Recent additions in the precipitation nowcast of INCA-BE: uncertainty plumes and hail

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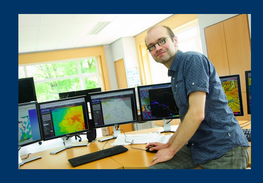


1 INCA-BE general characteristics

INCA-BE is the operational nowcasting suite at the Royal Meteorological Institute (RMI) of Belgium.

It produces deterministic nowcasts for several fields on a grid with spatial resolution of 1x1km^2. Fields include

- Temperature, humidity, wind: nowcast of 12h ahead, time step 1 h, update every hour
- Precipitation and precipitation type: nowcast of 4h ahead, time step 10 min, update every 10 min

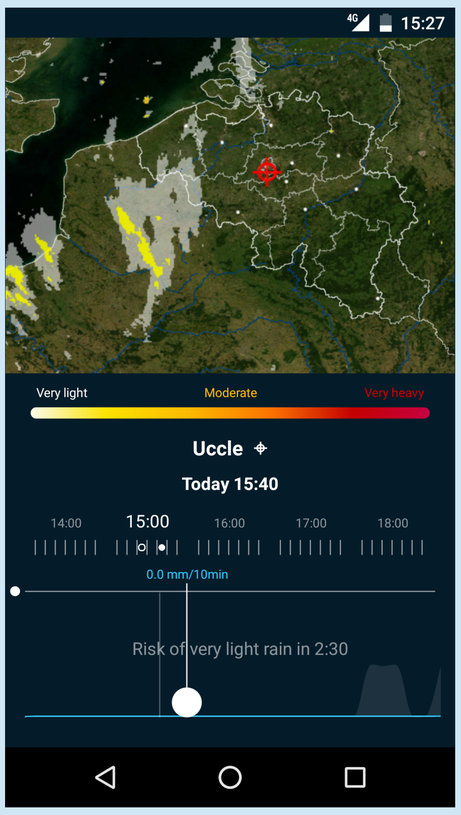
Precipitation type included only rain, melting snow, snow and freezing rain.

2 INCA-BE vs INCA

INCA-BE is built upon the INCA system developed at ZAMG (Haiden et al., 2011).

INCA-BE contains several improvements and developments compared to the original INCA system:

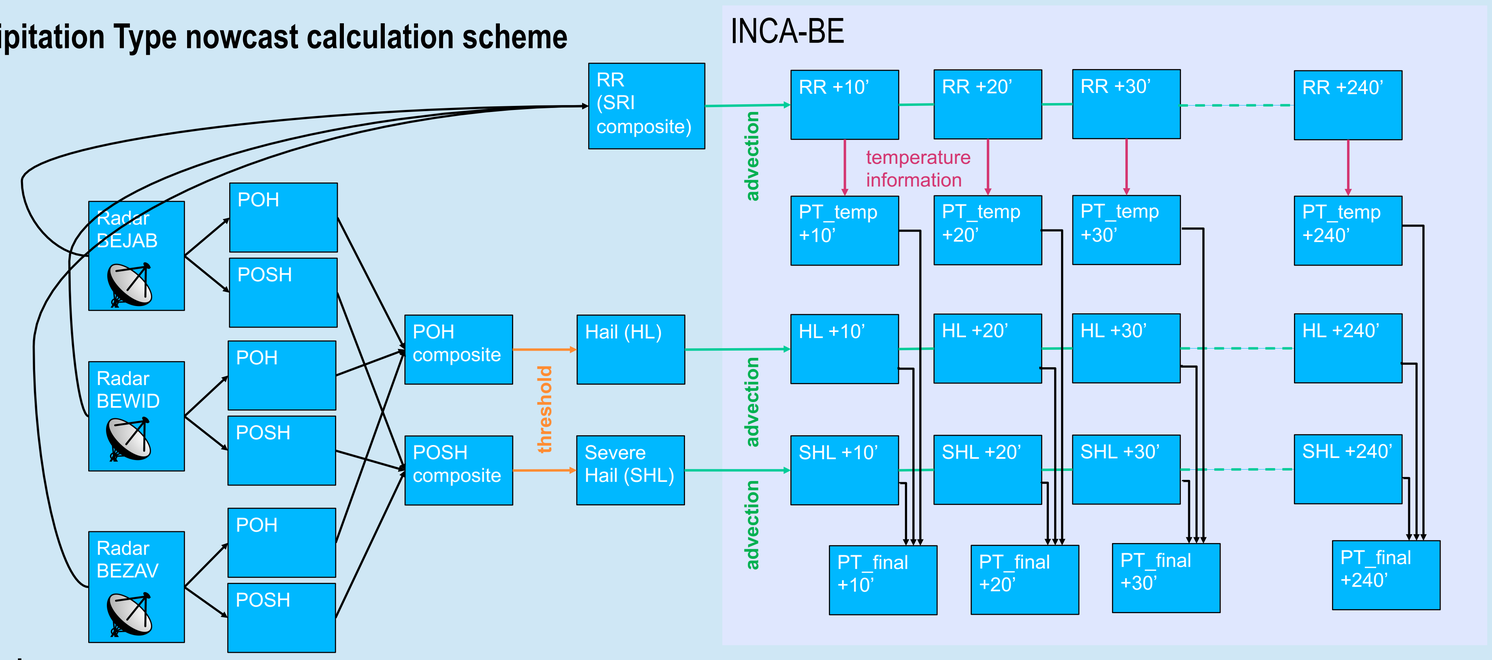
- export of all output in a standardised format (GRIB)
- a dedicated interactive webportal for internal use
- nowcast of the lightning activity based on the BELLS network (Reyniers, 2015)
- integration of the RMI webcams
- an automatic monitoring system
- the integration of the INCA-BE output in the free public smartphone app of the RMI



Screenshot of the precipitation nowcast produced by INCA-BE on the Android version of the RMI smartphone app. The app features a meteogram of the predicted precipitation for the current location and for three hours ahead.

4 INCA-BE Precipitation Type nowcast

Precipitation Type nowcast calculation scheme

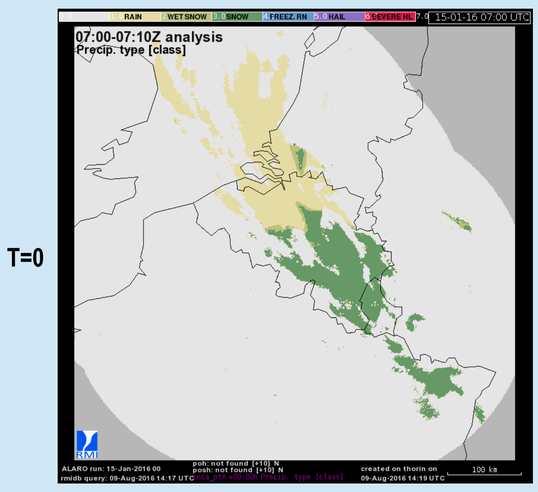


Legend

Radar	Original radar volume file, usually in hdf5	POH	Probability Of Hail product derived by the Waldvogel algorithm	HL	Thresholded POH (yes/no field)	PT_temp	'Temporary' Precipitation Type field, containing only rain, melting or wet snow, snow and freezing rain
RR	Standard rainfall product (10' accum)	POSH	Probability Of Severe Hail product derived by Witt's algorithm	SHL	Thresholded POSH (yes/no field)	PT_final	'Final' Precipitation Type field = PT_temp complemented with hail and severe hail

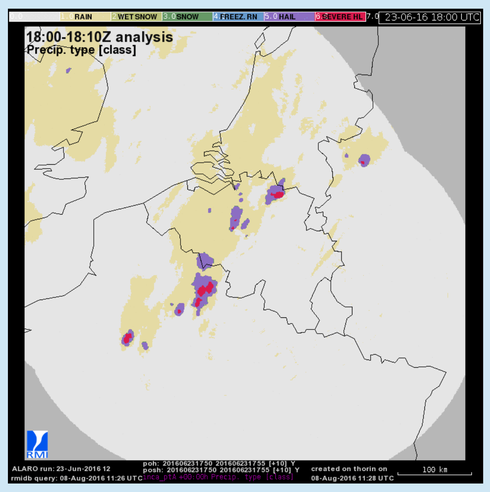
The Precipitation Type field is a combination of a snow prediction and a hail nowcast. Contrary to the snow prediction, hail is not generated in the nowcast: it is only an advection of observed hail at T=0.

Example PT nowcast 15/01/2016 (snow case)



Snow zone is more or less static, while precipitation is advected from N to SE.

Example PT nowcast 23/06/2016 (hail case)

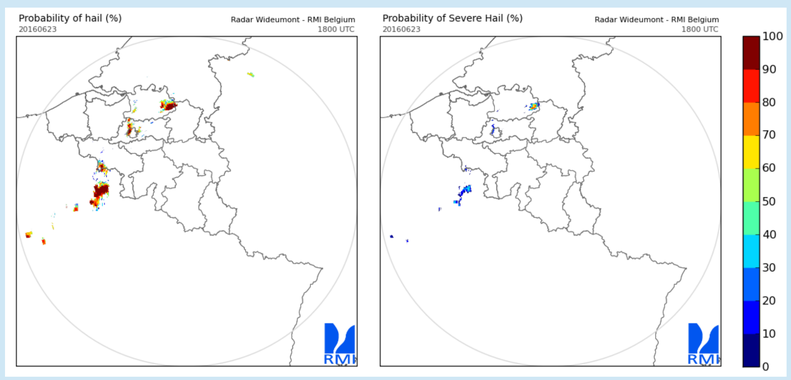


The hail zones are advected along with the rest of the precipitation.

3 Hail detection at the RMI

Two hail detection algorithms are currently operational at the RMI (Lukach et al., 2016):

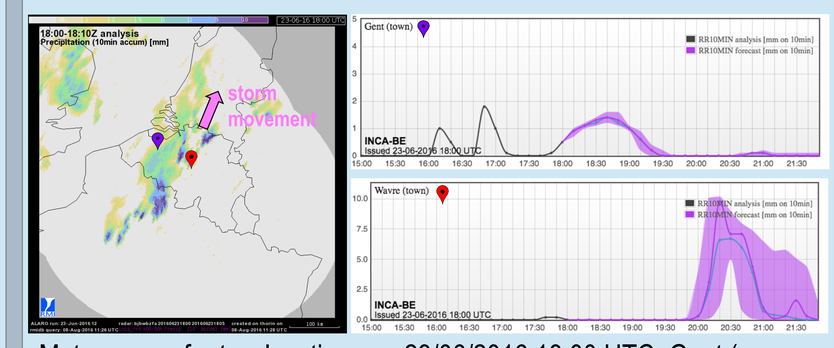
- Holleman's version of Waldvogel's probabilistic detection of hail (Holleman, 2001)
- Witt's algorithm estimating the probability of severe hail (POSH) with a diameter of at least 19 mm (Witt et al., 1998)



Output of the Probability Of Hail (POH, left) and Probability of Severe Hail (POSH, right) algorithms for the radar of Wideumont on 23 June 2016 18:00 UTC.

5 Uncertainty plumes on precipitation nowcast

The uncertainty plumes for the precipitation nowcast are another new addition to INCA-BE. Plumes are calculated by post-processing the deterministic nowcast, by looking at the variability of the precipitation values in the direct vicinity of the location. The vicinity is defined by all pixels within a certain range with a radius which is increasing with increasing lead time (+0.5km per 10'). Pixel values are ordered and the plume is constructed by the [5;95] percentile. Additionally also the median (blue) and deterministic (purple) curves are shown.



Meteograms for two locations on 23/06/2016 18:00 UTC. Gent (upper right panel) is located in a more stratiform zone (low uncertainties), while Wavre (lower right panel) is expected to be hit by some convective cells (high uncertainties).

6 Conclusions

We presented some recent developments in INCA-BE, the operational nowcasting system of the Royal Meteorological Institute of Belgium:

- A hail nowcast based on existing hail detection products
- An uncertainty plume on the precipitation nowcast by post-processing the deterministic nowcast

A probabilistic nowcasting system in which the deterministic radar extrapolation is perturbed with stochastic noise in order to generate an ensemble of possible future rainfall scenarios, is currently pre-operational at the RMI (Foresti et al., 2016).

References

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