EO4FLOOD

EARTH OBSERVATION FOR ADVANCING FLOOD FORECASTING

FLOODS are #1 cause of internal displacement worldwide

(2000-2024, EM-DAT)

1.8 billion
people affected

180 countries
impacted

135'000
deaths

973 billion
US$ in losses

EO4FLOOD is a project funded by the European Space Agency (ESA) demonstrating the potential of advanced satellite data in enhancing the accuracy and timeliness of flood forecasting systems.

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Problem Statement

Despite major technological advances, flood forecasting remains limited by incomplete, inconsistent, or delayed data. EO4FLOOD addresses this gap by integrating advanced Earth Observation datasets into forecasting systems.

Importance of Real-Time Forecasting

Real-time flood forecasting is critical for reducing immediate impacts and enhancing emergency response

Traditional flood forecasting relies on ground-based hydrological networks, but these systems often suffer from data gaps, particularly in vulnerable and data-scarce regions.

Satellite-based Earth Observation (EO) data emerges as a promising solution. Offering broad spatial and temporal coverage, EO technologies can bridge critical gaps in monitoring and improve the accuracy and reliability of flood forecasting systems.

Despite their vast potential, the integration of satellite data into operational flood forecasting remains limited.

EO4FLOOD Objectives

Developments of Advanced EO Datasets

1. Integration of high-resolution satellite products from ESA and non-ESA missions. Global coverage of critical
2. variables: precipitation, soil moisture, snow, flood extent, water level, and river discharge.

Integration into Flood Forecasting Models

1. Combination of EO datasets with machine learning–enhanced hydrological and hydraulic models.
2. Achieving more accurate flood predictions while quantifying uncertainty.

Demonstration for Science and Society

1. Showcasing applications in flood risk management.
2. Exploring the influence of human activities (land-use changes, dam construction, etc.) on flood dynamics.
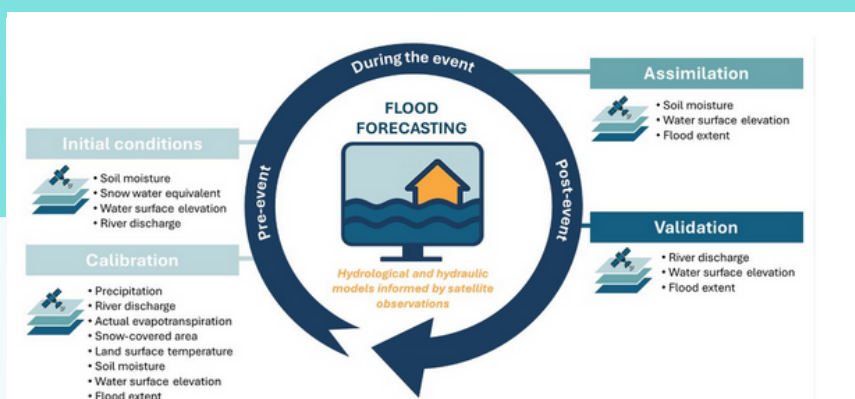
Testing Basins

The testing modelling framework will be implemented over selected areas within five specific basins (**Torne**, **Negro**, **Congo**, **Niger** and **Brahmaputra**).

EO datasets will also be provided for large European basins (**Po**, **Danube**, **Rhine** and **Ebro**).

Satellite data powering EO4FLOOD

EO4FLOOD uses advanced satellite Earth Observation data to fill gaps in flood monitoring, providing consistent, near real-time coverage across the globe.

Key variables of historical input data

Satellite data offer a solution to provide broad spatial and temporal coverage

- **Precipitation**

  GPM every 30' at 0.1° (IMERG as real time product)

- **Soil moisture**

  SMAP, AMSR2, ASCAT with resolutions and revisit time good for FFS. potential improvements with S-1 and CYGNSS

- **Water level and river discharge**

  From altimetry (Cryosat-2, Sentinel-3, -6, SWOT), optical sensors (NIR or visible) by rating curves

- **Flood extent**

  SAR (Sentinel-1, TerraSAR-X and COSMO-SkyMed) and Optical (Sentinel-2, VIIRS)

- **Snow**

  Sentinel-1 (SAR) and Sentinel-2 / VIIRS (optical) for snow-covered area; AMSR2 and SMAP for snow water equivalent.

Models

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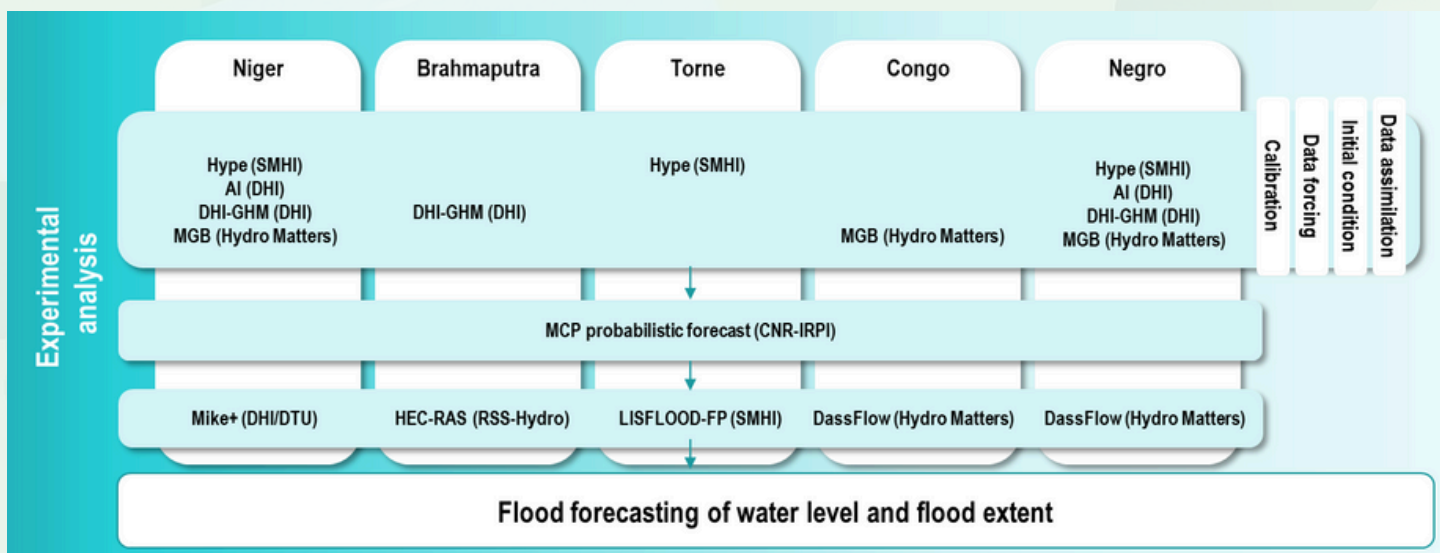
KEY INNOVATIONS

BETTER SATELLITE INFORMATION ON RIVER AND FLOODS

EO4FLOOD combines data from several satellites to get more accurate information on water levels, river width, flow and flood extent — even in places where ground measurements are missing.

SMARTER FLOOD MODELS

By mixing physical models with new AI methods, EO4FLOOD helps anticipate how rivers react during extreme events and improves the reliability of forecasts.

STRONGER EARLY WARNING SYSTEMS

EO4FLOOD integrates satellite information directly into flood forecasting tools used by national services, helping them issue faster and more accurate alerts.

SUPPORTING REAL-WORLD DECISIONS

The project produces probabilistic forecasts that help crisis managers and communities understand risks and prepare better in advance.

For more information, scan this QR code to visit our website eo4flood.org

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