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The nowcasting system INCA-BE in Belgium and its performance in different synoptic situations

Maarten Reyniers, Laurent Delobbe

Royal Meteorological Institute of Belgium (RMI), Brussels, Belgium

1 INCA main features

- Integrated Nowcasting through Comprehensive Analysis
- Developed by the national meteorological institute of Austria (ZAMG)
- Nowcasting system for the following meteorological fields:

1. **Basic**
   Fields: 2m temperature, 10m wind, 2m dewpoint, 2m relative humidity, snowfall level, freezing level, wind chill and ground temperature
   Forecast: up to +12h, time step of 1 hour
   Update: twice an hour
2. **Precipitation**
   Fields: precipitation intensity and precipitation type
   Forecast: up to +4h, time step of 10 minutes
   Update: every 10 min
3. **Convection**
   Fields: CAPE, CIN, LCL, Level of free convection, Lifted Index, Showalter Index, Deep Convection Index, Trigger temperature, Trigger temperature deficit, Equivalent Potential Temperature, Moisture convergence, Flow divergence and Precipitable water
   Forecast: no forecast, only analysis (hourly)
   Update: twice an hour
4. **Cloudiness**
   Fields: cloudiness and visibility
   Forecast: no forecast, only analysis (every 10 min)
   Update: every 10 min

- High resolution: 1km
- INCA combines observations and NWP: the INCA forecast starts with extrapolation of observations, and converges to the NWP forecast for longer lead times
- For a full description of INCA see Haiden et al., 2011, *Wea. Forecasting*, **26**, 166–183

2 INCA in Europe

- More and more European countries have implemented (or are implementing) INCA as their operational nowcasting system, including Slovakia, Slovenia, Croatia, Poland, Switzerland, Czech Republic, Italy (region Friuli-Venezia Giulia), Turkey, and Israel.
- INCA-CE: ambitious European project (from May 2010 till September 2013) with 16 partners to develop a transnational INCA version for Central Europe; see project website http://www.inca-ce.eu and Kann et al., 2012, *Adv. Sci. Res.*, **8**, 67–75

3 INCA in Belgium: INCA-BE

General

- Domain is 600×590 km (601×591 gridpoints) centered around Belgium (**Fig. 1**)
- Projection is Belgian Lambert 2008 projection (EPSG 3812)
- Runs on an operational Linux machine (Ubuntu 12.04 LTS) in a virtual environment
- Output presented on dedicated webportal for internal use (mainly forecasters)

Input

- NWP: ALARO-0 4km (=ALADIN adapted for high resolution), 4 runs per day
- Surface stations: for Basic fields 30 stations inside Belgium available within 10 min and ∼120 foreign synop stations within INCA-BE domain available after ∼25 min; for Precipitation fields 40 real-time gauges from hydrological service of Walloon region
- Radars: real-time composite of 3 C-band radars Wideumont (RMI), Zaventem (Belgocontrol) and Avesnois (Météo-France) with a 5 min time sampling (**Fig. 1**); in the near future, our new dual-pol radar in Jabbeke (**Fig. 2**) will be added to this composite
- Near future: add gauge stations of other regional hydrological services; add MSG Cloud Types product (SAFNWC) for Cloudiness fields

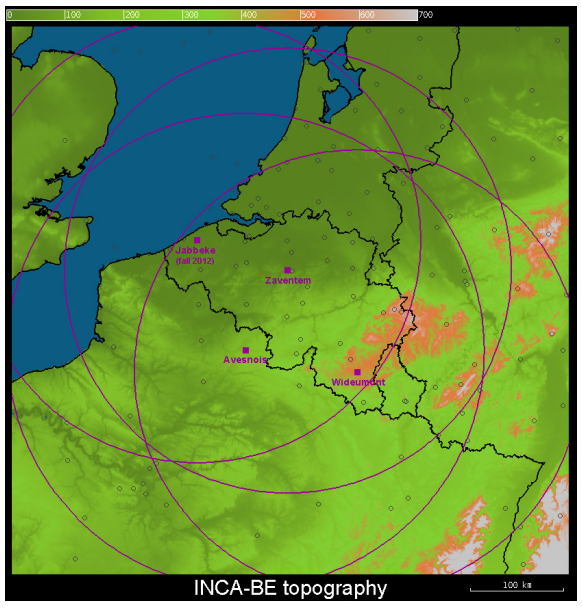

Fig. 1. The INCA-BE topography and the positions of the radars and their ranges (purple squares and big circles), and the surface stations (small circles).

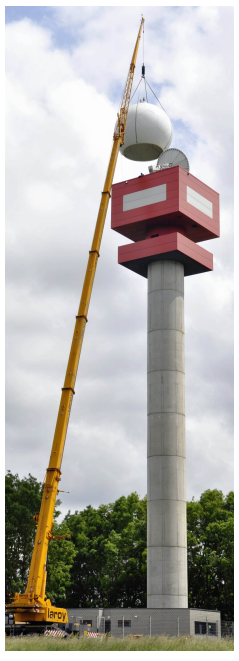

Fig. 2. Installation radar Jabbeke on 13.06.2012

4 Performance in different synoptic situations

Snow case on March 05, 2012 Case with snow starting in the western provinces of Belgium, and later in the center and the south of the country. The precipitation was caused by a low coming from the North Sea entering our country from the north of France. The snowfall level field was reaching the ground at analysis time (Fig. 3, upper left), while temperatures at 2 meter were still slightly positive (Fig. 3, upper right). The bottom panels of Fig. 3 show the precipitation intensity (left) and precipitation type (right) at analysis time. The light blue colour on the latter figure represents snow, while the green and khaki colours stand for mix rain+snow and rain, respectively. Although we did not perform a quantitative verification of the analysis and forecast fields, a qualitative evaluation of these results seemed to confirm the very good performance of INCA-BE in this situation.

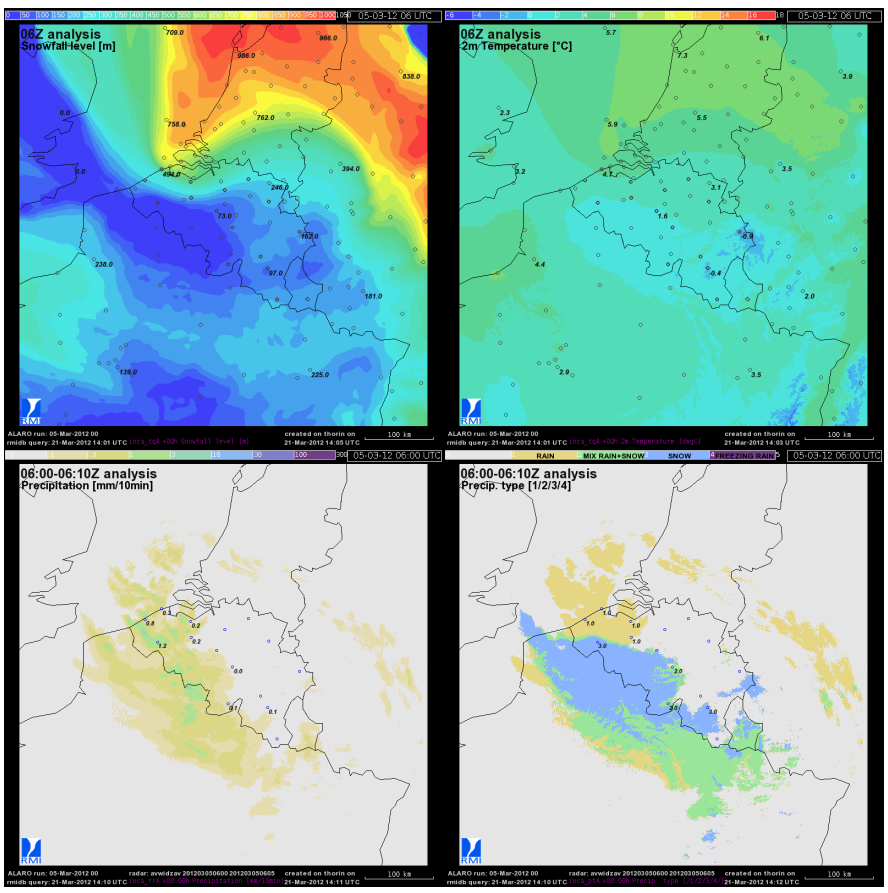

Fig. 3. Snow case of March 05, 2012

Pre-convective environment on May 22, 2012 The precipitation forecast is a pure conservative one for the first two hours, and after that it blends with the NWP for the next hours. The system performs very well in the case of large-scale stratiform precipitation, or in cases where cells are relatively isolated and long-lived. In convective situations with a high degree of complexity, a conservative forecast has only a limited predictive skill. However, by making use of the convective analysis it is sometimes possible to have an indication on the location or region where severe convection might develop or intensify. As an example of such a situation, we present here the convective analysis of May 22, 2012, at 14Z. The fields CAPE, Trigger Temperature Deficit, Moisture Convergence and Equivalent Potential Temperature are shown in Fig. 4. All these fields have consistently high values in the north-east part of Belgium. At 14Z, no precipitation has been recorded yet (Fig. 4, lower middle panel), but one hour later (Fig. 4, lower right panel) some clear intense cells are observed in this region.

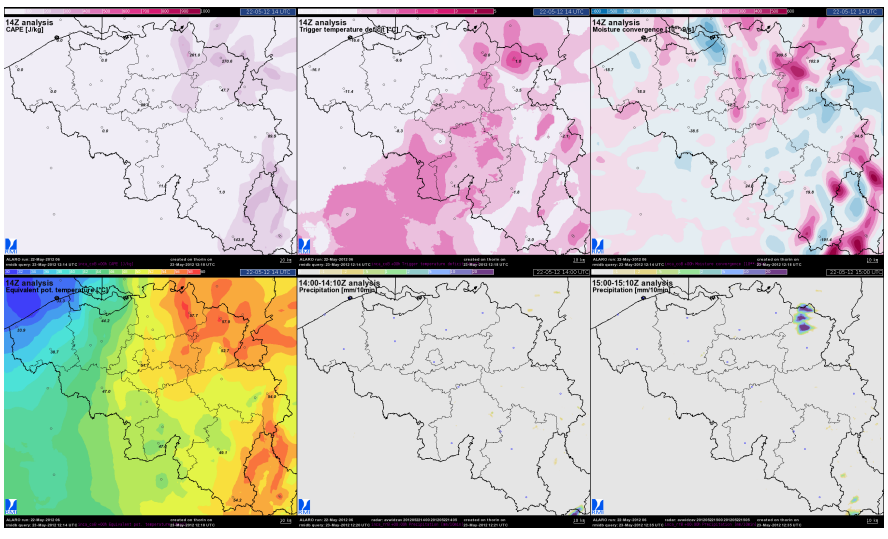

Fig. 4. Pre-convective environment on May 22, 2012

5 Conclusions

INCA-BE has now reached the operational stage: the system is implemented on an operational machine and a dedicated webportal to present its output is created. A first qualitative look at some specific situations reveals that the performance of the system is quite encouraging. This statement is strengthened by the experience of the forecasters. A thorough verification has not been carried out yet, but is planned in the future.

M. Reyniers, Royal Met. Inst., Ringlaan 3, B-1180 Brussels, Belgium – maarten.reyniers@meteo.be – http://radar.meteo.be
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