JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA PROCESSING AND FORECASTING SYSTEM AND NUMERICAL WEATHER PREDICTION RESEARCH ACTIVITIES FOR 2006

Croatia

1. Summary of highlights

Extension of the short-range forecast up to 72 hrs. Change of the equipment to SGI Altix. Continuation of the development and start with parallel runs of the new version of the model (ALARO). Continuation of research in downscaling of the ECMWF EPS members with ALADIN model. The non-hydrostatic dynamics is tested to be used in high resolution dynamical adaptation. Coupling of physics to dynamics with higher order accuracy is investigated. Sea-atmosphere interaction is studied during the DART (Dynamics of the Adriatic in Real Time) project.

2. Equipment in use

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

4. Forecasting system

4.1 System run schedule and forecast ranges

Short-range forecast up to 72 hrs. Hydrostatic ALADIN model is used, international project leade by Meteo-France. Model resolution is 8 km with 229x205 (240x216) grid points, 37 η vertical levels. 6 dynamical adaptations domain at 2 km resolution on 15 levels for high resolution 10-m wind forecast 72x72 (80x80) points. Two runs twice per day: 00 & 12 UTC. Products are used by Forecast division, Air-traffic control and commercial users.

4.3 Short-range forecasting system (0-72 hrs)

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation

Initial and boundary conditions retrieved from Météo-France global model ARPEGE, no assimilation, Digital Filter Initialisation.

4.3.2 Model

4.3.2.1 In operation

ALADIN spectral, 229x205 (240x216) grid points, corners: SW (36.18,3.90); NE (50.68,26.90), resolution 8 km, 37 η vertical levels, 72 hrs, Hydrostatic, model prognostic variables: horizontal wind components, temperature, specific humidity, surface pressure, 8 km horizontal resolution, 327.273 seconds time-step, mean orography, Davies coupling, Semi-Lagrangian horizontal diffusion (SLHD), the physical parameterization package includes vertical diffusion parameterization (Louis et al., 1982) with shallow convection (Geleyn, 1987); gravity wave drag, convective and stratiform processes are treated separately by a Kessler-type large-scale precipitation scheme and a modified Kuo-type deep convection scheme. Radiation is parameterized

according to Geleyn and Hollingsworth (1979) and Ritter and Geleyn (1992). The transport of moisture and heat vertically in the soil are parameterized by ISBA in two layers (Giard and Bazile, 2000). 6 dynamical adaptations domains covering Croatia at 2 km resolution and 15 levels for 10-m wind 72x72(80x80).

4.3.2.2 Research performed in this field

Development and parallel operational runs of new Aladin model version that includes 4 prognostic moist variables for cloud water and ice, rain and snow as well as prognostic TKE, all these accompanied with modifications in vertical diffusion, large scale precipitation, convection and radiation schemes.

References: Cartry, B., J.-F. Geleyn, M. Tudor, P. Bénardand A. Trojáková, 2007: Flux-conservative thermodynamic equations in mass-weighted framework. Tellus, 59A, 71-79.
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Gerard, L., 2007: An integrated package for subgrid convection, clouds and precipitation compatible with the meso-gamma scales, To appear in Q. J. R. Meteorol. Soc.
Gerard, L. and J.-F. Geleyn, 2005: Evolution of a subgrid deep convection parametrization in a limited-area model with increasing resolution. Q. J. R. Meteorol. Soc., 131, pp. 2293-2312.
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Geleyn, J.-F., R. Fournier, G. Hello and N. Pristov, 2005b: A new 'bracketing' technique for a flexible and economical computation of thermal radiative fluxes, scattering effects included, on the basis the Net Exchanged Rate (NER) formalism. WGNE Bule Book, <http://collaboration.cmc.ec.gc.ca/science/wgne>.
Geleyn, J.-F., F. Vana, J. Cedilnik, M. Tudor and B. Catry, 2006: An intermediate solution between diagnostic exchange coefficients and prognostic TKE methods for vertical turbulent transport. WGNE Bule Book, <http://collaboration.cmc.ec.gc.ca/science/wgne>.
Gerard, L., J.-M. Piriou and J.-F. Geleyn, 2006: Advances in the integration of deep convection and microphysics or the meso-scale. WGNE Bule Book, <http://collaboration.cmc.ec.gc.ca/science/wgne>.

The non-hydrostatic dynamics is tested to be used in high resolution dynamical adaptation.
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4.3.3 Operationally available NWP products

Output variables (3 hourly outputs):

- 3D: u, v, omega (Pa/s), geopotentiel, vorticity, divergence, absolute and potential vorticity, temperature, potential and equipotential temperature and relative moisture on pressure levels (1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 300, 250 hPa);
- 2D: u, v 10m above ground, temperature and relative humidity 2m above ground, low, medium, high and convective cloudiness, stratiform and convective rain and snow, mean sea level pressure, wind gusts u and v components, CAPE, moisture convergence and PBL height.

4.3.5.2 Research performed in this field

Testing of clustering of ECMWF EPS members and downscalled ECMWF EPS members by ALADIN. More in the memo :)

4.4 Nowcasting and Very Short-range Forecasting Systems (0-6 hrs)

4.4.1 Nowcasting system

4.4.1.1 In operation
System is based on satellite data.

4.4.1.2 Research performed in this field
Work on improvement of convective cloud detection.

4.7 Long range forecasts (LRF) *(30 days up to two years)*

4.7.1 In operation
Monthly weather forecasts are produced using dynamical-statistical adaptations which include analog technique on the basis of ECMWF medium range forecasts and monthly forecasts.

5. Verification of prognostic products

5.1 ECMWF and ALADIN/HR products are verified and compared operationally computing simple statistical measures (ME, MAE, RMSE, SS...) and some others (RPSS, KSS, HSS), using 11 SYNOP observations inside Croatia. Verification is perfomed along the EWGLAM standards.
Forecast range: 3 days for ALADINs and 10 days for ECMWF.
Parameters: temperature, precipitation, wind.

6. Plans for the future *(next 4 years)*

6.2.2 Planned Research Activities in Nowcasting

Development of a common Nowcasting model (INCA) within the region of Central and SE Europe is planned. Calculations are based on Observations, Satellite data, Radar data, LAM model results (Aladin..) out of which INCA makes a detailed analysis and nowcast of temperature, precipitation, wind etc…Common system is planned in which every interested institute will make the analysis of its own data and with agreed frequency. These local analyses will be sent to the centre (to be decided) and composited in a product valid for the whole region.