Meteorological applications at NIMH, Romania

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Romania, despite its relatively small area, has a substantial variation in its terrain and other factors influencing the airflow dynamics. The hilly and mountainous areas are strongly affected by flash flooding, and all areas are subject to diverse conditions ranging from severe thunderstorm with hail in summer to heavy snowstorms in winter.

In November 2000, the Romanian National Institute of Meteorology and Hydrology (INMH) began the first stage of the plan to modernize Romania's capabilities for detecting, monitoring and predicting meteorological phenomena affecting Romania, by implementing the *National Integrated Meteorological System – SIMIN project.*

SIMIN has upgraded the INMH sensor network and fully integrated with the existing sensors to provide comprehensive national coverage of all observation types. SIMIN adds 5 WSR-98D S-band radars, 60 AWOS stations, Meteosat 7 and MSG satellite receiving stations, an 8 sensor Lightning Detection Network and 11 meteo/hydro observations buoys.

SIMIN has upgraded the INMH communication infrastructure to support real-time collection and distribution of meteorological data and products throughout Romania.

SIMIN has upgraded the INMH meteorological processing capabilities including fully integrated and highly automated Forecasting and Nowcasting workstations for national and regional forecasting operations.

1 Surface observation processing and visualization

Within the SIMIN project a Surface Observation Processing (SOP) application has been developed to support the collection, validation, and distribution of all surface observations in the country. To achieve data validation, the application permits data visualization in:

- WMO standard messages
- table and graphs for each parameter
- geographically plotted form
- for one parameter or Bjerknes scheme
- time differences for a given parameter at two selected times
- variance from climatological values, for a given parameter
- sum of a selected parameter for a given interval
- comparison with INMH forecast model outputs
- warnings for a given interval

2 RADAR data visualization

The nowcasting environment of SIMIN centres on the display and advanced processing of radar information available in the Romanian National Radar Network (5 WSR-98D S-band radars and 4 C-band radars).

PUP (*Principal User Processor*) is a dedicated display system directly attached to the WSR-98D radar sensor providing the initial display of radar information. C-band radar products are converted to 88D/98D formats allow the PUP to display of products from all radars in the network. It allows visualization of stand-alone image products, image overlay products, alphanumeric products, time lapse looping, image algorithm processing

The **RPI** (*Radar Product Integrator*) application provides the foundation of the now-casting environment at the INMH central and regional level. The RPI provides a unique combination of real-time radar processing, enhanced 2D (figure 1) and 3D (figure 2) visualization and automated product distribution. It contains a wind shear identification algorithm and could identify storm cell tracks and post estimates times of arrival for local communities.

The RPI provides real-time processing and display of radar information with capabilities designed to enhance early warning to the public. This includes display of street-level mapping for all cities in Romania, allowing warnings to occur at the local level.

The RPI includes an integrated implementation of a hydrostatic NWP model, to provide current and forecasted value-added radar products, such as precipitation types (figure 3) and accumulation amounts. These advanced products provide situational awareness to now-casting operations, greater than what is possible with radar information alone.

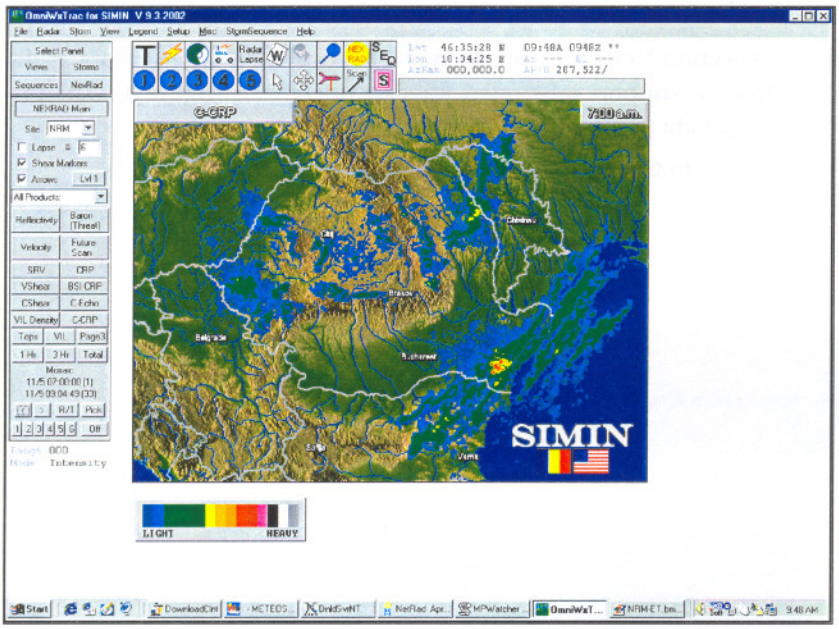

Fig. 1 National Radar Mosaic

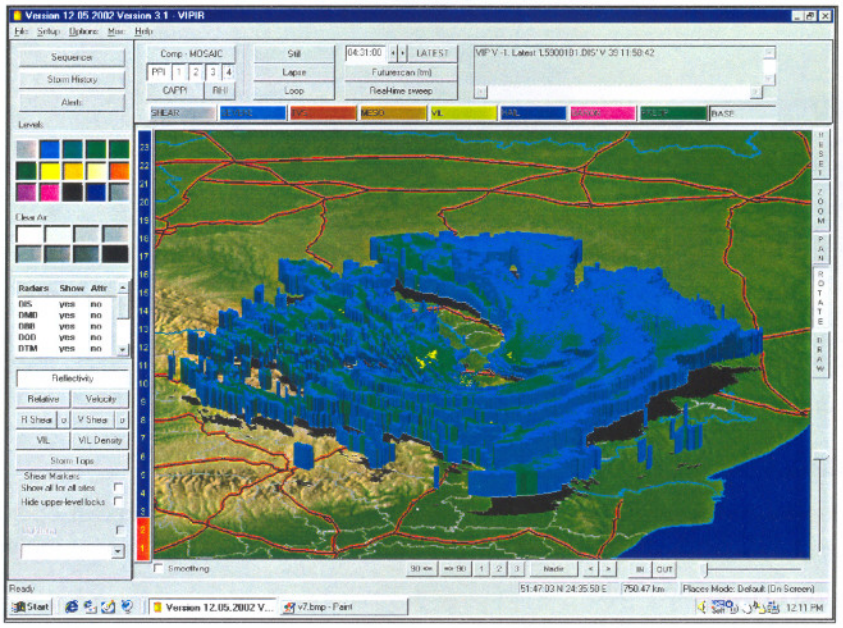

Fig. 2 Multiple layer reflectivity display

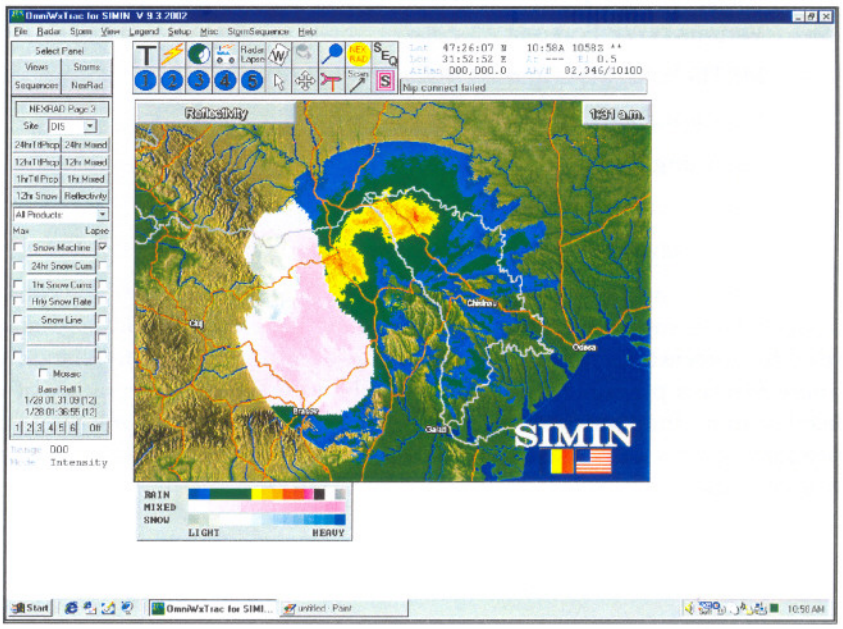

Fig. 3 First tilt reflectivity product showing the precipitation type (rain, mixed, snow)

3 Lightning system data visualization

The information received from the Lightning Detection Network, containing 8 electrical discharge sensors, is distributed throughout the system in near real-time to support integrated forecast operations (figure 4). The processing and visualization application for lightning data provides:

- Lightning discharges (Intra Cloud and Cloud to Ground)
- Lightning discharges density
- Lightning discharges cells
- Specific discharge information
- Monitoring area function

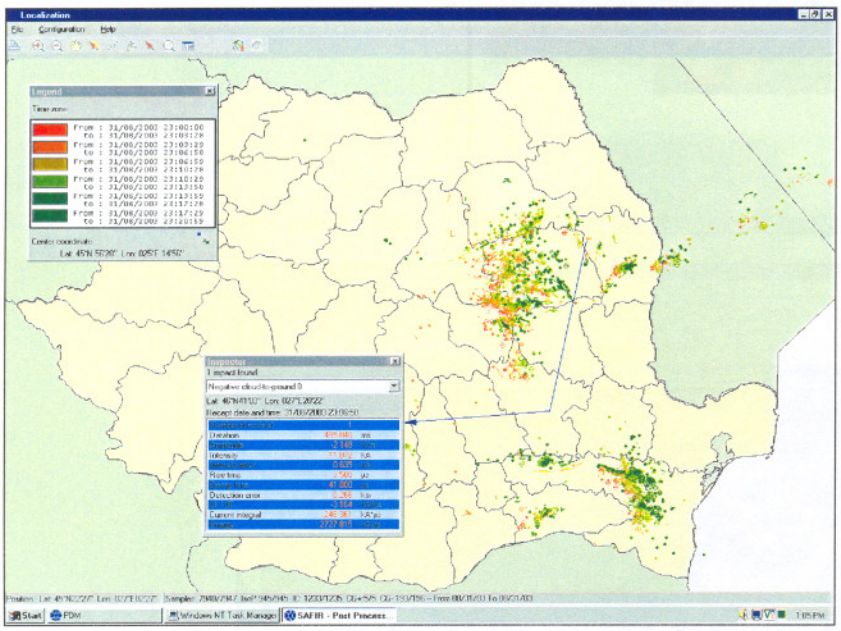

Fig. 4 Lightning discharges (IC and CG) and Specific discharge information

4 Integrated data visualization

NeX-REAP application provides a wide variety of interactive tools to support forecast operations. This includes integrated processing of data from various sensor platforms and processing equipment including:

- Surface and Upper Air station data
- Alphanumeric products from WMO sources
- Various NWP Forecast models
- METEOSAT, MSG and NOAA satellite imagery
- Individual and Mosaic Radar products
- Lightning Strike information
- Manual vector graphic products
- Thermodynamic analysis products

Key features of the neX-REAP system are the ability to define the content of all products (combined data) used in operations and fully automate the product generation (product examples in figure 5). This includes products used for forecast operations, as well as those for distribution to Associated Subscribers using Briefing Terminals. These features provide the ability to highly automate the generation of a large majority of the routine products, leaving more time for detailed analysis and monitoring of developing conditions. The automated distribution of products allows a diverse set of end users to continuously receive real-time information in support of their specific operations.

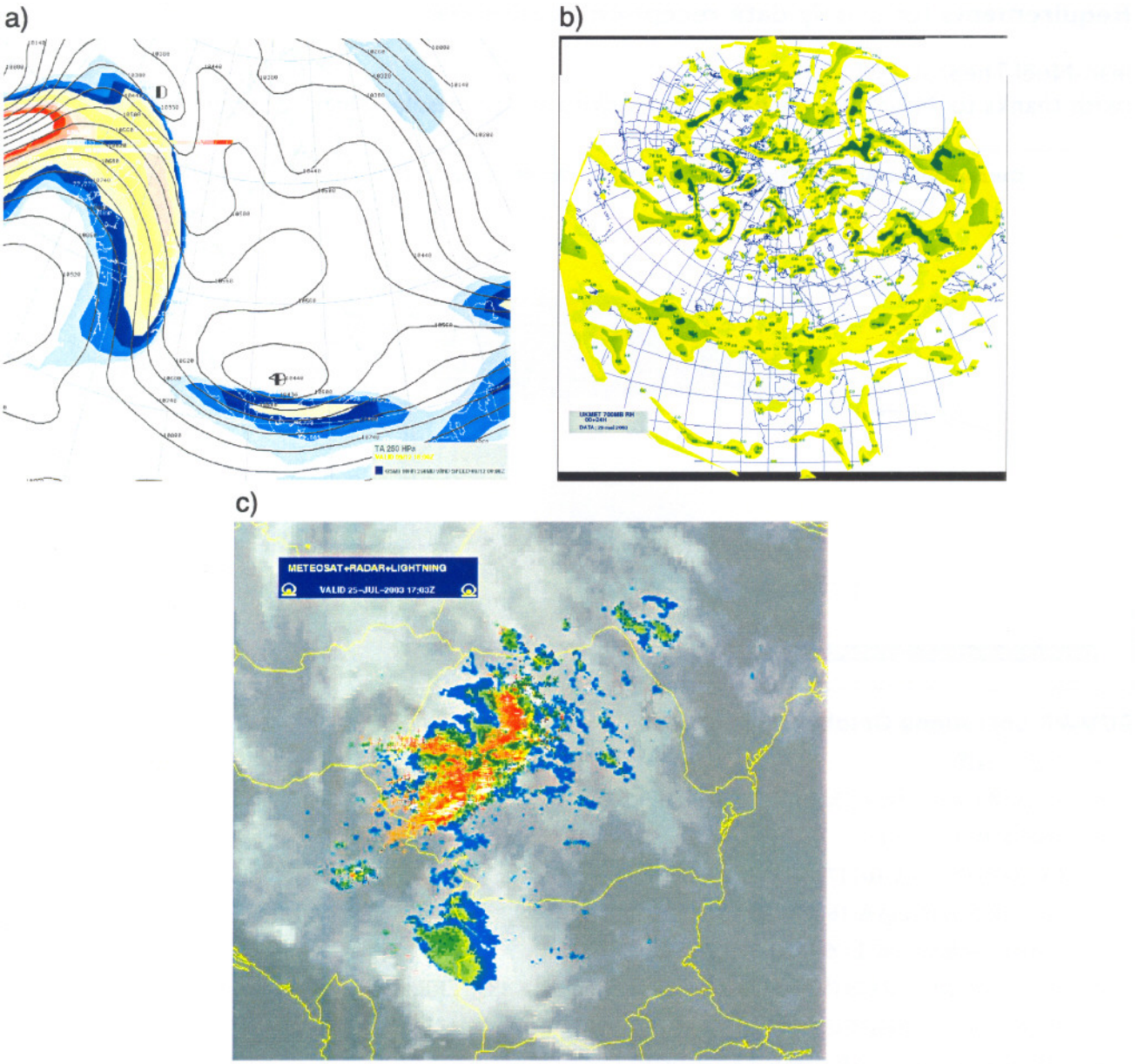

Fig. 5 Examples of neX-REAP products: atmospheric model outputs (a, b), integrated satellite, radar mosaic and lightning data (c)