



Fog event causes 58 car accidents on Serbian roads in 24 hours

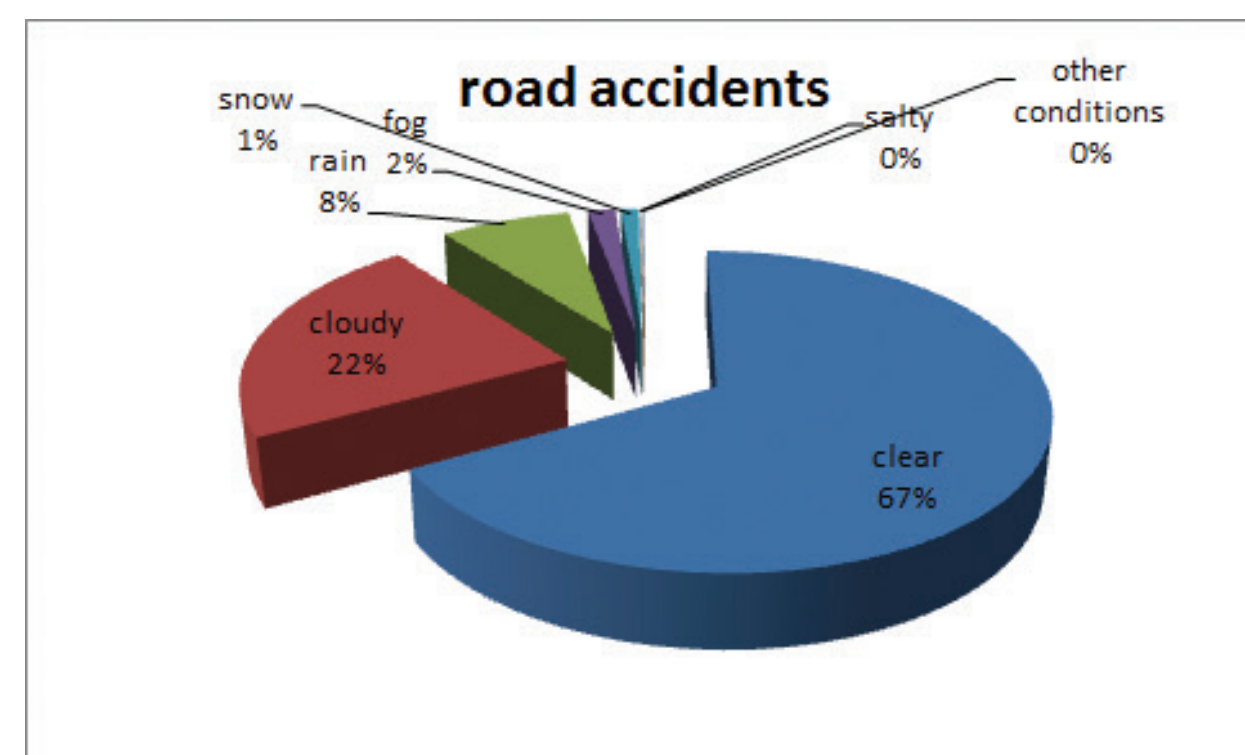
Aleksandra Arsic and Milana Vuckovic,
Republic Hydrometeorological Service of Serbia



Introduction

On average, there are over 40,000 vehicle crashes each year in Serbia, where between 600 and 800 people are killed and over 19,000 are injured. About 25% of these crashes are weather related.

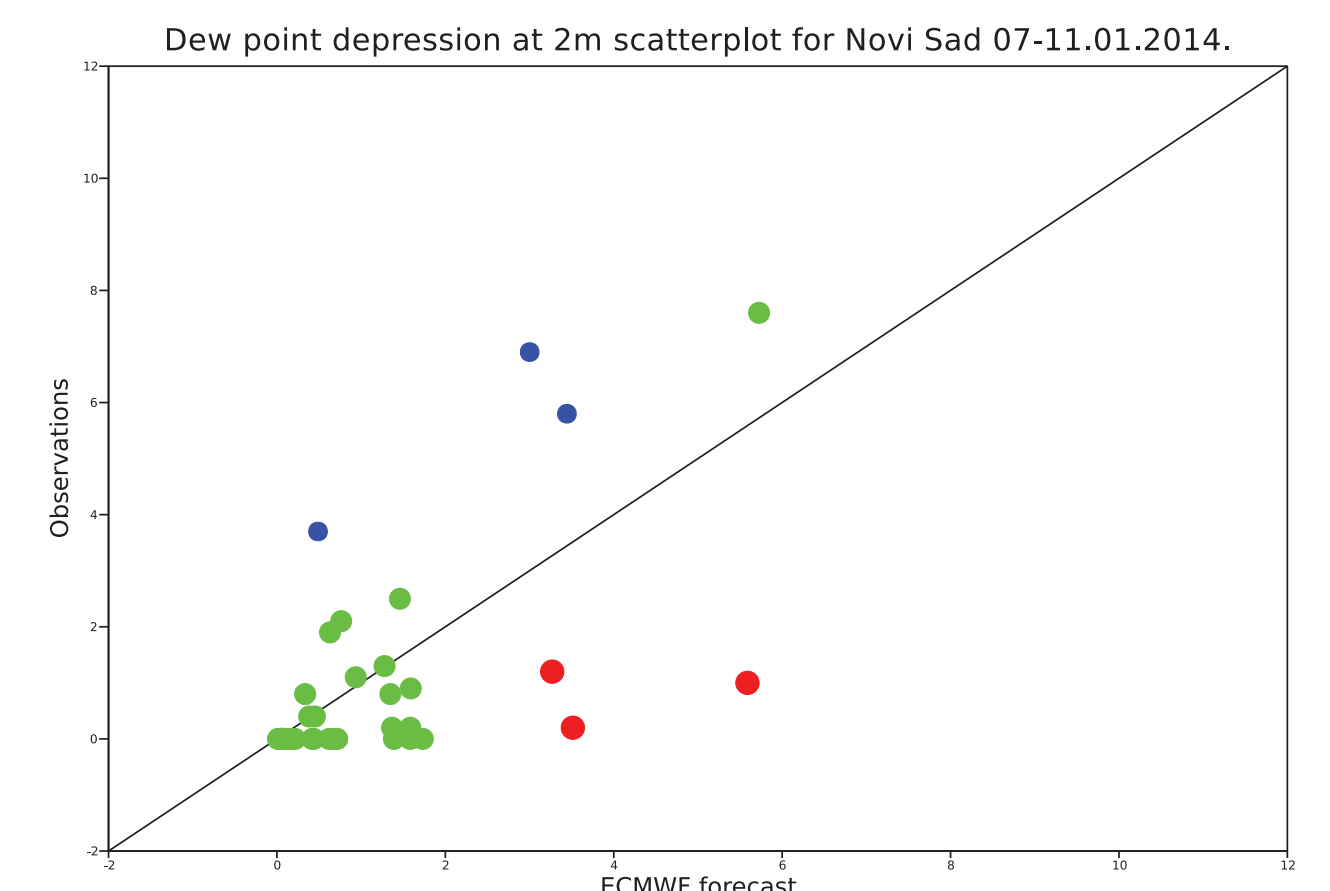
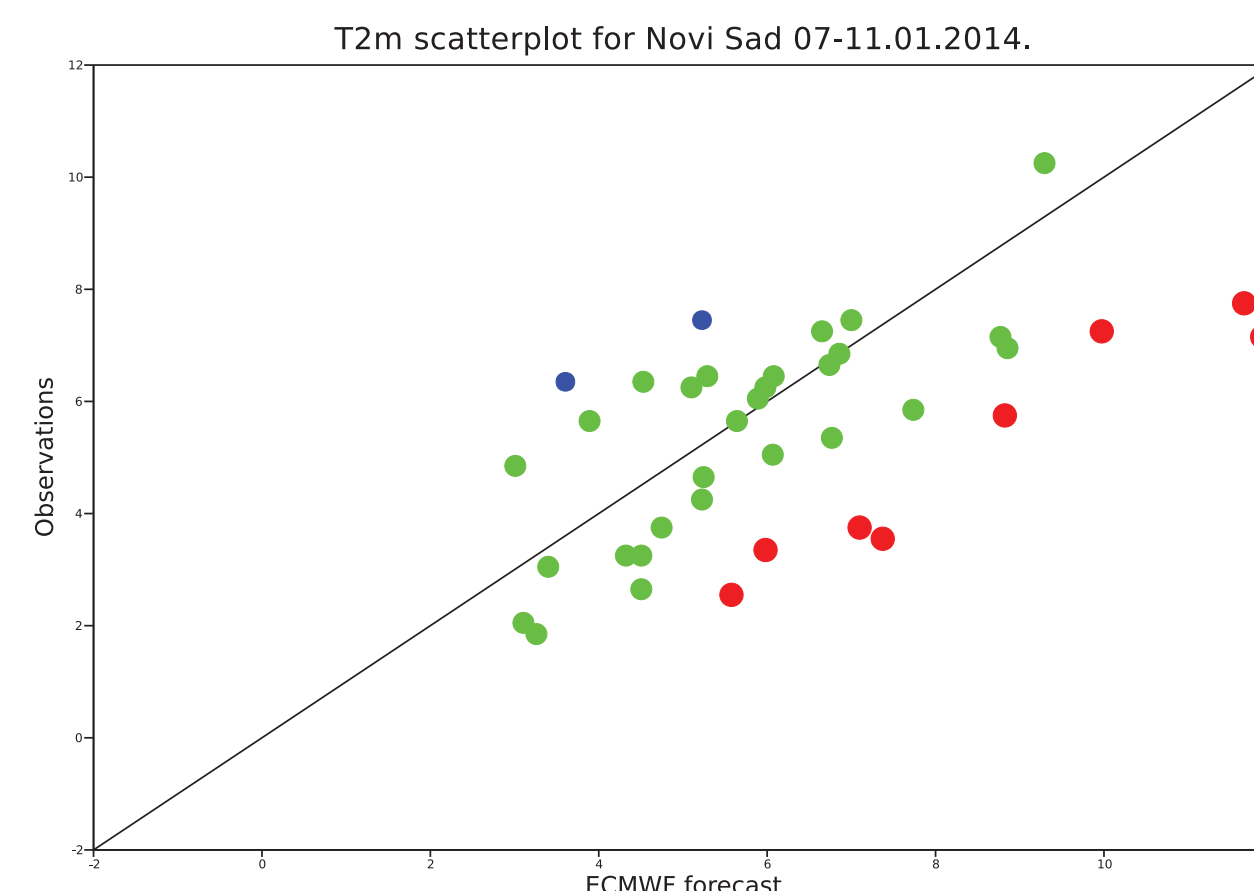
Weather-related crashes are defined as those crashes that occur in adverse weather (i.e. rain, sleet, snow, and/or fog) or on slick pavement (i.e. wet, snowy/slushy, or icy).



Shallow fog is visible on satellite images and on image taken from plane, where we can see Fruska Gora (539m) and Avala mountain (511m).



Scatterplots for Novi Sad show that most errors are in $\pm 2^\circ\text{C}$ interval, but it is also noticeable that model tends to overforecast T2m.



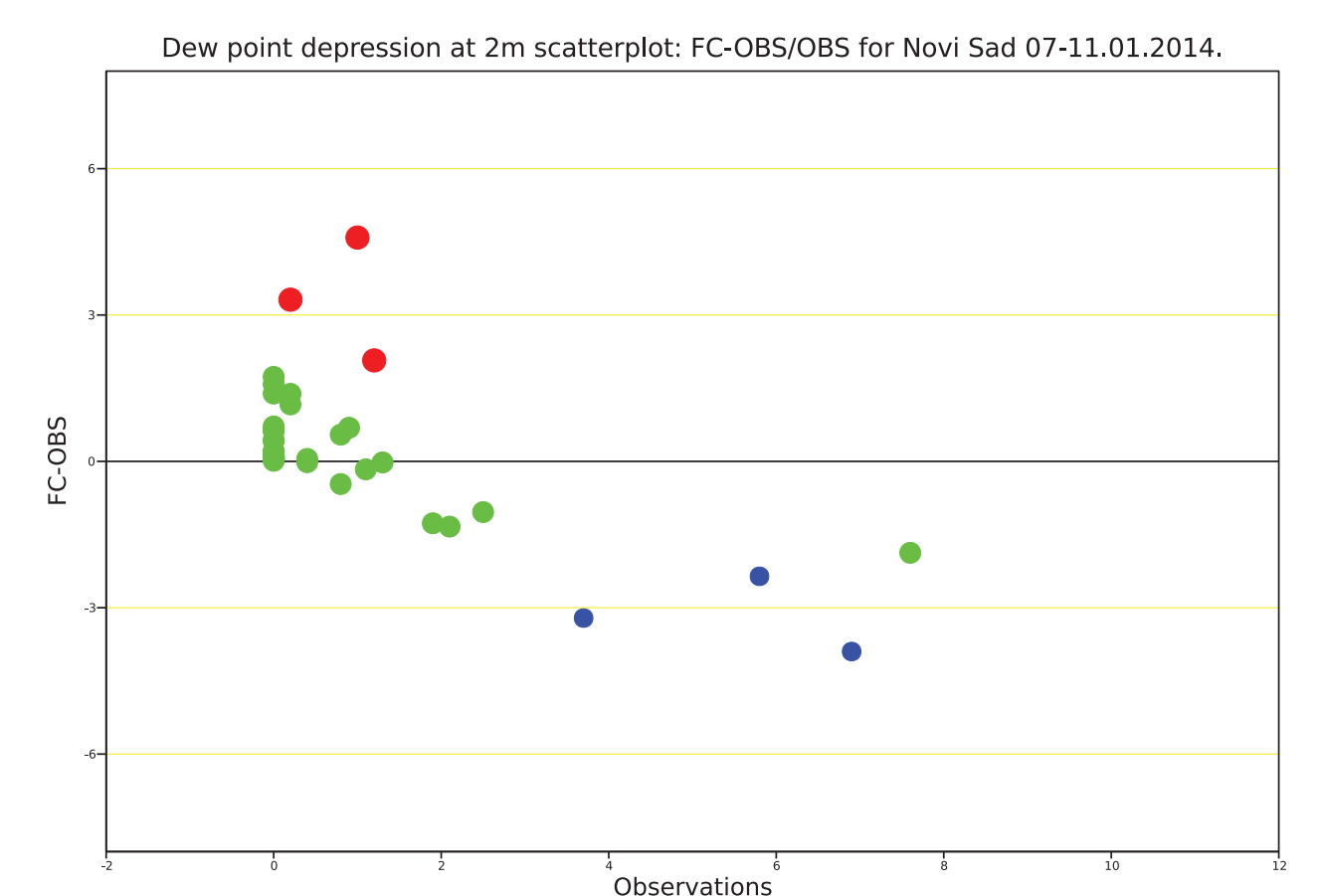
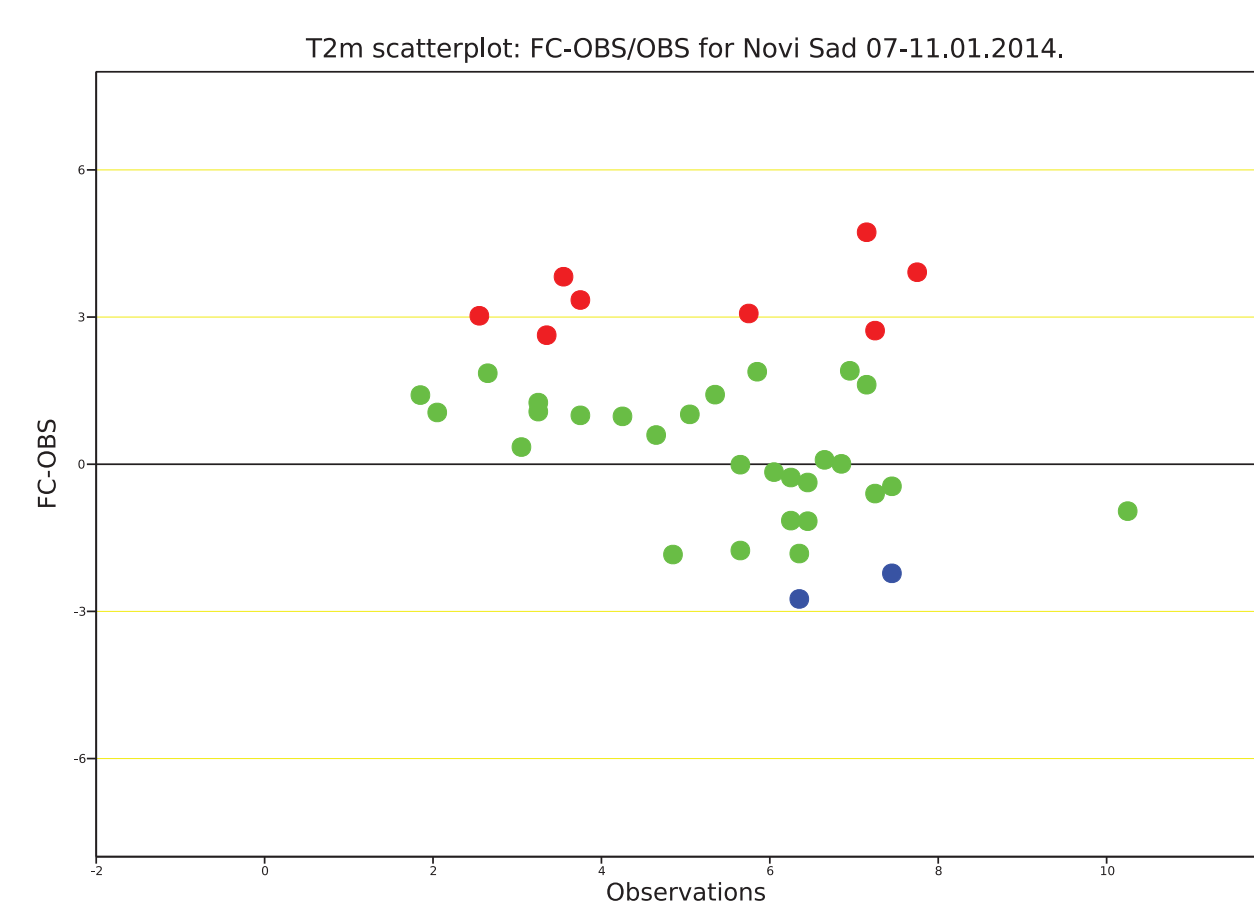
Fog is rare meteorological occurrence, but consequences of traffic accidents caused by fog are much larger than average.

Objective

This case study shows that opportune severe weather forecast, fog in this case, has important role on road safety.

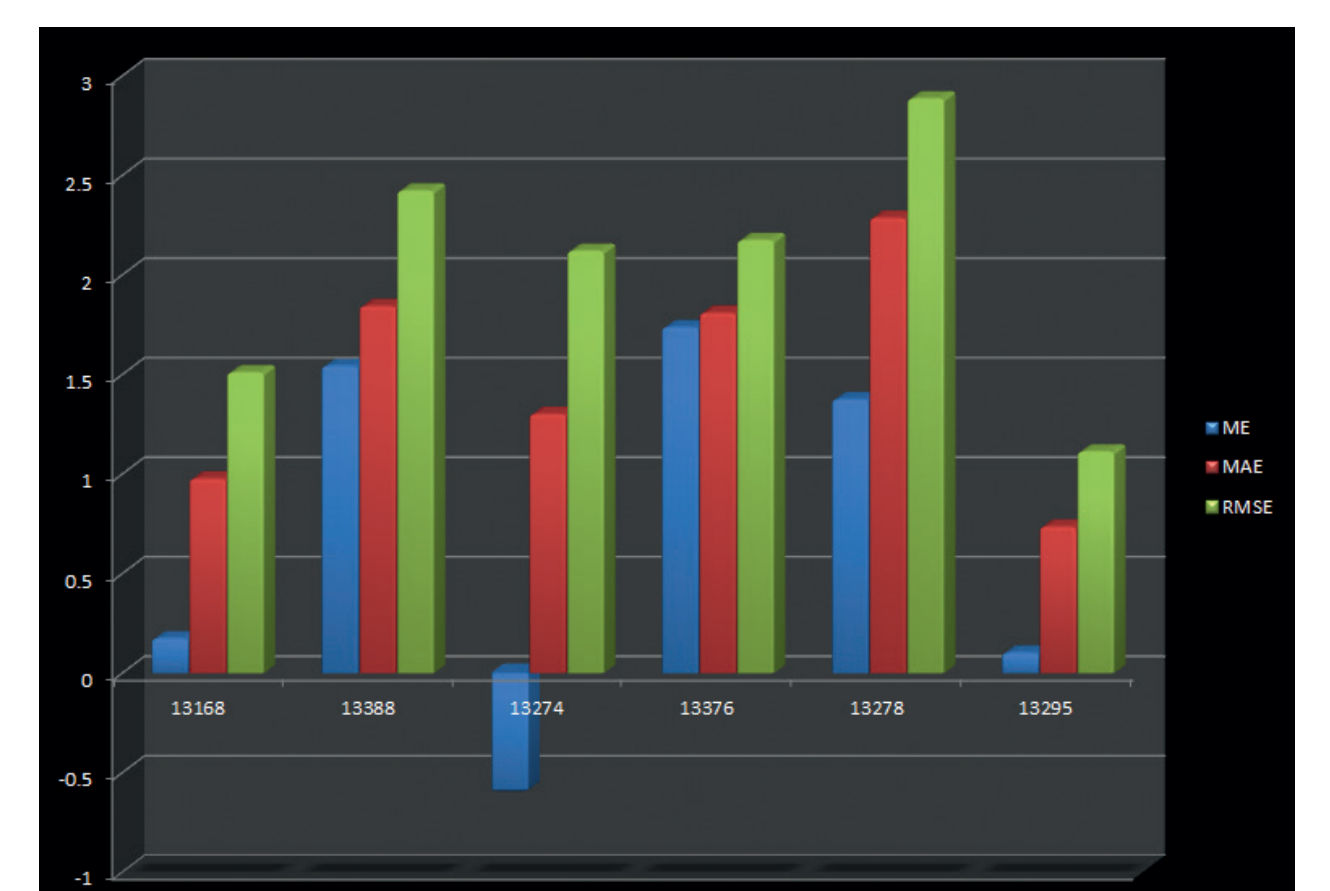
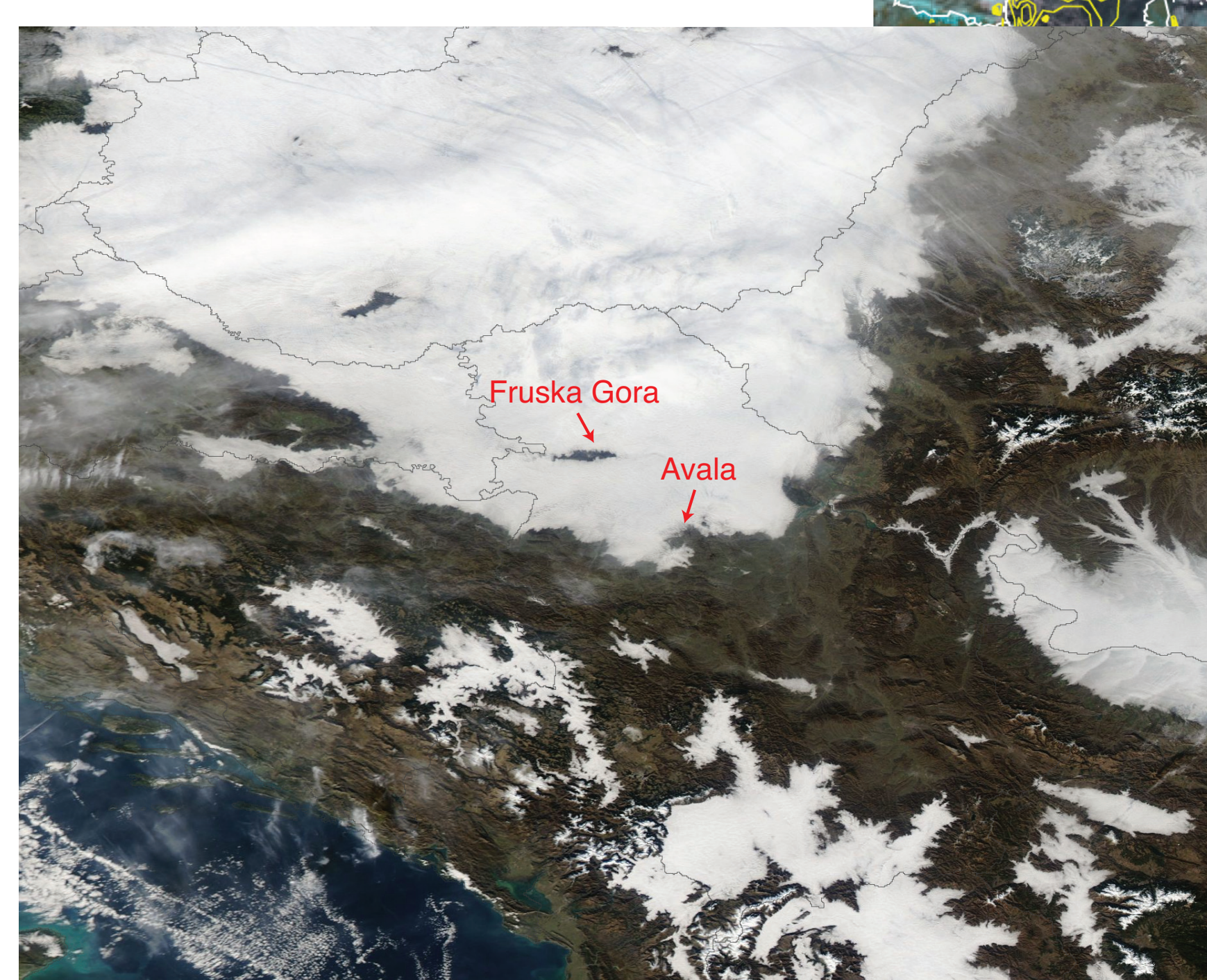
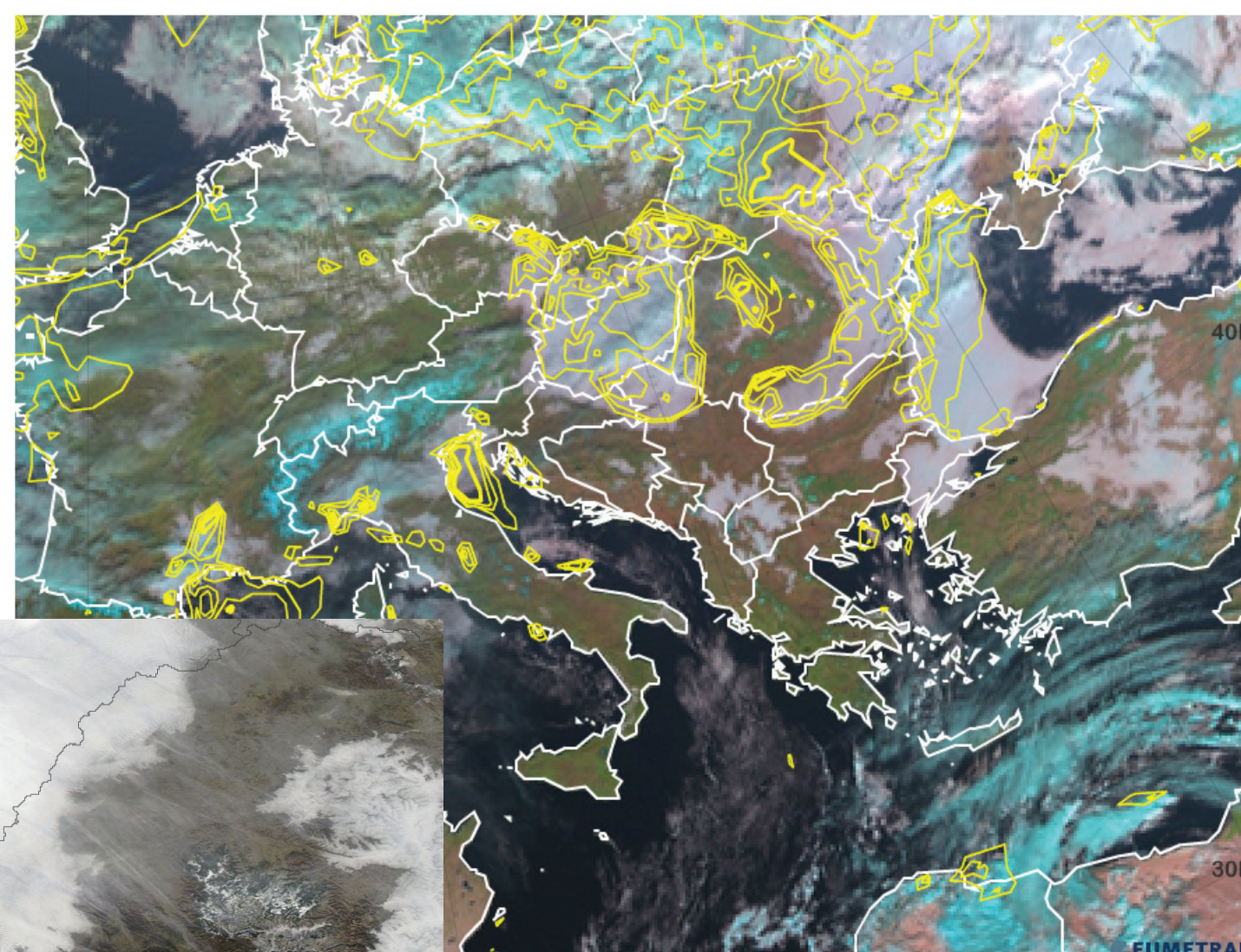
Methods

- The main criteria for fog formation is water-saturated air. When air is saturated, the watervapor turns into liquid water droplets in condensation process. Air can become saturated by cooling the air to its dewpoint temperature or evaporating moisture into the air and increasing its vapor content.
- Additional factors for forecasting fog formation are long nights during colder months, clear sky and light wind, moist air...
- In this case study verification method for two continuous variables was used: dewpoint depression (measure of saturation) and temperature on 2m from ECMWF model from 7th January to 11th January 2014, model run from 7th January 2014 at 00 UTC.



Results and discussion

Natural color RGB (right) from Met 10 with dew point depression from ECMWF model and True color - corrected reflectance from Aqua/MODIS satellite (down).



ME, MAE and RMSE for T2m (left) and dew point depression (right) from ECMWF model (7th January 2014 00UTC run) compared to SYNOP observations for 6 cities in Serbia.

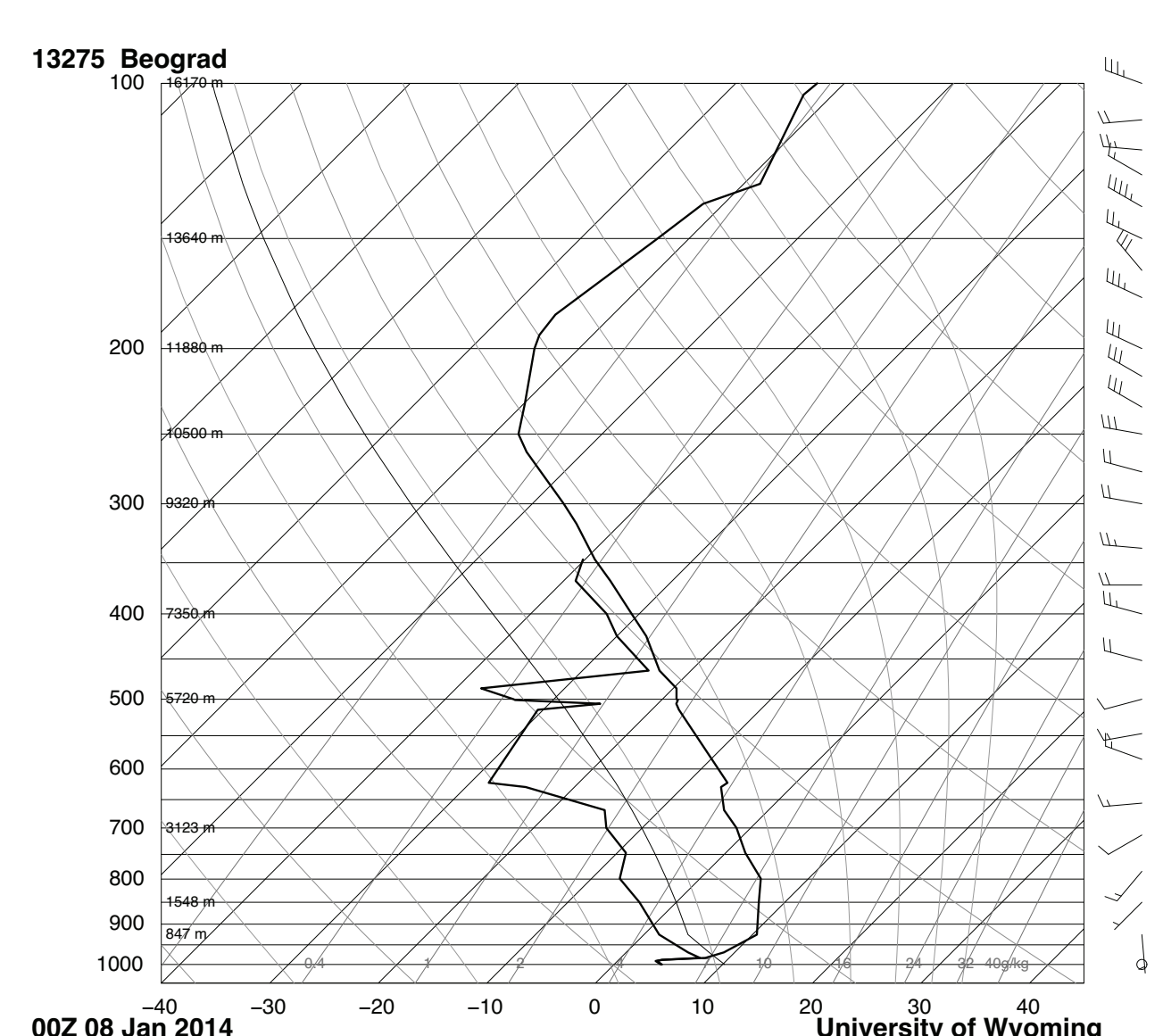
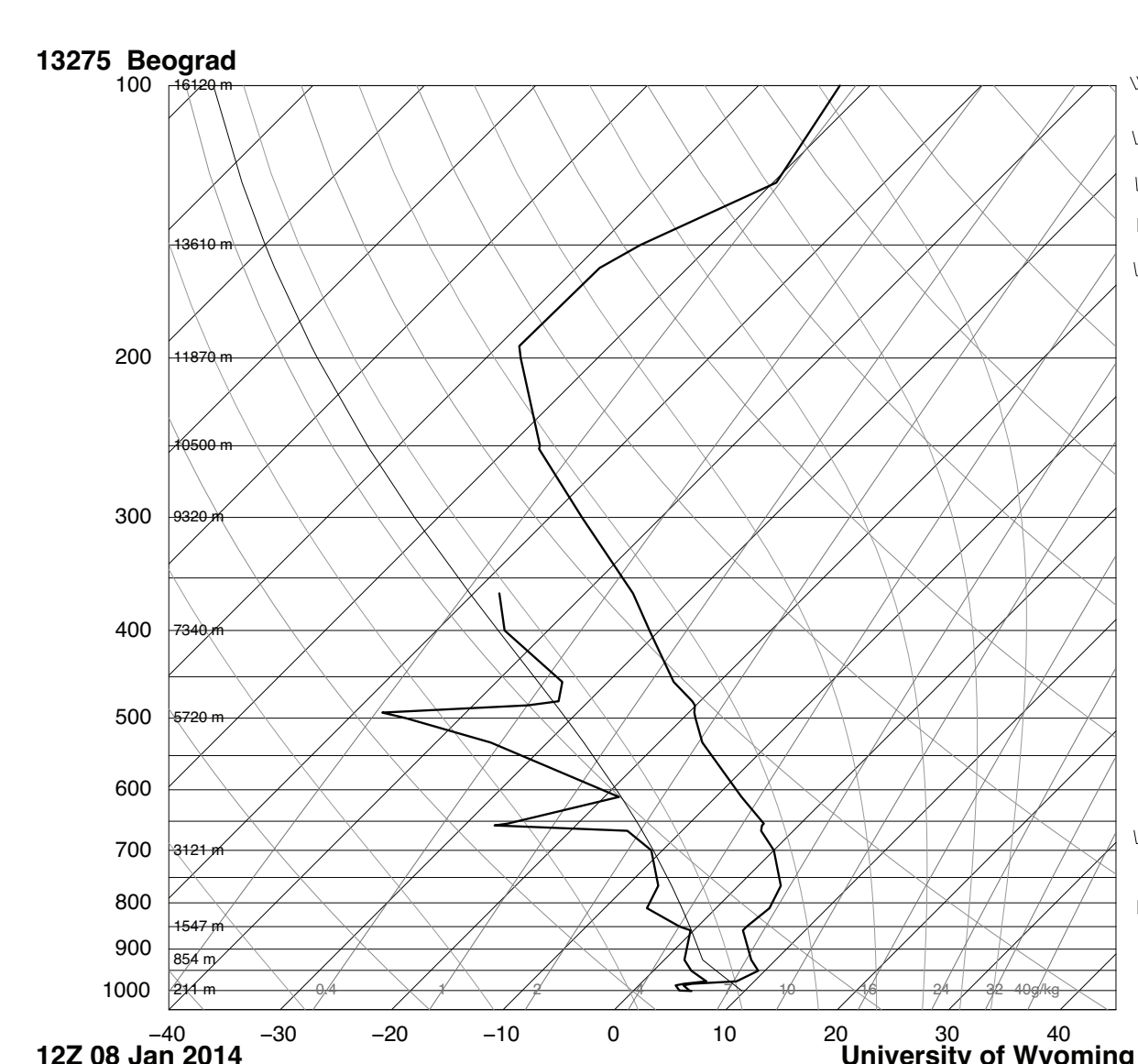
ME → Overforecast for all stations except Belgrade

MAE → 4 stations have MAE below 2.5°C, and only Kraljevo and Negotin have larger MAEs

RMSE → Greatest value is for Kraljevo which leads us that there were a lot of big misses in forecast for this town.

From verification results we can see that ECMWF model predicted fog formation and its arrest. According to the model forecasters issued warning on reduced visibility in Vojvodina region and valleys lower than 200m from 7th to 11th January, but it was Orthodox Christmas time in Serbia and a lot of people did not obey advice and traveled by car without taking precautions and as a result 58 road accident happened, 33 people were injured and seven people have died in 24 hours on 7/8th January 2014.

Sounding data shows saturated air and temperature inversion in shallow low layer and very dry air between 900 and 500 hPa, and calm/light wind, which points to fog conditions.



Conclusion and recommendations

For safety of all participants in road traffic it is very important to use meteorological information about severe weather conditions on the roads, because thousands of deaths on the roads is just a statistic, and the death of one man is a tragedy.

Acknowledgments

- Ruzica Popovic (2012) Highway Safety in Conditions of decreased and bad visibility caused by fog in XI International Symposium ROAD ACCIDENTS PREVENTION 2012.
- Statistički izveštaj o stanju bezbednosti saobraćaja u Republici Srbiji u 2012. godini.
- <http://www.eumetrain.org>
- <http://weather.uwyo.edu>
- <https://earthdata.nasa.gov/labs/worldview/>
- <http://www.telegraf.rs/>
- <http://www.source.ba/>