [Latest operational GloFAS release](#)

GloFAS datasets

GloFAS historical

This dataset contains global modelled daily data of **river discharge** from GloFAS. River discharge. This dataset is simulated by forcing the the LISFLOOD hydrological modelling chain with in operational historical simulation is from 1979-01-01 up to near real time. Data can be accessed in several ways, the most common is through the CDS (see [Data Access](#)).

Table: River discharge and related historical data from GloFAS

DATA DESCRIPTION	
Data type	Gridded
Horizontal coverage	Global except for Antarctica (90N-60S, 180W-180E)
Horizontal resolution	0.1° x 0.1°
Vertical resolution	Surface level for river discharge
Temporal coverage	1 January 1979 to near real time for the most recent version
Update frequency	A new river discharge reanalysis will be published with every major update of the GLOFAS system. The latest version will always be the version used in operations. For more information on versions we refer to GloFAS versioning system .
Conventions	WMO standards for GRIB2
Versions	Current version - GloFAS v3.1 released 2021-05-26. For more information on versions we refer to GloFAS versioning system .

> Pre-release: GloFAS version 4.0

GloFAS real-time forecasts


This dataset contains global model with the ECMWF extended-range e

Table: River discharge and related f

DATA DESCRIPTION	
Data type	Gridded
Projection	Regular
Horizontal coverage	Global e
Horizontal resolution	0.1° x 0.1°
Temporal coverage	5 Novem
Temporal resolution	Daily dat

Tailored ftp service

- For information not available through the CDS and **time critical access**
- Set-up up to 15 working days



> CEMS-Flood Data User Guide

- CEMS-Flood Terminology
- > Data Catalogue
- > Data Structure and Formats
- > Data Access
 - > CDS
 - > MARS
 - FTP
 - > Web Services
 - > Working with CEMS-Flood Data
 - > FAQs
 - CEMS-Flood Data Support

Join us in Gather.Town!



#EUSpace



GloFAS Data Access: C3S Copernicus Data Store

<https://cds.climate.copernicus.eu/cdsapp#!/dataset/>

[/cems-glofas-historical?tab=overview](https://cds.climate.copernicus.eu/cdsapp#!/dataset/cems-glofas-historical?tab=overview)

[/cems-glofas-forecast?tab=overview](https://cds.climate.copernicus.eu/cdsapp#!/dataset/cems-glofas-forecast?tab=overview)

[/cems-glofas-reforecast?tab=overview](https://cds.climate.copernicus.eu/cdsapp#!/dataset/cems-glofas-reforecast?tab=overview)

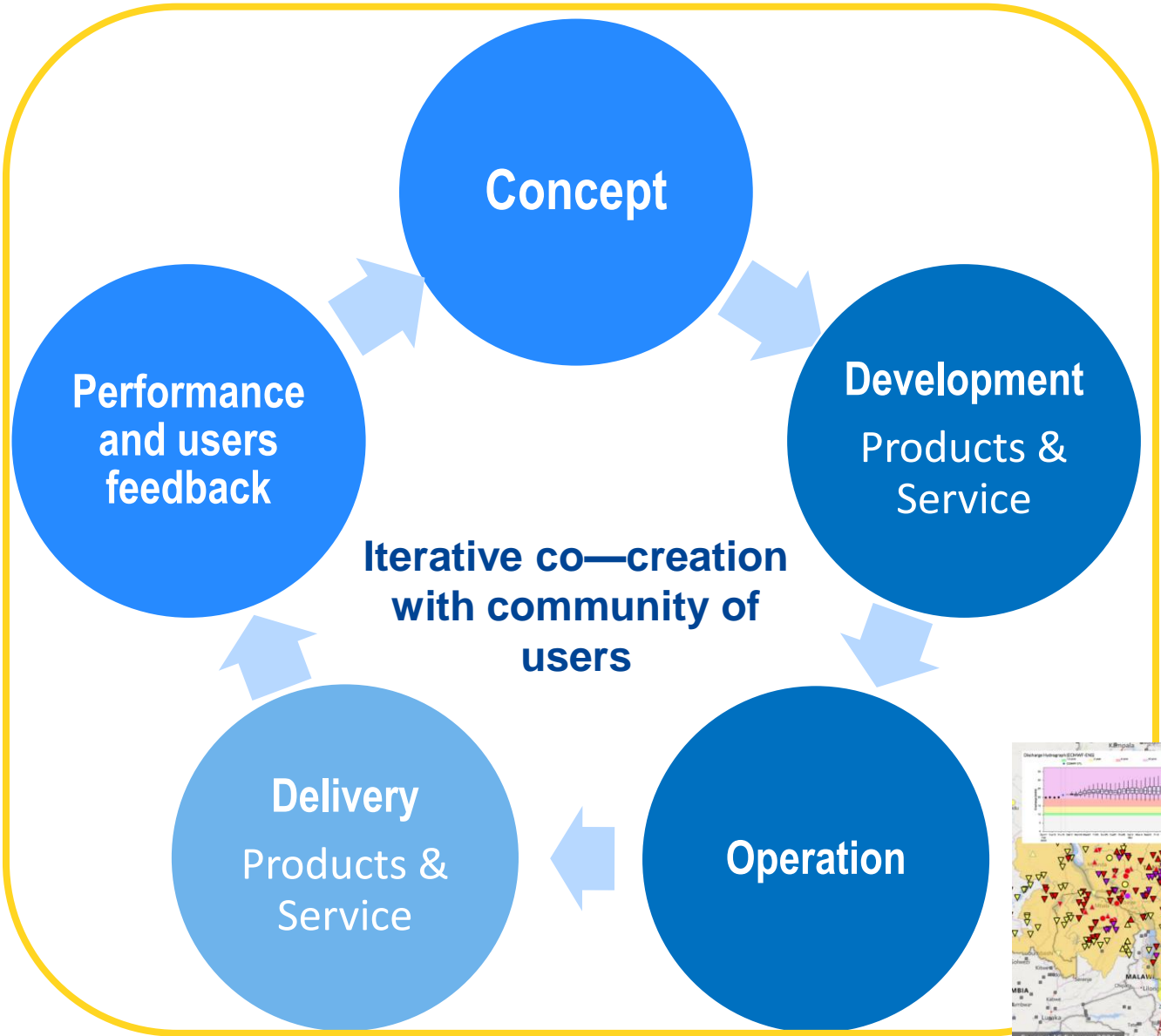
[/cems-glofas-seasonal?tab=overview](https://cds.climate.copernicus.eu/cdsapp#!/dataset/cems-glofas-seasonal?tab=overview)

[/cems-glofas-seasonal-forecast?tab=overview](https://cds.climate.copernicus.eu/cdsapp#!/dataset/cems-glofas-seasonal-forecast?tab=overview)

<https://confluence.ecmwf.int/display/CEMS/CEMS-Flood+Data+User+Guide>

<https://www.globalfloods.eu/news/149-training-material-for-accessing-and-working-with-cems-glofas-data/>

DISCHARGE and RELATED DATA



GloFAS implementation cycle

HELP SHAPE THE FUTURE OF GloFAS

- Annual meetings and webinars
- User surveys
- Share your **discharge** data
- Ask for a **static reporting point**
- **Contact form** (users support and collaboration)

<https://www.globalfloods.eu/contact-us/>

Users satisfaction survey NOW OPEN!!

Join us in Gather.Town



#EUSpace



Thank you



© European Union 2024

Unless otherwise noted the reuse of this presentation is authorised under the [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) license.