TORNADO OF 27 JULY 2011 IN LITHUANIA – A CASE STUDY

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I. INTRODUCTION

Lithuania's climate is relatively mild and ranges between Maritime and Continental. However, environmental conditions within Lithuanian territory vary from severe thunderstorm with heavy rainfall and hail in the summer to heavy snowstorms in the winter. The last two summers in Lithuania were especially convective due to active cyclones moving from Southern Europe to Baltic States. Summer of 2011 was exceptional – at least three tornadoes were spotted in Lithuanian territory. A strongest twister passed Northern part of the country on 27 July. This tornado not only caused significant damage to human property but some people were also injured during this event. After lifting a lorry 27 July tornado could be classified as F2 in damage intensity level.

II. ANALYSIS OF METEOROLOGICAL ENVIRONMENT AND TORNADO PATH

The most convective days in Lithuania happen when there is a southern circulation. Cyclones from Southern Europe during the summer as well as during the winter bring significant amounts of moisture and heat (warmth) to Baltic states. Thus, on 27 July 2011 conditions for severe weather in Lithuania and surrounding regions were great - Lithuania was in a warm part of active cyclone moving from lower latitudes. Thereby, having moist and hot air mass over Lithuania the only ingredient for a deep convection needed was a lifting mechanism (Doswell III, 1996). Lifting mechanism was created by moving warm front over Northern Lithuania – those regions appeared in flow convergence zone while Southern part of the country was more affected by cyclone center situated over Northern Poland (Fig. 1) and moving towards the Baltic Sea.

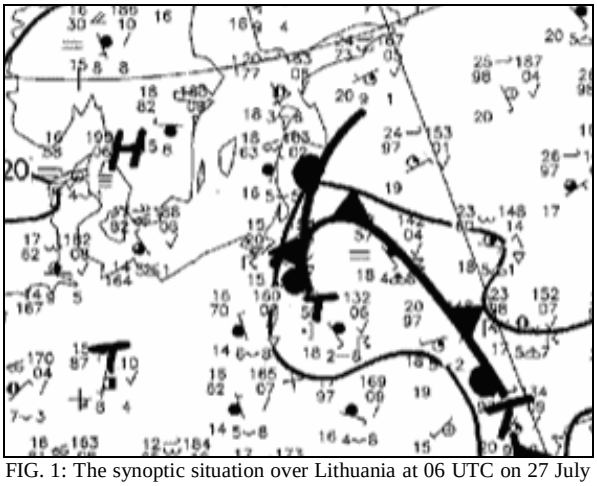

FIG. 1: The synoptic situation over Lithuania at 06 UTC on 27 July 2011.

Severe storms started to develop quite early in the morning and about noon it was an outbreak of a deep convection. Worst storms with hail, heavy rains were passing over Central and Northern Lithuania. It is not completely clear yet if on 27 July there were one, two or even three separate tornadoes. Depending on witnesses statements, one tornado was spotted near Kėdainiai town and another or two separate twisters were traveling from Radviliškis town surroundings to North-east of Šiauliai town (Ginkūnai village). The biggest harm was done in Ginkūnai village.

As mentioned above tropical air mass was very favorable for a deep convection in Lithuania (as well as in Latvia) on 27 July. Thus, due to synoptic conditions squall line formed and produced tornado(es) in Northern and Central part of Lithuania (Fig. 2). Doppler radar base reflectivity of tornadic cell was more than 72 dBZ.

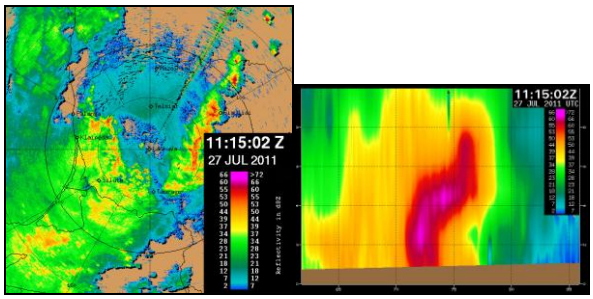

FIG. 2: Doppler radar base reflectivity, dBZ, and tornadic storm cross-section at 11:15 UTC on 27 July 2011.

Cloud tops in Northern Lithuania during tornado event were reaching 14-15 km; cloud top temperature was about -54…-58 ^{o}C while temperature near the ground was around +25...+28 ^{o}C. The synoptic situation, i.e. convergence at low levels and divergence at higher levels (ascending part of the trough at 500 hPa) were favorable for severe storms to form (Fig. 3).

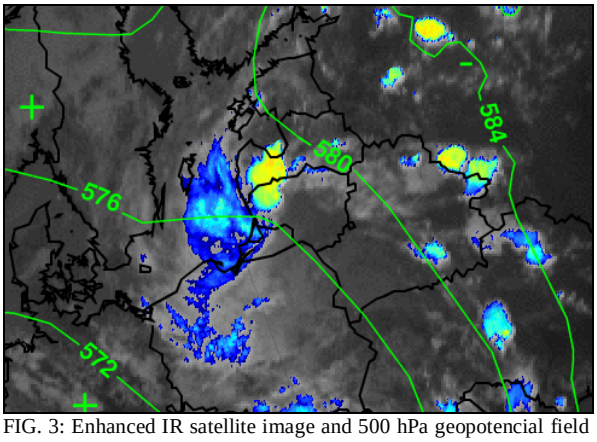

FIG. 3: Enhanced IR satellite image and 500 hPa geopotencial field at 12 UTC on 27 July 2011.

All necessary ingredients – moisture, heat and lifting mechanism – over Lithuanian territory led to deep convection on 27 July 2011 in Lithuania. In addition, HIRLAM numerical model forecasted high CAPE values - 2500-3500 J/kg (Fig. 4). Hence, synoptic and mesoscale conditions were auspicious not just for a heavy rain and hail but also for a devastating tornado(es).

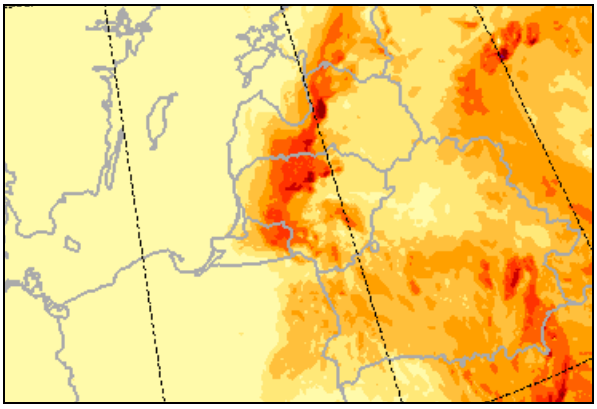

FIG.4: High CAPE values over Lithuanian and Latvian territory at 12 UTC on 27 July 2011.

III. DAMAGE SURVEY AND CONCLUSIONS

Tornado that developed on 27 July 2011 in Northern Lithuania near Radviliškis town and headed north-east towards Šiauliai town was the strongest reported twister since 29 May 1981. Tornado of 27 July caused meaningful harm to human property and nature – rooted trees, damaged buildings, broken cars and trucks, etc. (Fig. 5). Not only material damage registered but some people were also injured during this event. Judging the fact that lorry was overthrown tornado might be at least F2 in damage intensity level. Luckily, there are no reports of people being killed.

FIG. 5: Devastating tornadoes and their destruction in Northern Lithuania on 27 July 2011.

The aim of this study was to identify the synoptic and mesoscale processes favorable to formation of the tornado, thus, leading to the improvement of severe weather forecasting.

IV. REFERENCES

Doswell III C. A., 1996: Flash Flood Forecasting: An Ingredients-Based Methodology. *Weather and Forecasting*, 11 560-581.