imprex
Learn from today to anticipate tomorrow

www.imprex.eu
@imprex_eu

INNOVATIVE APPROACHES FOR FLOOD RISK ASSESSMENT

New hydro-meteorological forecast and risk management products by IMPREX improve the operational efficiency of European flood management and help mitigate the vulnerability to hydro-meteorological extremes.

Floods are one of the most frequent natural hazards worldwide leading to high socio-economic impacts. Various phenomena can cause a flood, mostly related to heavy precipitation falling on saturated or frozen soil, but also related to other drivers such as sea surge. The probability of occurrence of floods caused by the coincident occurrence of multiple flood drivers, so called compound events, may change with changing climate, especially in Southern and Eastern Europe.

Flood risk analysis is an integral part of the EU Floods Directive, requiring tools for reliable risk assessments on various scales. Currently no systematic monitoring of flood events is taking place, which would significantly improve effective flood risk management. Reliable hydro-meteorological forecasts, loss estimation and analysis of multiple hazards are needed to effectively implement a flood risk management system.

IMPREX TOOLS:

IMPREX developed two innovative approaches to face existing challenges and improve flood risk assessments:

- A Probabilistic Flood Loss Estimation Model
- Mapping compound events and their impacts

PROBABILISTIC FLOOD LOSS ESTIMATION MODEL –

A practical tool to quantify and reduce uncertainties in flood loss estimation, allowing improved risk management and real-time assessments.

Flood loss modelling and risk assessments are widely used for example by insurance companies to assess potential losses and defining pricing structures.

Traditionally, flood models are often based on simplified assumptions offering deterministic flood loss estimations. Most of these models have a limited representation of uncertainties, generating concrete but often wrong estimations of flood risks. Particularly the uncertainty related to the damage caused by a flood is poorly covered.

Probabilistic flood loss estimations provide a comprehensive set of information, allowing for efficient risk management and real-time assessment

A probabilistic, multi-variable Flood Loss Estimation Model for the private sector (BN-FLEMOps) has been developed within IMPREX. The model enables a short-to-medium, seasonal and long-term improved flood risk assessment for fluvial flooding and has been developed in close consultation with relevant stakeholders, including insurance companies. Compared to the traditional

deterministic estimation of flood loss, a probabilistic approach is especially suitable for planning purposes and real-time assessments where flood loss uncertainties play an important role. The BN-FLEMOps model enables probabilistic flood loss estimation for residential buildings at a European level, relying primarily on open access background information.

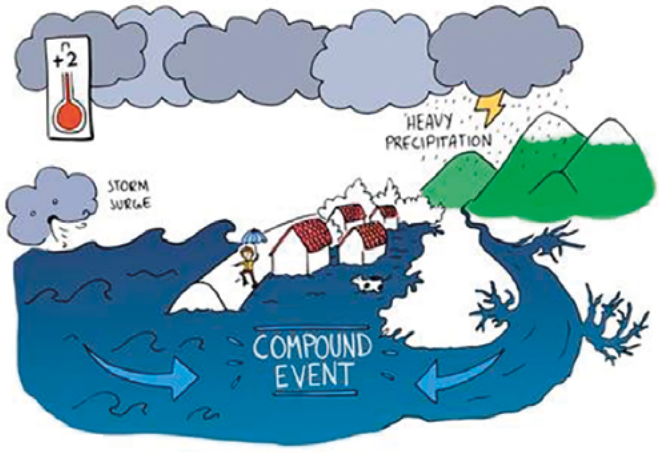
Within the framework of IMPREX, the model has been applied and validated successfully in three European river basins with varying spatial scale in Germany, Italy and Austria. BN-FLEMOps data sets for European wide flood loss estimation will be integrated into the OASIS hub (The global window to free and commercial environmental and risk data tools and services) promoting the uptake of the model by both practitioners and researchers. Transferring the model to different European regions is feasible through an updating approach with empirical data from the target regions.

Apart from (re)insurance and asset management agencies, the target group also includes NGO's, EU policy makers, national governments, and local, national and European water authorities involved in assessing risks and impacts associated with extreme events.

MAPPING COMPOUND EVENTS AND THEIR IMPACTS –

Analysis framework to support river basin authorities in realistically estimating risks and related impacts of interconnected climatic processes

Extreme events, such as floods and storms often result from a combination of interacting processes across different spatial and temporal scales. In order to efficiently design flood hazard and risk assessments, IMPREX analysed and assessed so-called 'compound events": a combination of processes contributing jointly to major impacts, such as heavy precipitation and storm surges (see figure 1). Compound events can cause extreme flood events even if individual drivers are not extreme. In recent years, compound events caused some of the major flood events within Europe as for example the flood event in 2013 and 2014 in the South West of the UK which was caused by heavy precipitation on an already saturated soil in combination with high sea water levels.



The emergence of compound events

IMPREX research demonstrated the need to consider the complexity of impacts of extreme events to improve modelling and risk assessments. The project has provided an analysis framework and tested it in a number of case studies in the Netherlands and the UK.

Case study results show that the developed approach supports decision-makers in realistically estimating impacts and related risks of interconnected climatic processes. The effect and role of compound events and compound drivers is very case specific and cannot easily be captured in a single tool. Yet, a better understanding of compound events enhances the realism of flood statistics and consequently the reliability of flood hazard maps. It provides a basis for improved cooperation between various stakeholders that are active in the field of flood risk management, such as climate and social scientists and decision-makers on various levels.

CASE STUDY

IMPREX partners collaborated with different companies in the European insurance industry.

For calculations of premiums and definition of solvency requirements, many insurance and reinsurance companies regularly use flood loss estimation tools. In collaboration with IMPREX partner GFZ, German Research Centre for Geosciences, insurance companies tested and applied the probabilistic flood loss estimation tool for assessing future flood risk.

> *The model represents an important step forward in flood risk modelling, because it delivers reliable flood loss estimations and additionally considers uncertainty information.*
> *Collaboration partner of international reinsurance company.*

The companies applied the model for residential buildings in various European areas, feeding it with extensive local data and information. The model offers a comprehensive response to (re)insurance needs by delivering reliable information to evaluate flood risks.

Referring to a large pool of experiences, some companies stated that data availability is a crucial aspect for transferability of damage assessment tools, essential for reliable risk assessments. Mapping the inherent uncertainty is important for achieving this reliability. A consistent package of tools that support considering uncertainty is an indispensable asset for involved companies.

> *The model should be made available for as many practitioners as possible as it might significantly strengthen societal resilience and it improve risk awareness.*
> *Collaboration partner of international reinsurance company.*

Working with the probabilistic flood loss estimation tool, the companies successfully conducted a flood risk analysis and have been convinced of the advantage of working with a probabilistic, multi-variate approach. Insurance companies rely on risk information on affected regions during certain timespans as this determines the level of insurance. The presented tool offers the possibility to adapt the loss model to regional characteristics to meet that need.

For further information please visit www.imprex.eu and check out our interactive product demonstrator!

CONTACT INFORMATION

Probabilistic Flood Loss Estimation Model: Heidi Kreibich (GFZ), **heidi.kreibich@gfz-potsdam.de**
Mapping compound events and their impacts: Dorien Lugt (HKV), **d.lugt@hkv.nl**

IMPREX Contact and Coordination:
Bart van den Hurk
Deltares
P.O. Box 177, 2600 MH Delft, The Netherlands
Bart.vandenHurk@deltares.nl

Janet Wijngaard
Royal Netherlands Meteorological Institute
P.O. Box 201,3730 AE De Bilt, The Netherlands
janet.wijngaard@knmi.nl

This factsheet was compiled by adelphi based on the work carried out within the context of the research project IMPREX and interviews of involved users. Special contributions were made by Dr Heidi Kreibich (GFZ), Dorien Lugt (HKV) and Bart van den Hurk (Deltares).

Visit www.imprex.eu and engage with us!

IMPREX has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 641811.

IMPREX is designed to help reduce Europe's vulnerability to hydrological extremes by achieving a better understanding of the intensity and frequency of potential disrupting events. Enhancing our forecasting capability will increase the resilience of European society as a whole, while reducing costs for strategic sectors and regions at the same time. The research project brings together 23 partners from 9 countries and has received funding from the European Union's Horizon 2020 Research and Innovation Programme.