Annual WWW Technical Progress Report on the Global Data - Processing System 2001

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1. SUMMARY OF HIGHLIGHTS

- A considerable effort has been made towards the improvement of the new operational version of the Eta model, with new comprehensive physical package and orography.
- The 120-hours regional Eta forecasts are generated twice a day, using data from 00UTC and 12UTC and DWD NMC Offenbach boundary values.
- The mesoscale shot range model for the Balkans area running at 23km resolution has been upgraded.
- The system has been developed and installed to generate a set of automated weather forecast elements at 6 hours intervals out to 120 hours for 100 cities in Europe (40 cities in Yugoslavia).
- Further work has continued on the development on the operational regional Eta model run as the basic in support of Federal Hydrometeorological Institute's aviation responsibilities. The quality of the operational WT and SWC chats for the Yugoslav area, as domestic flights documentation, has been improved significantly.

2. EQUIPMENT IN USE AT THE CENTRE

2.1. Work stations and PC Pentiums

- POWER INDIGO^2 R8000
  OS: IRIX 6.2
  CPU module: R8000 64-bit RISC Processor
  300 MFLOPS
  XZ Graphics
  128 MB memory
  HDD: 2 x 9GB SCSI, 4.5GB SCSI

- INDY SC/R 4400
  OS: IRIX 6.2
  200MHz R4400 IPP22 Processor
  50 MFLOPS
  32 MB memory
  HDD: 4.5GB SCSI, 1GB SCSI
- SGI SG550
  OS: Linux SUSE 7.1
  2 x 933MHz Intel Processor
  512 MB RAM memory
  HDD: 2 x 18.2GB ULTRA SCSI
- 3 SGI 02 200 MHz
  FPU: MIPS R5000
  CPU: MIPS R5000
  Data cache size: 32 Kbytes
  Main memory size: 64 Mbytes
  OS: IRIX 6.3
  HDD : 2 GB
- PC Dual Pentium:
  2 x 1GHz
  512MB RAM
  17GB HDD
  OS: Linux SUSE 7.1
- 2 x PC Pentium :
  600MHz
  256MB RAM
  2 x 14GB HDD
  OS: Linux SUSE 7.1
- PC Pentium :
  1.2GHz
  256MB RAM
  40GB HDD
  OS: Linux SUSE 7.1
- 2 x PC Pentium:
  400MHz
  64MB RAM,
  6GB HDD,
  OS: Linux, Windows NT, Windows 98

Used for operational forecasts and research.

2.2. The Hardware Characteristics of Telecommunications

- Micro VAX 4000/200 and Micro VAX 3600:
  OS: VMS 5.5.2,
  2x(32 MB RAM, 2x3 GB HD),
  2x(64 RS232),
  2x(KMV-11),
  48 Telegraph adapters.

Support: MSS, BulletinDBases, ReprotDbases, DataFiles

- 4xPentium II 400/433 MHz:
  OS: Suse Linux 6.4,
  64/128 MB RAM,
  4-10 GB HD.

Support: Internet (WWW, FTP, DNS, POP, PROXY), DialUp, DataFile Acces, Intranet (My SQL RDBMS), RTH Sofia.

- Pentium 633 MHz
  (FAX-E workstation, 256 kbps Satellite channel):
  OS: Windows NT 4.0 Workstation,
  128 MB RAM,
  8 GB HD.

- Pentium II 400 MHz
  (SADIS workstation, 64 kbps Satellite channel):
  * OS: Windows NT 4.0 Workstation,
  * 128 MB RAM,
  * 8 GB HD.

- DEC Multiprotocol ruter DECNIS 600
  (18 channels, TCP/IP(PPP), X.25, DECnet, Frame Relay).

- Cisco 2520 Router
  (4 Sync/Async channels+BRI)

2.3. SADIS satellite broadcast system

Satellite ground receiving station supported by a PC Workstation running Windows NT OS.

3. DATA AND PRODUCTS FROM GTS IN USE

GTS data are received directly through two X.25 (9600 bps, channels from RTH Sofia / NMC Budapest.

- Data in use:
  SYNOP 10000 - 12000 / day
  TEMP 360 - 430 / day

- Products in use:
  GRID ECMWF 40 - 50 / model output
  GRID EGRR 610 - 630 / model output
  Significant weather forecast

  Winds/Temperature forecasts for various flight levels

3.1. *Products from the Internet in use*

GRIB KWBC 360 / model output.

4. DATA INPUT SYSTEM

Fully automated system. Some manual intervention may be performed for report correction.

The monitoring of data exchange on the national level is automatically performed daily.

Other types of monitoring (e.g. on the regional level) are performed on request (e.g. by WMO or by RTCs) and the results are recorded and distributed on floppy disks.

5. QUALITY CONTROL SYSTEM

Automated quality control system.

5.1. *Quality control of national data prior to transmission on the GTS*

There is quality control system in use.

5.2. *Quality control of incoming data*

The formats of all coded reports are checked.

Surface and upper air reports are checked for internal consistency before storing and exchange.

Checks on temporal consistency.
Checks against the model background values.
Buddy checks.

6. MONITORING OF THE OBSERVING SYSTEM

Monitoring of the observing system is being carried out.

Surface observations and upper air observations are monitored on the national level.

7. FORECASTING SYSTEM

The main component of the forecasting system is the limited area model, with the Eta vertical coordinate and step-like mountain representation, is operationally produced twice a day.

7.1. System run schedule

120-hours forecasts based on 00 and 12 UTC observational data are produced twice a day.

7.3. Short-range forecasting system (0 - 72 hrs)

7.3.1. Data assimilation, objective analysis and initialization

Assimilated data: TEMP (parts A and B), SYNOP and SHIP.

Assimilation cycle: 12 hours.

Cut - off time: 3 hours.

Analysis method:
- multivariate analysis by successive corrections (Bratseth,1986);
- multivariant spectral (truncated Fourier series) fitting method applied to the differences between observations and first - guess values.

Analyzed variables: sea level pressure, geopotential, horizontal wind components and specific humidity.

Coverage:
- Europe, North Atlantic, North Africa;
- 24°N - 70°N, 40°W - 55°E.

Horizontal resolution: 0.33° x 0.33°.

Vertical resolution: ten standard pressure levels, from 1000 hPa to 100 hPa.

Initialization: scale - selective dynamic initialization scheme.

7.3.2. Preprocessing

New items such as soil and vegetation type have been introduced. Sintetization of SST (NCAR climatology data set), soil temperature and soil wetness has also been implemented.

7.3.3. Model

Basic equations: Primitive equations system.

Independent variables: λ, φ, η, t.

Dependent variables: T, u, v, q, surface pressure, turbulent kinetic energy, surface potential temperature, ground wetness and depth of snow cover.

Numerical technique: horizontal advection has a built-in nonlinear energy cascade control on semi - staggered Arakawa E grid, split-explicit time differencing.

Integration domain: limited area with 73 x 121 grid points.

Resolution:
- horizontally : ~ 46 km
- vertical: 32 η layers in
- time step: 120 s.

Vertical coordinate:
- η - coordinate

Orography:
- grid box representation; "silhouette" mountains extracted from 30" degree US Navy data set

Boundaries: forecast fields with 6 hours interval functioning as boundary values have been obtained from NCEP Washington; concurrent version with boundary values being derived from DWD, NMC Offenbach.

Physical parameterization:
- Mellor Yamada level 2.5 turbulence closure model for PBL and for surface layer processes;
- fourth order nonlinear lateral diffusion;
- surface processes;
- OSU parameterization scheme;
- large scale precipitation;
- Betts-Miller-Janjic deep and shallow convective scheme;
- GFDL radiation scheme.

7.3.4. Numerical weather prediction products

- geopotential
- mean sea level pressure
- temperature
- horizontal and vertical wind components
- precipitation (total and convective)
- wind stress

- specific humidity
- short wave and long wave radiation
- turbulent kinetic energy
- turbulent exchange coefficients
- surface potential temperature
- soil moisture
- snow cover
- evaporation
- surface sensible heat flux
- surface latent heat flux
- convective cloud top and depth
- total cloud cover
- R_i number

Regional Eta model products are distributed internationally through Internet as the primary means of distribution (address: **www.meteo.yu**)

They are also distributed nationally on the National Telecommunication System

7.4. Mesoscale forecasting system

The formulation of the high - resolution Eta model for the Balkans area is identical to the regional model in most respects except the following:

The model has 23km horizontal resolution and 64 vertical levels. It is nested into the regional model, and it has been run 48 hours over the smaller area extending from 3°W - 27°E and 35°N - 55°N. Initial fields have been defined using the 48 hour Eta forecast as preliminary fields and surface and upper-air observations analyzed by multiple iteration successive corrections analysis scheme. Boundary conditions have been updated hourly from the regional model run.

8. VERIFICATION OF PROGNOSTIC PRODUCTS

The objective verification of prognostic products is operationally performed. The verification system is enlarged to include the comparison of model results with observations. The verification of precipitation is also included. The system can be easily used for various horizontal grids, resolutions and areas of the model.

Eta forecasts are verified operationally over the area roughly covering Central and Southern Europe. Verification parameters are RMS error of the vector wind difference, BIAS, mean absolute error, root-mean-square error, standard deviation of forecast error, S1 skill score and threat score. These statistical scores are computed for MSLP, geopotential height and temperature on four levels from 1000 to 500 HPa, wind at 850, 700, 500 and 250 HPa and precipitation. Objective verifications of 12, 24, 36 and 48-hour Eta forecasts against analysis are produced.

9. PLANS FOR THE FUTURE

- The plan was made for the implementation of the connection the new RMDCN, in the first quarter of 2002. Acces to the RMDCN backbone is scheduled of 64/128 kbps, with ICDN backup.
- The implementation of the new MSS and RDBMS under LINUX OS on Alpha DS20E hardware platforms during 2002 is being planned.
- The inplementation of CLUSTER - based on Athlon 1.46 GH (10CPU) under LINUX OS.
- New non-hydrostatic version will be operationally implemented.
- Improvement will be made to the atmospheric transport of pollutans modelling, chiefly radionucleids transport.
- Further work on the Eta model possibilites research in the context to regional climate change modelling.
- New methods on objective verification system will be introduced.
- Implementation on the project on new data management system for non real time data.
- A move to the test phase of the coupled ocean - atmospheric regional Eta model.
- The introduction of the MOS system.
- The implementation of the graphical package METVIEW.

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