NWP in Croatian Meteorological and Hydrological Service

**DHMZ**

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
PBS Pro for LINUX as queuing system

LBC files and lines
global model ARPEGE, coupling frequency 3 hrs
Internet and **RMDCN** through ecgate as backup from July

Products on Internet
http://prognoza.hr/aladin_prognoza_e.html
http://www.dhmz.htnet.hr/prognoza/aladin_prognoza_e.html

Domains and forecast range
from December 1st 2005
resolution: **8 km**, 37 levels
229x205 (240x216) grid points
Corners: SW (36.18,3.90)
                NE (50.68,26.90)
resolution 2 km, 15 levels
6x 72x72 (80x80) grid points
1x 97x72 (108x80) grid points
forecast range was prolongated
from 54 to **72 hours** from May
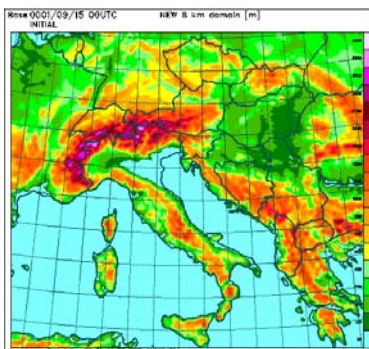
Model set-up
AL29T1mxl with SLHD
Xu-Randall cloudiness scheme
with random overlap
mean orograhy with changed
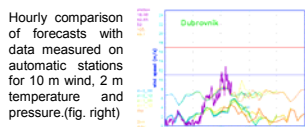gravity wave drag
Digital Filter Initialisation

Visualisation
numerous surface field
and fields on pressure levels
meteograms, vertical time cross section HRID's and vertical cross sections
hourly verification against automatic meteorological stations
50 points for wind, 26 for 2m temperature and 9 for pressure
comparison of forecasts with data measured on SYNOP and automatic stations
is done hourly for the last 5 runs giving an EPS-like picture through 5 days (example bellow)
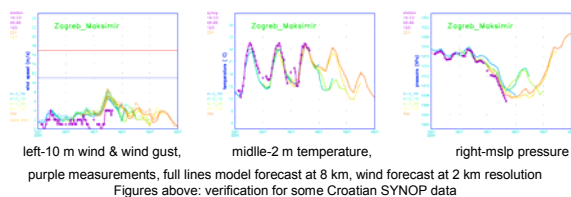
left-10 m wind & wind gust,   midlle-2 m temperature,   right-mslp pressure

purple measurements, full lines model forecast at 8 km, wind forecast at 2 km resolution
Figures above: verification for some Croatian SYNOP data

New developed products

New meteograms of "surface parameters" up to 72 hours were developed that should be more user-friendly for forecasters, showing: total, low, medium and high cloudiness, total precipitation and snow, 2 m temperature and dew point, msl pressure, 2 m relative humidity, 10 m wind direction and wind speed. Some special fields are still missing (surface temperature, wind gusts, convective precipitation, ...). (figure right)

Hourly comparison of forecasts with data measured on automatic stations for 10 m wind, 2 m temperature and pressure.(fig. right)

New computer

Core of the new computer were bought with help of the Norwegian Meteorological Institute through WMO Voluntary Co-operation Programme. Therefore computer got a name - Viking. First upgrades were done with help of the Croatian Ministry of science education and sport and Croatian Meteorological and Hydrological Service. At the moment computer is used for operational NWP forecast. In the framework of the joint project with met.no EMEP4HR ("High resolution environmental modelling and evaluation programme for Croatia") computer will be used to develop air chemistry models on meso and urban scales as well as regional downscaling of global climate models.

28th EWGLAM + 13th SRNWP Meetings
9th - 12th of October 2006, Zurich
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Meteorological and Hydrological Service,
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Status of compilation and porting

Compilation of ALADIN code (including a version of ALARO0) is ported with gmkpack tool. Better optimisation of code is still missing. Some problems were solved during compilations as accvimp and accvimpd should not be optimized with Intel compiler version 9.0.031. PALADIN, emoslib, gribeuse are installed too. Thanks a lot to Jure Jerman for help with porting and to Ryad El Khatib for the new version of gmkpack. Prolongation of the forecast up to 72 hours was possible when operational suite was moved to Viking. Compilation and testing of the 3D-VAR and ALARO0 is in progres, many thanks to Hungarian and Czech coleagues.

EPS downscaling with ALADIN

Four cases with Severe weather (precipitation and wind) in 2003 and 2004 were studied. 5 day forecasts of the full set of 50+1 ECMWF EPS members were downscaled with ALADIN on old LACE domain (12.2 km horizontal resolution 37 levels). The same clustering method was applied on ECMWF EPS and downscaled ECMWF EPS with ALADIN NWP model.
Results from both systems were manipulated in the same way (interpolated to 0.5°x0.5° grid) to determine the impact of dynamical downscaling. Comparison with ECMWF analysis was done on same resolution. Clustering was done using the Metview, unfortunately clustering on the Lambert projection was not possible with Metview 3.6.
First results for the chosen severe weather events in Croatia show that downscaling is a useful tool, especially if orography is the triggering effect and it is promising that good ECMWF EPS forecast were not spoiled with downscaling. The two measures of modelling error with respect to ECMWF operational analysis (mean absolute difference and mean deviation), defined over the downscaling domain indicate that the errors in ECMWF and ALADIN EPS upper-air fields are comparable.
Clustering on different base parameters were done for Z500, Z700, T850, wind 850, RT500/1000, RT700/1000, ω500, ω700. In principle a lot of common cluster members were found in most populated clusters members for ECMWF and ALADIN EPS. It seems therefore that in the case of dynamical downscaling many common members do not necessarily guarantee similarity between clusters from the two different populations.
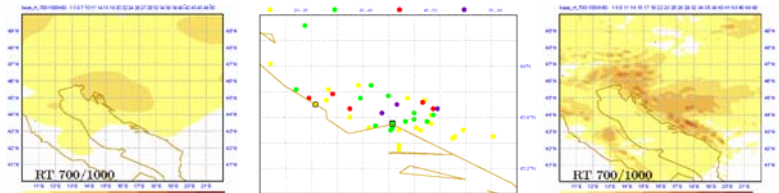
Middle figure: 24-hour accumulated precipitation from the Dalmatian rain gauges between 06UTC 4 July 2003 and 06UTC 5 July 2003. Only rain gauges with more than 20 mm/24 hr are shown, most of the precipitation in first 12 hour.
The 12-hour accumulated precipitation between T+54 and T+66 hr in the summer Adriatic convective case: left- for ECEPS cluster no. 3 for the RT 500/1000 clustering base, and right-for ALEPS cluster no. 2 for the ω500 clustering base. Contouring for precipitation 1, 5, 10, 20, … mm/12 hr

DART cruise (Dynamics of the Adriatic in the Real Time)

From 28th February till 28th March and from 13th till 31st August 2006 the central Adriatic was a subject of an interdisciplinary research under DART acronym using NRV Alliance as a platform. Aladin/HR forecast were used for driving ocean and wave model forecast operationally. It was also used for planning the schedule of sensitive operations. Already the first results show potential for improving atmospheric forecast using better ocean data. The cold current along the Italian coast of 7 °C is 6 °C colder than the nearby waters of open Adriatic cooling the air above and supporting for formation that was not recognized in the model forecasts.
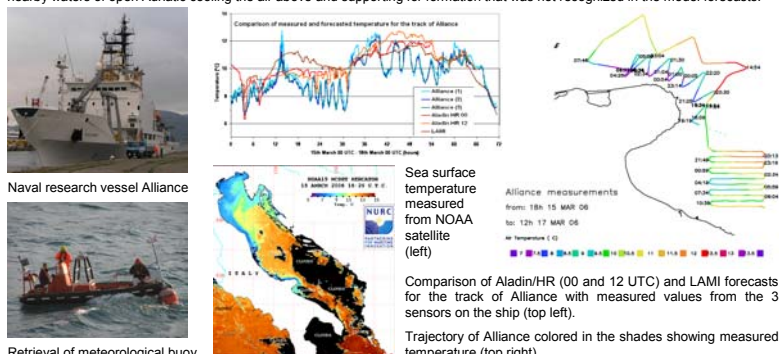
Naval research vessel Alliance

Retrieval of meteorological buoy

Sea surface temperature measured from NOAA satellite (left)

Comparison of Aladin/HR (00 and 12 UTC) and LAMI forecasts for the track of Alliance with measured values from the 3 sensors on the ship (top left).

Trajectory of Alliance colored in the shades showing measured temperature (top right).

SatManu

Weather analysis and forecasting department of Croatian Met Service participates in EUMETSAT's satellite and synoptic meteorology projects. For SatManu (2003-2005), a new conceptual model of Jet Fibres was investigated and some Computer Aided Learning materials were produced. Together with ECMWF, Aladin fields and cross-sections were used for research of this interesting small-scale phenomenon. Some of Aladin products were included in the Manual, in chapters Typical Appearance in Vertical Cross Sections and some related Exercises.
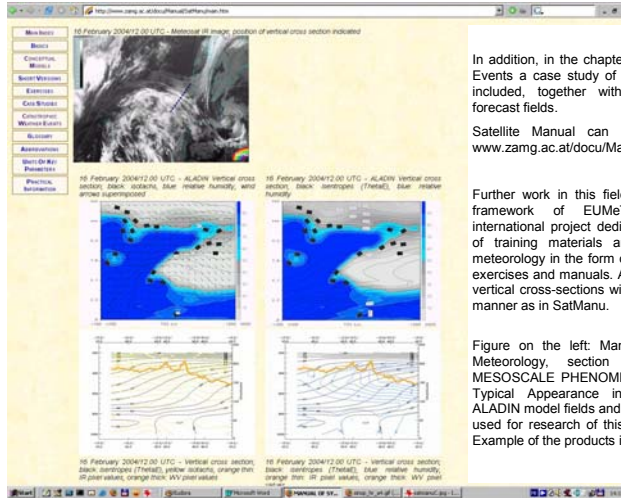
In addition, in the chapter of Catastrophic Weather Events a case study of the Adriatic Hail Storm is included, together with relevant Aladin model forecast fields.

Satellite Manual can be found on the web: www.zamg.ac.at/docu/Manual/SatManu/main.htm

Further work in this field is continuing within the framework of EUMeTrain (2005-2009), an international project dedicated to the development of training materials and methods for satellite meteorology in the form of case studies, interactive exercises and manuals. Aladin horizontal fields and vertical cross-sections will be included in the same manner as in SatManu.

Figure on the left: Manual of Synoptic Satellite Meteorology, section Conceptual Models - MESOSCALE PHENOMENA - Jet Fibres, chapter Typical Appearance in vertical cross-sections. ALADIN model fields and vertical cross-sections are used for research of this interesting phenomenon. Example of the products included in the Manual.