Limburg (the Meuse at Venlo), July 2021

A Baseline against the Copernicus EMS flood map of the event: the event's flood mapped from radar (M3), and the flood-prone zones, which never saw it.

> **Draft, not yet independently reviewed (2026-11-15).** Numbers come from `case_study_limburg.json` (`manage.py case_study_event limburg`, code 3ca21d6). The comparison rules were fixed before any score was computed; they are in the command's description.

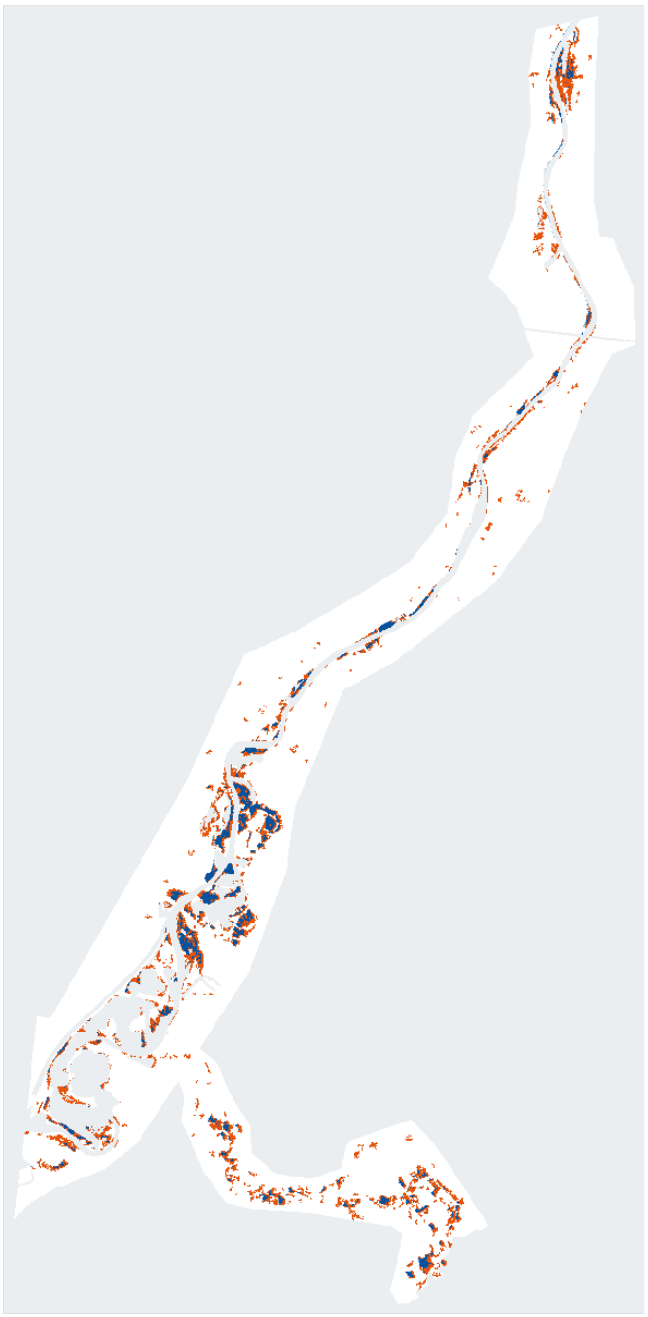
What was compared

- **Reference:** Copernicus EMS rapid mapping EMSR520 (Flood in the Netherlands), flooded area of Venlo, from Sentinel-1B, 16 July 2021 05:41 UTC (from the map's image notes): the same scene M3 uses. **The same radar scene M3 uses**: for M3 this checks the method, not the data. The zones are independent of it. © European Union. Copernicus Emergency Management Service.
- **Baseline:** 965 km² around the EMS areas, event date 2021-07-16, radar up to 1 day after (M3 used 2021-07-16, 2021-07-17). Run 8b6c23f7.
- **Scored** on the Baseline's 30 m grid inside the EMS areas (120 km² compared), without rivers and lakes, water before the event, or cells the radar didn't see. CSI = hits / (hits + misses + false alarms): 1 is a perfect match. Bias = Baseline area / EMS area − 1: 0 is the same size, below 0 smaller, above 0 larger.

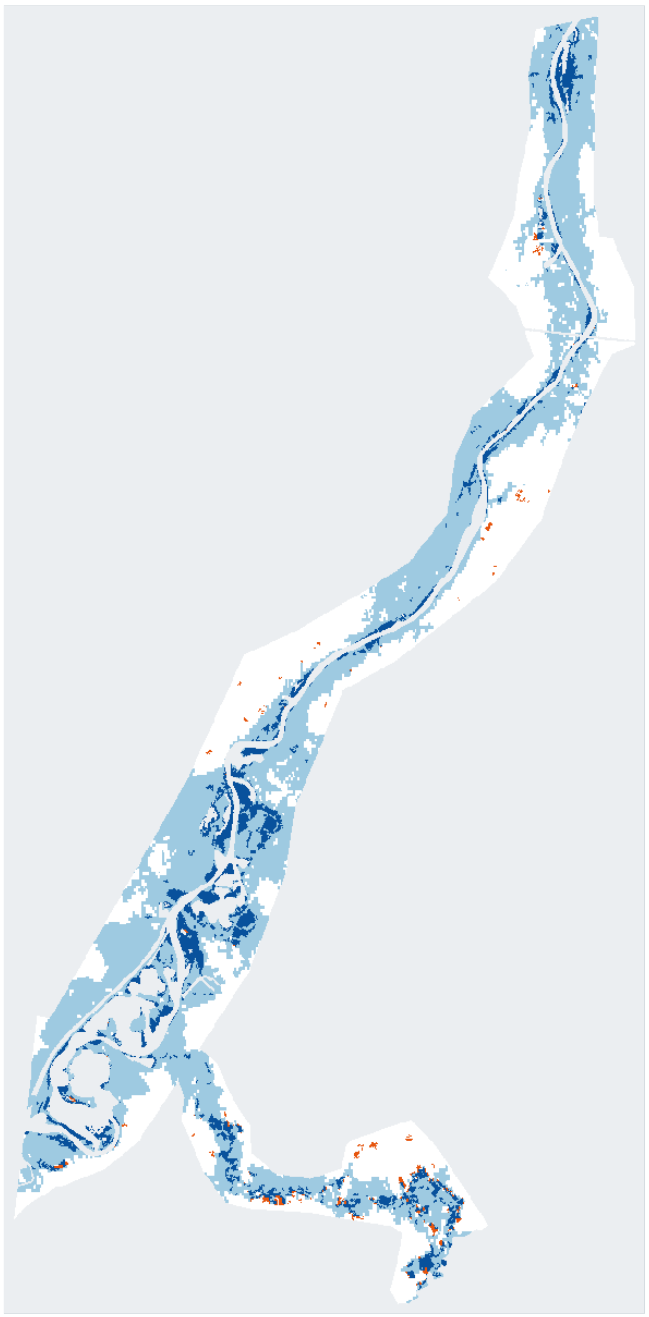
Results

	CSI	Hit rate	Precision	Bias	Baseline, km²	EMS, km²
M3 event flood	0.281	0.29	0.92	-0.69	3.5	11.1
Zones A + B	0.149	0.93	0.15	5.16	68.2	11.1
Zones A + B + C	0.110	0.99	0.11	8.00	99.6	11.1

Of the EMS flood, 92.8 % lies in the flood-prone zones A + B (12.4 % in zone A) and 99 % in zones A, B or C.



M3 against the EMS flood.



Zones A + B against the EMS flood.

Both · EMS flood only (missed) · Baseline only · Not compared

The small tributary: Geul valley at Valkenburg

The worst damage in Limburg in July 2021 was along the Geul, a small tributary of the Meuse (Valkenburg). It is not scored here; a Baseline of 244 km² around it shows what the evidence covers there:

Evidence	km²
Flood model (JRC, 1-in-100-year)	5.4
Water seen by satellites (1984-2020)	0.5
Low land near streams	23
Zones A / B / C	0.4 / 5.2 / 20

Confidence in its zones: low. The flood model and the observed water disagree (overlap 0.05, under 0.2). 93 % of the flood-prone land is zone B, which rests on one kind of evidence. No held-back flood was available to check the zones.

Limits

- M3 and the EMS map read the same radar scene, so their agreement shows the method, not whether radar saw all the water.
- Radar (of either kind) misses water under trees and between buildings, and flood water among crops can look bright, not dark.
- An EMS map is a rapid product made in hours; it is a reference, not the truth.
- The zones are not a forecast of one event: they show where floods are likely, so a single event fills only part of them, and a large one can reach beyond.
- Along a small tributary like the Geul the evidence is thin: the JRC flood model maps 5.4 km² there and satellites saw water on 0.5 km², so the zones rest mostly on terrain, and a flash flood after extreme rain can reach land the zones don't show.