

Copernicus Emergency Management Service

On-Demand Mapping Urban Flood Workshop



Flood products are a staple of the CEMS RM portfolio

Context





A History

Prior to late 2023



- Flooded areas
- Detailed hydrography features



History



Late 2023 – Early 2024: SpeedyFlood







History



April 2024 – July 2024: INFLOS v1





- Flooded areas, flood depth
- Detailed hydrography features



History





- Flooded areas
- Flood depth

OPERPICUS Europe's eyes on Earth

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Detailed hydrography features

European

Commission





Need for flood depth estimation





Combine elevation data and observed flood event:

- Interpolate a flood surface.
- Infer flood depth.



Hydrography





Multi-stage process to obtain flood depth.







INFLOS

Computation of flood depth and validation process



COPERICUS European Commission

Improved observed event mapping

Extract only flooded areas by image processing









Quality and consistency of elevation data.





European Commission

Development process

Multi-stage development of INFLOS, like any TRL process.



Flood product reprocessing

- First reprocessing phase
 - 8 activations, 137 products
- Second reprocessing phase
 - 5 activations, 47 products

| Activation | Locality | | Number of products | |
|------------|----------|----------------|--------------------|---|
| EMSR692 | | Greece | 28 | |
| EMSR697 | | Greece | 2 | |
| EMSR698 | | United Kingdom | 5 | |
| EMSR705 | | Italy | 7 | 1 |
| EMSR706 | | France | 15 | |
| EMSR708 | | Belgium | 8 | |
| EMSR712 | | Germany | 71 | |
| EMSR713 | | Germany | 1 | |
| EMSR720 | | Brazil | 7 | |
| EMSR722 | | Germany | 7 | |
| EMSR723 | | France | 7 | |
| EMSR725 | | Sweden | 3 | |
| EMSR728 | | Germany | 23 | |







Copernicus







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Potentiary population

Situation as of 05/05/2024 22:15 UTC Delineation Consolidation - Overview map 01

GDACE ID ~16992 Took diversion 1

GUIX ranker NA Ini Chele Ad. ID 575

Bellin Pear 2.6 km

Reference

For more information, refer to the publication on INFLOS.

Preprint Article Version 1 Preserved in Portico This version is not peer-reviewed

INterpolated FLOod Surface (INFLOS), a Rapid and Operational Tool to Estimate Flood Depths from Earth Observation Data for Emergency Management

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(EXtrapolated FLOod Surface)

Towards modelling of potential flooding (rural, urban)





Introduction

Methodology

Results



Context:

- Need for a tool to improve the remote-sensed flood extent and to assess the correspondent flood depth distribution
- Operational rapid mapping context → short production time, several PS involved, ...
- Heterogeneity of the input data → resolution of the DTM, resolution of the satellite image, ...



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Idea:

- Start from the polygons of the remote-sensed flood extent
- Improve the limits of the observed event
- Interpolate a surface that represents the estimate flood surface
- Retrieve water depth



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EXFLOS, the vision:

- Tool under development in the context of rapid flood mapping
- **Quick computation** of the water depth distribution in correspondence of the polygons of the observed event



- It works with SAR and optical sensors
- Possibility to improve the results with the implementation of gauges measurements or social media geotagged flood/flood depth information





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Case studies:

- EMSR492 Flood in Landes, France -> 1m res. DTM & media markers in the town
- EMSR708 Flood in Belgium -> 5m res. DTM & media markers in the town (used for validation only)
- EMSR692 Flood in Greece -> 10m res. DTM & media markers in the town
- EMSR756 Flood in South West Poland -> 30m res. DTM (?) & media markers in the town



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EMSR492 - Flood in Landes, France



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EMSR492 - Flood in Landes, France





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EMSR708 - Flood in Belgium - Roesbrugge

estimated water depth: 0.1 m (next to the building)





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EMSR708 - Flood in Belgium - Roesbrugge



In this case the social media markers were used just as validation (not in the interpolation process)



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EMSR692 - Flood in Greece





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EMSR692 - Flood in Greece - Palamas





estimated water depth: 2.0 m

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EMSR692 - Flood in Greece - Palamas





Methodology

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EMSR692 - Flood in Greece - Metamorfosi





Methodology

Results

EMSR692 - Flood in Greece - Metamorfosi





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EMSR756 - Flood in South West Poland



European Commission

EMSR756 - Flood in South West Poland

sub_AOI





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EMSR756 - Flood in South West Poland Klodzko, 15/09/2024









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EMSR756 - Flood in South West Poland

Comparison water depth distribution – situation as of 15/09 05:01UTC







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EMSR756 - Flood in South West Poland

Comparison water depth distribution: EXFLOS - FLEXTH



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EMSR756 - Flood in South West Poland Comparison water depth distribution: EXFLOS - FLEXTH





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EMSR756 - Flood in South West Poland

Comparison water depth distribution – zoom on the town of Klodzko







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EMSR756 - Flood in South West Poland

Media markers in the town of Klodzko



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Media markers in the town of Klodzko



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Media markers in the town of Klodzko



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EMSR756 - Flood in South West Poland

EXFLOS water depth distribution – introduction of the media markers depth values



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EMSR756 - Flood in South West Poland DTM and media markers

Methodology

EVENT **PRE-event** 493.00 m 489.08 m Kościustki 33333333 7 7 7 7 7 7 489.90 m 494.73 m Mickiewicza OPERICUS Europe's eyes on Earth European Commission

Results

- Automate the algorithm to foster testing and parameters tuning
- Select case study with suitable conditions (ex. Availability of media markers) to calibrate / validate the approach



- Good results, especially in areas with dense coverage of flooded areas.
- The quality of the DTM has a drastic impact on the consistency of the results
- The availability of in situ data collected through social media markers, could significantly improve/validate the results.
 - Collaboration with JRC EFAS colleagues (FLEXTH).



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Results

Applications of FAST Flood

Preliminary FEP for flood events and further mapping benefits:

- Provide **flood forecasting-type** information at activation time
 - giving a rough estimation of potential event location and impact.

• Help define AOIs

- focusing on high-impact areas
- > and avoiding the omission of potentially impacted sectors.
- Help PSs:
 - focus their attention during production,
 - clean their flood extents by masking areas for DEL and modelling
- Provide ancillary data to other tools, such as EXFLOS.







Fast Flood App on FABDEM

Flood depth for EMSR720 AOI01 with precipitations set to 60 mm per hour, similar to what was measured during the activation.

Fast Flood App on WorldDEM v2

Flood depth for EMSR720 AOI01 with precipitations set to 60 mm per hour, similar to what was measured during the activation

Fast Flood App software (<u>https://fastflood.org/</u>), which provides pertinent results rapidly



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SERVICE EVOLUTION PROPOSALS FOR YEAR 3 - DRAFT

Application of Fast Flood App

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European Commission

SERVICE EVOLUTION PROPOSALS FOR YEAR 3 - DRAFT

Application of Fast Flood App for flood delination cleaning



Fast Flood App



Sentinel 1 image



ESRI Basemap









Methodology

