What-if the waterbomb would have fallen on the Netherlands?

Kymo Slager & Karin de Bruijn

What if the centre of the extreme event of July 2021 would have occurred above the Netherlands instead of above the Ardennes and Eifel? To address this question and to enhance the preparedness and resilience of the Netherlands for such extreme weather events, a 3-day hackathon was carried out.

In July 2021, an extremely large rainfall event over the Ardennes (Belgium), Eiffel (Germany) and the province of Southern Limburg in the Netherlands lead to severe floods with enormous losses and damages. In neighboring countries, the consequences were disastrous with 220 casualties, several demolished villages and lengthy disruption of critical infrastructure services including power supply and transport (see the reports from ENW and WWA published in the period after the floods for more information).

Such an amount of precipitation is exceptional. However, it may happen again and not only there, but also in other parts of the Netherlands. In a three-day hackathon session, a team from Deltares explored what kind of consequences we could expect if such an extreme event would unfold somewhere else in the country. To answer this key question, the meteorological situation of July 2021 as such was shifted north and consequences for different parts of the country were assessed. The hackathon resulted in the identification of knowledge gaps and crucial recommendations to enhance preparedness and resilience of the Netherlands for such extreme weather systems.

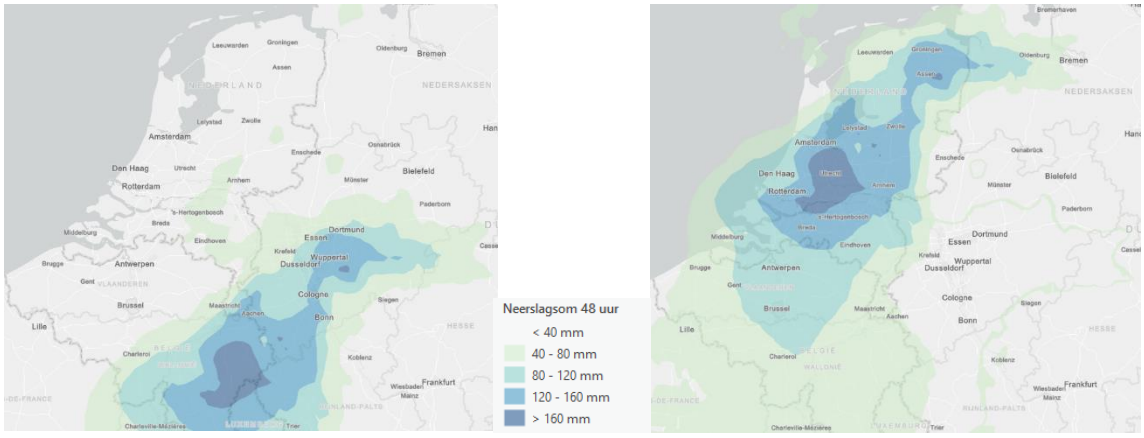

Figure 1. 48-hours rainfall as reported in July 2021; original situation (left) and example of a transformed situation (right)

The most important conclusions from this exploratory analysis are:

1. **The rainfall event of July 2021 was very extreme**: in addition to record-high precipitation amounts in the core of the rainfall area, the size of the area affected is exceptional. The area in which more than 110 mm fell in 24 hours covers about half the size of the Netherlands.
2. Our first estimates show that if such a rainfall event would occur, **the affected area could be enormous and would experience considerable and lengthy impeded drainage situations and (shallow) flooding**. Local and regional water systems- and infrastructure would for a longer

period experience high water levels up to design conditions. Locally, this could even lead to overtopping or failure of regional or primary flood defences.

3. In the **Dutch polder systems that rely on pumping**, regional water authorities would probably need to stop pumping excess rain water from low-lying areas into larger waterways in order to protect the embankments along those waterways and to prevent embankment failures. As a consequence, rainwater needs to be temporarily stored in agricultural and nature areas, but also in the lowest parts (streets) of built-up areas. This may result in the flooding of thousands of hectares of agricultural land and lead to huge yield losses. Hundreds of low-lying buildings may become flooded, and local disruptions in power supply may occur. Transport infrastructure will be disrupted at many locations (such as tunnels) for a longer period, and inland water transport will be disrupted, as well as train- and metro transport services. Furthermore, health impacts can be expected as surface water may become contaminated by wastewater and sewer outflows. Cascading impacts to critical services and objects (e.g. hospitals, ICT etc.) are not investigated in depth yet, but are considered very well possible.
4. If such an event would occur in the higher regions of the country **where rainfall is drained by gravity**, the rainwater will accumulate more rapidly and flow quickly to points where brooks or rivers meet. These points are of particular interest as water levels can rise quickly and overflow banks. Traditional bottlenecks for discharge in regional water systems will be aggravated. River discharges can rise above design and warning levels. As such, failure of regional and primary flood defences cannot be excluded for some river floodplains (e.g. Overijsselse Vecht).
5. It is plausible that total damage can easily rise to **more than a billion euro**. **In case of failures of flood defences, flooding could lead to casualties**
6. The extreme rainfall event may lead to **large challenges for the logistics of disaster response: many areas will be affected at the same time and for a longer period**. During and for a considerable number of days after such a rainfall event, demands for people, materials and transport will be high and widespread. The response will need to focus on multiple crises at the same time over a larger area: potential evacuations of people and animals from endangered areas, pumping out of tunnels and buildings, and monitoring of embankments and other infrastructure.
7. The Netherlands is not well prepared for flooding due to extreme rainfall at this large scale. It is impossible to fully prevent any flooding in these extreme conditions; it should however be prevented that such an event leads to a national disaster. To head for a more resilient country and society, the following activities are recommended:
    a) Develop and perform **large-scale flood risk stress testing**; at the most relevant detail level and with explicit attention for the temporal dimension (e.g. timing, duration and recovery) and spatial dimension (e.g. compounding and cascading impacts, as well as prioritization of crisis response measures); this will increase insight in above-regional water system functioning and possible consequences in extreme conditions;
    b) Improve and focus developments in flood early warning-and flood monitoring systems to provide **timely and adequate information** to disaster management authorities, before, during and after such an extreme event;
    c) Develop or update **location-specific disaster action perspectives** for water authorities (emergency measures, pumping strategies, emergency storage, bottleneck adaptations, etc.) with explicit attention for functioning in extreme conditions (e.g. disaster script books, standing orders and disaster plans);
    d) Intensify **transboundary flood risk information exchange**, also for smaller regional rivers;
    e) Evaluate **flood disaster management** capacity at different authorities (for preparation, response and recovery phases)
    f) Minimize the consequences of extreme rainfall events through spatial planning: identify hazardous areas (e.g by the stress-tests) and either do not locate **critical and vulnerable functions at hazardous locations or adapt these investments.** Keep **investing in (emergency) storage capacity** in rural and urban areas.
    g) **Continuously work on informing stakeholders** about future risks from flooding and provide location-specific action perspectives.