South-East European Consortium for Operational weather Prediction (SEECOP)

S. Nickovic
Republic Hydrometeorological Service of Serbia (RHMSS), Belgrade, Serbia

37th EWGLAM and 22th SRNWP Meeting, 5-8 October 2015, Belgrade, Serbia

- **SEECOP Consortium**
  - 2006:
    - RHMSS initiated establishment of South East European Virtual Climate Change Center (SEEVCCC);
    - supported by UNECE and met services in the region;
  - 2010:
    - SEEVCCC formally established, hosted by RHMSS
    - Expert Workshop "SEE Research Framework in Regional Climate Modeling", 2011, Belgrade

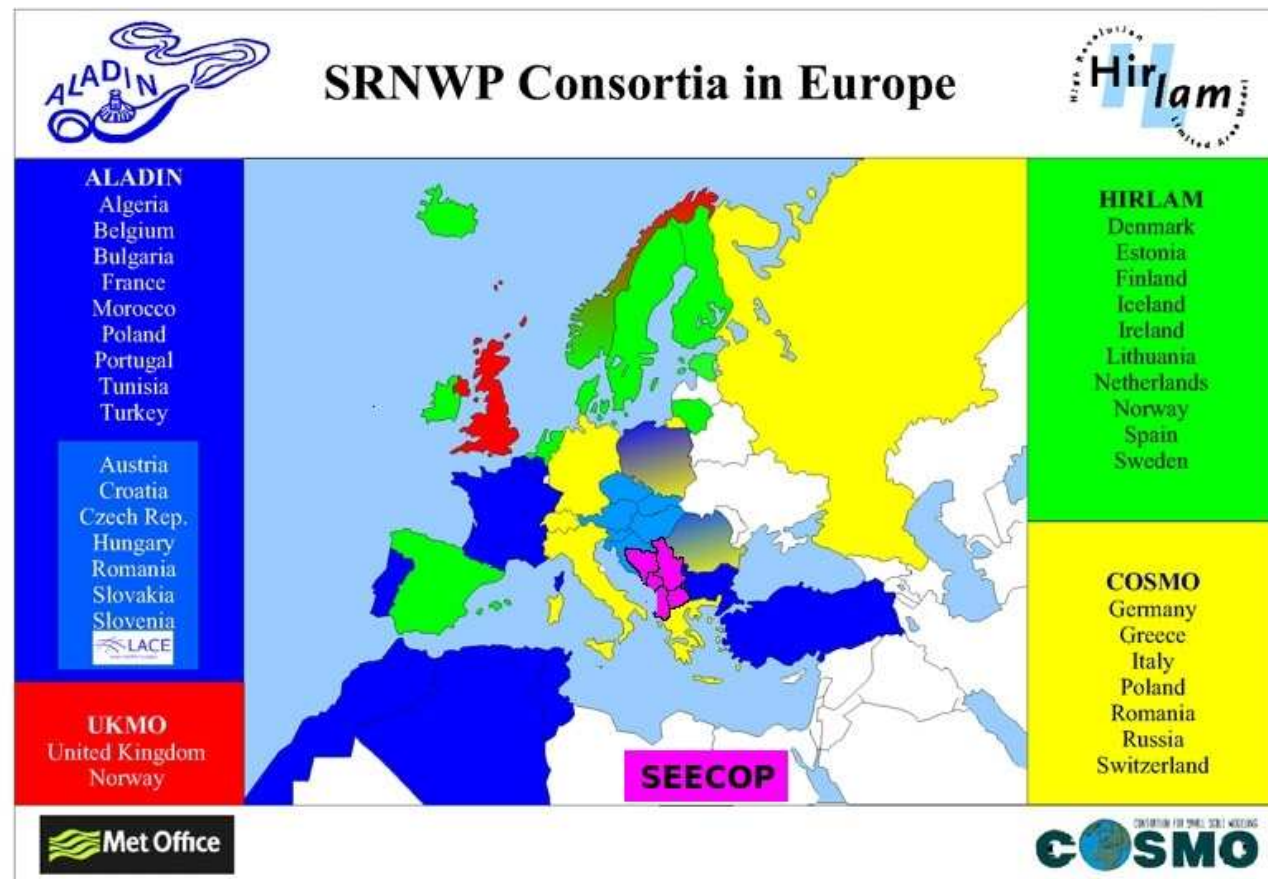- **SEECOP Agreementbasic features**

  Recognises
  - importance of cooperation in NWP in South East Europe
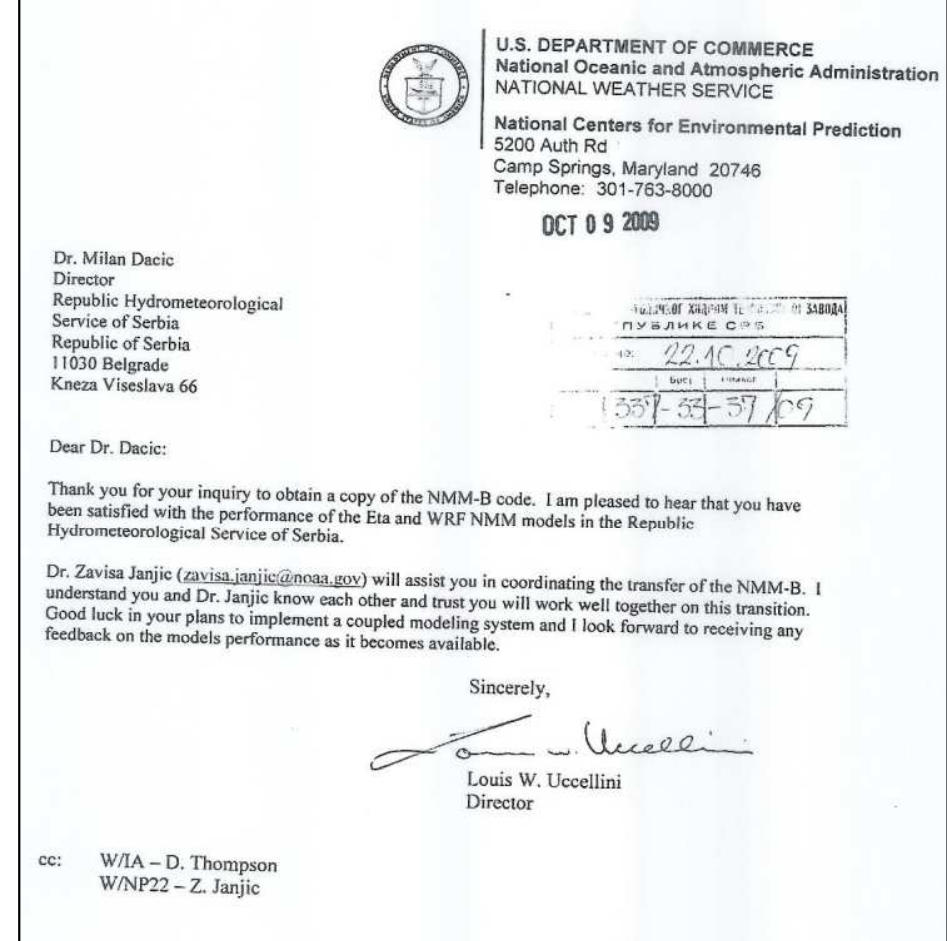 - need to facilitate research and development of NWP models for region

  – Objectives
  - Using NMMB, to
    – improve accuracy of NWP and warning services related to severe weather phenomena
    – to further improve environmental forecasts in general, including hydrological, oceanographic, aerosol forecasts, etc driven by NMMB
    – to perform research and development focussed on operational forecasts
    – to share available expertise, data, modelling and technical resources between Members;
    – to reduce overlapping in NWP between Members
    – to organize trainings for different areas related to NWP
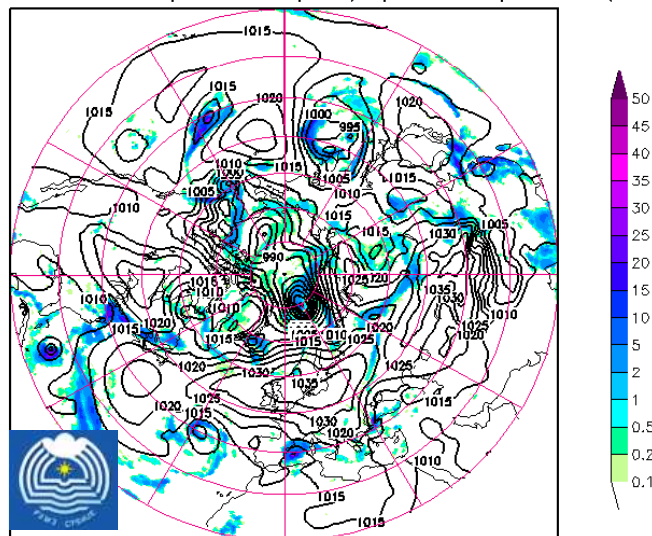   – to enhance in general the operability in NWP in the region.

- 2012:
  - MoU - Technical Annex to SEEVCCC on establishing SEECOP consortium for South East Europe
  - 5 European countries (also members of WMO); 6 met services
    - the Republic of Albania, the Federation of Bosnia and Herzegovina (represented by both entities: Bosnia and Herzegovina, and the Republic of Srpska), the former Yugoslav Republic of Macedonia, Montenegro, and the Republic of Serbia
- 2015, March :
  - first SEECOP meeting

SRNWP Consortia in Europe

ALADIN
Algeria
Belgium
Bulgaria
France
Morocco
Poland
Portugal
Tunisia
Turkey

Austria
Croatia
Czech Rep.
Hungary
Romania
Slovakia
Slovenia
LACE

UKMO
United Kingdom
Norway

Met Office

HIRLAM
Denmark
Estonia
Finland
Iceland
Ireland
Lithuania
Netherlands
Norway
Spain
Sweden

COSMO
Germany
Greece
Italy
Poland
Romania
Russia
Switzerland

SEECOP

COSMO

- **The SEECOP model: NCEP/NMMB**
  - Its distant causins: models in 70ties and 80ties of the Belgrade NWP group
  - NMMB developed by Zavisa Janjic
  - Agreement between NCEP and RHMSS on collaboration – NMMB implementation and developments
  - Operational regional model at NCEP
  - Global and regional NMMB NWP at RHMSS from Jan 2011
 - **Most of SEECOP members already use or test NMMB**

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE

National Centers for Environmental Prediction
5200 Auth Rd
Camp Springs, Maryland 20746
Telephone: 301-763-8000

OCT 0 9 2009

Dr. Milan Dacic
Director
Republic Hydrometeorological
Service of Serbia
Republic of Serbia
11030 Belgrade
Kneza Viseslava 66

Dear Dr. Dacic:

Thank you for your inquiry to obtain a copy of the NMM-B code. I am pleased to hear that you have been satisfied with the performance of the Eta and WRF NMM models in the Republic Hydrometeorological Service of Serbia.

Dr. Zavisa Janjic (zavisa.janjic@noaa.gov) will assist you in coordinating the transfer of the NMM-B. I understand you and Dr. Janjic know each other and trust you will work well together on this transition. Good luck in your plans to implement a coupled modeling system and I look forward to receiving any feedback on the models performance as it becomes available.

Sincerely,

Louis W. Uccellini
Director

cc: W/IA – D. Thompson
     W/NP22 – Z. Janjic

NMMB globalni – 3h padavine (mm), prizemni pritisak (hPa)

Start: 00Z30SEP2015   Valid: 06Z30SEP2015

SINGLE DOMAIN 10-M WIND CONUS4 01H
FCST VALID 16Z 29 JUN 2012
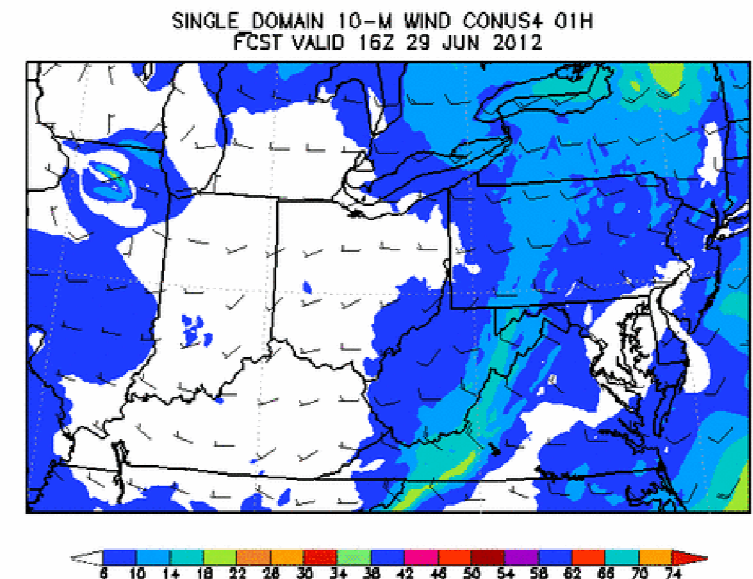
- **NMMB basic features**
  - Defined on B horizontal grid
  - Switching options in a single model code
    - Global/regional
    - Hydrostatic/nonhydrostatic
  - Conservation of important properties
  - Pressure-sigma hybrid
  - Lorenz vertical grid
  - Physics
    - RRTM, GFDL radiation
    - NOAH, LISS land surface model
    - Mellor-Yamada-Janjic turbulence
    - GFS Gravity Wave Drag
    - Ferrier, Zhao microphysics
    - Betts-Miller-Janjic, SAS convection

  - Very efficient execution
    - Global *nonhydrostatic*, full physics
      - Resolution 2305 x 1623 x 64, ~ 12 km
      - 8 x more work than 1149 x 811 x 64, ~ 24 km
      - 3600 processors, 7.6 wall clock min/day
      - 7.2 times more processors for 8 times bigger job in less time
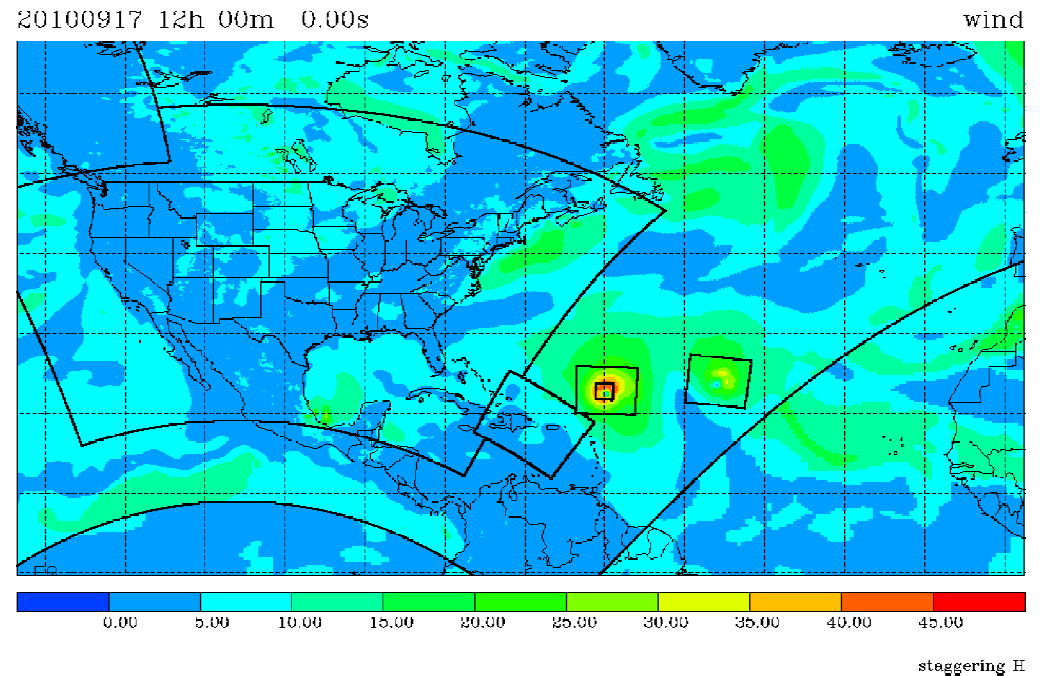
- **SEECOP Earth Model System (EMS) concept**
  - First atttempts in 2002 to build EMS
  - NMM as driver of other systems
  - Feedback mechanisms between Earth systems: atmosphere, aerosol, hydrology, etc

18th International Conference on Carpathian Meteorology, 7-11 October 2002, Belgrade, Yugoslavia

**Towards integrated treatment of the Earth environment:
Current and future modelling developments at ICoD**

*Slobodan Nickovic,
Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD),
Foundation for International Studies, Malta*

Components of the Earth system are interacting through different feedback mechanisms. Interconnections between different natural environments must be properly represented in mathematical environmental models in order to increase today's quality of atmospheric, marine, land and air-quality forecasting. Taking into account that components of the Earth system are strongly interrelated and inseparable, ICoD is designing an integrated environmental modelling system in which its different environmental models will be appropriately linked. These developments are and will be performed through a number of international cooperation arrangements.

The core of the system is an atmospheric model, which drives the other environmental models. The following concept in designing the system will be followed: a) the model driving will be done on-

SEECOP Earth Model System components:
DREAM - Dust Regional Atmospheric Model
(Nickovic et al, 2001; Pejanovic et al, 2010; Vukovic et al, 2013)
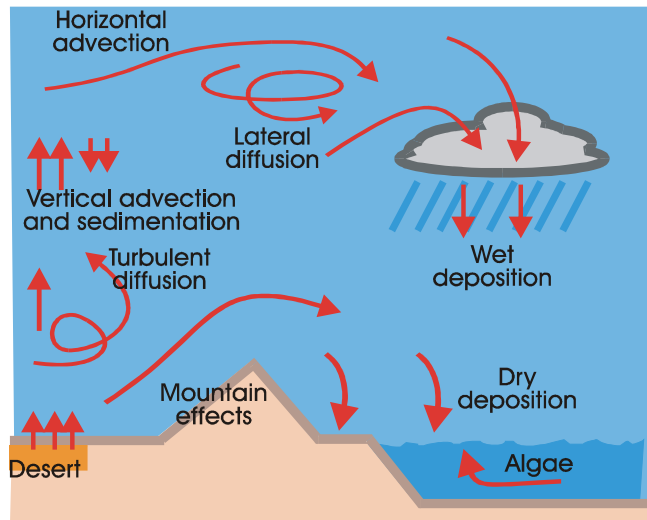
- Operationl dust forecasts
- Dust data assimilation
- Predicting processes affecting the atmosphere
  - Direct effects: dust-radiation
  - Indirect effects:dust-cold cloud interactions
  - Aerosol-marine interactions

2m Temperature difference (k) RAD-CTR 12 April 2002 UTC
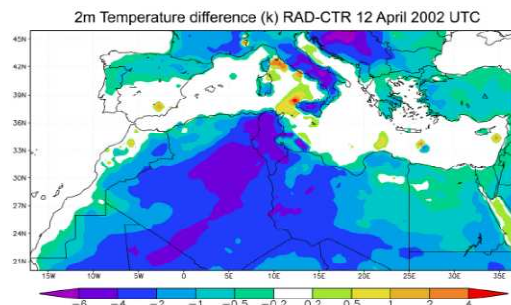
Figure 10. Vertical cross-sections between latitudes 30°N and 40°N along longitude 12°E of (a) the extinction coefficient at 550 nm from RAD and (b) the atmospheric temperature difference between RAD and CTR on the 12 April 2002 at 1200 UTC. (c) Horizontal distribution of 2m temperature difference over the whole domain.
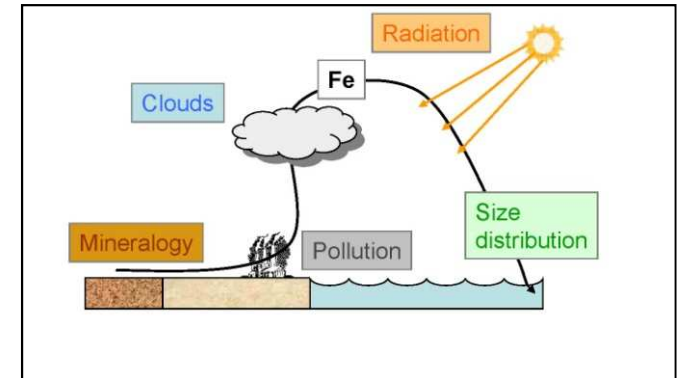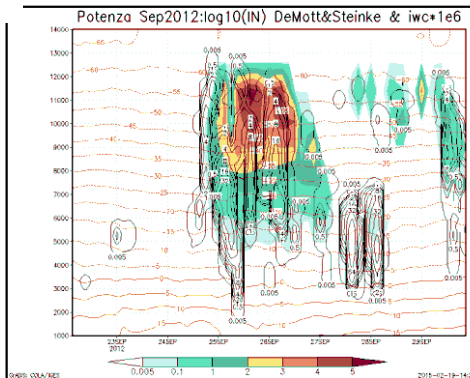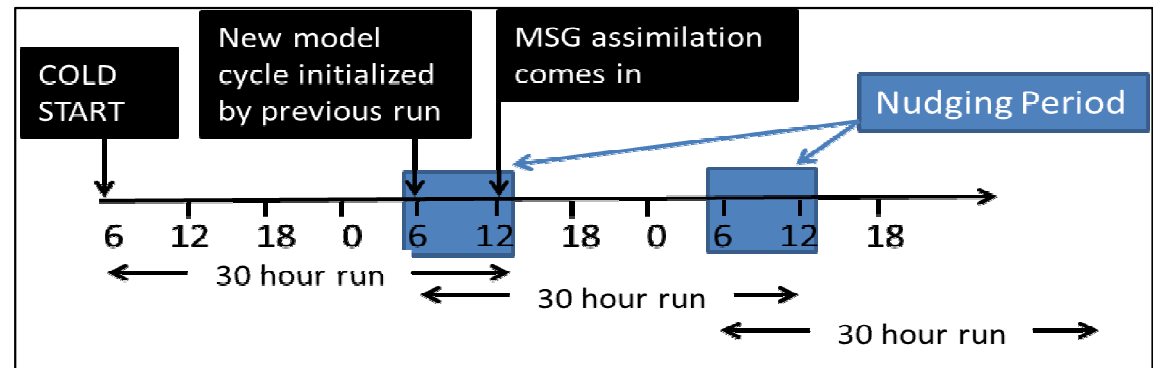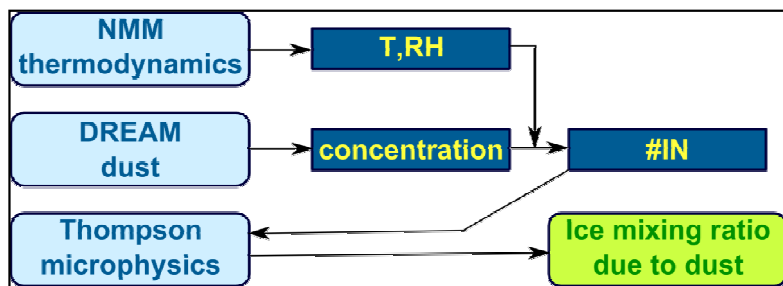
SEECOP Earth Model System components:
HYPROM- Hydrology Prognostic Model
(Nickovic et al, 2012; Vujadinovic, 2015)
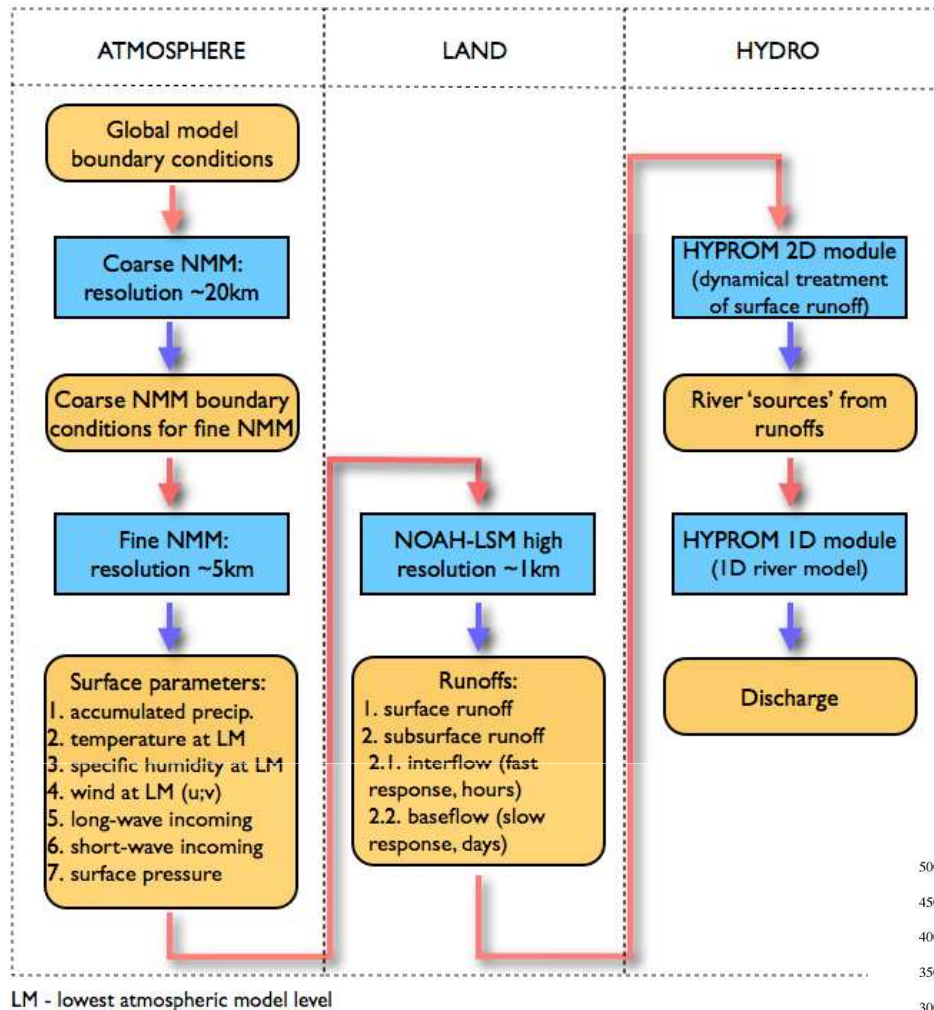
- HYPROM integrated with NMM
- Lateral and infiltration dynamics
- Governing equations based on full dynamics
- River routing included
- Atmosphere-hydrology feedback included

integrated system
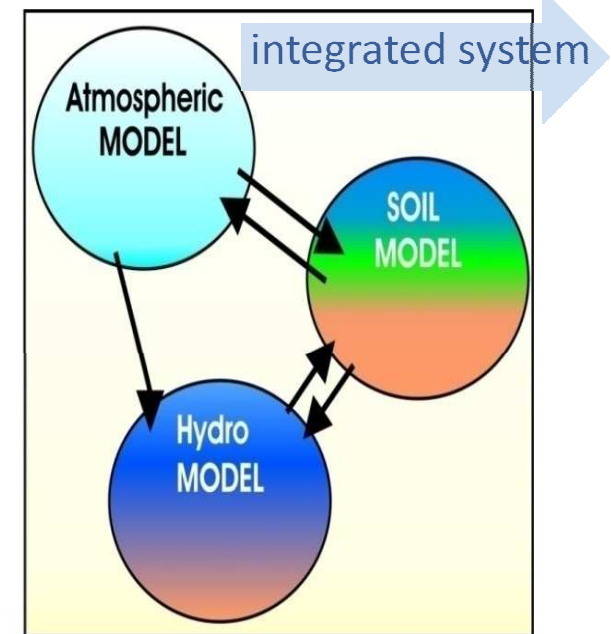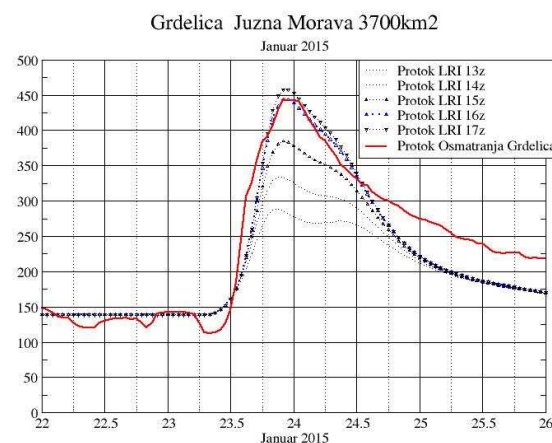
- **The SEECOP first collaboration steps**

    – test uploading of global NMMB forecast parameters to be available to other SEECOP members (Serbian HMS) → (Montengro HMS)

    – SEECOP web site in development (Montenegro HMS)

Index of /srbija/test/nmmb/2015070600

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Republic Hydrometeorological Service of Serbia

Republic Hydrometeorological Service of Serbia (established 1888, WMO member since 1947)

NMMB at RHMSS

- Operational since:
  - 2011 Global
  - 2013 Regional 12 Km
  - 2015 Regional 4 Km
- What has been implemented and tested so far in RHMSS:
  - Global NMMB on GFS analysis, IFS analysis
  - Regional model on GFS, IFS, NMMB boundary conditions. Rezolutions from 2.5km to 12km
  - Nesting, 2-domains and 3-domains; resolutions from 12 km to 1.3 km
  - Different physical options:
    - Radiation: RRTM, GFDL
    - Convection: BMJ, None (< 4 km)
    - Microphysics: Ferrier, Ferrier for hi res.
    - Land-sfc: NOAH, LISS
- Future plans:
  - Further optimization (products from NMMB-4km are now available on intra web at 6 UTC / 18 UTC)
  - 2-way nesting
  - Model climatology

NMMB 4KM BALKAN 500 HPA GEOPOTENCIJAL, TEMPERATURA I VETAR

NMMB 4Km – 500hPa Geopotencijal (gpdm), vetar i temperatura (C)
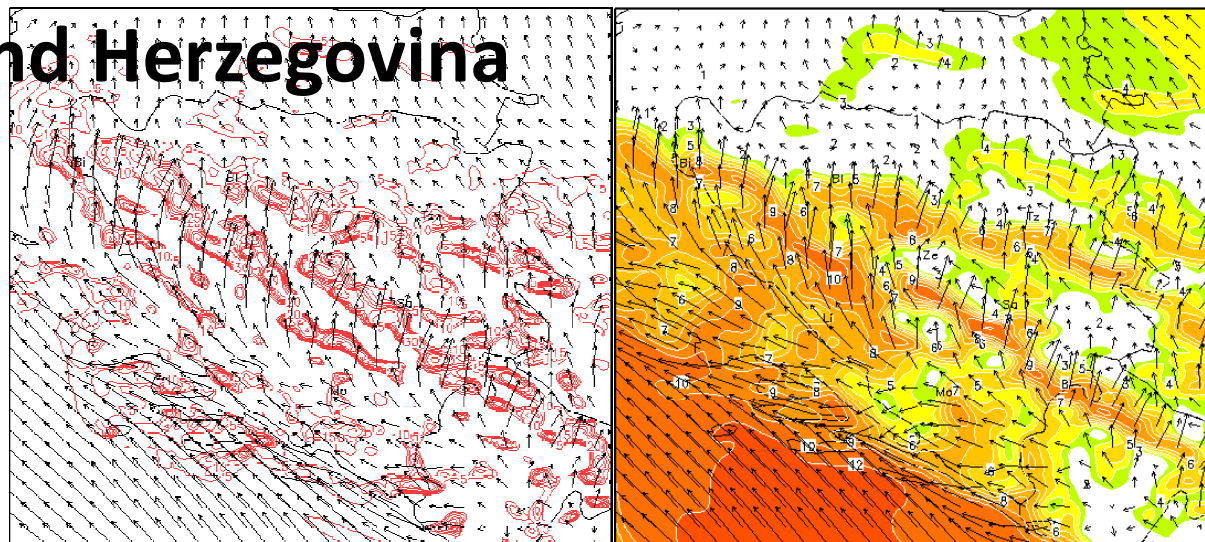Start:24.03.2015. 00UTC   Valid:24.03.2015. 06UTC
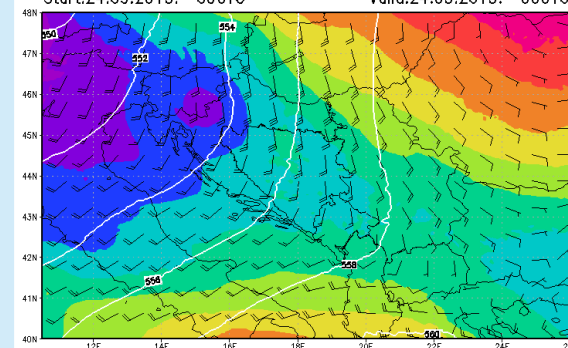
Federal Hydrometeorological Institute, the Federation of Bosnia and Herzegovina

WRF-NMM

- Input data from NCEP (GFS 0.5 deg)
- Microphysics: Ferrier
- Cumulus physics: BMJ...
- 12 and 4 km resolution ,
- Domain 1 (nx=114, ny=164)
- Domain 2 (nx=73, ny=157)
- 45 vertical levels,
- Forecast for the next 96 h
- 1 runs daily.

Moisture convergence + Wind vectors 17Z21feb2015

WRF-NMM Brzina i smjer vjetra 22Z21feb2015
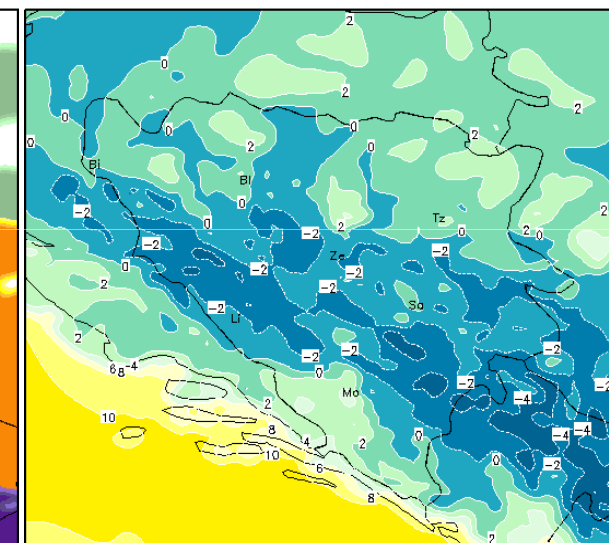
Made by Federal Hydrometeorological Service of B&H

WRF-NMM Kompozitna oblacnost (%) 00Z22feb2015

WRF-NMM Temperatura na 2m (nC) 01Z21feb2015
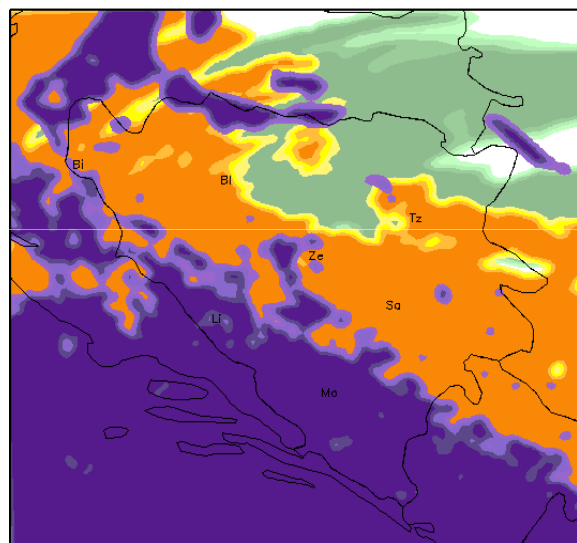
Made by Federal Hydrometeorological Service of B&H

Made by Federal Hydrometeorological Service of B&H

Niska oblacnost
Srednja oblacnost
Visoka oblacnost

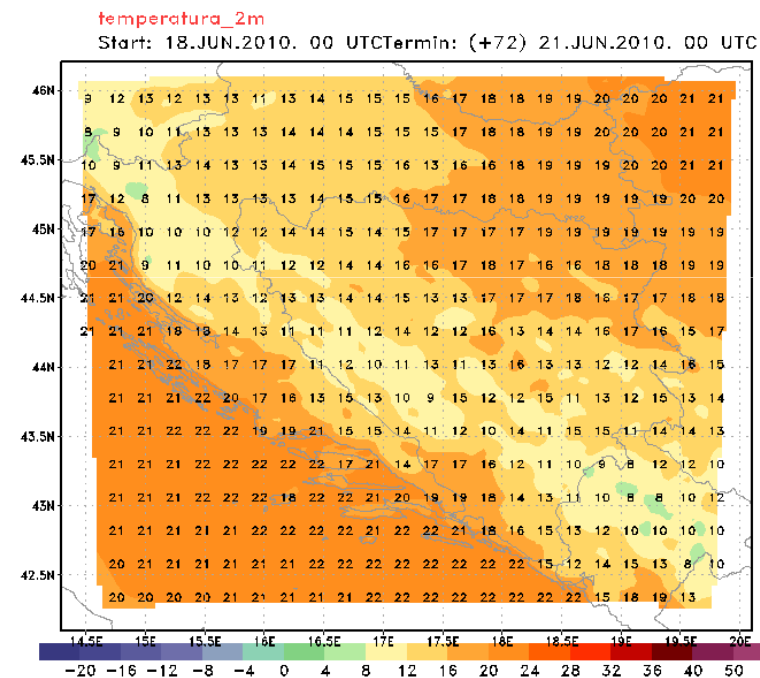# Republic Hydro Meteorological Service of Republic of Srpska, the Federation of Bosnia and Herzegovina

- For a short range weather forecast (0-122h), numerical models used for weather prediction :

- Since November 2009, the Service ran a model WRF-NMM on 12 km and 5 km resolution and ETA model, with 32 km resolution in operational mode with the help of Eastern Weather Agency (Belgrade)
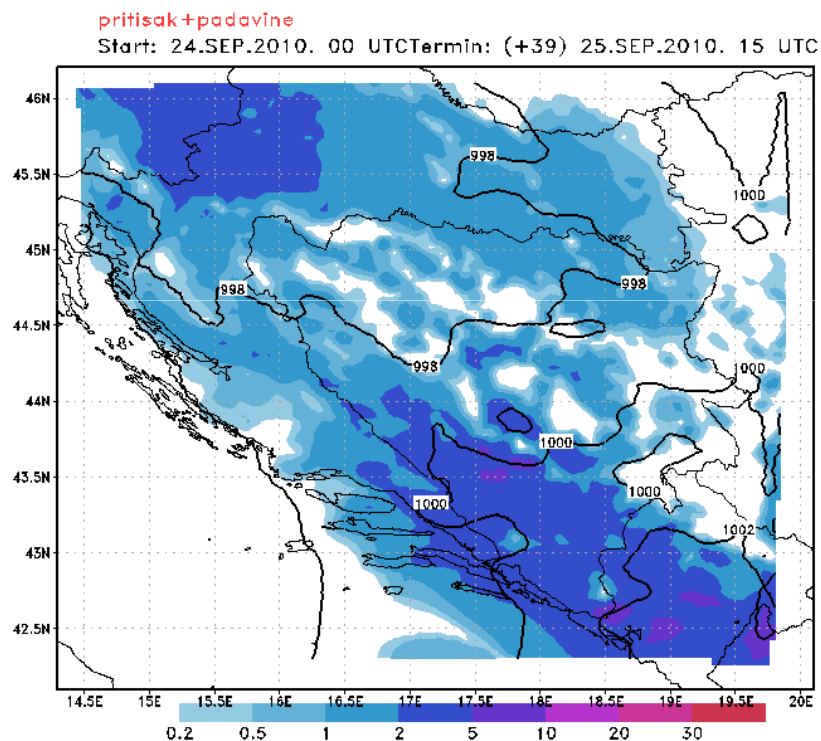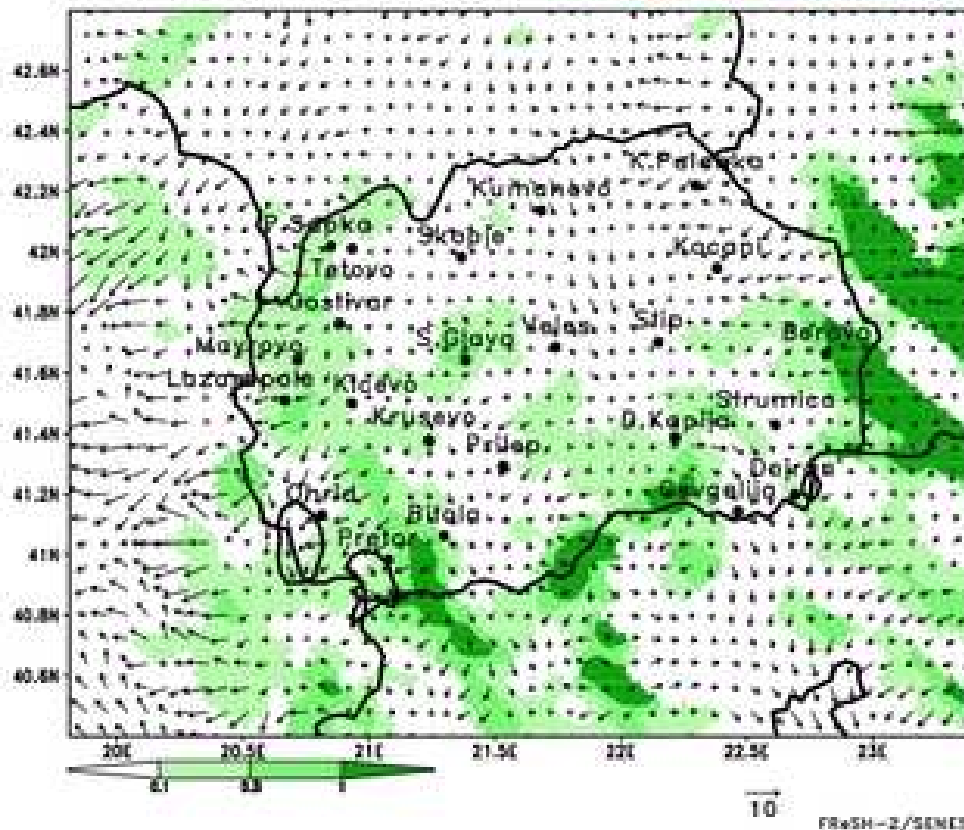

WRF-NMM 5km

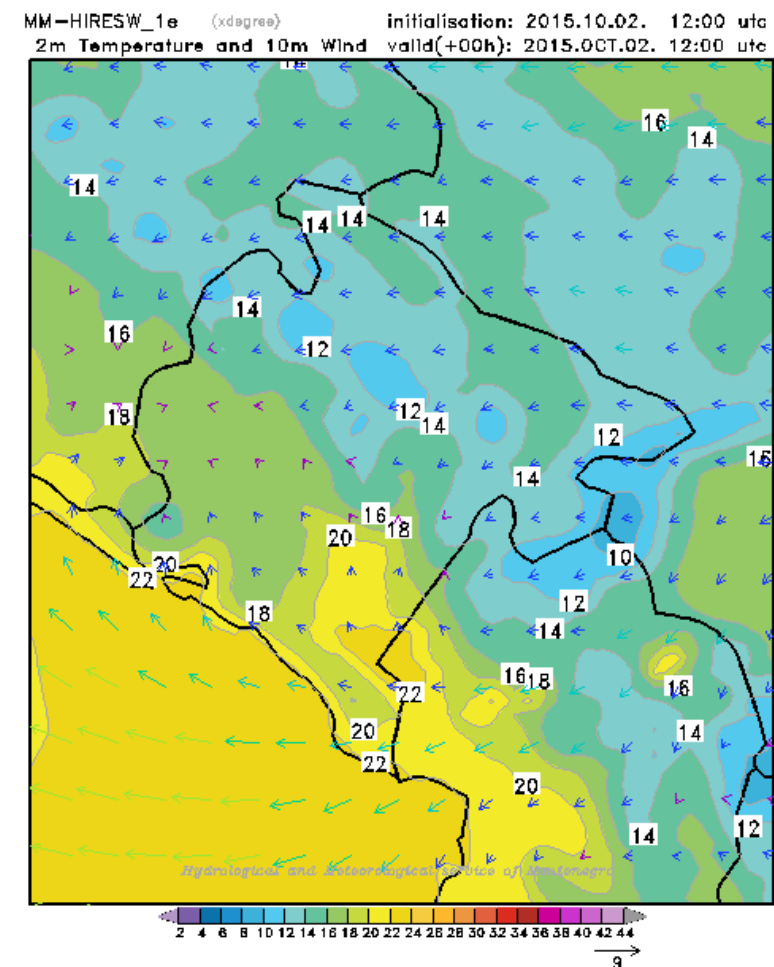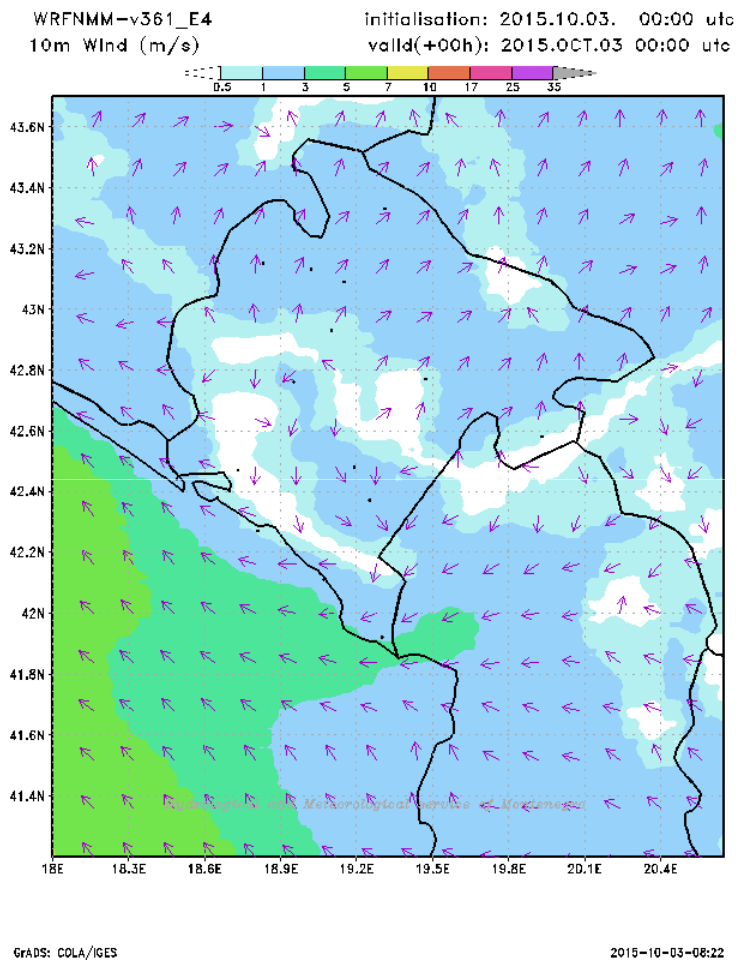# Hydrometeorological Service of Macedonia, The Former Yugoslav Republic of Macedonia

NMM forecast with 4km resolution over the country region

MONTENEGRO INSTITUTE OF HYDROMETEOROLOGY AND SEISMOLOGY

WRFNMM-4km

Thank you !