



CONVECTIVE GUST ALERTS GENERATED BY THE RADAR-BASED "SEVERE WEATHER INDEX" IN THE INCA-BE NOWCASTING SYSTEM

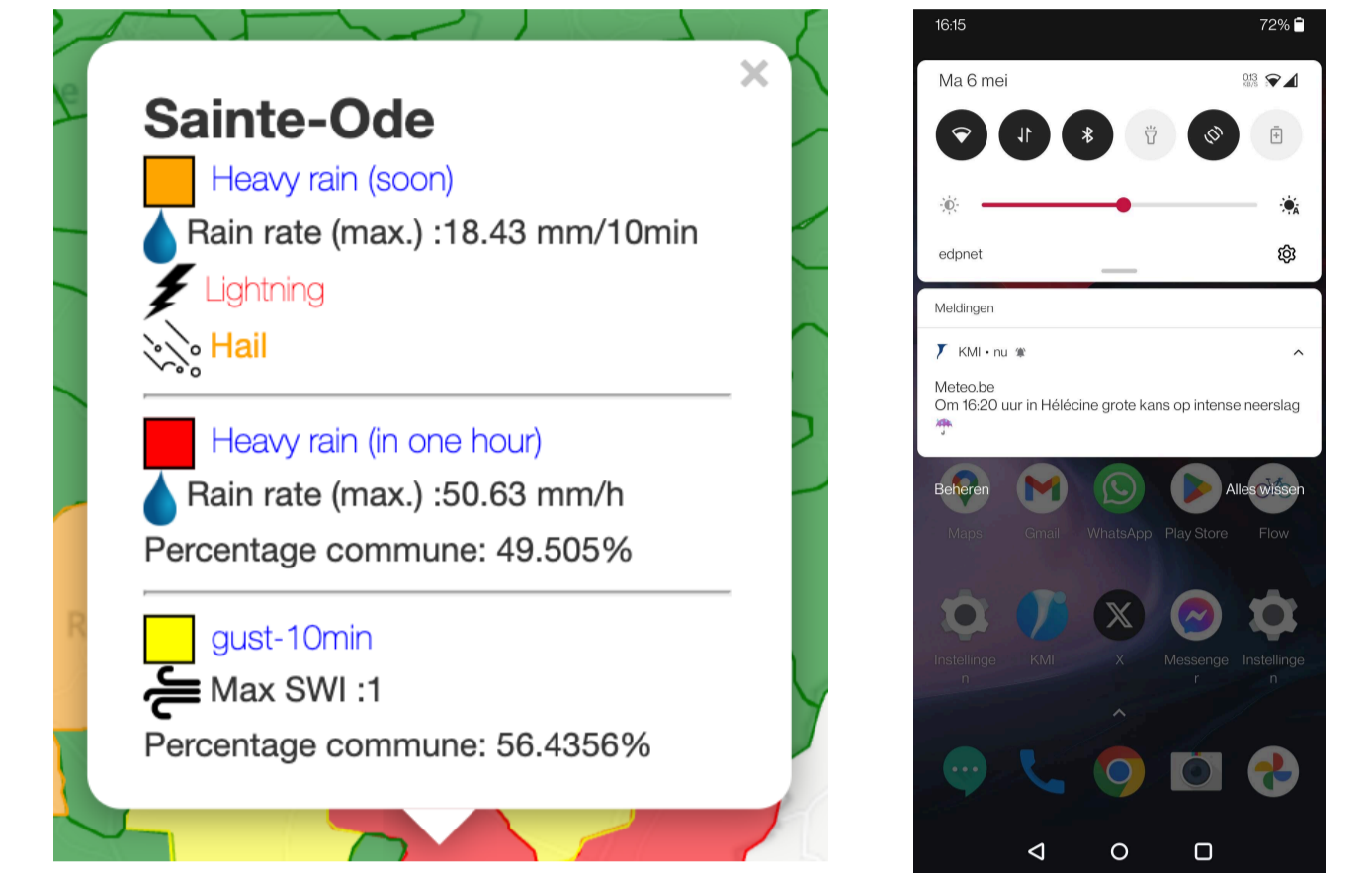
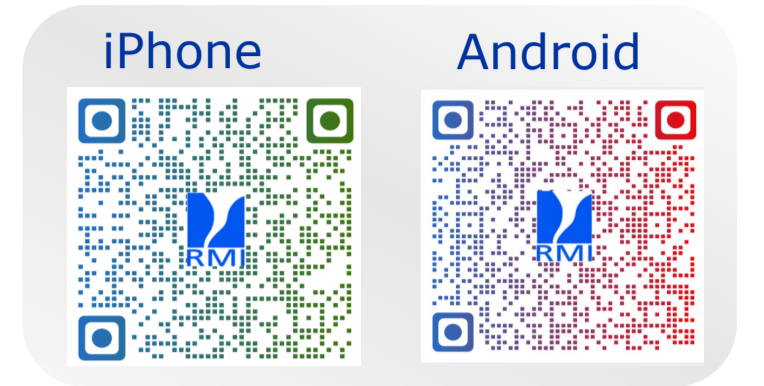
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Summary

- **Purpose:** detect and warn against **hazardous gusts** during convective events.
- **Methodology:**
 - Leonardo Rainbow®5 software for detecting convergence, divergence, and mesoscale rotation in reflectivity and radial velocity.
 - Aggregate and convert output into a raster field with yellow, orange, and red warning levels.
 - Advect raster field along with INCA-BE precipitation nowcast.
- **Municipality alerts:** alerts on the Belgian municipality level with up to 20 minutes lead time.
- **Dissemination:** RMI app and website, and national crisis centre.
- **Performance:** good performance in past cases, false alarms to be studied further.
- **Challenges:** limited case availability hinders optimisation and evaluation.

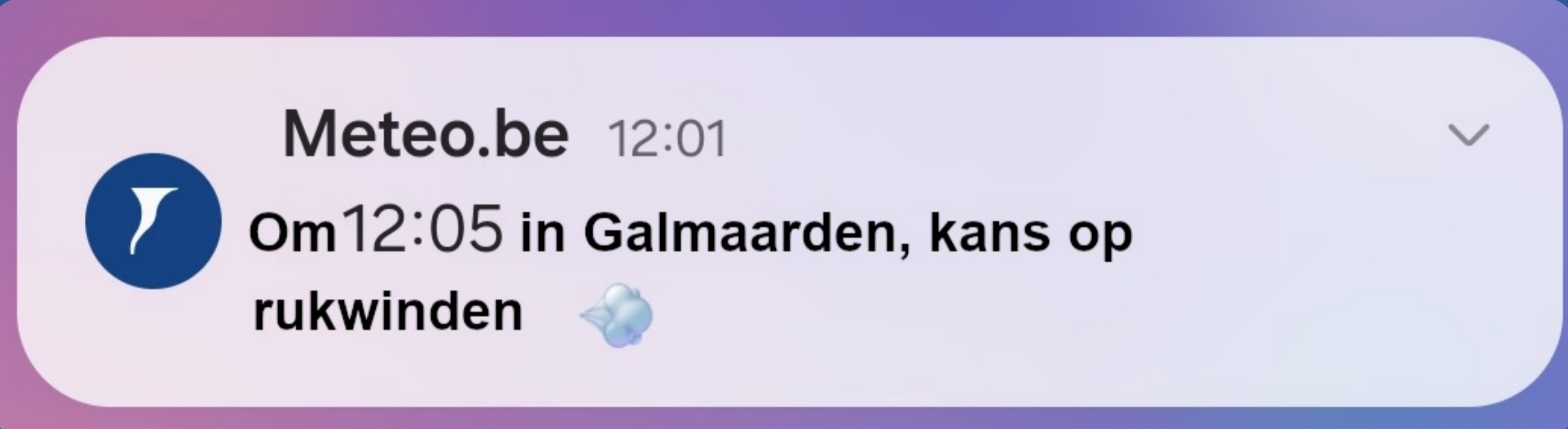
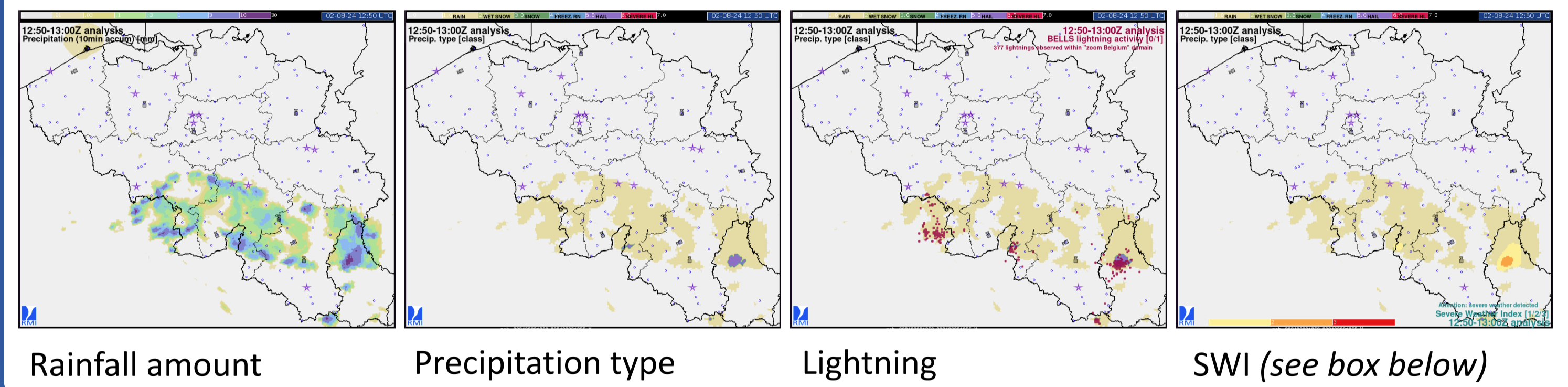
"Flash warnings": RMI's short-term notifications for severe weather

- Automated **push notifications** via RMI smartphone app
- **570,000 app users** opted in to receive flash warnings
- **Three severity classes:** yellow, orange, red
- **Temporal scale:** nowcasting range. Distinction between
 - *Near real-time:* 0-20 minutes ahead
 - *Short-term:* 20-80 minutes ahead
- **Spatial scale:** municipality
- Currently **four types** of flashes:
 - **Heavy rain** with additional tags for **lightning** and **hail**
 - Snowfall
 - Freezing precipitation
 - Convective gusts (*this poster*)
- Gust flashes only *near real-time*



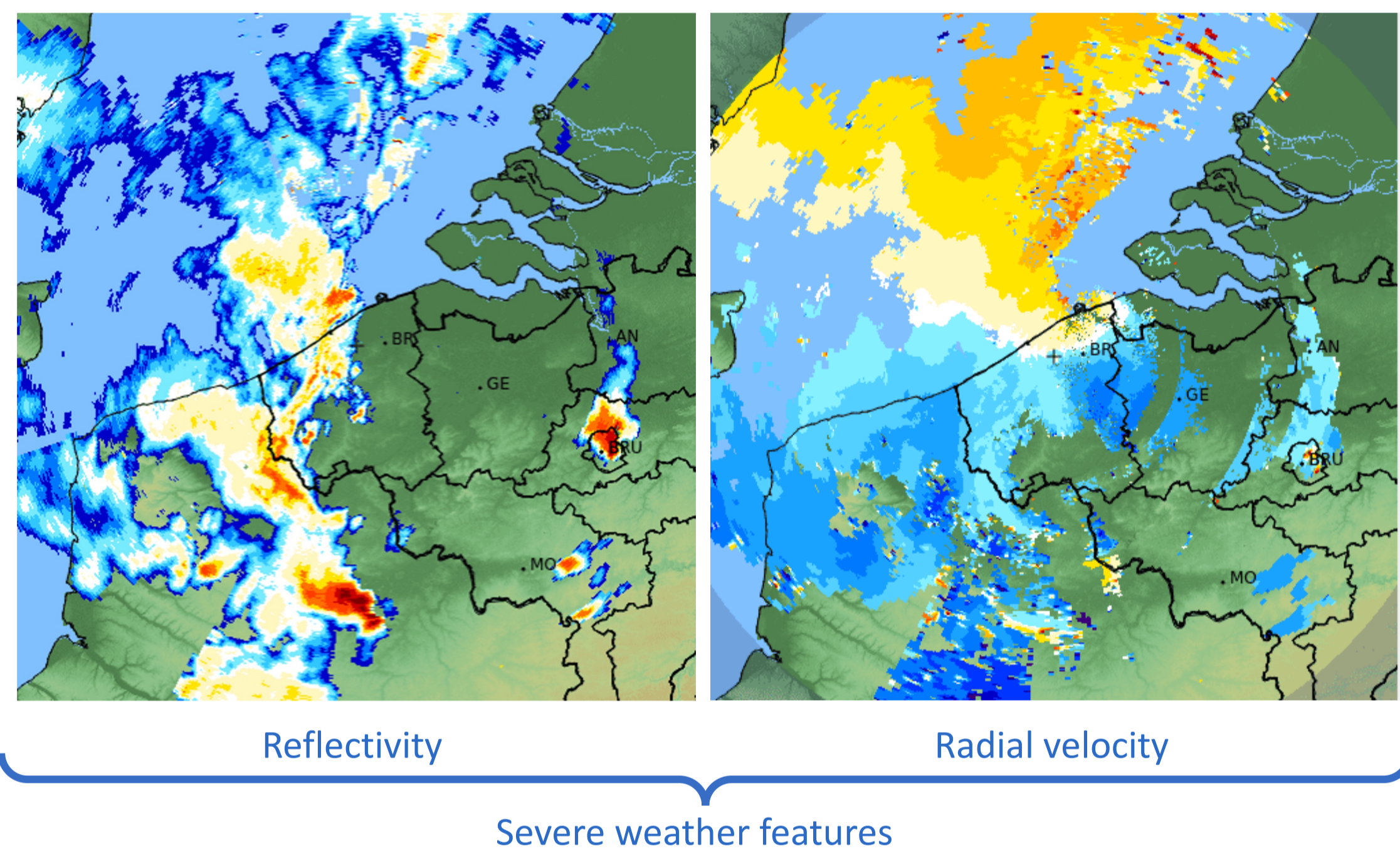
INCA-BE precipitation nowcasting: the workhorse behind the flashes

Analysis + forecast on 1x1 km² grid cells - 4 h forecast - 10 min resolution - 10 min update



Wind gust flash generation: 4 steps

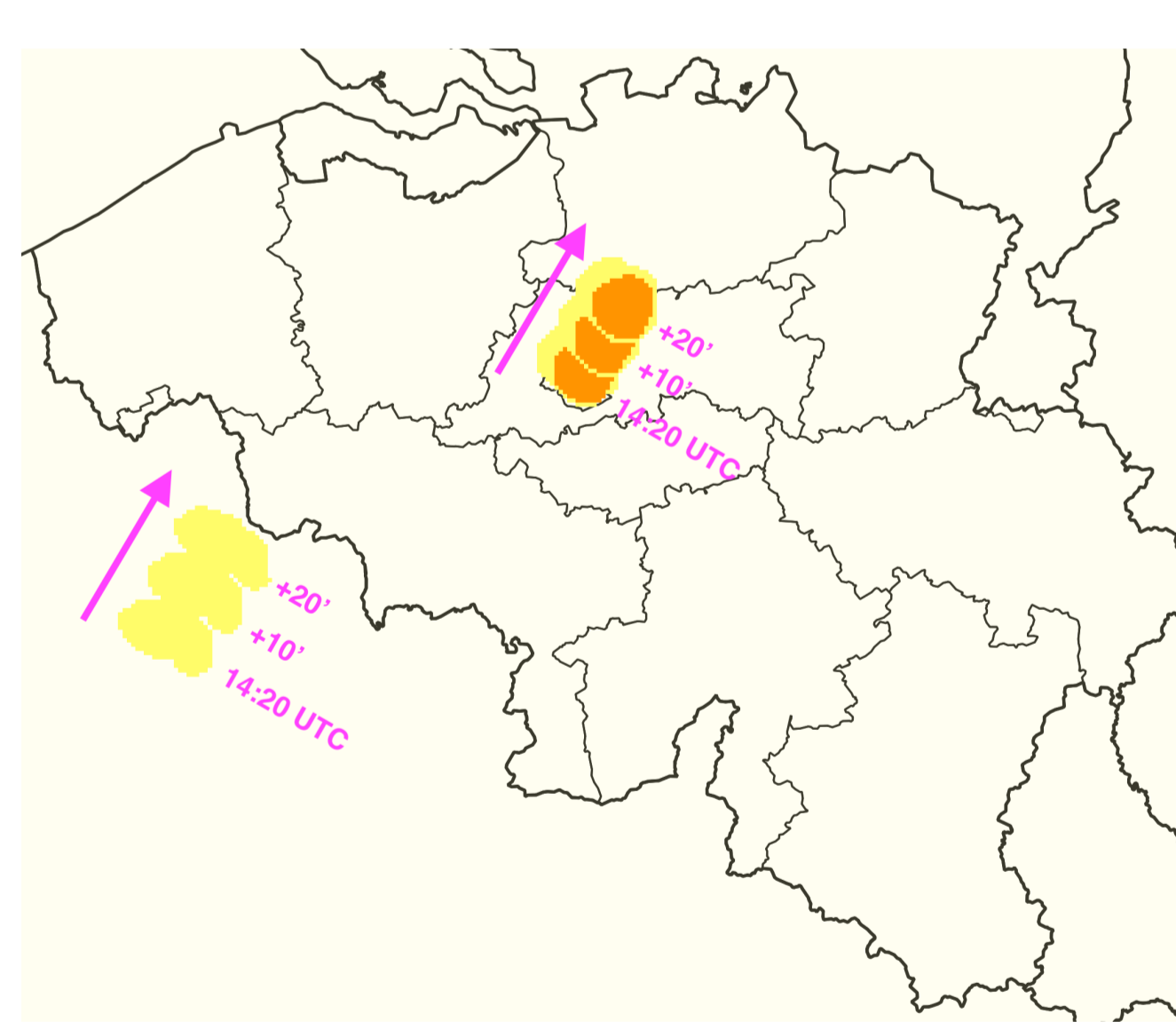
[1] Leonardo Rainbow®5 severe weather feature detection



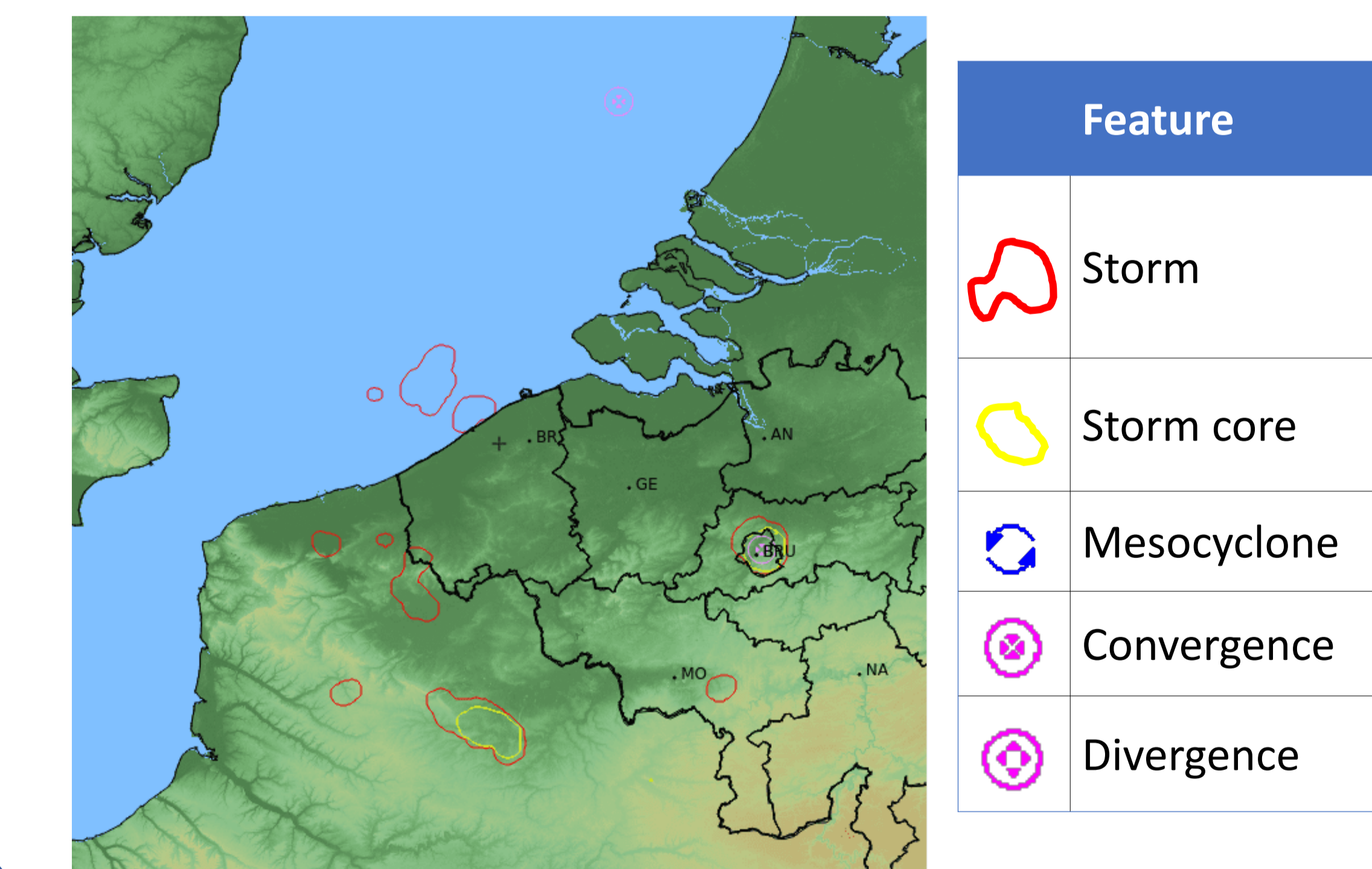
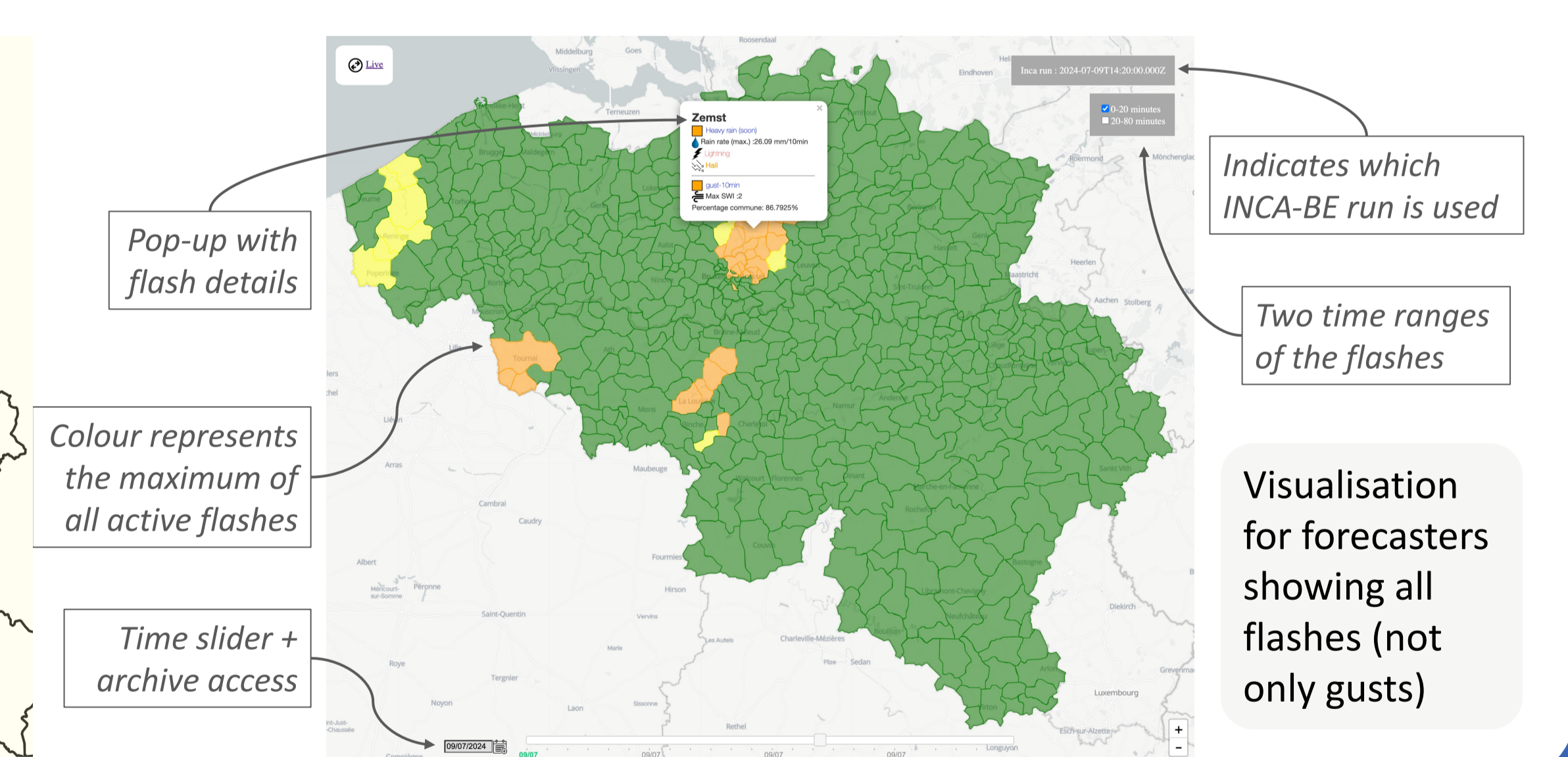
[2] Aggregation into Severe Weather Index (SWI) raster product

| SWI | Description | Looks like |
|-----|--|------------|
| 1 | Storm intersection with areas of ≥ 7 m/s average wind. The intersection must include at least 1 div/conv or 1 rotation. | |
| 1 | Entire storm area that contains at least 1 storm core and includes at least 1 div/conv or 1 rotation. | |
| 1 | The entire area of a storm core. | |
| 2 | The entire area of a storm core with at least 1 div/conv or 1 rotation. | |
| 3 | The entire area of a storm core with at least 2 div/convs or 2 rotations. | |

[3] Advection SWI in INCA-BE along with precipitation vectors

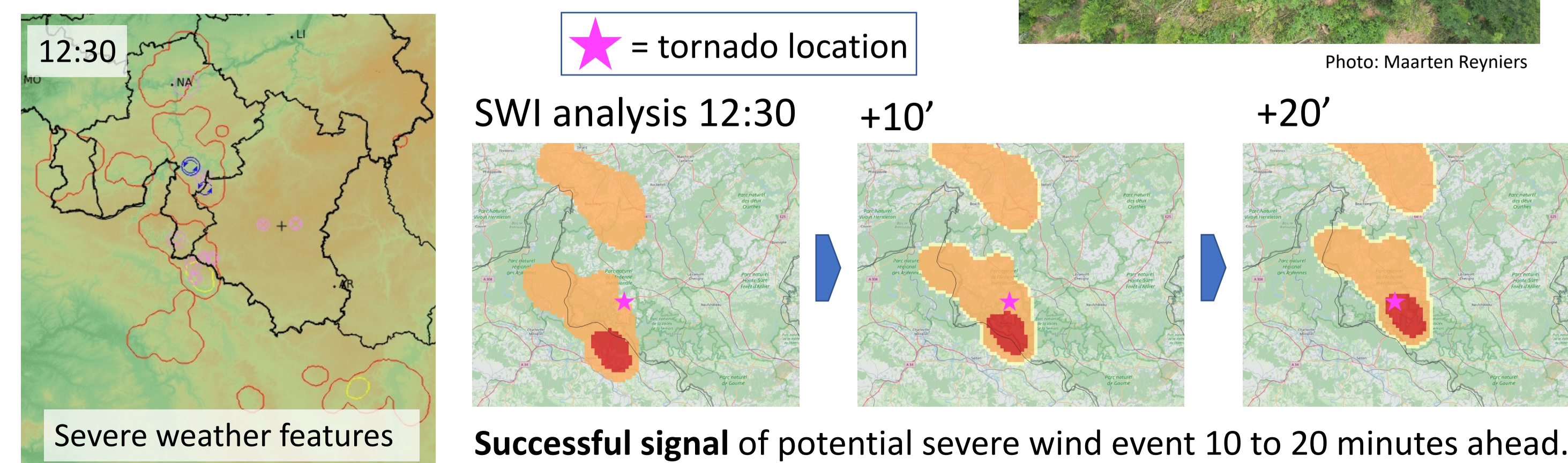


[4] A flash on municipal level is triggered if at least 1/3 of the INCA-BE grid cells within the municipality reach 1|2|3 SWI level



Case 1: tornado in Bouillon 22/06/2023

- Radar images show bookend vortex
- Tornado touchdown between 12:40 and 12:45 UTC
- Damage assessment:
 - 1,400-meter damage path through the forest
 - 684 trees damaged
 - "small" EF2, implying wind velocities up to 200 km/h



Case 2: downburst in Mechelen 09/07/2024

- Radar images do not show evidence of rotation
- Downburst from ~15:45 to ~16:00 UTC
- Wind gusts estimated >150 km/h
- Damage assessment:
 - populated area but luckily no casualties
 - toppled power poles, church tower blown off
 - damage to ~20,000 private homes

