

Implementation and first evaluation of the nowcasting system INCA in Belgium (INCA-BE)



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1 INCA main features

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

temperature (3d)	humidity (3d)	wind (3d)
precipitation	precipitation type	cloudiness
derived fields	convective analysis fields	

The *derived fields* include ground temperature, freezing level, snowfall line, wind chill and icing potential. The *convective analysis fields* include 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, Precipitable water

- High resolution: 1km
- INCA combines observations and NWP: INCA forecast starts with extrapolation of observations, and converges to the NWP forecast for longer lead times (**Fig. 1**)
- Forecast lead time: +12 h in steps of 1 h, except precipitation (lead time +4h in steps of 10 min) and convective fields (only analysis, hourly)
- A full description of INCA in Haiden et al., 2011, Wea. Forecasting, **26**, 166–183

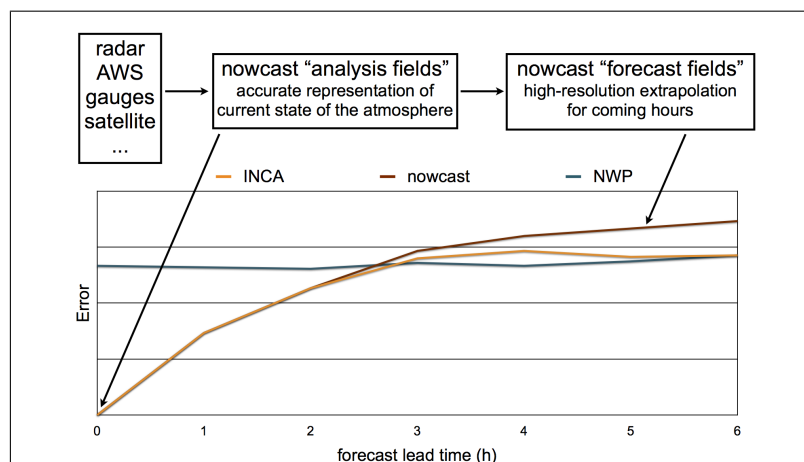


Fig. 1. Schematic representation of the error in three nowcasting strategies: nowcasting by NWP (blue), a “conventional” nowcasting system (red) and INCA (orange). A conventional nowcasting system realises an extrapolation of the current atmospheric conditions in time; INCA combines this nowcast with the NWP forecast for longer lead times.

2 INCA in Europe

- More and more European countries are implementing (or planning to implement) INCA as their operational nowcasting system, including Slovakia, Slovenia, Croatia, Poland, Switzerland, Czech Republic and Turkey
- INCA-CE: ambitious European project with 16 partners to develop a transnational INCA version for Central Europe (from May 2010 till end 2013); see project website <http://www.inca-ce.eu>

3 INCA in Belgium: INCA-BE

Domain

- Domain is 600×590 km (601×591 gridpoints) centered around Belgium (**Fig. 2**)
- Belgian Lambert 2008 projection (EPSG 3812)
- Most parts flat, but it contains also hilly terrain
- Contains sea surface (contrary to Austrian domain)

Input

- NWP: ALARO-0 4km (=ALADIN adapted for high resolution), 4 runs per day
- Surface stations: 30 stations inside Belgium available within 10 min
~120 foreign synop stations within INCA-BE domain available after ~25 min
- Radar: the real-time composite of 3 C-band radars Wideumont (RMI, **Fig. 3**), Zaventem (Belgocontrol) and Avesnois (Météo-France) with a 5 min time sampling; in the future the composite of the Opera Data Centre Odyssey will be considered
- Near future: add gauge stations of regional hydrological services; add MSG Cloud Types product (SAFNWC) for cloudiness module
- Later: add sounding data (our institute performs 3 soundings per week, more frequent soundings are performed in nearby sounding stations)

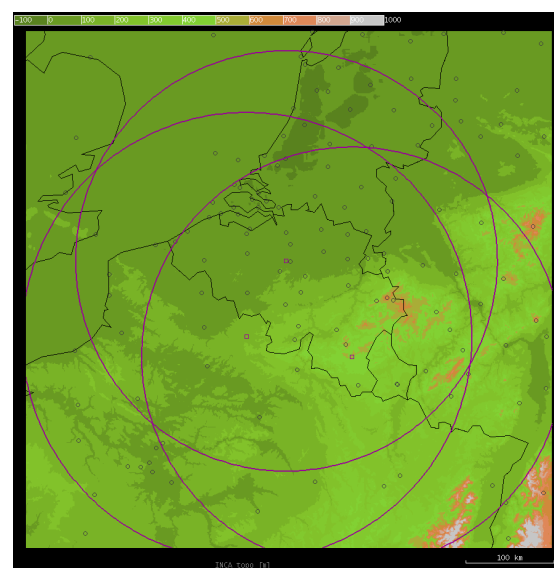


Fig. 2. The INCA-BE topography and the positions of the radars and their ranges (purple squares and circles), and the surface stations (small circles).



Fig. 3. Wideumont radar (RMI)

Precipitation nowcast

- Precipitation rate + type (rain/snow/mix rain+snow/freezing rain), see **Fig. 4**
- Lead time of forecast: +4h with 10 min timestep, generated every 10 min
- First two hours pure extrapolation, next two hours merge with NWP
- Motion vectors by area tracking method, and filtered by NWP wind field

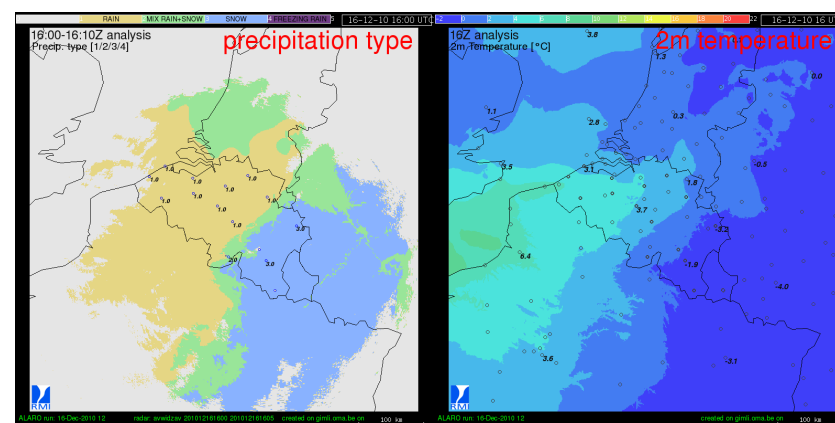


Fig. 4. Example of a *precipitation type* analysis field (left) together with the corresponding *2m temperature* field (right).

4 Case study

Fig. 5 shows a case with a clearly non-uniform velocity field. In the left row, images of the INCA-BE precipitation forecast are shown (for +1h, +2h and +3h) made at analysis time 13:30UT. In the right row, the corresponding verification images are shown. For this particular case, a qualitative comparison between the images reveals that the INCA-BE precipitation forecast performs quite well up to +2h, and also the +3h has still some skill. Obviously, these statements have to be confirmed by appropriate verification techniques.

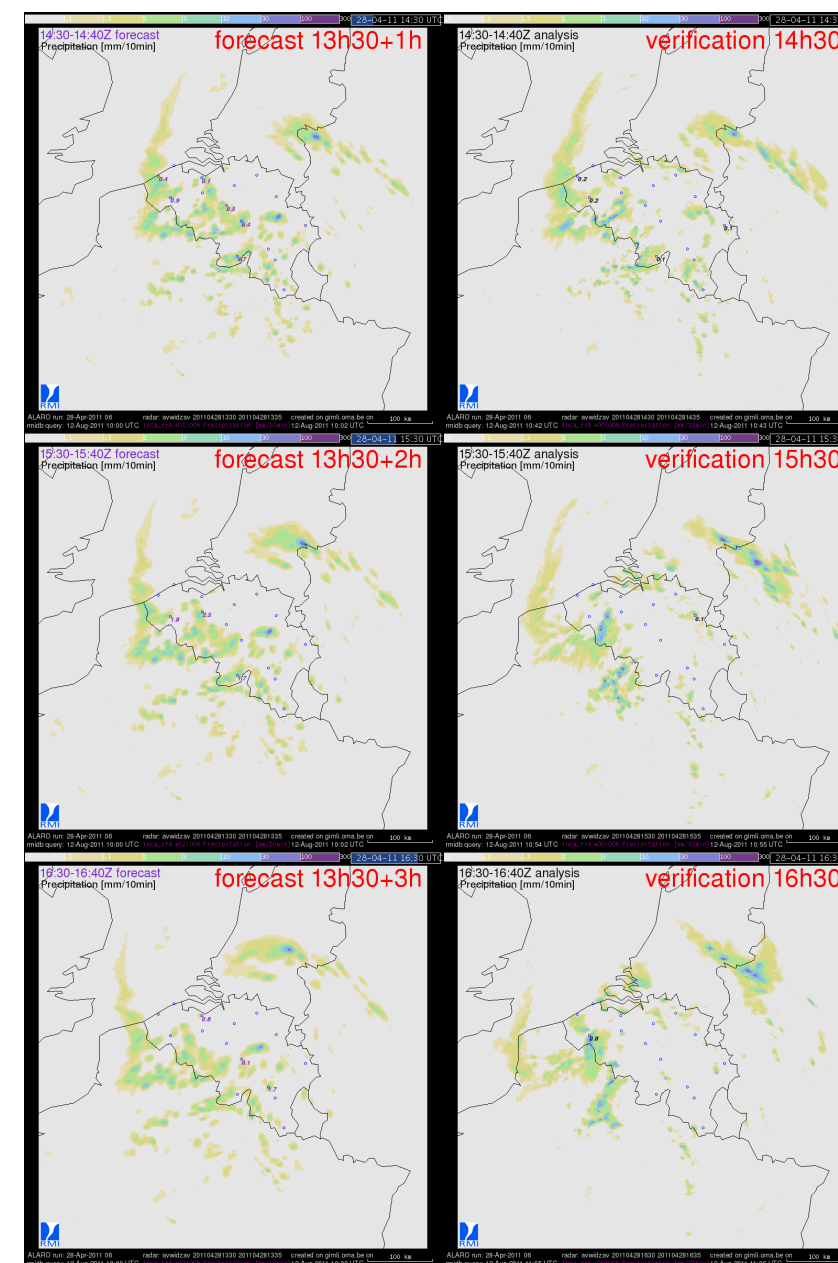


Fig. 5. Right: INCA-BE precipitation forecast; left: verification images

5 Conclusions

The implementation of the nowcasting system INCA for Belgium is almost complete, except for the cloudiness module. INCA-BE is running in test phase for some months now and a first qualitative evaluation based on some case studies reveals that INCA-BE will definitely improve the nowcasting accuracy of our service. A fully operational version of INCA-BE is expected in the course of 2012.