# Numerical weather prediction at the Faculty of Sciences, University of Novi Sad

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## 1. Abstract

At the Department of Physics, Faculty of Sciences, University of Novi Sad, students have learned the skill in running numerical weather forecast - WRF model. Both WRF cores (ARW and NMM) are being ran daily over the region of Balkan peninsula with spatial resolution of about 10 km. The initial and boundary conditions for regional models are fed with NCEP GFS (global forecast system) output data. Both WRF model cores start their numerical procedure with the midnight GFS output data and run for the next 96 hours. The model outputs are saved every 3 hours. Fully operational weather forecast procedure is obtained in October 2014. Information after the post-processing procedure is available at the official web page of Department of Physics, Faculty of Sciences, University of Novi Sad. Information is available in the form of 3-hourly meteograms for 63 cites and meteorological maps in our domain of Balkan peninsula.

We performed two test cases with WRF model. The model verification was attained for the surface temperature BIAS compared with observed values for time period of the April 2015. We used the same model set-up for the reconstruction of the weather situation for the extreme precipitation event for the May 2014. Our particular interest was in forecasting the amount of precipitation.

## 2. Weather forecast

- The 96 hour forecast contains both WRF-NMM and WRF-ARW model core output for 63 larger cities in 5 different countries.
- The forecast can be viewed in the form of the weather charts over the region of Balkan. Weather charts show precipitation distribution, geopotential and wind field, relative humidity and air temperature.
- There is a semi-empirical UV index forecast for 29 cities.

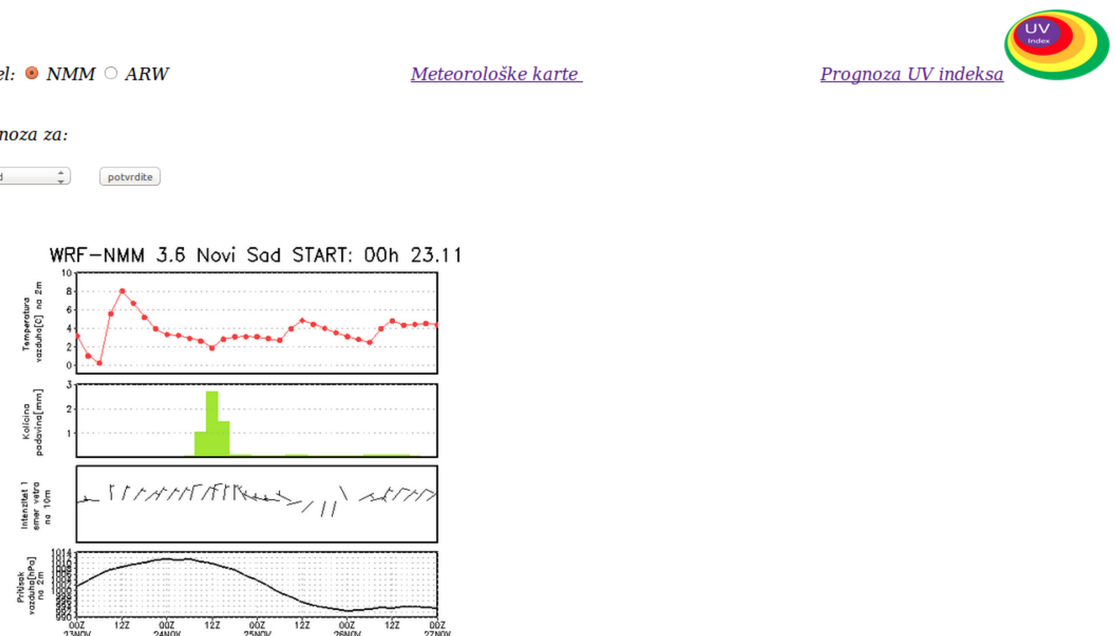
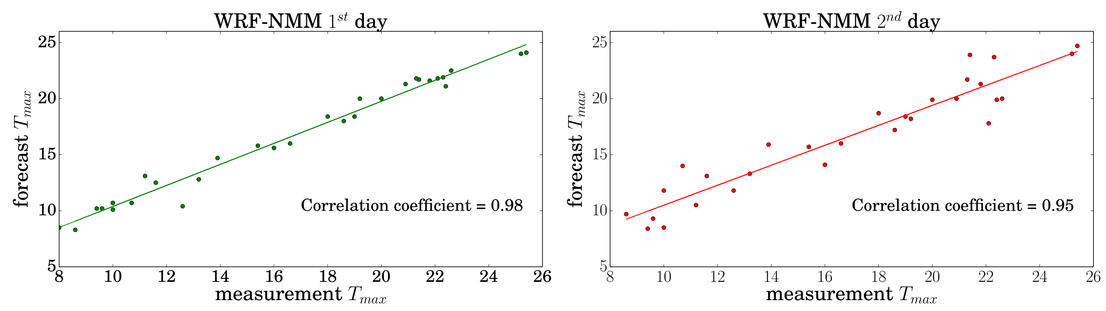



Fig. 1: Main page of the website for the weather forecast. At the top of the page, in the left corner, there is a possibility for a user to choose meteogram for a specific model and a city. At the top centre there is a link for weather charts and on the top right there is a link for 24 hour UV index forecast.

- Model domain information:
  - Domain center: 45.25°N and 19.85°E,
  - Horizontal grid dimension: $151 \times 151$ points (for both NMM and ARW model core),
  - Horizontal grid spacing: 0.096290° longitude and latitude for NMM, and 10 km in $x$ and $y$-direction in the ARW model.
- Weather forecast link: http://www.df.uns.ac.rs/dfprog/prognoza.php

## 3. Validation of weather forecast



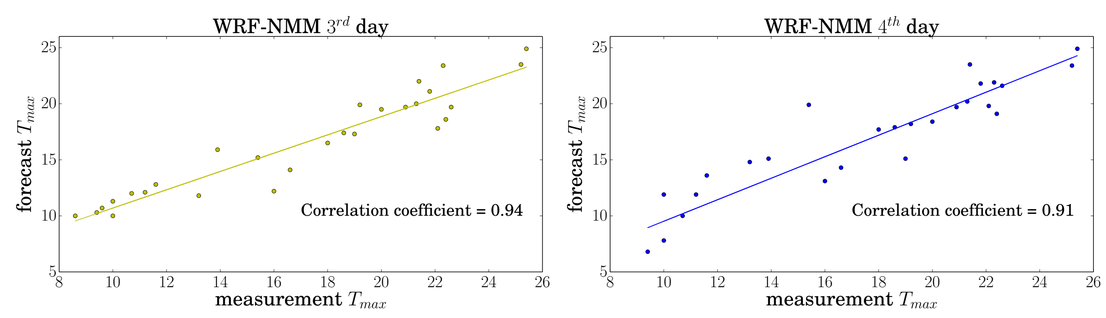




Fig. 2: Scatter plot validation for WRF-NMM model core for Novi Sad in April 2015.

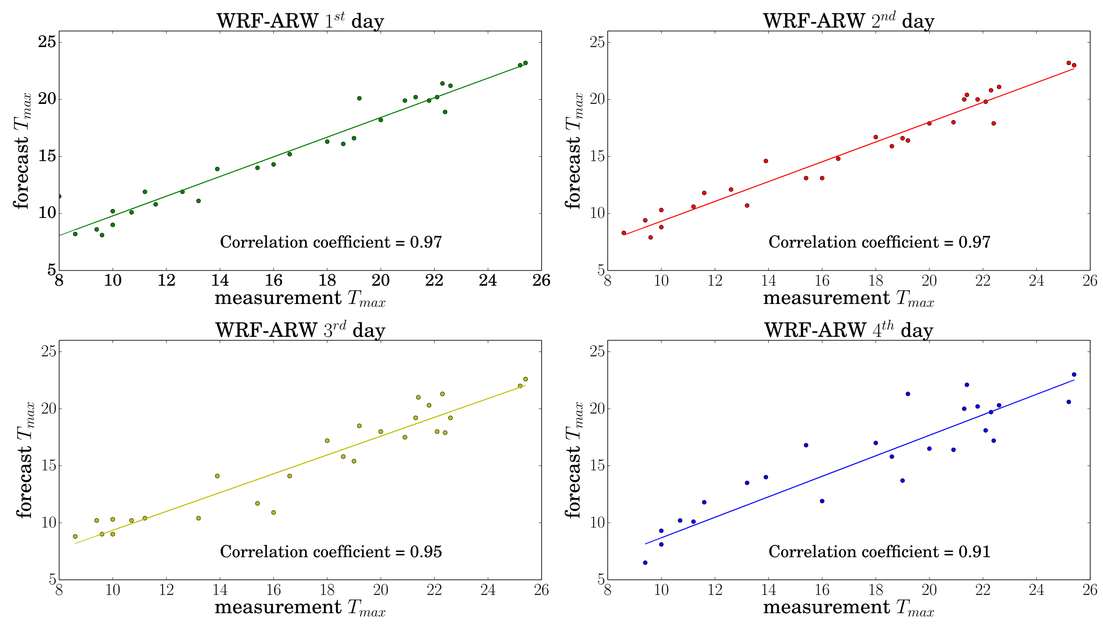



Fig. 3: Scatter plot validation for WRF-ARW model core for Novi Sad in April 2015.

| — — | NMM model core | ARW model core |
|---|---|---|
| 1st day | −0.20 % | −6.64 % |
| 2st day | −1.53 % | −9.42 % |
| 3st day | −3.50 % | −11.14 % |
| 4st day | −4.50 % | −11.84 % |

Tab. 1: BIAS for NMM and ARW model.

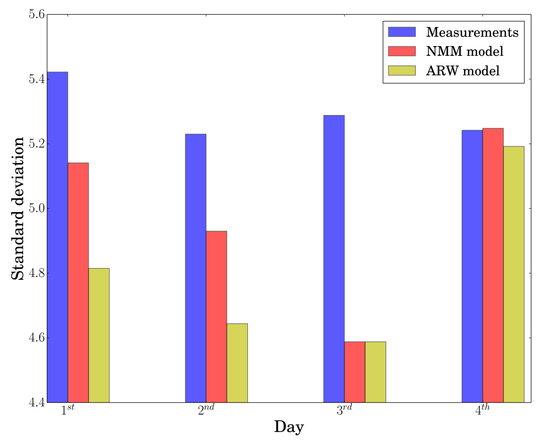



Fig. 4: Standard deviation for measurements and model output data.

## 4. Reconstruction of the atmosphere and estimate of amount of precipitation for May 2014

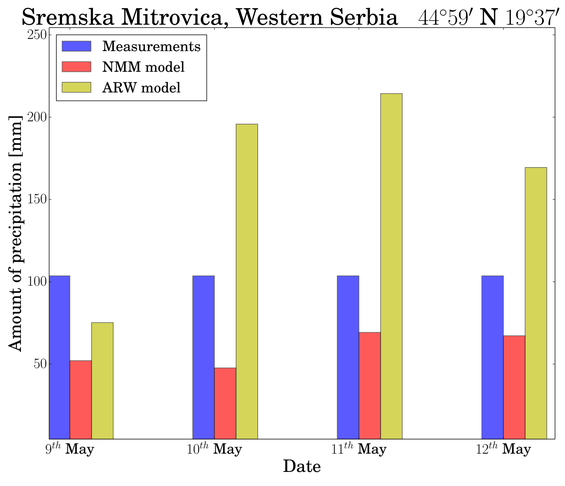



Fig. 5: Modeling the extreme amount of precipitation during the cyclone “Tamara” for Sremska Mitrovica.

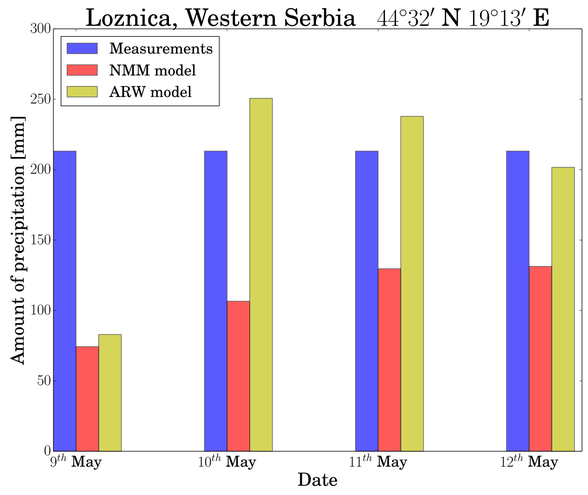



Fig. 6: Modeling the extreme amount of precipitation during the cyclone “Tamara” for Loznica.

## 5. Further research

- Verification of the amount of precipitation.
- Running WRF-CHEM.
- More student involvement in the project.