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Severe Thundershowers Over the Central Part of Latvia on 29 July 2014

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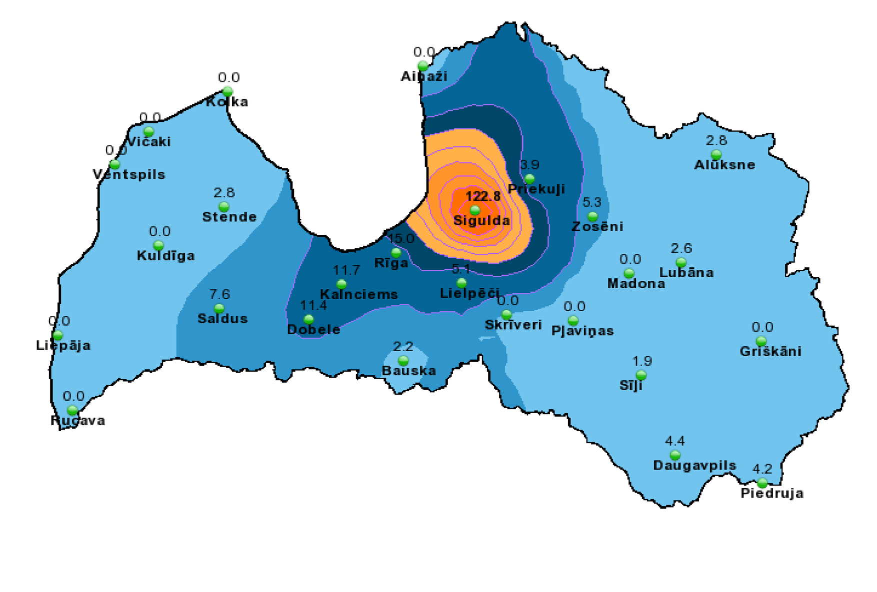
INTRODUCTION

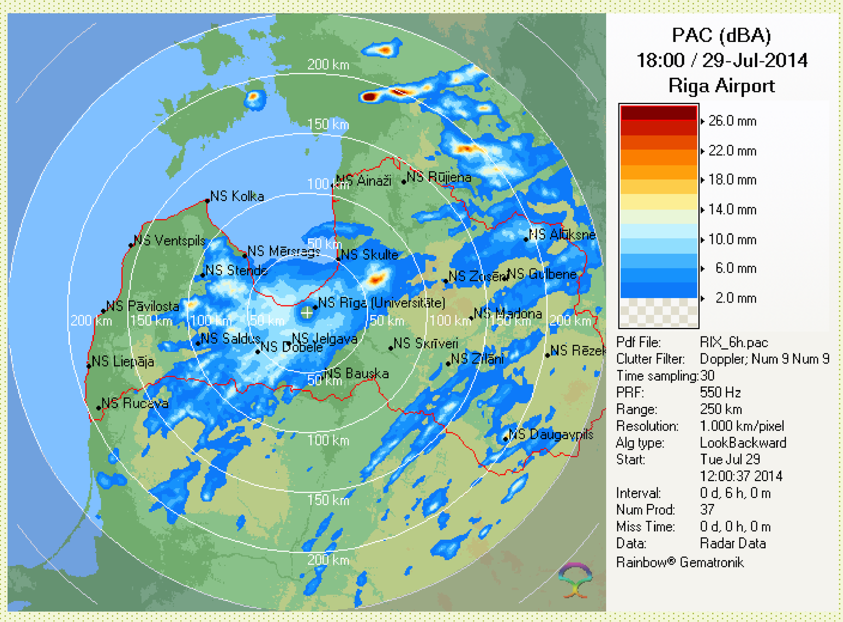
In the end of July 2014, during a continuous heat wave, record-breaking thundershowers occurred in the central part of Latvia. In small town Sigulda the amount of precipitation reached 123 mm in six hours. This was an extreme weather phenomenon not only for Sigulda but also for the whole Latvia - it was the 6th highest precipitation amount observed in Latvia so far.

This storm caused tens of thousands of Euros damage in the Sigulda municipality, but during the recent years other parts of Latvia have experienced high impact severe thunderstorm events as well. Therefore the analysis and identification of the features associated with such intense and rare processes is essential for the increase in understanding and forecasting these summertime weather hazards. This study presents an analysis of this extreme convective event over Latvia by the exploration of mesoscale atmospheric processes, available satellite and radar imagery and products and also in-situ observations.

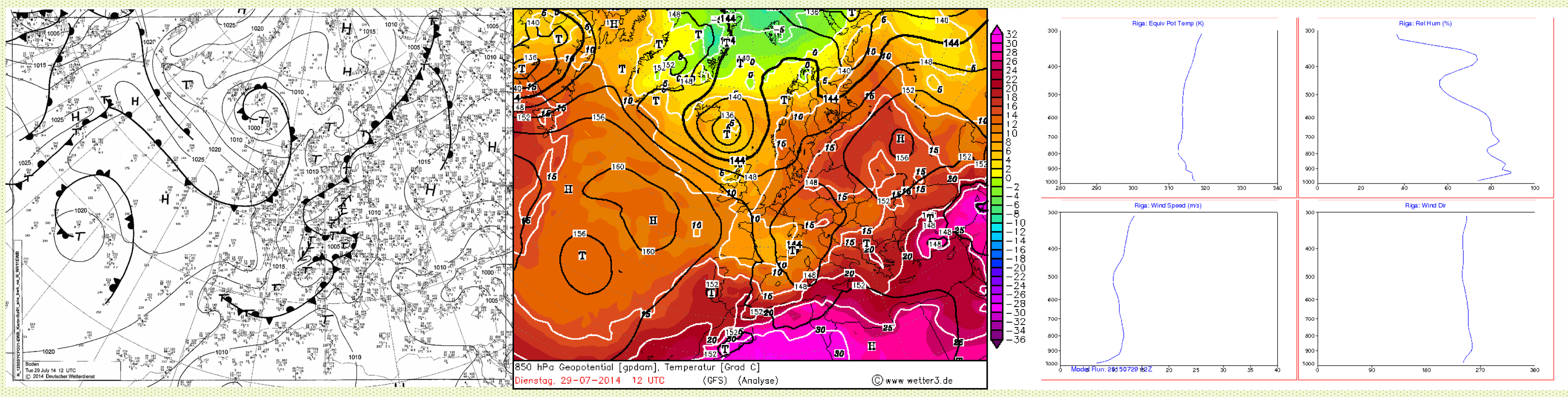
In the middle of the summer 2014, warm and moist air prevailed over Latvia for several weeks, which resulted in the development of an intensive convective process, which caused local heavy showers and flooding in some municipalities of Latvia (Figures 1-2).

An area of weak pressure gradient in combination with high temperatures, sufficient humidity conditions and with weak vertical wind shear (Figures 3-5) contributed to slow motion of clouds and resulting extremely heavy showers over some parts of Latvia. The possible activity was also confirmed by the common instability indices, with the Showalter index values of -3, CAPE between 400 to 2500 J/kg and GII values of -8 to -12 over Latvia.

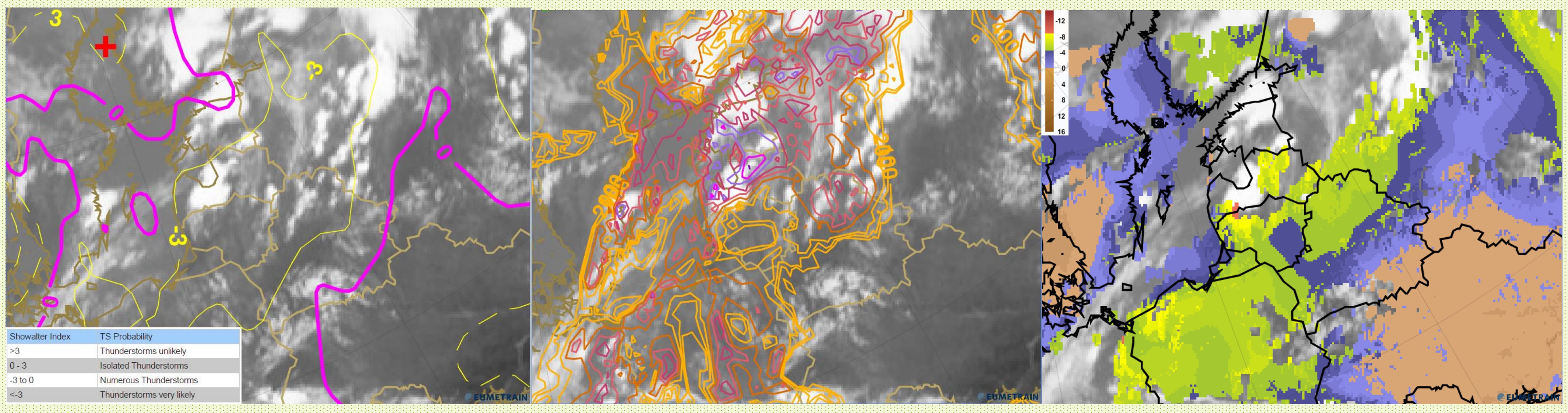




Figures 1-2. 6-hour precipitation amount on 29.07.2013. On the left – observations from the surface stations, on the right – accumulated precipitation observed by the meteorological radar located at the Riga airport

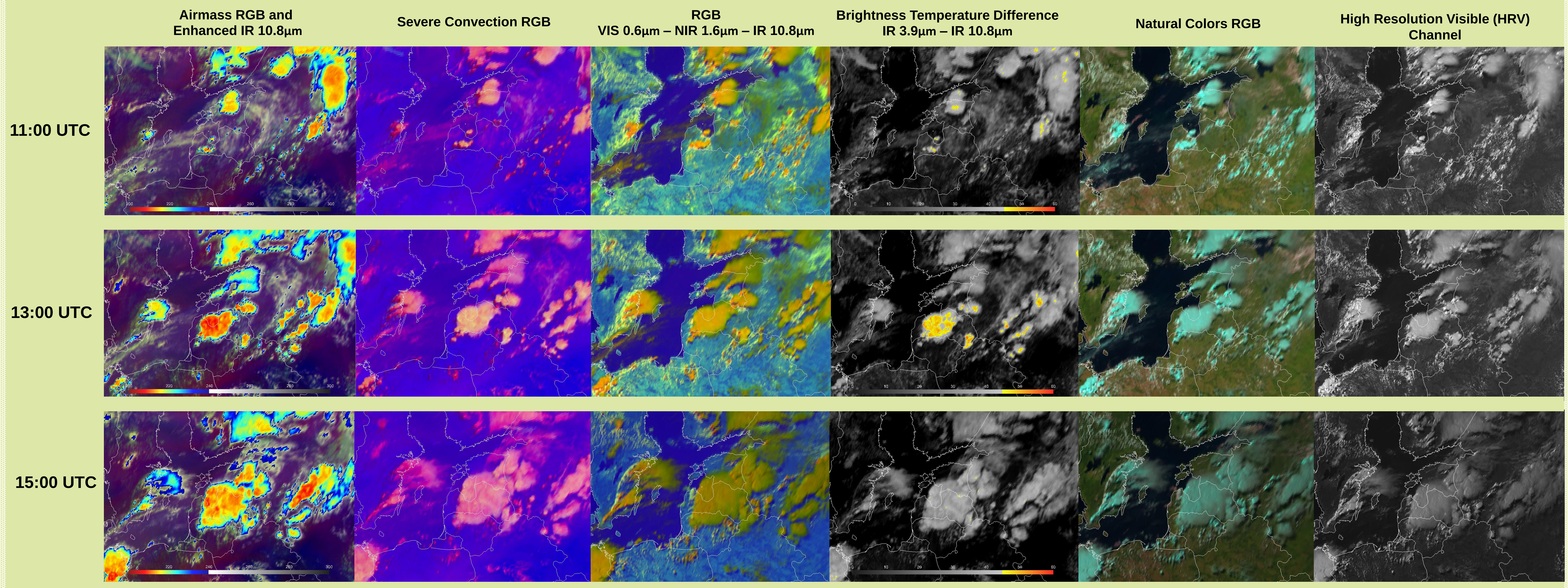


Figures 3-5. Synoptic analysis indices at 12:00 UTC 29.07.2013
From the left: surface chart, GFS geopotential and temperature at 850 hPa and ECMWF vertical profiles for Riga



Figures 6-8. EUMeTrain ePort analysis – instability indices at 12:00 UTC 29.07.2013
From the left: Showalter index, CAPE [1200 to 2500 J/kg in pink → rose → lavender → magenta colour], Global Instability Index GII

Even though early in the afternoon of July 29 there were only a few storms present, their further development was very intense and rapid during the following hours. EUMETSAT Meteosat 10 satellite imagery presented in the matrix below shows the development and physical properties of the convective clouds. The main activity of the storm was observed around 13 UTC, when there were small ice particles evident on the tops of the high and cold convective clouds, represented by the yellowish colours in the Severe Convection RGB, as well as the RGB 0.6-1.6-10.8 and also the brightness temperature difference of the channels 3.9µm and 10.8µm. The cloud top temperature reached 206K or -67°C, and some overshooting tops were evident from the HRV image as well. All these features indicate deep vertical development of the storm clouds contributing to an increased lifespan of the storm. Already at 15 UTC there were almost no new sources of small ice particles evident, indicating weakening of the updraft, decrease in the storm's activity and it's transition to the dissipation stage.



CONCLUSIONS

The storm caused considerable damage in the Sigulda municipality – intense flows of water and mud slides with falling trees swept downhill in the river valley and destroyed roads on their way (Figures 9-10). The damage of these very local and very severe thundershowers was estimated to be tens of thousands of Euros.

From the forecaster's on duty point of view this was a complicated event difficult to predict. This study did not focus on the analysis of radar imagery, since, besides accumulated precipitation, there were no signs of such severe weather identifiable. Also the analysis of cloud physical properties as seen from the satellite imagery presented here did not show clear indicators of the storm severity and nature of its impacts. But at the same time, mesoscale and synoptic analysis with a complex view on available remote sensing data was helpful in building the storm development scenario.

Figures 9-10. Flooding caused by thundershowers in the Sigulda municipality on 29 July 2014

References:
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