# A Romanian Forecast and Training Experience, August 2002

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## Introduction

During 2002 Romania has gone through a modernization program for its weather services similar in some ways to the modernization of the U.S. National Weather Service. This program, known as SIMIN or the "Sistemul Meteorologic Integrat National", has included a new Doppler weather radar system, a new meteorological data collection, display, analysis and communications system, and many other observation equipment and station upgrades. As part of SIMIN there was a comprehensive severe convective storm and radar interpretation-training program given by an American severe storm and radar specialist, Leslie Lemon. A storm damage survey, based on procedures used at the National Severe Storms Laboratory (NSSL) in Norman, Oklahoma, was also offered as "On-the-Job" training and took advantage of a recent damaging storm occurrence in eastern Romania on August 12$^{th}$ 2002.

## Background

The storm damage survey for the case mentioned above was one of the few, if not the first ever done in Romania and revealed a long track moderately severe tornado. This was the first well-documented tornado in the history of Romania. By way of this storm damage survey, radar data analysis, many eyewitness accounts along the storm's path, and one short video segment, we concluded that despite long held beliefs that "tornadoes do not and cannot occur in Romania" that they in fact do occur and have occurred many times in the past. In fact, Wegener (1917) reported a possible damaging Bucharest tornado with supporting barograph trace on June 9$^{th}$ 1886. We have also obtained photographs, again in the eastern part of the country, of tornadoes moving from the land and into the Black Sea area. (In this case an observer from a nearby weather observing facility actually failed to report the tornado when it was clearly visible! - After all, "tornadoes don't occur in Romania"). Moreover, when one studies the tornadic storm, the tornado itself and the physics of these phenomena (Klemp, 1987, Davies-Jones, et al., 2001) there is little doubt as to why these storms occur in Romania or virtually all mid-latitude countries of the world (Brooks and Doswell, 2001).

Because it was believed that tornadoes did not occur in Romania they were never forecast and forecasters were not trained about the severe storm environments conducive to tornadoes and tornadogenesis. In fact, even the dynamics of supercell storms and tornadoes, supercell storm structures and the radar signatures of such storms were not generally taught. Thus, there were no radar "warning criteria" for these storms in existence in Romania. However, during the SIMIN training program, all were presented and taught in some detail.

## Analysis of available data

A variety of observations were used to determine the storm phenomenon that was responsible for 3 fatalities, a large but undetermined number of injuries, at least 33 homes destroyed and a further 395 damaged. In addition to examining the synoptic and mesoscale environment through conventional data and a mesoscale numerical model we also used reflectivity data from the Romanian National Meteorological and Hydrological Institute (INMH) C-band Doppler weather radar. Of course, the first known ground storm damage survey in Romanian history was crucial in establishing the damage cause. As a result of this survey, which took several days to compile, numerous eyewitness accounts were obtained all along the path. Following a detailed data analysis we established the parent storm as a "classic supercell" moving out of Bulgaria from $225^0$ at 25 m/s and crossing the southeast of the country. Most importantly we established that a long-track (74+ km), wide (averaging 1 km), and strong (F3+ on the Fujita damage scale) tornado was responsible for the damage.

We do not feel there is any question as to what inflicted the damage observed on the damage survey but we must emphasize this because of the extreme rarity or even absence of these phenomena as believed by many meteorologists and physicists in Romania. The environment was consistent with that shown to promote and sustain tornadoes as documented by many researchers. It was an environment with a strong vertical wind shear and abundant low-level instability. Amongst other things, there was a low-level mesoscale convergence zone and thermal boundary along which the storm travelled. In addition, the storm itself has been shown to possess the radar attributes of a classic supercell for much of the analysis period. Those radar attributes being a low-level hook echo, an extensive mid-level overhang, and indications of a displaced echo top above the updraft-storm flank. Furthermore, the ground survey itself revealed damage that could only be attributed to a tornado. Some might disagree and point to the fact that significant portions of the damage were in the direction of storm motion and could be attributed to straight-line winds. However, other case studies, numerical models and the theoretical derivation of flow patterns have long shown that this observation is especially true for fast moving storms as this one was. For example, this same alignment of debris was observed with the extensively photographed and surveyed Union City, Oklahoma tornado. Additionally there were numerous locations where the debris patterns and the fall of trees and poles were across the path or even fell against the storm motion. Finally we not only have a video of the funnel on the ground but also numerous observations all along the path of the attendant funnel and debris cloud. Thus, when all is considered from climatology and physics to the ground survey and observations, we can only conclude that this was a large and strong, long-track, tornado. Moreover, there have been other observations from long ago up to the actual writing of this report that confirm Romanian tornado occurrence.

## Conclusion

This storm has afforded the authors an opportunity to examine the environment of a European long-track tornado and has encouraged the development of tornadic-storm forecasting tools and techniques to be used by Romanian forecasters. While techniques have been used to forecast hail, there has been little attempt to forecast severe storms beyond this. Training efforts will now include information on tornadoes. Also we suggest that efforts are made to develop public awareness and public safety procedures and education materials concerning tornadoes. As we pointed out here, many were caught outside unaware, unprepared, and vulnerable to this tornado and actually to the supercell storm as a whole. This storm and tornado have been a defining moment in alerting Romania to the need for understanding tornadoes. It has also served as a "wake-up call" announcing the need for forecaster and public safety tornado-awareness training development.

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Commercially made red brick  "double-brick" home in Facaeni, Romania.

Downed trees along Danube.

Destroyed forest near Danube.  Trees were downed by a southeast wind on the forward side of tornado.

Aurora Stan-Sion (left) addressing the Romanian President and others concerning the Facaeni tornado

Leslie R. Lemon (right) explaining a severe storms concept to his Chinese host during a training trip to China.