NWP at Meteorological and Hydrological Service of Croatia in spring 2018

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INTRODUCTION

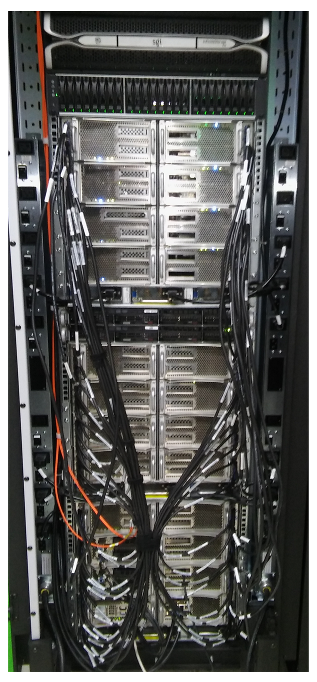
The operational model version used is AL38T1 with ALARO0 physics for 8, 4 and 2 km resolution forecasts. Operational forecasts run for:
- 8 km res, 360 sec, 4 times per day, 3D-Var and surface OI, 3h cycling, to 72 hours, LBCs: IFS, 37 levs.
- 4 km res, 180 sec, hydrostatic, 4 times per day, up to 72 hours, 3D-Var and surface OI, 3h cycling, LBCs: IFS, 73 levs.
- 2 km dynamical adaptation, 60 sec time-step, hourly, up to 72 hours,
- 2 km non-hydrostatic run, 60 sec time-step, using AL36T1 with available ALARO0 developments, from 06 UTC up to 24 hours.

Hardware upgrade

The mainframe computer was upgraded by 10 nodes (60 cores) reaching 48 nodes (288 cores).

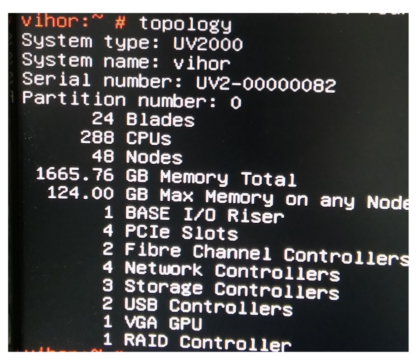
5 slots empty
Before

+5 drawers
2 nodes each
After



And + lot more new cables

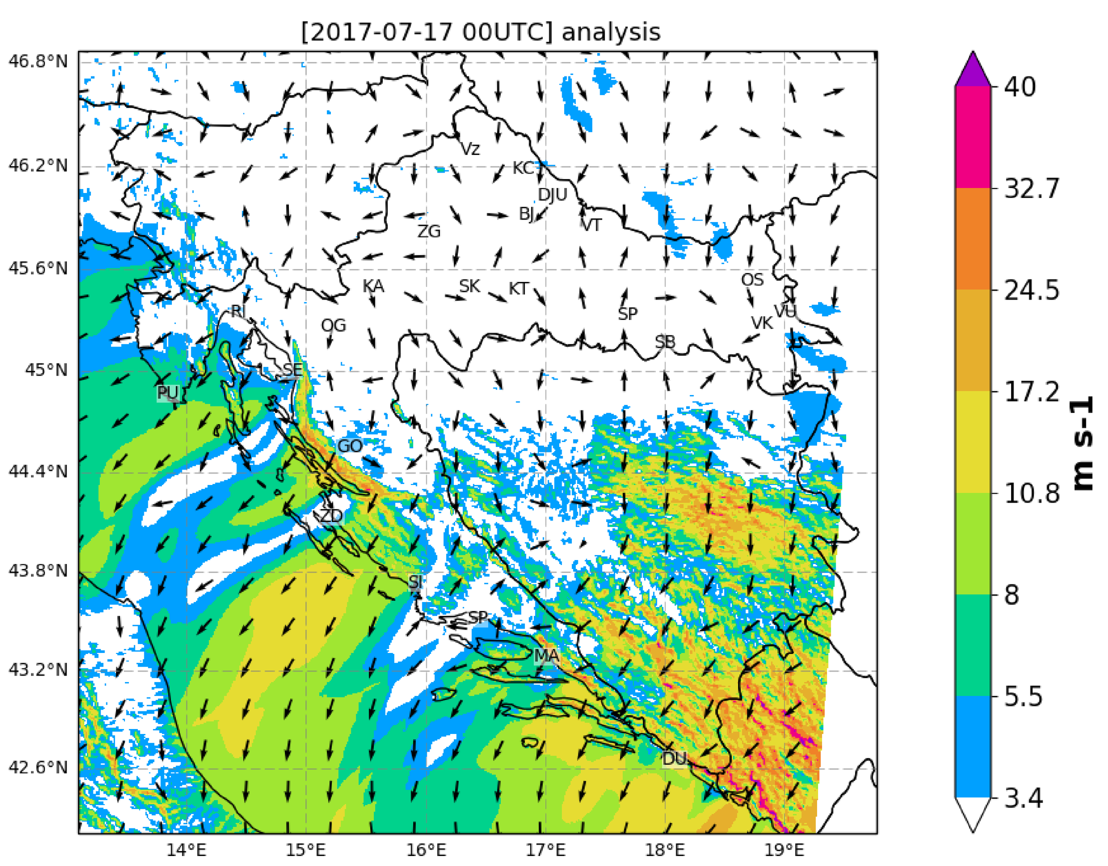
Final hardvare configuration


```
vihor:~ # topology
System type: UV2000
System name: vihor
Serial number: UV2-00000082
Partition number: 0
        24 Blades
       288 CPUs
        48 Nodes
   1665.76 GB Memory Total
    124.00 GB Max Memory on any Node
         1 BASE I/O Riser
         4 PCIe Slots
         2 Fibre Channel Controllers
         4 Network Controllers
         3 Storage Controllers
         2 USB Controllers
         1 VGA GPU
         1 RAID Controller
```

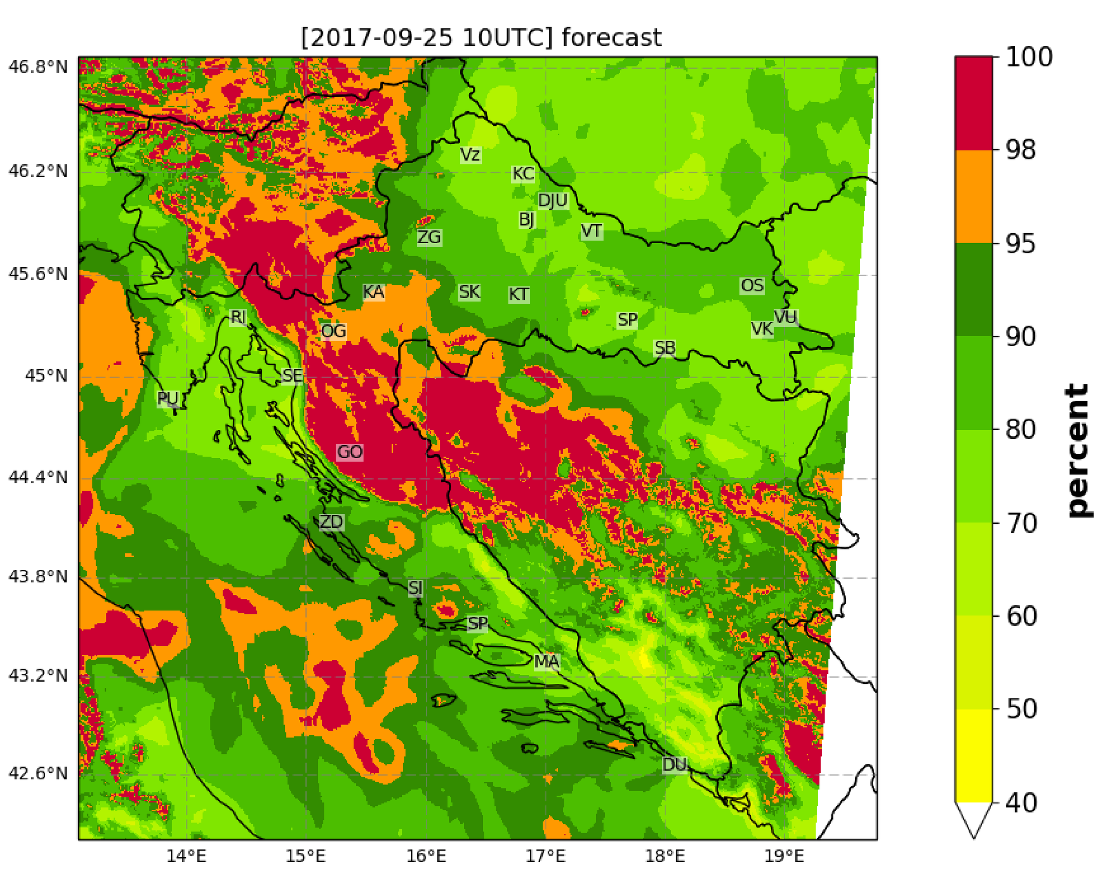
Nowcasting using INCA in Croatia

Results of nowcasting 10 m wind and 2 m relative humidity using INCA with ALADIN-HR4 forecast as first guess.

Wind speed



Relative humidity



Impact of SST on heavy rainfall events on eastern Adriatic during SOP1 of HyMeX

The season of late summer and autumn is favourable for intensive precipitation events (IPE) in the central Mediterranean. A study examines how precipitation patterns change in response to different SST forcing. We focus on the IPEs that occurred on the eastern Adriatic coast during the first HyMeX Special observing period (SOP1, 6 September to 5 November 2012). The operational forecast model ALADIN uses the same SST as the global meteorological model (ARPEGE from Meteo France), as well as the forecast lateral boundary conditions (LBCs). Results of the SST assessment show that SST in the eastern Adriatic was overestimated by up to 10 K during HyMeX SOP1 period. Then we examine the sensitivity of 8 km and 2 km resolution forecasts of IPEs to the changes in the SST during whole SOP1. Forecast runs in both resolutions are performed for the whole SOP1 using different SST fields prescribed at initial time and kept constant during the model forecast.

experiment	Description
OPER	operational SST from ARPEGE
TM5K	SST reduced by 5°C
TM2K	SST reduced by 2°C
TP2K	SST increased by 2°C
TP5K	SST increased by 5°C
TM10	SST reduced by 10°C
OSTIA	SST taken from OSTIA
ROMS	SST from ROMS over Adriatic and OSTIA elsewhere
MUR	SST taken from MUR
MEAS	SST from OSTIA nudged towards measurements

List of experiments for 8 km and 2 km resolution.

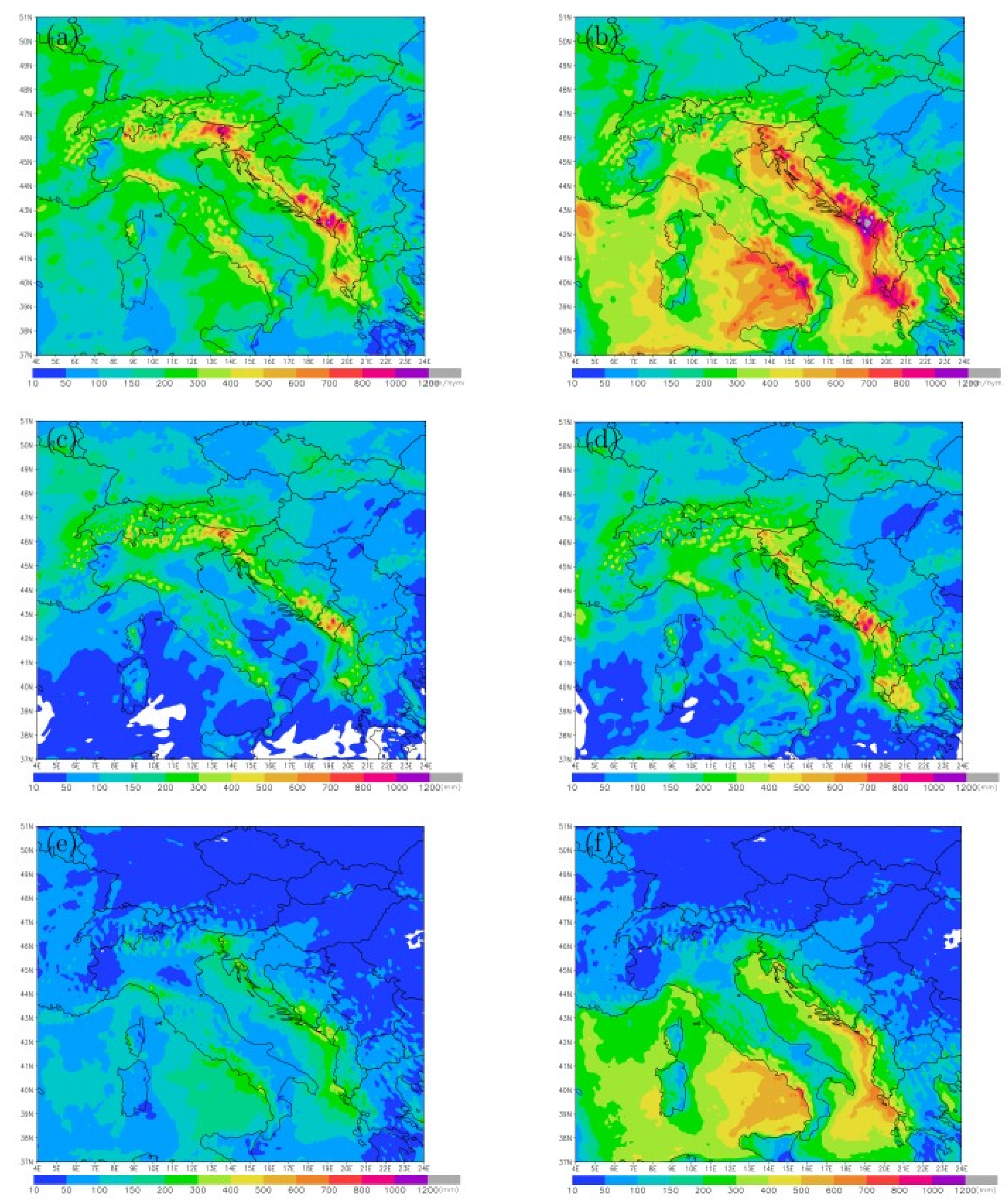


Figure 7: Precipitation (mm) accumulated during 61 days of SOP1 from 8 km resolution forecasts initiated at 00 UTC and accumulated from 06 to 30 hours of forecast: total (a,b), resolved (c,d) and convective (e,f) from operational forecast (a,c,e) and experiment TP5K (b,d,f).

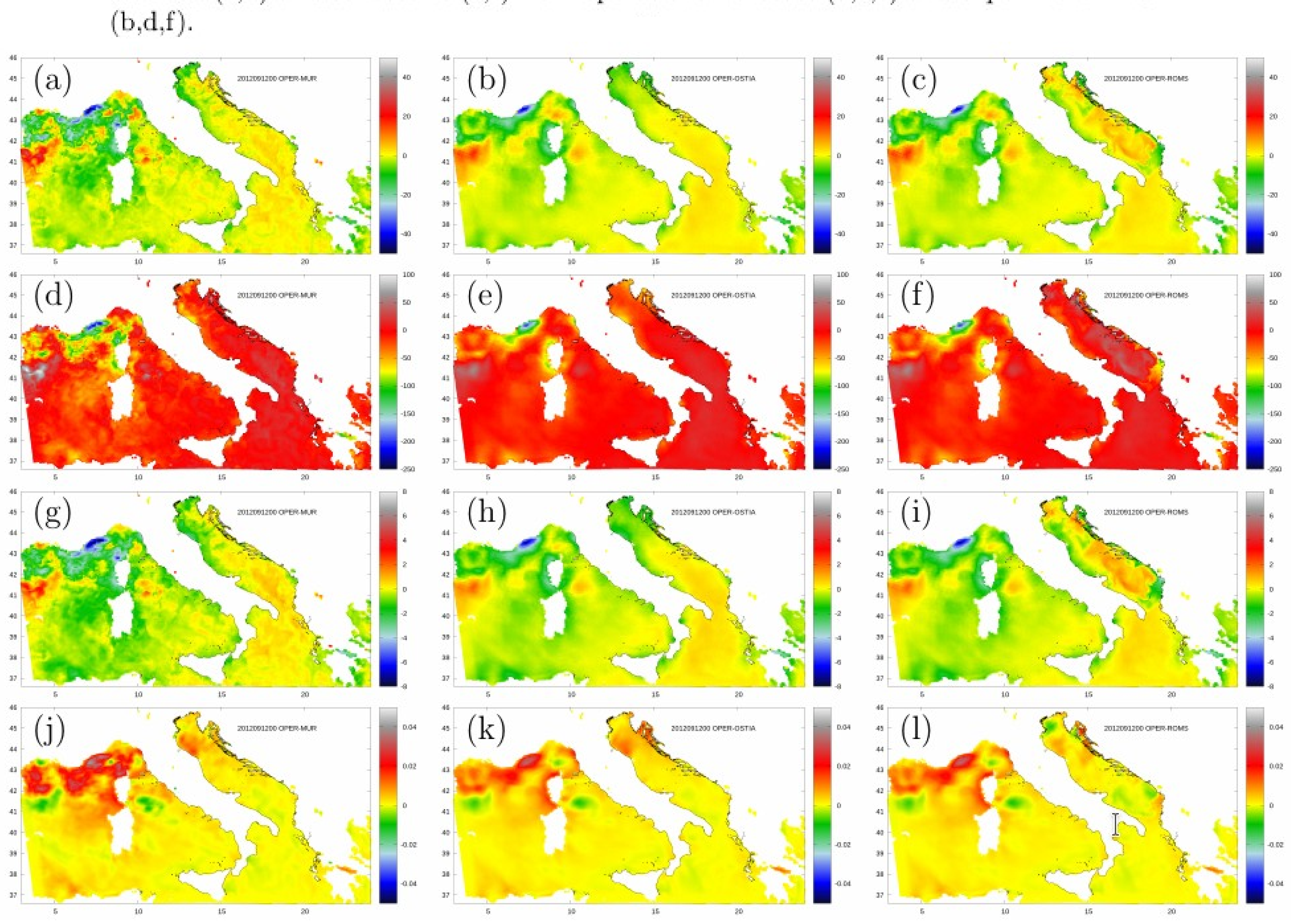
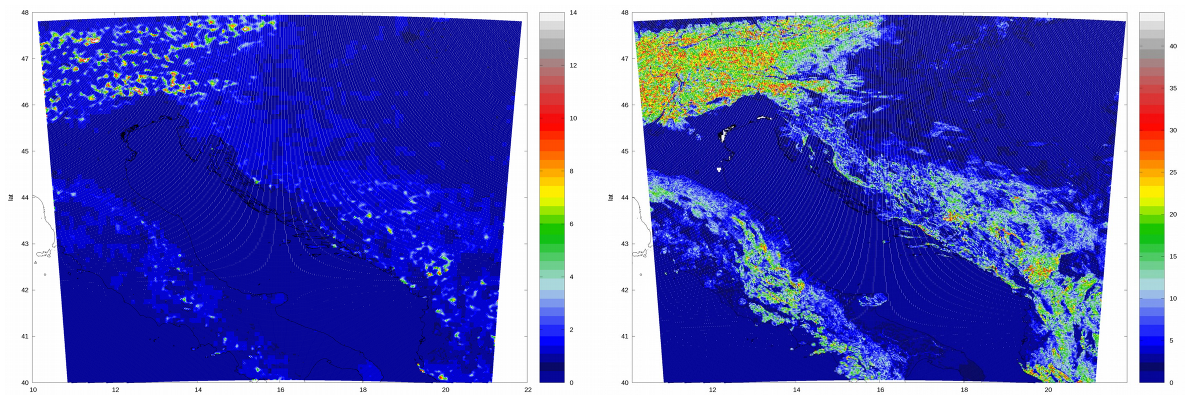


Figure 13: Differences of the accumulated 24 hourly fluxes for 12 September 2012 from 8 km resolution forecasts: sensible (a,b,c) and latent heat flux (d,e,f) in J/m2/day, evaporation flux (g,h,i) in mm/day and turbulent momentum flux (j,k,l) in kg m/s/day, experiments OPER-MUR (a,d,g,j), OPER-OSTIA (b,e,h,k) and OPER-ROMS(c,f,i,l).

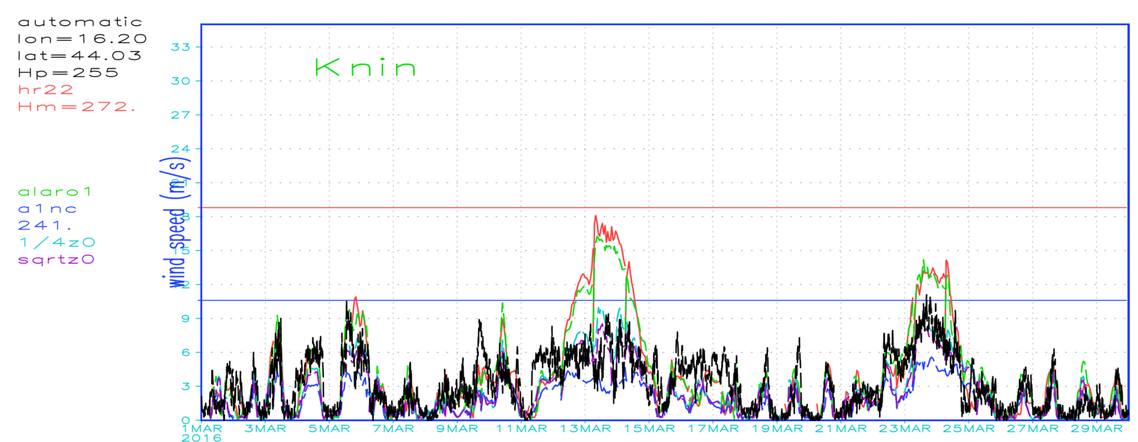
Infulence of surface roughness on downslope windstorms and mountain waves

Here we analyse the effect of surface friction in the framework of the ALADIN System, particularly the version used for operational forecast at 2 km horizontal grid spacing with ALARO physics package and non-hydrostatic dynamics. The problem is analysed using the real terrain and real meteorological conditions. Surface friction is controlled via the surface roughness field. In order to assess the relative importance of the surface friction to the turbulence scheme, experiments with two different turbulence schemes were performed: I) a pTKE scheme and II) more advanced TOUCANS, which includes additional prognostic equation for total turbulence energy, as well as the anisotropy effects among other.

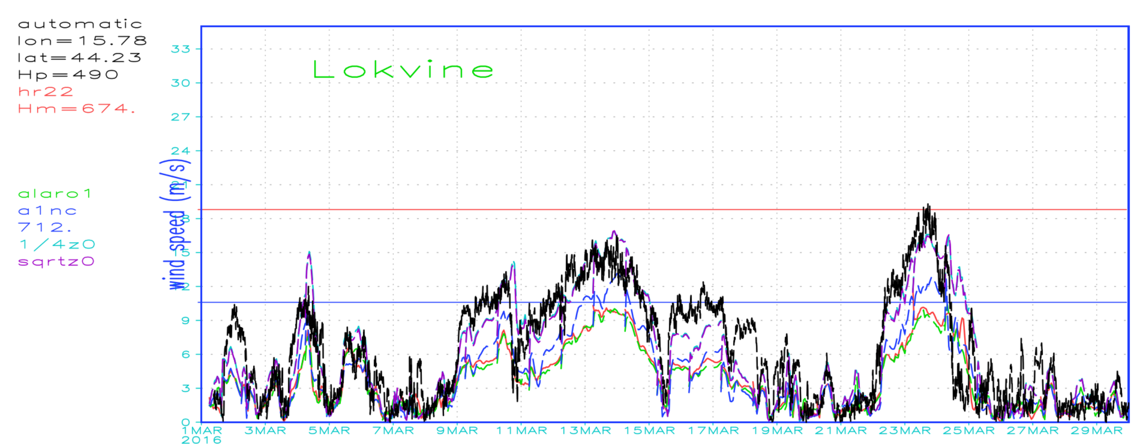


The surface roughness used in the model: old (left) and new (right).

The impact of modified roughness length was tested by running 31 consecutive forecasts at 2 km horizontal grid spacing (Tudor and Ivatek-Šahdan, 2010) starting from 00 UTC 1st of March 2016. The forecast using low roughness length (from the old database) occasionally produced excessive wind speed for location Knin in a valley downstream of a mountain during bura episodes. Simultaneously, wind speed was underpredicted for another location (Lokvine) which is in the lee of a mountain about 50 km westward from Knin. The experiments have shown that this windstorm develops due to too smooth mountains (which is unrealistic). The introduction of roughness length from the new database made the terrain rougher in general. When using this more realistic and larger surface roughness field, the windstorm did not develop over Knin, but it did over Lokvine, which better corresponds to the measurements .



Measured (black(and forecast 10m wind in Knin for March 2016: using old z0 and pTKE (red), old z0 and TOUCANS (green), new z0 and TOUCANS (blue), 0.25 new z0 (light blue) and sqrt(new z0) (violet).



Surface roughness is recomputed using new terrain database. The field used in the operational forecast computed from a low resolution database had small values making Dinaric Alps very smooth. It impacts the wind field forecast as well as the small scale dynamics features that develop over mountains and in valleys between. More realistic surface roughness allowed for model dynamics to develop local features at appropriate place and time and produce more accurate 10-m wind forecast. The effect is the same for the old TKE scheme and if the new TOUCANS turbulence scheme (Bašták Ďurán et. al. 2014).

- Bašták Ďurán, I., J. Geleyn, and F. Váňa, 2014.: doi:10.1175/JAS-D-13-0203.1
- Tudor, M., Ivatek-Šahdan, S., 2010. Meteorol. Z., 19 (5) 453–466.