

Facts and findings on the 2021 floods in Limburg (NL)

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23 June 2022



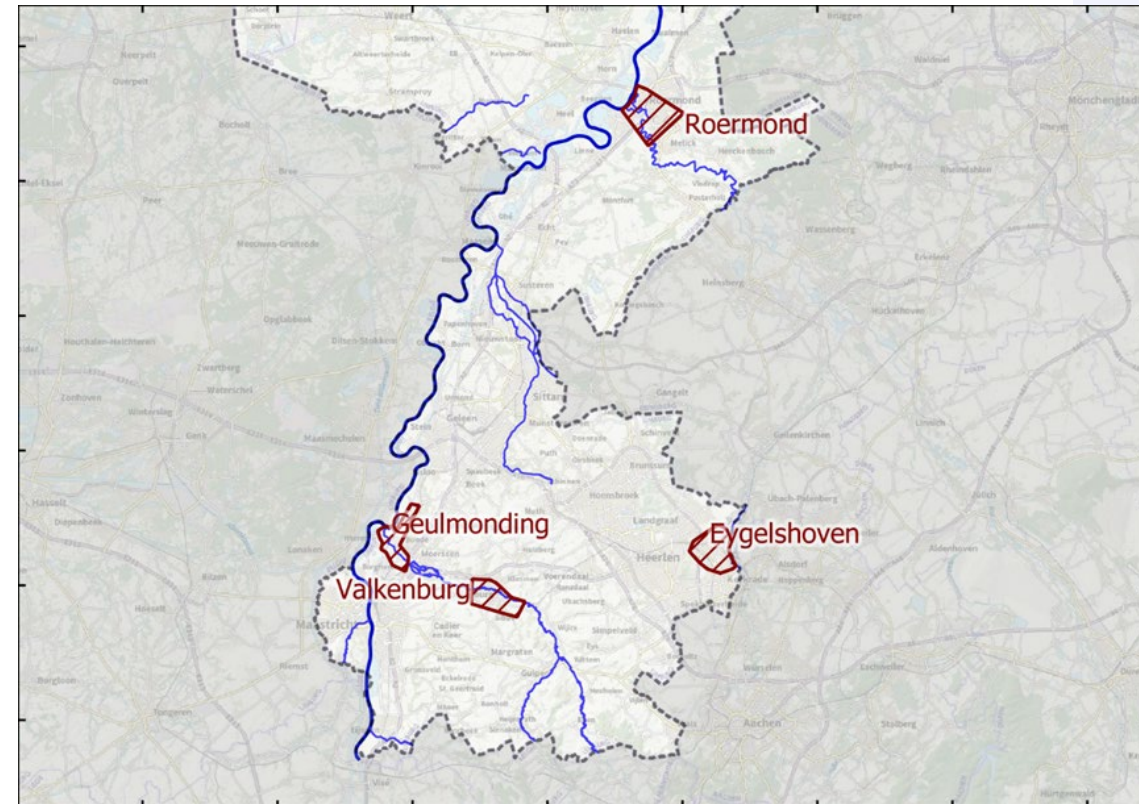
Watersystem evaluation

Questions:

- What happened in July 2021?
- How does the water system function under extremely wet conditions?
 - Where are bottlenecks located? What are locations with a high risk?
- What measures could be effective?
 - Increase the sponge function of the catchment?
 - Improve drainage capacity of the rivers?
 - Decrease vulnerability (improved spatial planning)?

Start with 4 casestudies:

- First lessons before starting the system wide assessment
- Not 'more important' than other flooded areas
- Different causes (pluvial, fluvial, compound flooding)

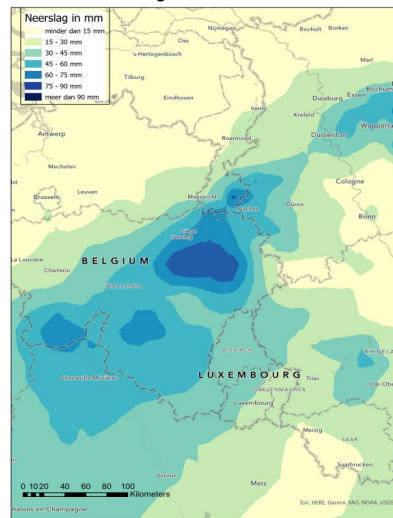


A 'cold-core low' (koudeput)

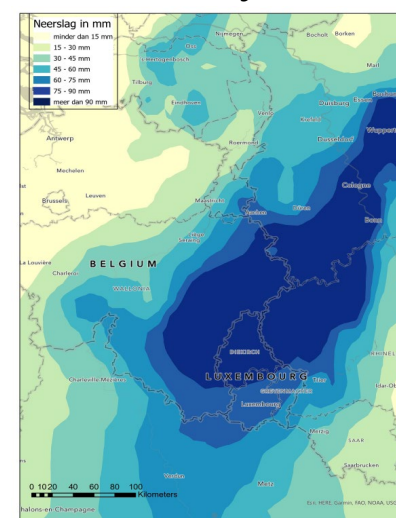


Precipitation

July 13



July 14

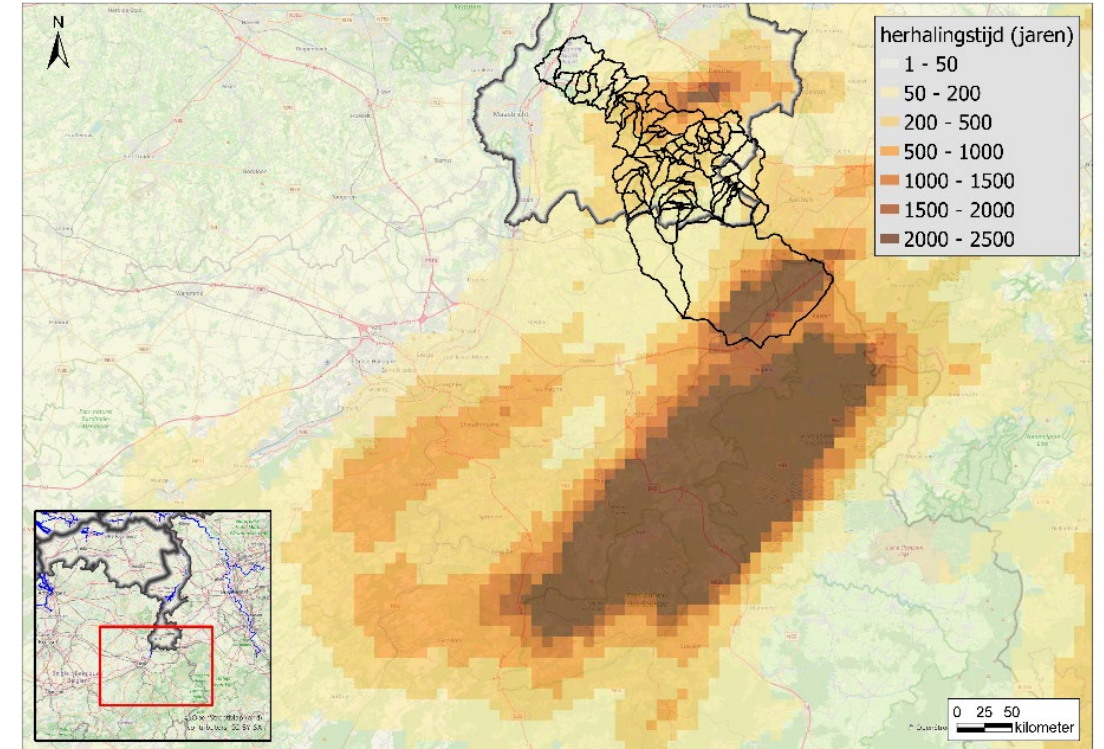
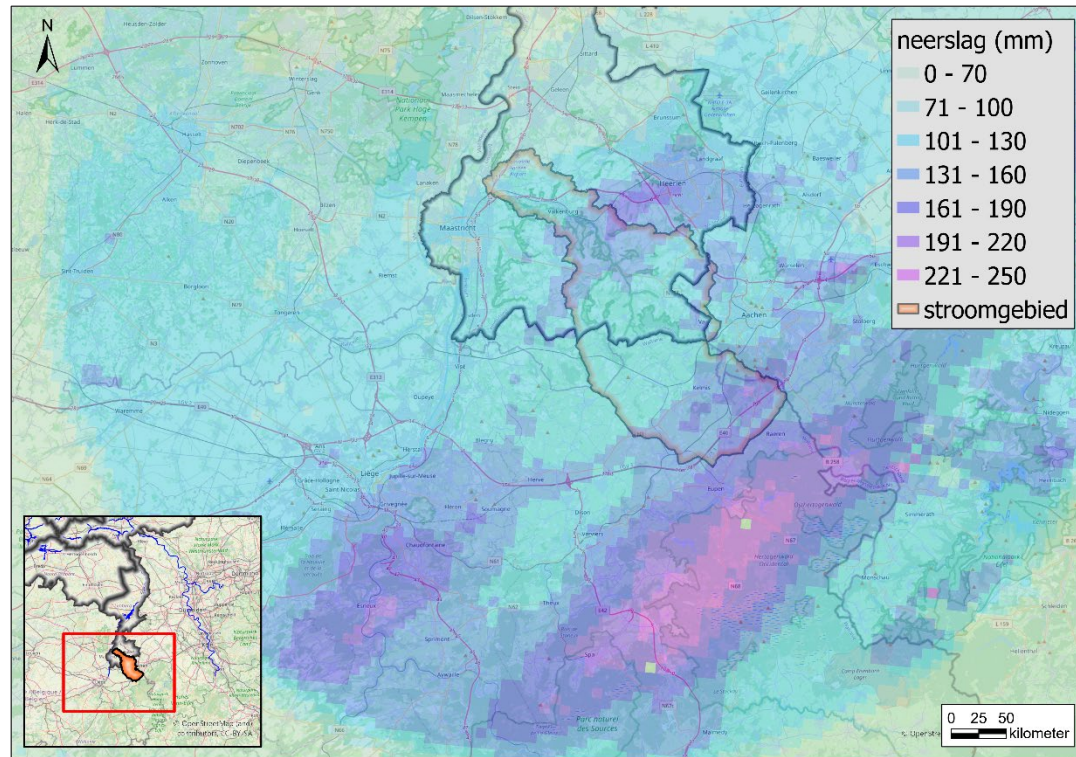


Occurs more frequently, however in July

- Large system
- Slowly moving
- Heat wave Baltic States

→ Precipitation record

Precipitation amount and probability



Geul catchment:

- Average precipitation 128 mm (spatial variations!)
- Probability 1:900 (~1:500 now? ~1:100 end of this century?)

Discharge

Meuse:

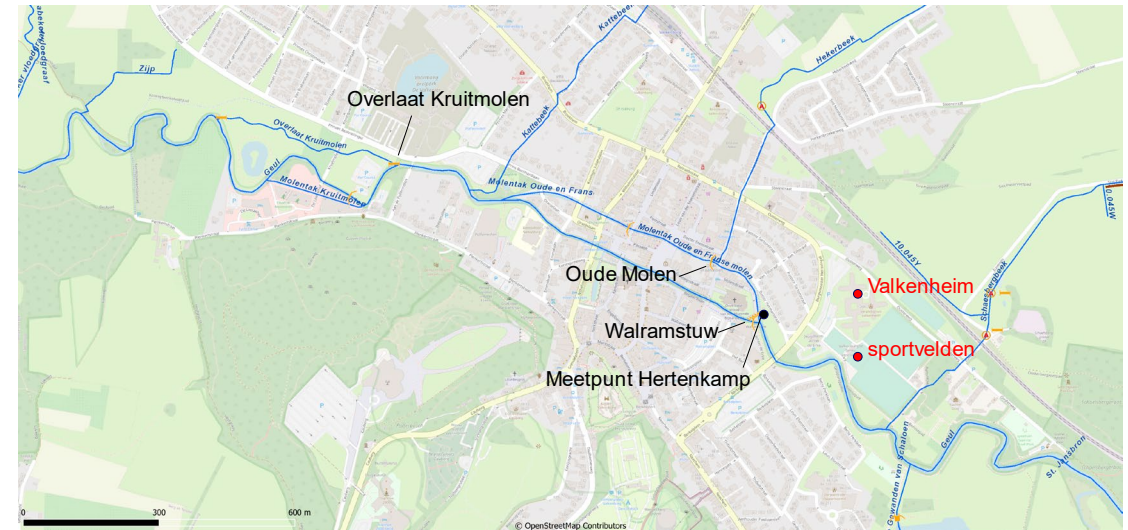
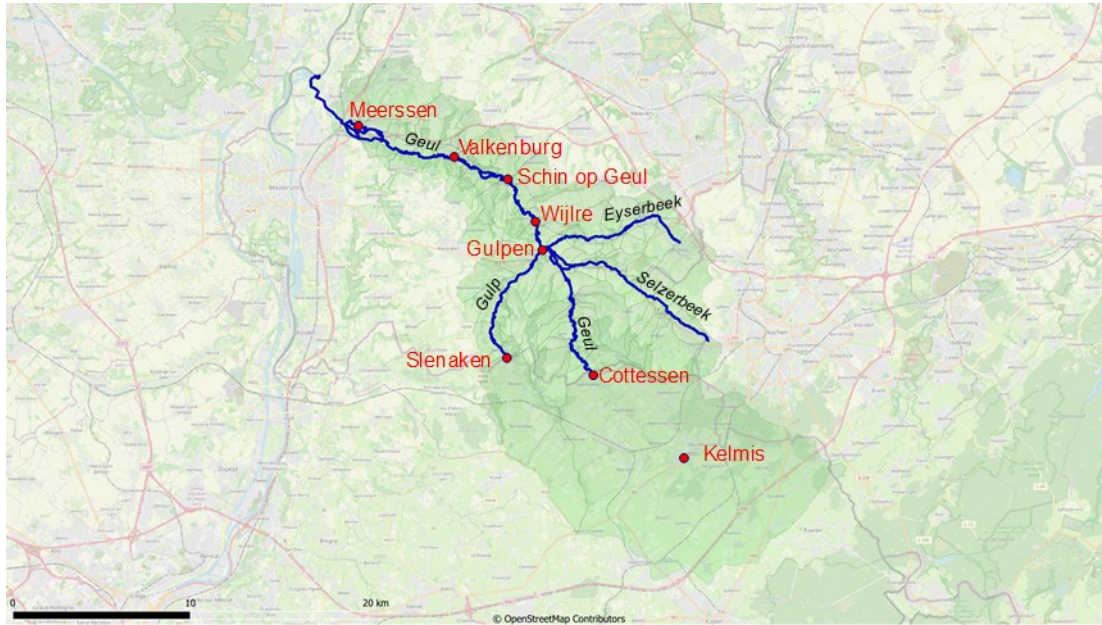
- Peak discharge 3310 m³/s (first estimate 3260 m³/s)
- ~1:100 per year (more extreme during summer?)

Geul near Valkenburg:

- Peak discharge ~135 m³/s
- 1:100 to 1:1000



Valkenburg



Flooding in Valkenburg



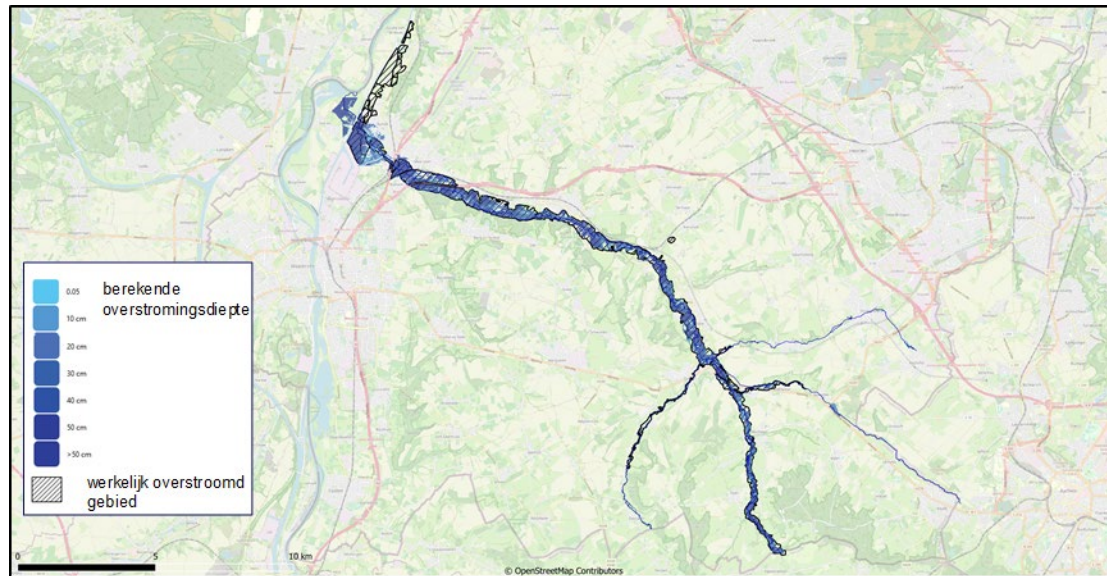
Water depths at many locations about 1,25 m

High flow velocities in some streets

Damage to buildings and bridges



Flooding in Valkenburg

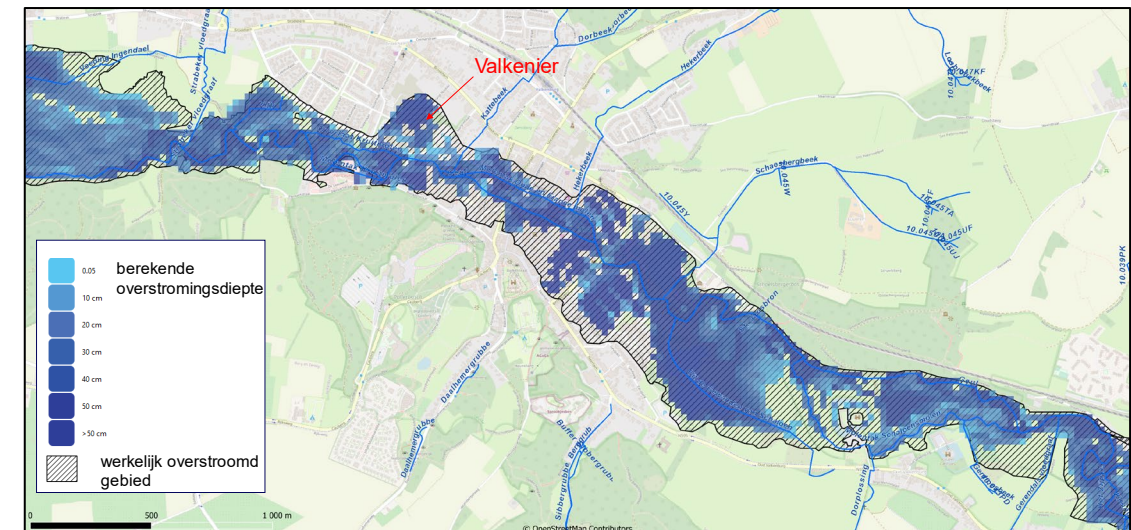


Hydrologic model (HBV) combined with hydraulic 1D2D SOBEK model

Additional calibration for extreme event

Still not 100% correct

New models are being developed



Flooding in Valkenburg – possible measures



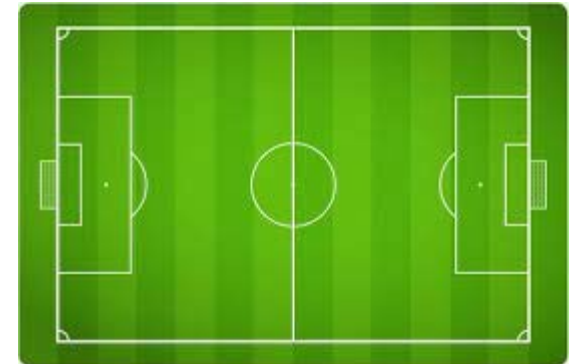
Embankments:

3 m high in city centre, starting 2.5 km upstream
Problems with foundation, bridges and existing buildings

Deltares



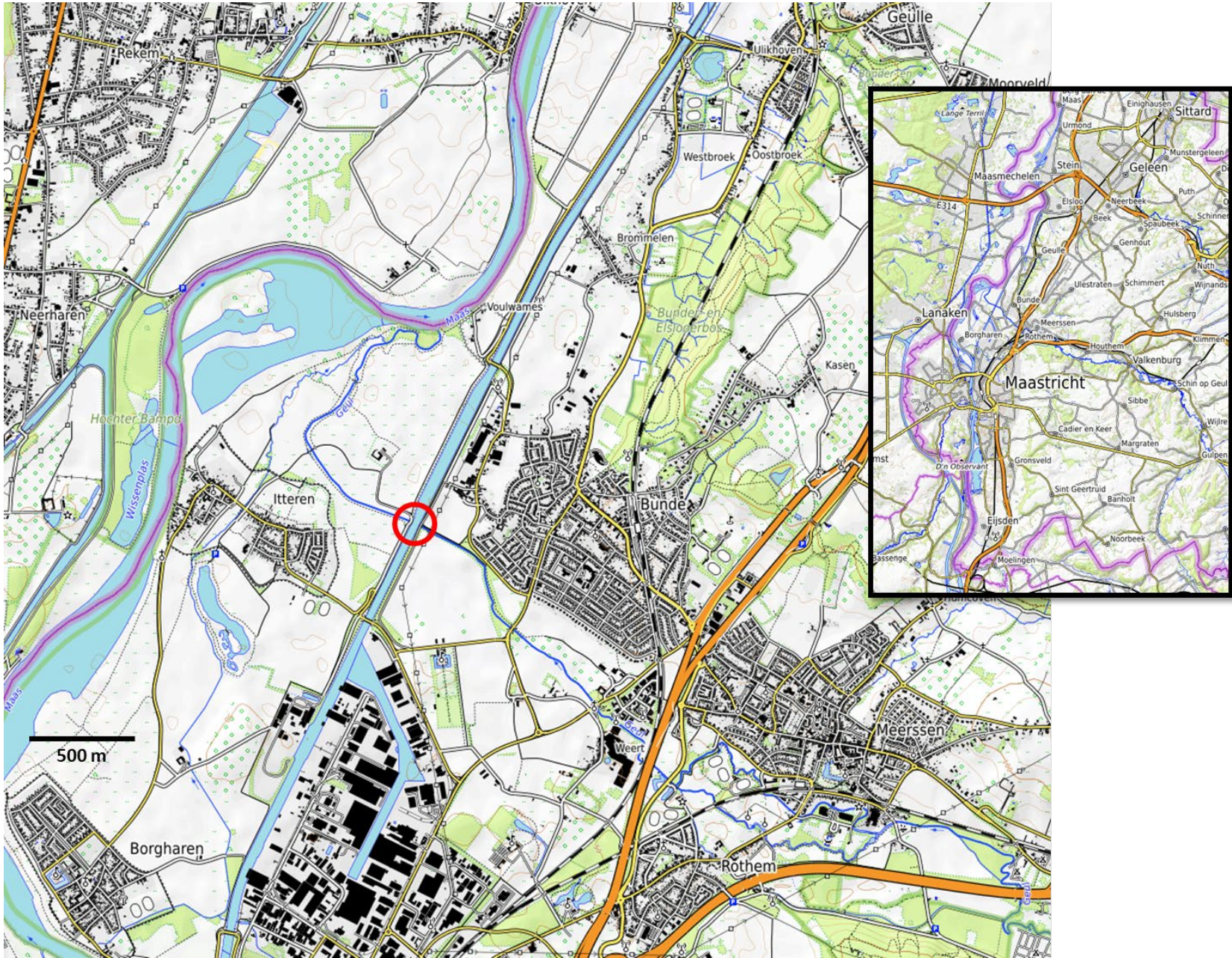
Tunnel (2 pipes, diameter = 3.5m) \rightarrow $\sim 40 \text{ m}^3/\text{s}$
Small negative effect downstream



Detention:

10.000.000 m^3
(1400 soccer fields under 1 m of water)

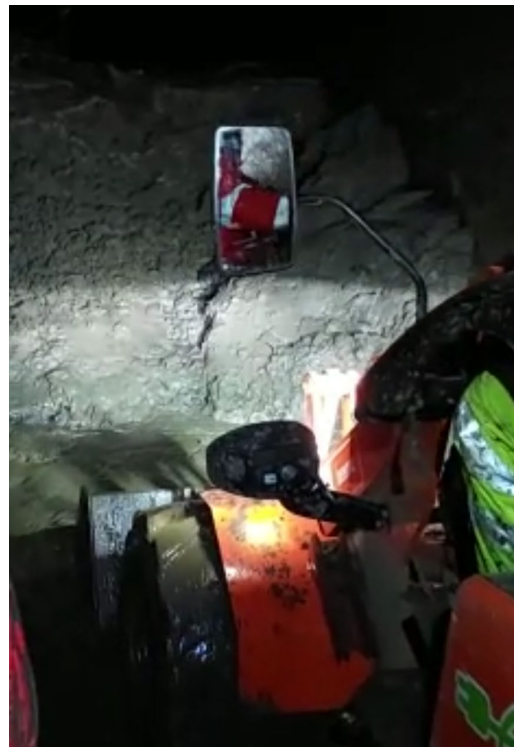
Confluence of Geul and Maas (Bunde-Meerssen)



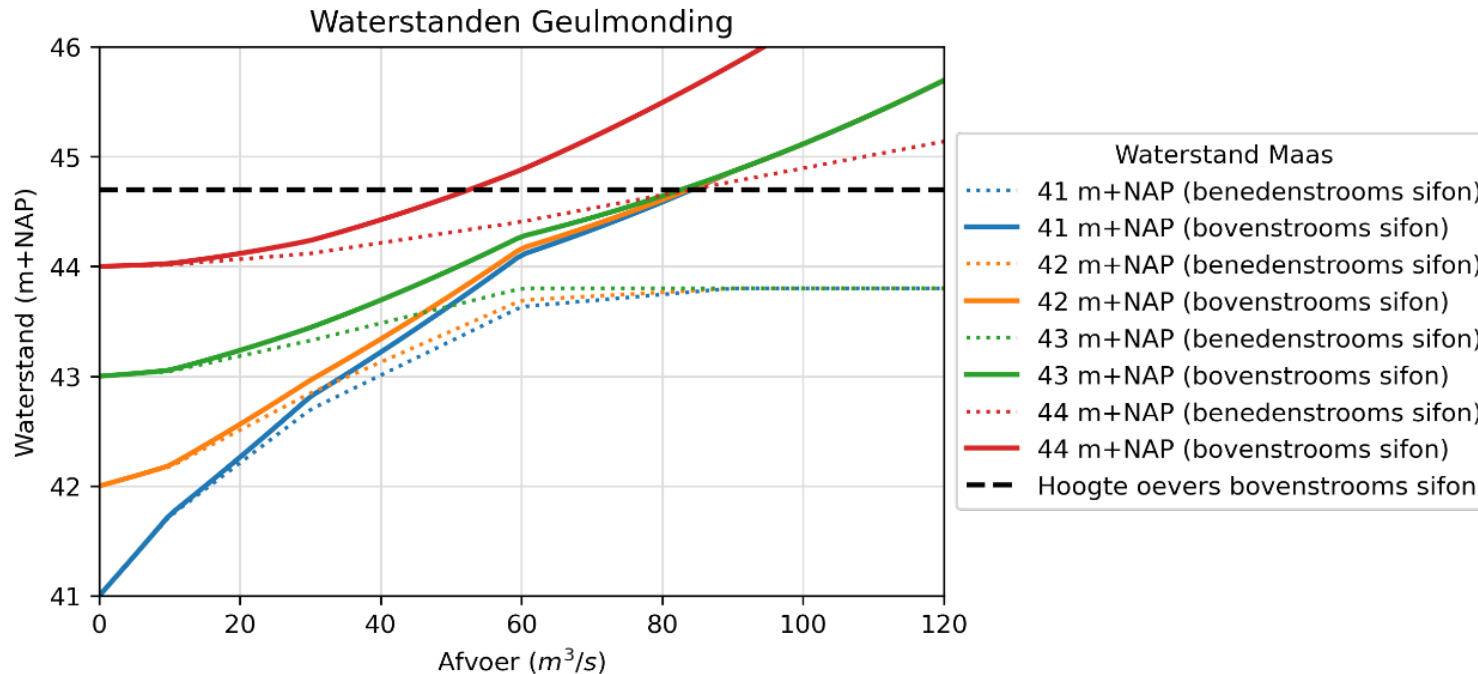
An aerial photograph showing a large area of residential and agricultural land in the Netherlands that has been inundated with floodwater. The water is a muddy brown color. In the foreground, a long, straight canal or dike runs diagonally from the bottom left towards the center. To the right of this waterway, several houses and buildings are surrounded by floodwater. A prominent windmill stands on a small island of land in the lower right. In the background, more houses and green fields are visible, some also partially submerged. The horizon shows a distant city skyline under a clear sky. An inset image in the bottom right corner provides a closer view of the flooded houses and fields.



Confluence of Geul and Maas



Confluence of Geul and Maas



- Peak discharge near Meerssen $\pm 110 \text{ m}^3/\text{s}$
- Capacity culvert low water levels Meuse $\pm 85 \text{ m}^3/\text{s}$
- Capacity culvert July (high water levels Meuse) $\pm 55 \text{ m}^3/\text{s}$
- Capacity may have been reduced further by blockage with driftwood or sediment

Functioning of the system

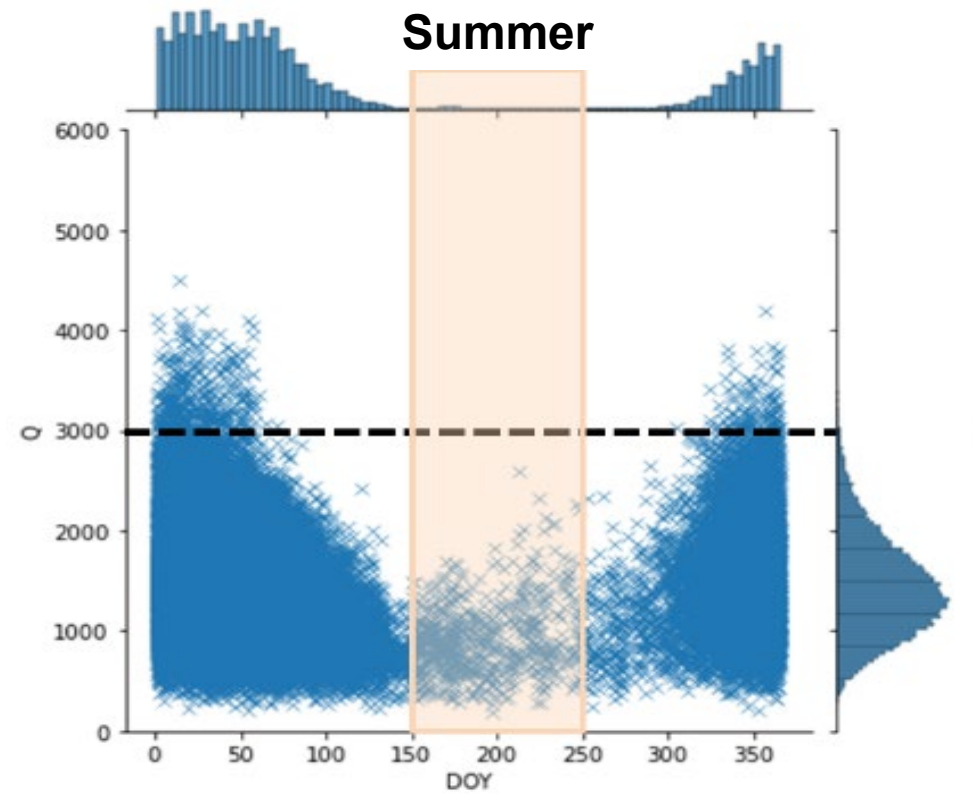
LESSONS
LEARNED



Flood statistics - unexpected summer flood



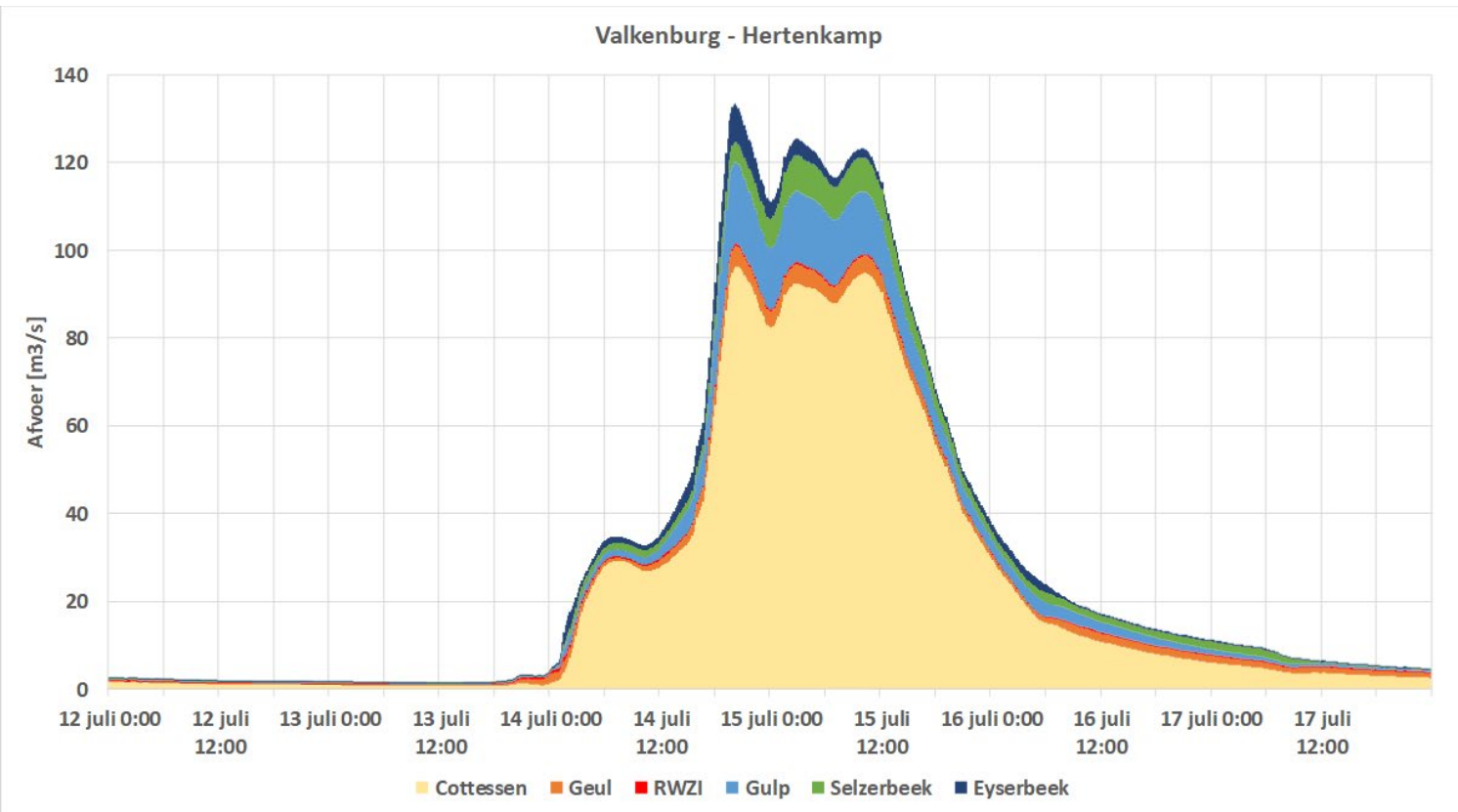
Probability < 1:50.000 per year (according to 'GRADE')?



Present Climate

- Can we trust our statistics?
- What do the uncertainties mean for FRM?

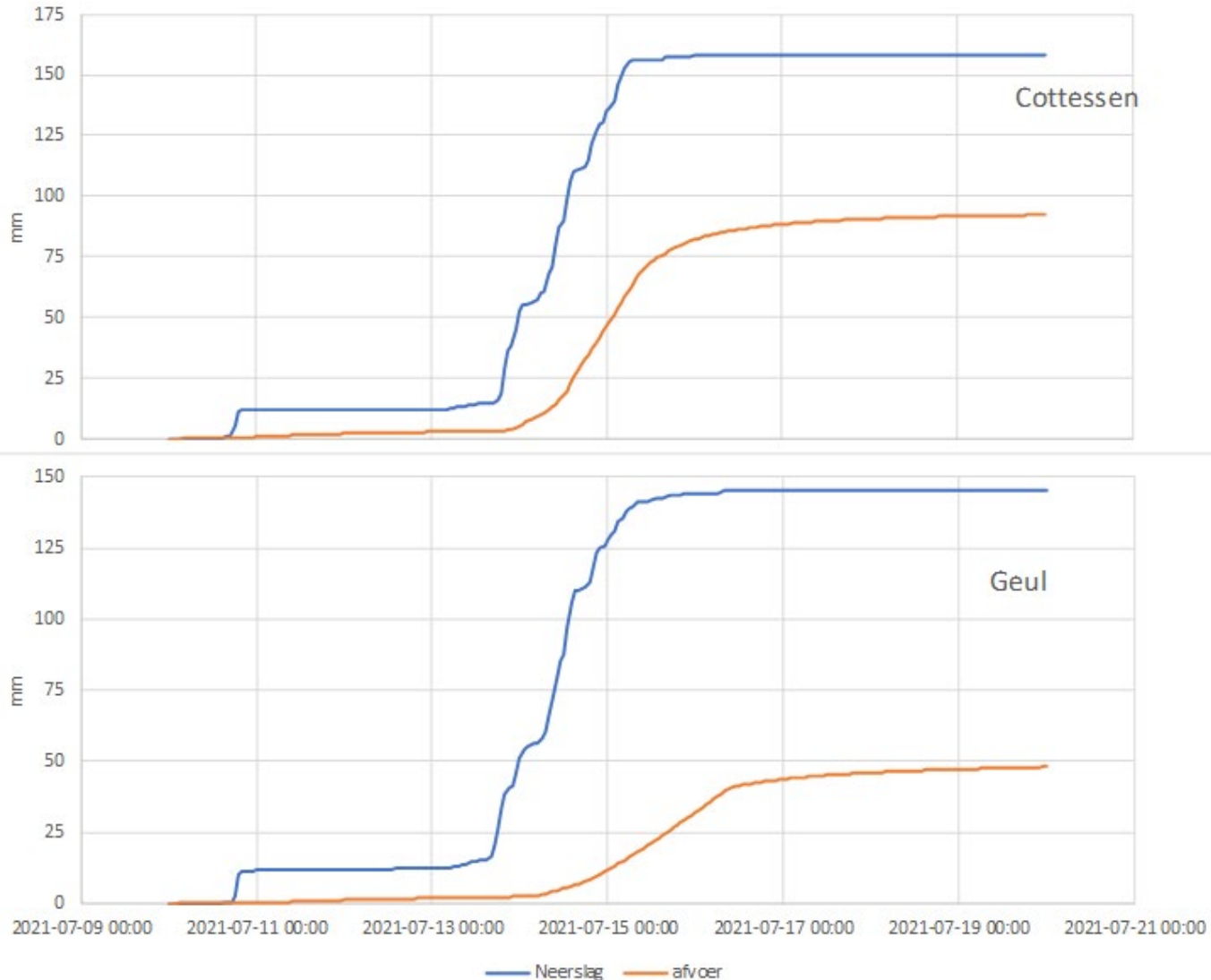
Discharge: 'origin' of the water



- Peak discharge Valkenburg 135 m³/s
- Large contribution (70%) from Belgium

→ development of a cross border FRM plan would be 'ideal'

Discharge: storage of water



Large differences in runoff:

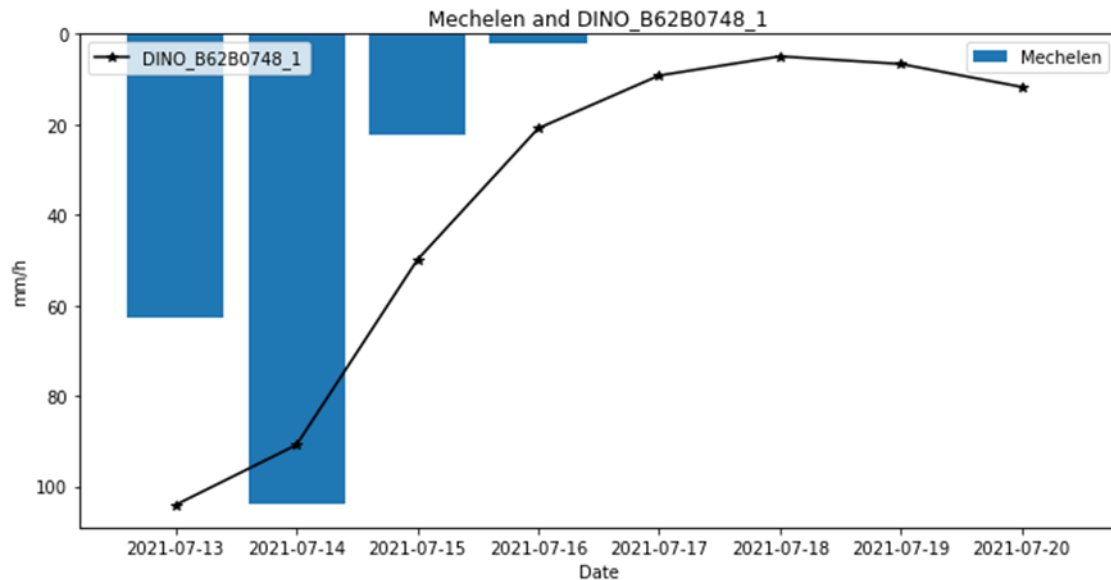
- Belgium: 60% of total precipitation
- Total catchment: 30% of total precipitation

Possible reasons:

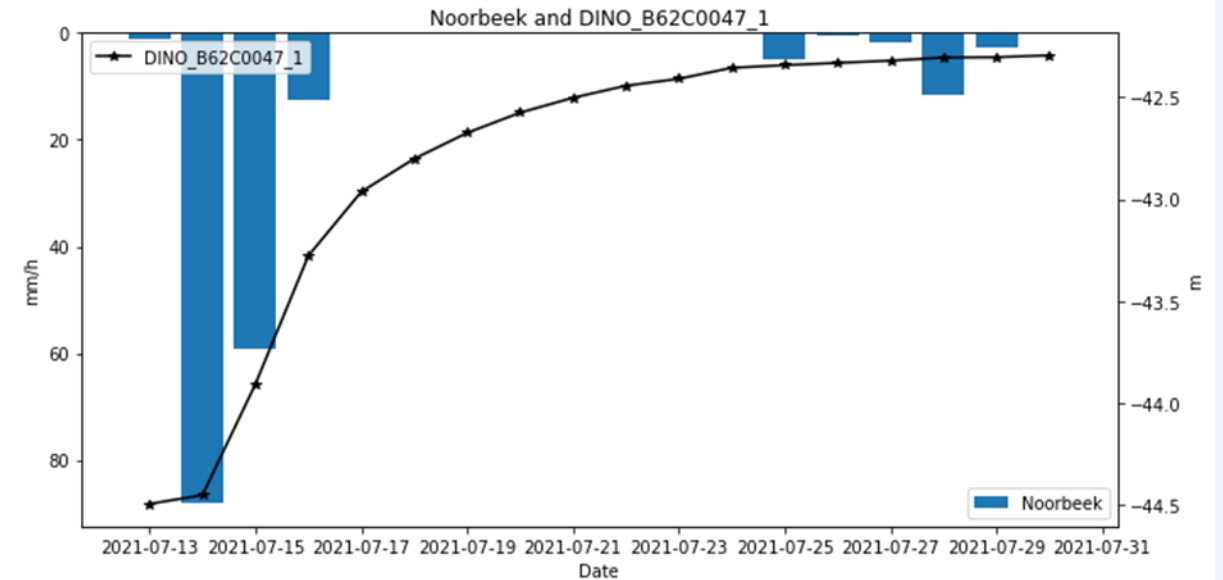
- Higher rainfall amounts and intensities
- Different geology (infiltration/storage capacity)
- Storage in floodplain

Groundwater storage important in Geul catchment

At the foot of a slope, N of Gulpen



At plateau near Belgian border,
East of river Gulp (near Slenaken)



Similar patterns in northern part of Belgium

Groundwater storage important in Geul catchment

- Contribution Geul river to Meuse discharge under low flow conditions is relatively high

→ Sponge function of the catchment is 'not that bad'

Lage afvoeren in de Maas

Bijdrage zijrivieren



*Inzicht waar het water van
de Maas vandaan komt*

Storage in flood plain: peak attenuation



- Large scale flooding
- Peak discharge near Valkenburg 135 m³/s
- Near Meerssen 110 m³/s (-20%)

→ peak attenuation is important and should be maintained/accounted for in the FRM plan

Contact

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