

# NWP in Croatian Meteorological and Hydrological Service



## Current status of the operational suite

### Computer

SGI Altix LSB-3700 BX2 Server with 24 Intel Itanium2 1.6GHz/6MB  
48 GB standard system memory, 2x146 GB/10Krpm SCSI disk drive  
OS SUSE Linux Enterprise Server 9 for IPF with SGI Package  
Intel Fortran & C++ compilers version 9.0.031  
Queueing system (PBS Pro)

### LBC files and lines

global model ARPEGE, coupling frequency 3 hrs  
Internet and RMDCN through ecgate as backup from July 2006

### Products on Internet

[http://prognoza.hr/karte\\_e.php?id=aladin&param=&it=](http://prognoza.hr/karte_e.php?id=aladin&param=&it=)  
[http://www.dhmz.htnet.hr/prognoza/karte\\_e.php?id=aladin&param=&it=](http://www.dhmz.htnet.hr/prognoza/karte_e.php?id=aladin&param=&it=)

## Domains, model set-ups and forecast range

**main:** 8 km horizontal resolution, 37 levels in the vertical, 229x205 (240x216) grid points, Corners: SW (36.18,3.90), NE (50.68,26.90) AL32T3 – ALARO0-3MT version 72 hrs forecast range with 1 or 3 hrs time resolution, Digital Filter Initialisation.

### Only one domain for high resolution dynamical adaptation:

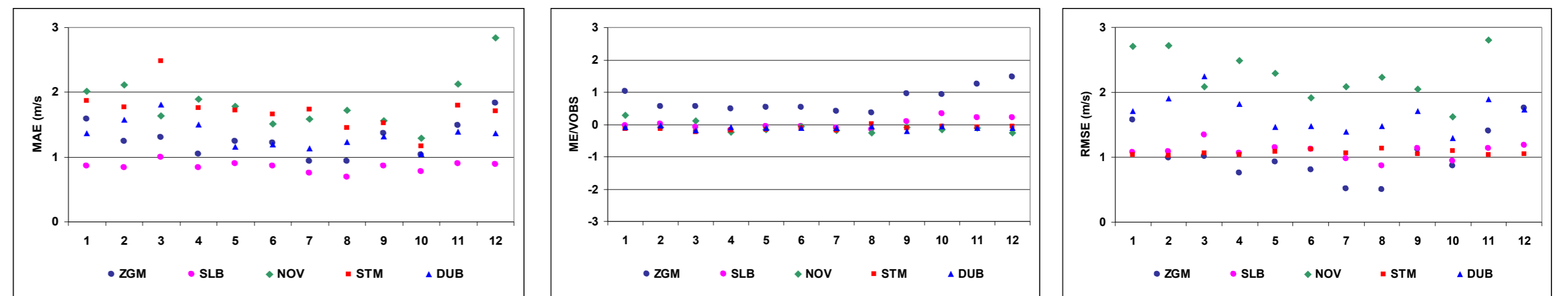
- 2 km horizontal resolution,
- 15 levels in the vertical,
- 439x439 (450x450) grid points.



## Research activities

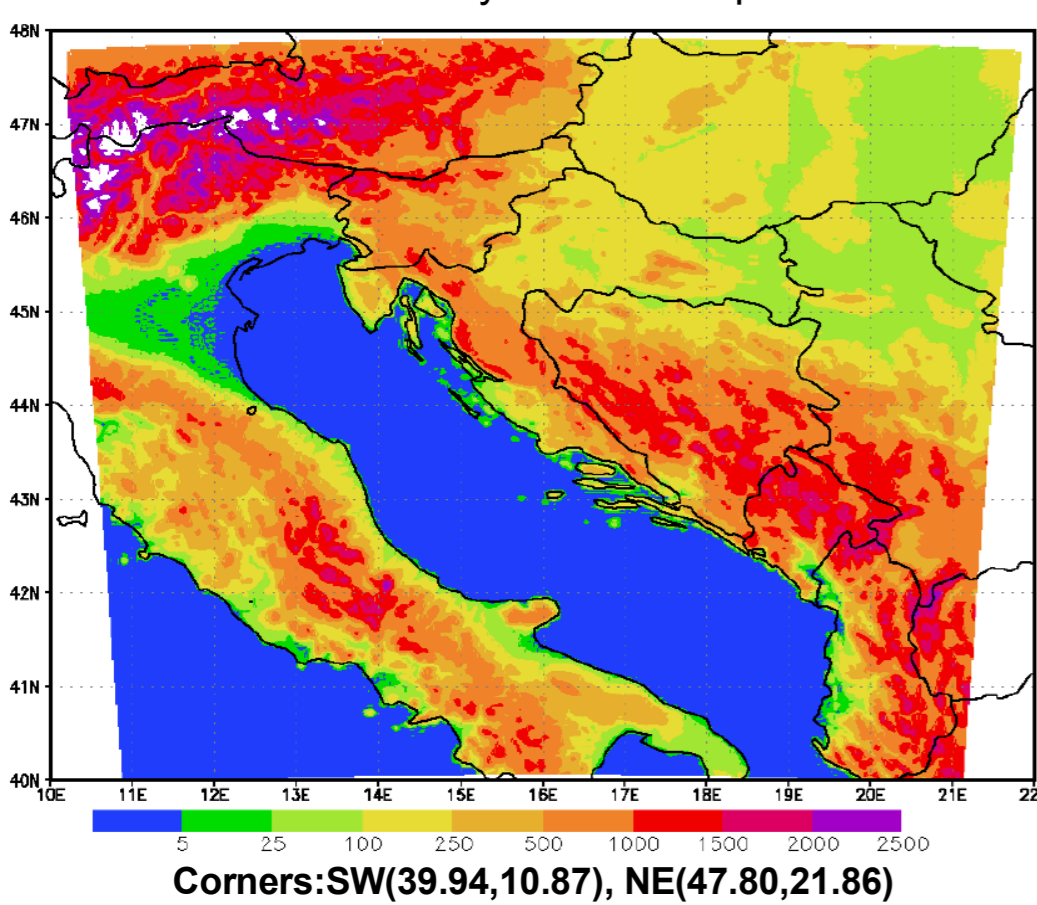
### Downscaling of the 10 year period of ERA40

In order to estimate wind energy potential in Croatia, the mesoscale numerical weather prediction model ALADIN has been applied for downscaling ERA40 data onto a 8 km grid covering operational ALADIN/HR forecast domain in the 10-year period 1992-2001. Additionally, the output fields have been dynamically adapted to a 2 km resolution. The results has been verified against the measured wind in one year period (2001) at five locations that represent different climatic regions (Zagreb M. - western inland, Sl. Brod – eastern inland, Novalja – middle Adriatic island, Split M. – middle Adriatic coast, Dubrovnik – southern Adriatic coast). The best results we have obtained for the stations without the very local influences that restricted their representativeness to a radius of few hundred meters (Sl. Brod and Split Marjan). If we take the 1 m/s as representativeness error of the near surface wind speed in a well-mixed boundary layer compared to model simulation in a complex terrain, the preliminary results of conventional verification statistics indicate that the downscaling has been successful.

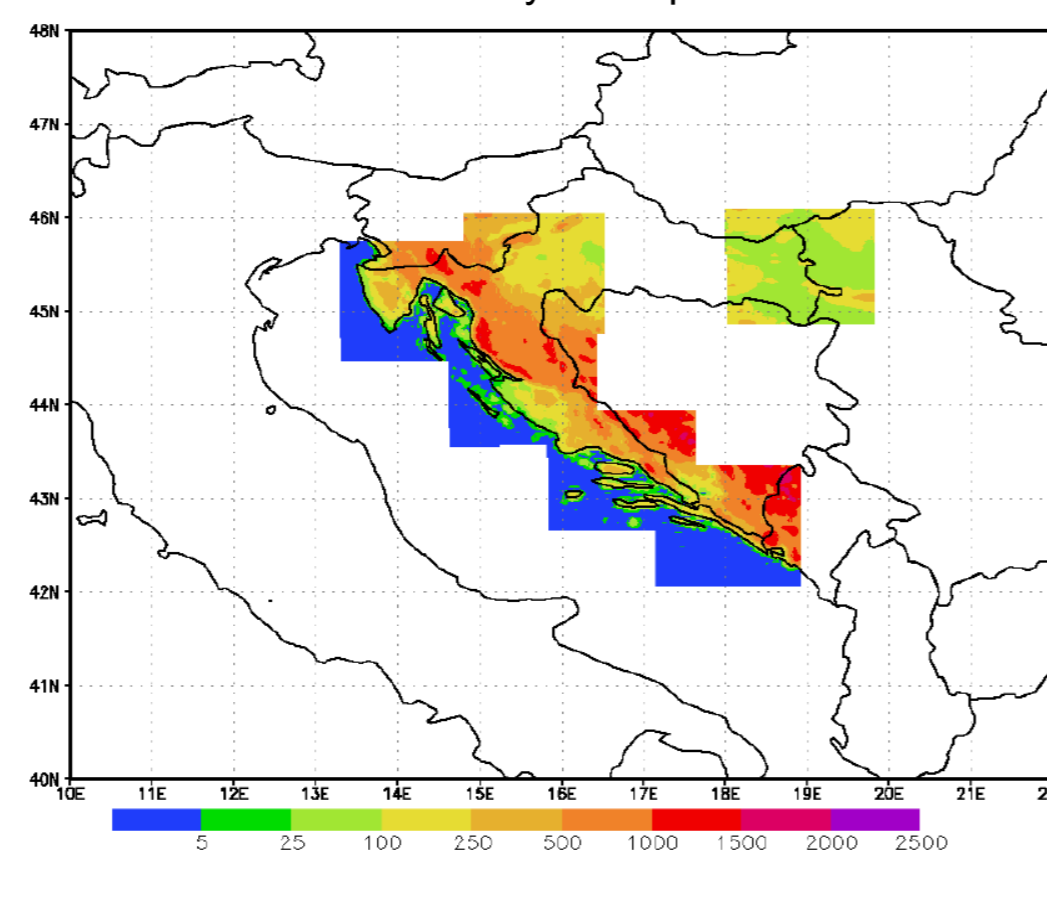


Monthly mean absolute error (MAE), root mean square error (RMSE), mean error/observed wind speed (ME/VOBS) at 5 stations during 2001.

### 2 km domain for Dynamical Adaptation



### old domains for Dyn. Adaptation

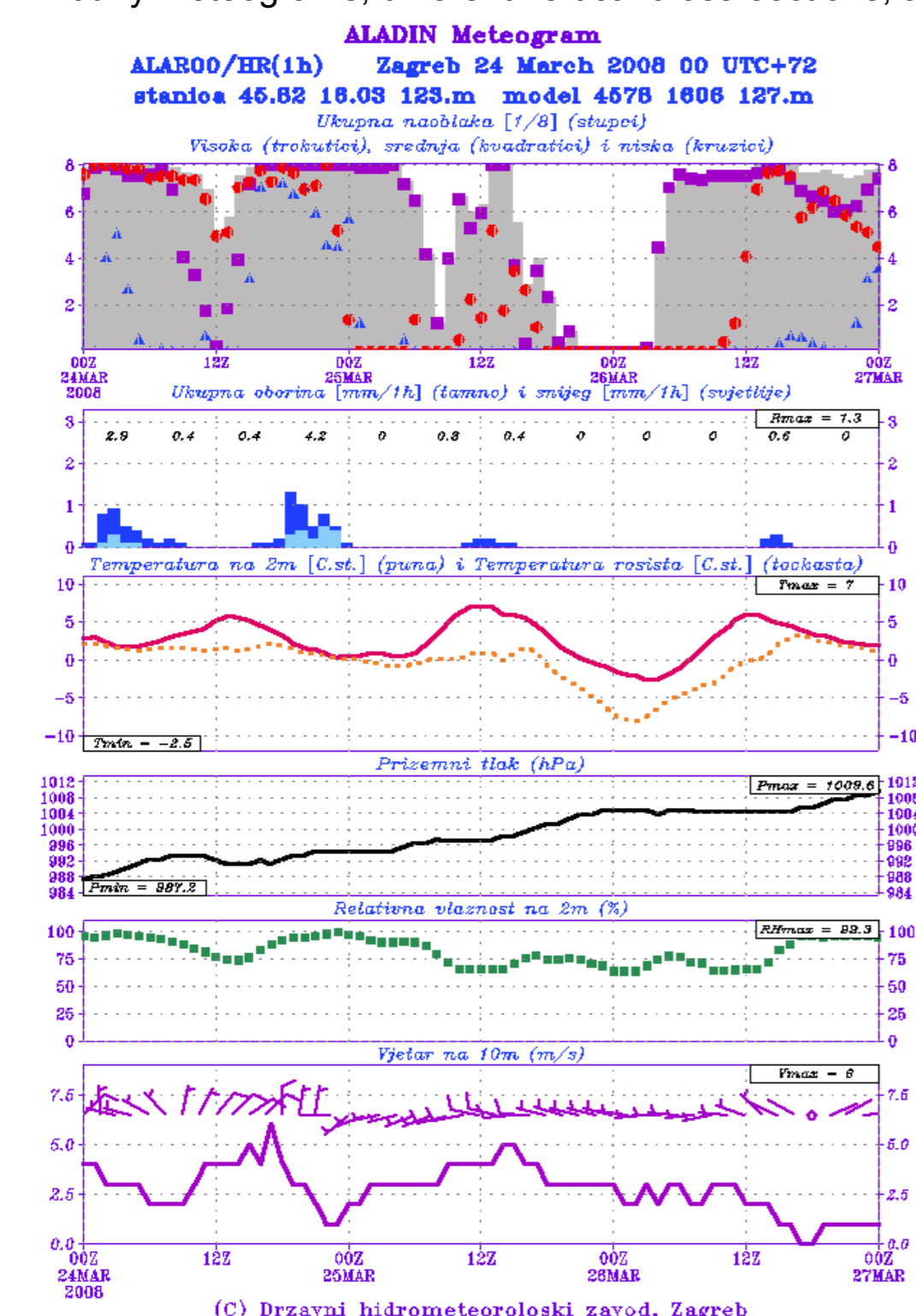


## Major changes in operational suite from the last WS

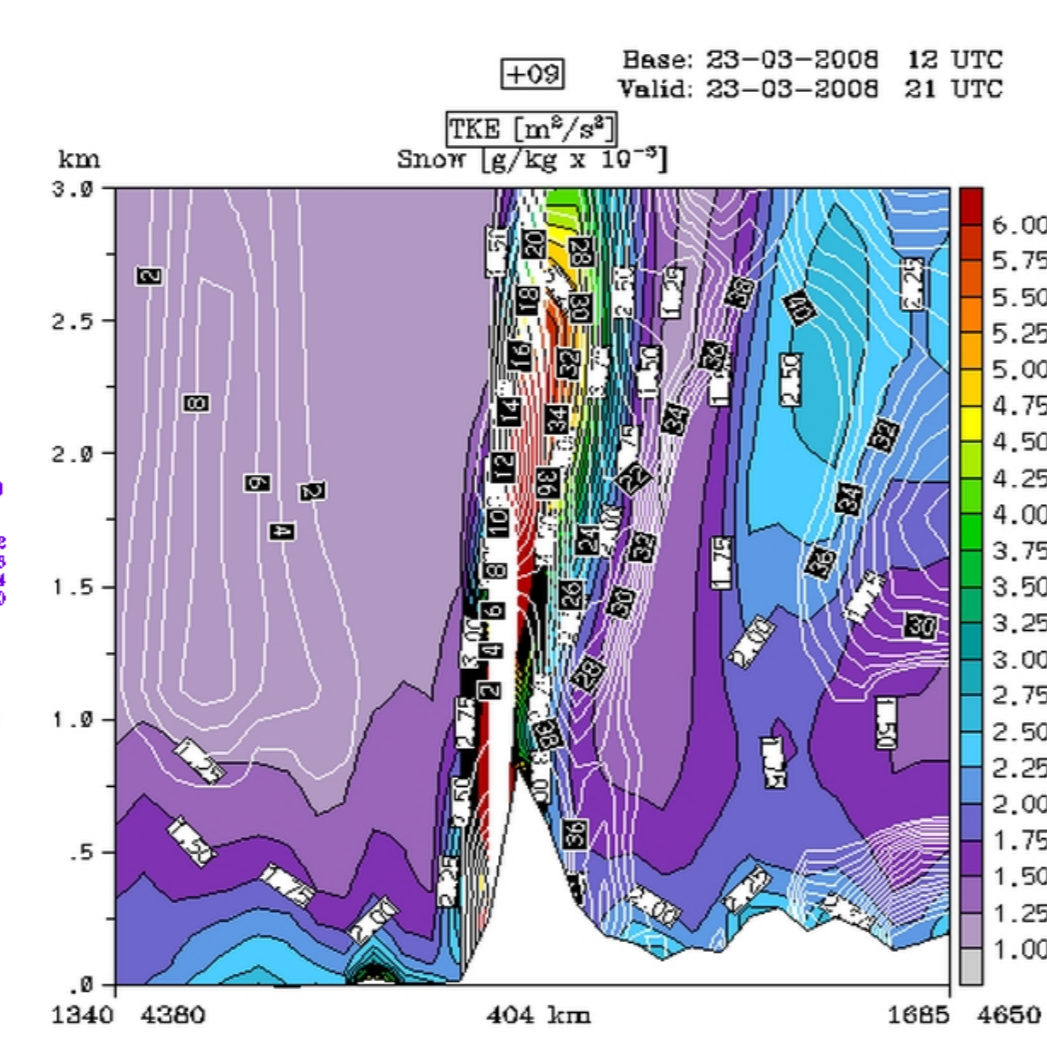
- Reduction of the operational suite to one model version Alaro0-3MT, after more than one year of parallel suite (Dec 2006-Feb 2008),
- Change of the operational version from AL29T2mx1 to AL32T3 at the end of February 2008,
- Introduction of the huge 2 km domain for 10 m wind dynamical adaptation (problems with lateral boundary conditions disappear and it is much easier to control the operational suite),
- Replacement of the old visualisation machines with new Linux machine, number of the operational machines for visualisation of the operational products and operational verification results reduced from 6 to just 1.

## New operational products

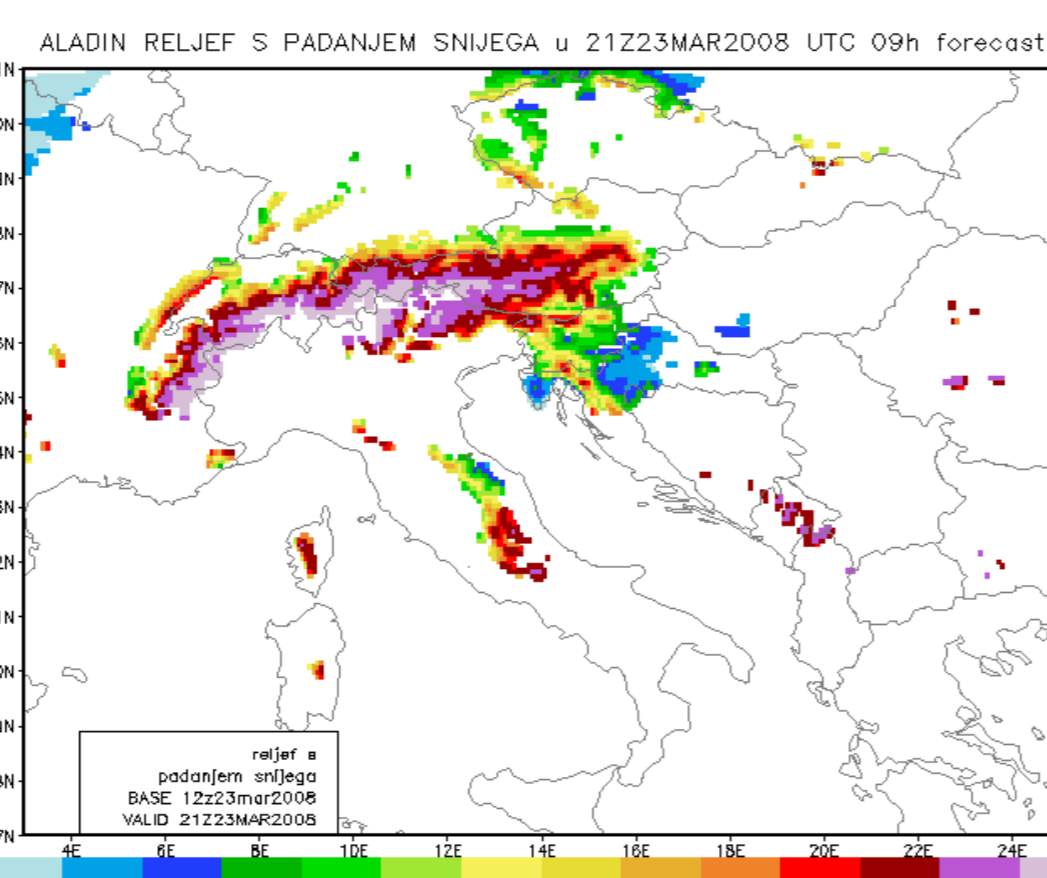
- Hourly meteograms, different vertical cross-sections, area with snow fall



Left- new hourly meteograms: total, high, medium and low cloudiness (1/8); precipitation (blue) and snow (light blue) (mm/hr) and precipitation for 3 hrs (numbers); 2m temperature and dewpoint temperature (deg C); mslp (hPa); relative humidity (%); 10m wind (m/s).

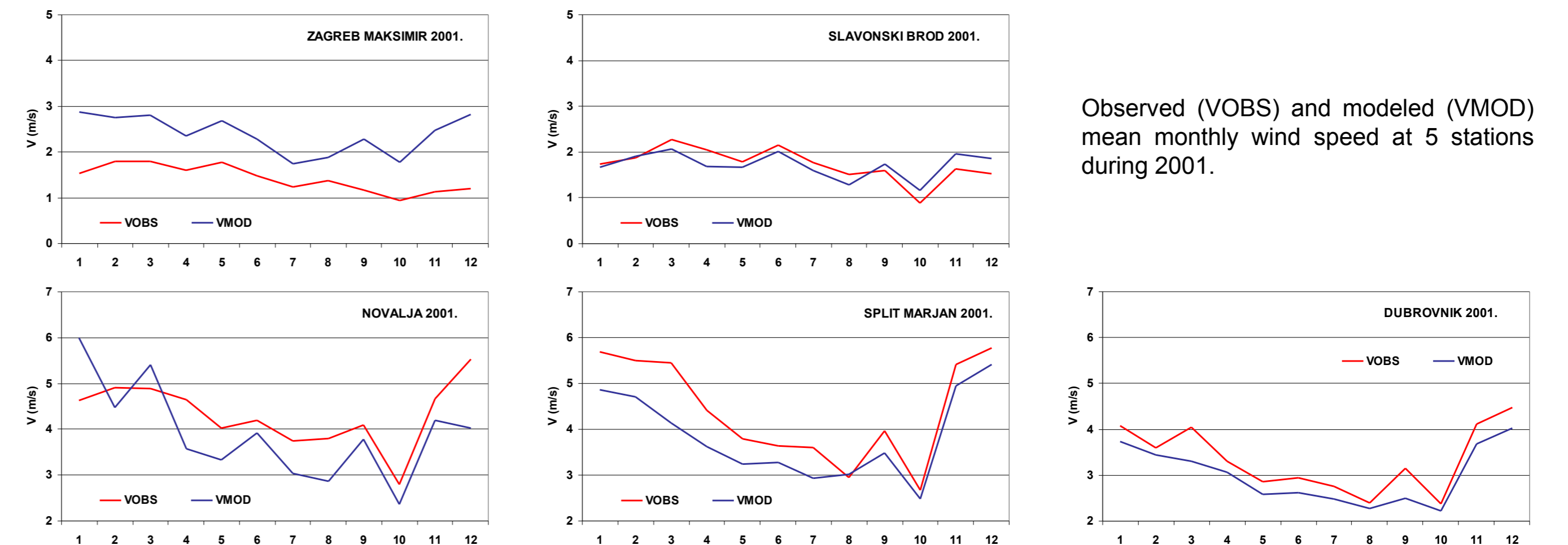


Above- vertical cross section for TKE and snow.

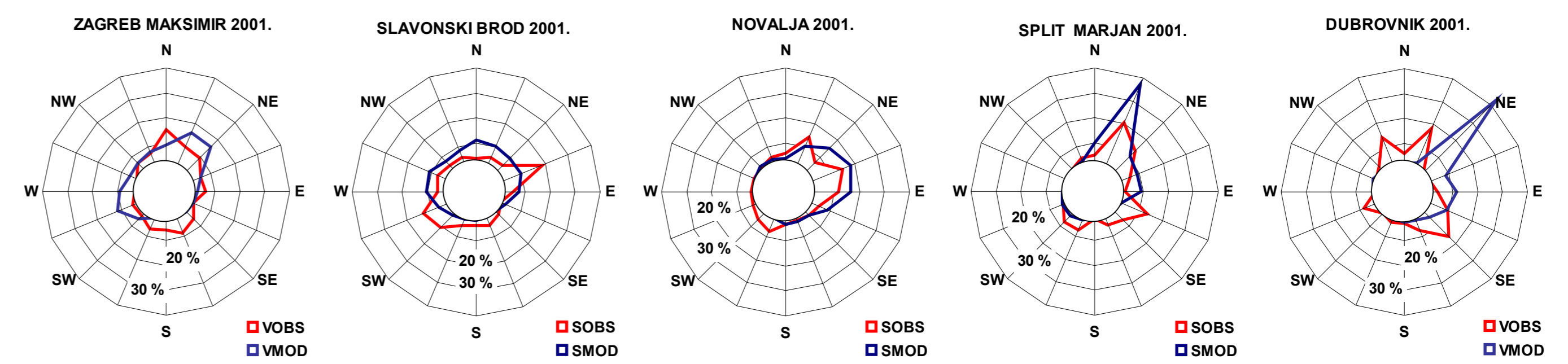


Right- new visualisation of snow fall, if snow is forecasted during the last 3 hours, then model orography is shown.

**18th ALADIN Workshop and HIRLAM All Staff Meetings**  
7th - 10th April 2008, Bruxelles, Belgium  
Alica Bajić, Kristian Horvath, Stjepan Ivatek-Sahdan, Lovro Kalin, Tomislav Kovačić, Antonio Stanešić & Martina Tudor  
Meteorological and Hydrological Service, Grič 3, HR-10000 Zagreb, Croatia

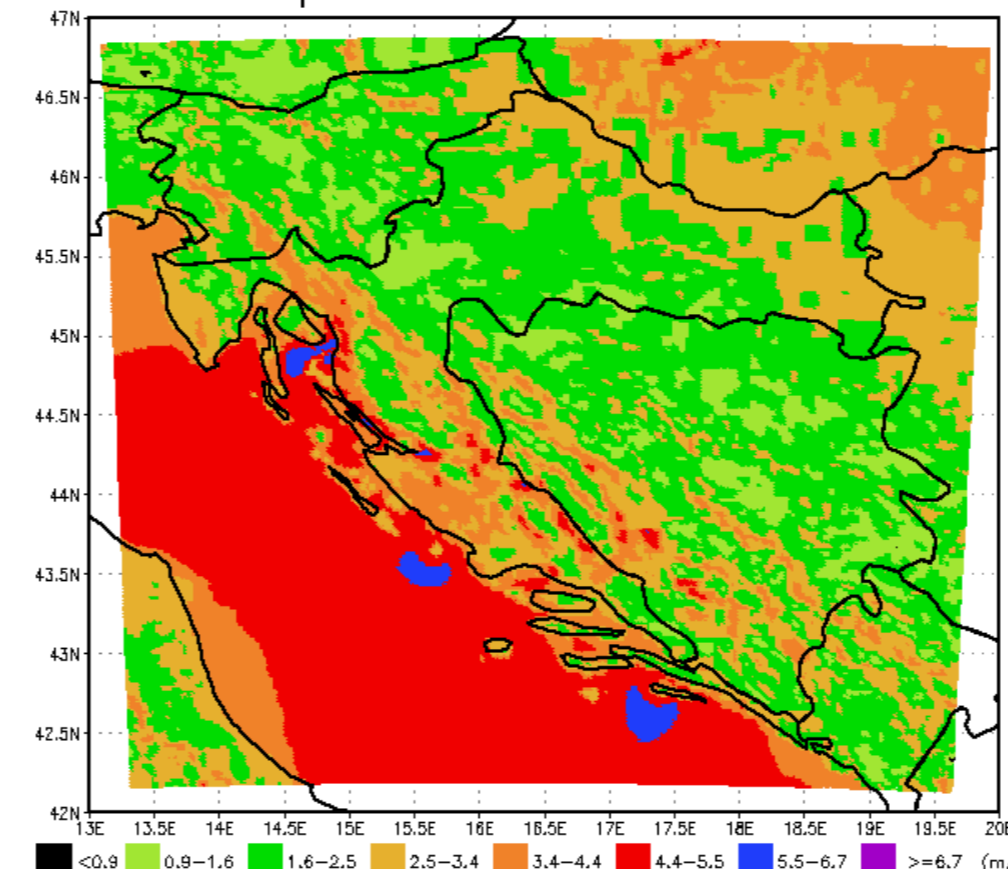


Observed (VOBS) and modeled (VMOD) mean monthly wind speed at 5 stations during 2001.



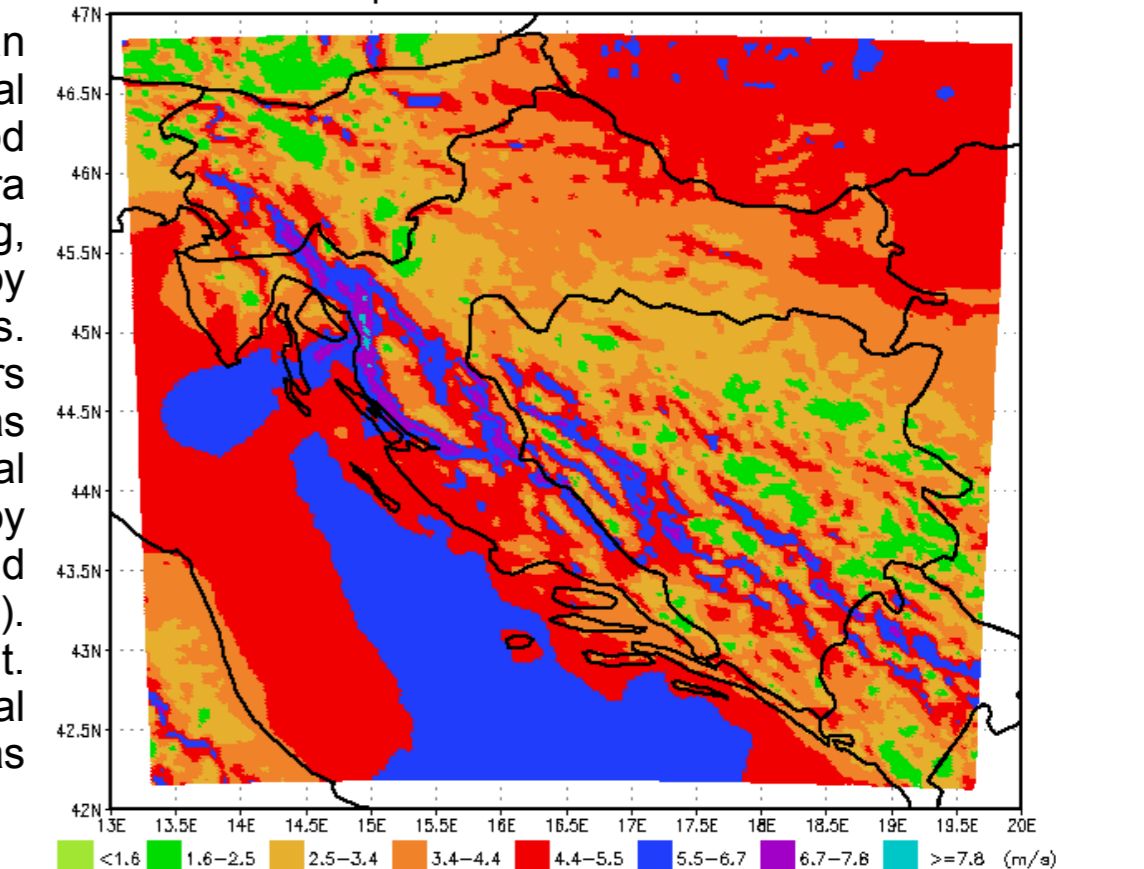
Observed (VOBS) and modeled (VMOD) wind roses at 5 stations during 2001.

### Mean wind speed ERA40 at 2 km DADA 1997-2001



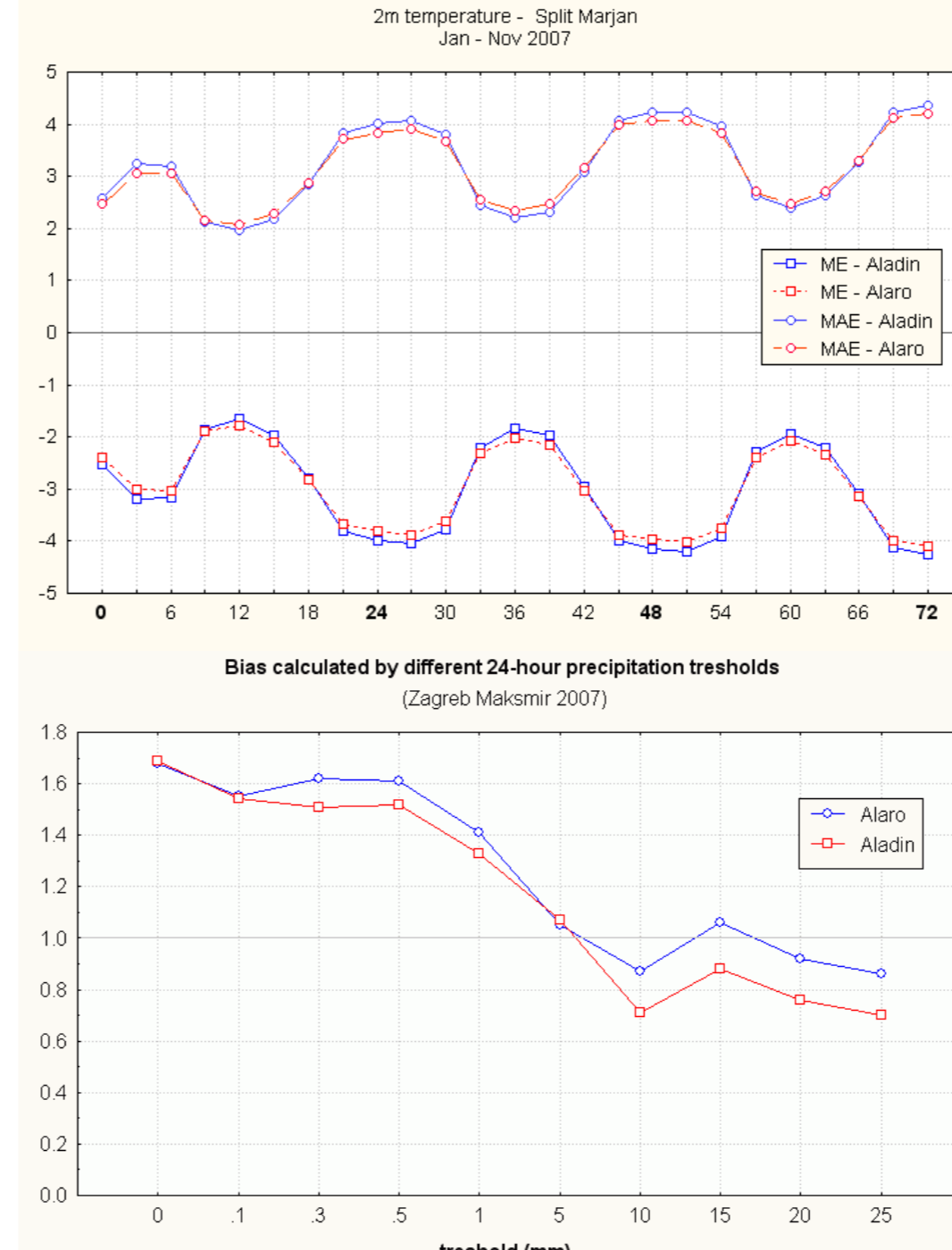
Left: "wind climatology" mean 10m wind at 2 km horizontal resolution for 5 year period (1997-2001). Well known Bura positions (Senj, Karlobag, Maslenica) are captured by downscaled ERA-40 reanalysis. Some new position appears above open sea probably as combination of Bura (in general NE wind locally modified by orography) and Jugo (SW wind canalised by Dinaric Alps). Right: same for 80m height. Areas with high wind potential are in mountainous areas mostly near the coast.

### 80m mean wind speed ERA40 DADA at 2 km 1997-2001



## ALADIN-ALARO0-3MT comparison

During more than one year of the parallel ALARO0-3MT suite it was concluded that in general there is no significant difference between these two model configurations. Some verification results for 2m temperature for Split Marjan on the sea side (top) and precipitation for Zagreb Maksimir inland (bottom) are shown. Big diurnal cycle is visible in 2m temperature scores for both versions. Verification scores for precipitation higher than 1mm/24hrs in Zagreb are slightly better for ALARO0-3MT.



## DDH-some examples

Work on DDH for AROME was continued during two stays in Meteo-France, together with colleagues from Meteo-France, and at home. DDH code was debugged and verified. Documentation was prepared together with colleagues from Meteo-France, too. During one stay in Prague at CHMI, DDH for ALARO0 was done.

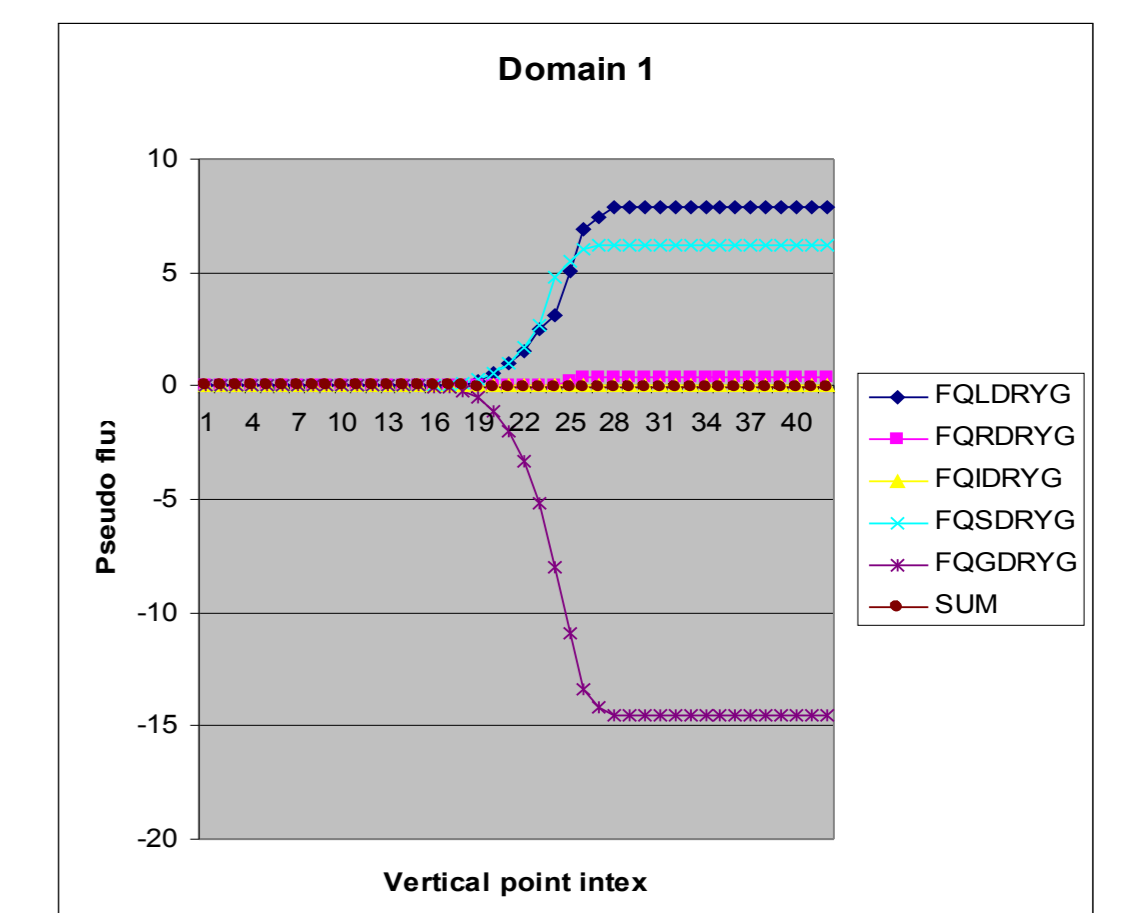


Figure above: Verification of DDH in AROME: Pseudo-fluxes dry growth of graupel.