

## **Report of the Rainfall Hazards Workshop**

Royal Library of Belgium - 23 March 2023

### **Introduction**

The Rainfall Hazards Workshop was organized at the Panoramazaal of the Royal Library of Brussels, Belgium. It aimed to encourage communication and create a collaborative network between meteorologists, hydrologists, and diverse stakeholders in the context of extreme rainfall and its associated hazards. It was also the opportunity to kick off these multidisciplinary projects, with a common goal to improve and integrate weather forecasts with impact-based warning systems for extreme precipitation and floods.

- DERISC: Deep learning based Extreme Rainfall and flood warnings through Seamless foreCasting. BELSPO-funded BRAIN-BE project, partners: Lesley De Cruz - RMI (Royal Meteorological Institute, coordinator), Patrick Willems - KU Leuven, Adrian Munteanu - VUB (Vrije Universiteit Brussel), VMM (Vlaamse Milieumaatschappij)
- EXPRIMA: Probabilistic nowcasting and forecasting of extreme precipitation for impact-based warning systems. BELSPO-funded FED-tWIN position between RMI and KU Leuven
- Flash floods within the RMI-SPW (Service Publique Wallonie) cooperation agreement.

Associated stakeholders and national and international experts were invited to encourage cooperation, guide the research and shape the products related to precipitation observation, forecasts and warnings. The workshop and the accompanying survey allowed us to map out the needs of various actors in this field.

### **Organizing committee:**

Arthur Moraux

Sylvain Watelet

Edouard Goudenhoofd

Ricardo Reinoso-Rondinel

Lesley De Cruz

### **Workshop activities**

The morning sessions covered topics such as radar products for precipitation observation and the importance of seamless prediction methods in nowcasting and forecasting. The research performed and planned at RMI, VUB and KU Leuven in the context of the new projects DERISC and EXPRIMA was also presented. The presentations were given by the PI's and researchers: Patrick Willems (KU Leuven), Ricardo Reinoso Rondinel (RMI / KU Leuven), Arthur Moraux, Sylvain Watelet, Edouard Goudenhoofd and Michiel Van Ginderachter (RMI), Lesley De Cruz (RMI / VUB), Simon De Kock (VUB).

In the afternoon, the floor was given to the scientific advisors from MeteoSwiss and the stakeholders. Daniele Nerini and Lionel Moret presented the precipitation forecasting chain at MeteoSwiss, from precipitation estimation and nowcasting to automatic alerts for heavy precipitation sent to forecasters and customers. They presented their ongoing developments and research activities including those based on machine learning (e.g. QPE RainForest,

deep generative nowcasting and post-processing). The warning system of the future should be closer to users and more understandable, with greater flexibility and diversity in the warning services. The recently started **seamless weather project** aims to unify different products and models into a seamless weather grid.

Inge De Jongh (VMM) presented FEWS-VMM, an impact-based approach to flood forecasts. They use INCA-ALARO and ECMWF EPS (percentiles) among others, and can use ensembles. A clear and user-friendly interface/ dashboard helps decision-makers assess the situation.

Michaël Antoine (Bruxelles Environnement) discussed observations, planned actions, and development needs in Brussels, an area prone to pluvial flooding. There is a clear need for warnings when certain return periods are / will be exceeded, and RMI's warning levels are not always clearly linked to such return periods. A conversation was started on how we can better address these needs, potentially with a professional version of the RMI App.

Philippe Dierickx's (SPW) presentation focused on the impact of climate change, which will increase the intensity and severity of pluvial floods especially (potentially mixed with fluvial floods). These are especially dangerous in narrow valleys such as the Vesdre. As for the tools, they find that weather model info comes too late whereas nowcasting/observations are too short; there are too many different sources of information and interpreting them is not straightforward.

He stressed the importance of improving communication about flood risks in Wallonia during extreme rainfall events. Communication should happen as soon as possible (early warnings with updates), with easily understandable messages on different media. The efficiency of communication has more impact than scientific accuracy. The preparedness of the authorities and population is crucial.

Guillaume Dervaux (NCCN) presented the structure of the Belgian National Crisis Center, the different phases of crisis management (Federal, Provincial, Municipal) and operational coordination. He discussed the importance of local forecasts of the impact of extreme precipitation, something that was lacking during the July 2021 floods.

Maarten Descamps from Flanders Hydraulics discussed flood forecasting systems for navigable waters (waterinfo.be). They stressed the importance of realtime quality information /verification of the RMI's rainfall products (QPE and forecasts), and the uncertainty quantification of the model output.

Ronny Van Looveren presented the City of Antwerp's climate change adaptation plans and citizen awareness. He showed the need for rainfall nowcasting within their adaptation strategy, emphasizing the role of real-time data in proactive flood risk reduction.

Stefan Kroll focused on smart control of urban drainage assets using rainfall forecast data, showcasing the potential of data-driven approaches to optimize drainage systems. Innovative and decentralized initiatives such as AqtiRain and AqtiPut were presented, that could benefit greatly from seamless probabilistic rainfall forecasts.

The stakeholder presentations were followed by lively and interactive Q&A sessions and a reception at Plein Public.

### Conclusions

- The **efficiency of communication** has more impact than scientific accuracy.
- The **preparedness** of the authorities and population is crucial.
- Users want real-time **quality** information of the rainfall products.
- **Return period** nowcasts are crucial for urban flood forecasting (not all users run hydrological models in cities)

### Recommendations

The next step should be a **co-creation** process. Users are invited to send their requirements and specify the properties of their "dream precipitation forecast product" (e.g. separate files for high-frequency short-term and hourly long-term predictions?) Based on these inputs and the survey results, we will create a minimum viable product and help integrate it into their systems so they can provide feedback. A first proof-of-concept seamless precipitation forecast product, ready for technical tests and feedback, is foreseen for autumn 2023.

After providing this MVP, the next preliminary outcomes for users to experiment with include **seamless rainfall predictions translated to return periods** and a parallel set-up with a real-time test product.

The final outcomes of such products should be better pluvial flood modelling and warnings; added value for the end users should be ensured.

In order to **understand the quality requirements** for the products, tell us what kind of decision will be taken based on your data. (e.g. only extremes are important?)

**A list of case studies** would be extremely useful. To gather flood data, community is key, but it's difficult to get people involved because these are infrequent events. RMI app offers the possibility to obtain these data.

**A platform for feedback on forecasts:** severe weather / wrong forecast logger should be set up.

A possible **revision of the warning colour meanings** could be considered (cfr MeteoSwiss: yearly evaluation)

Finally, the **rainfall hazards survey** was filled in by 14 stakeholders and the results will be made available in a separate document.

*We stress to all stakeholders that in case of issues with a product, please get in touch with RMI!*

### Acknowledgements

This workshop was organized by a team from RMI, KU Leuven and VUB, and made possible thanks to BELSPO funding in the framework of the DERISC project. We are deeply grateful to the many stakeholders for their insightful presentations and for making the event a success. We plan a follow-up mid-term in-person event for the DERISC project and a final workshop.