Annual WWW Technical Progress Report

On the Global Data Processing and Forecasting System 2003

ARGENTINA

Department of Automated Processes
National Weather Service
(http://www.meteonet.com.ar)

I. Summary of research development and main operational changes.

The Specialized Regional Meteorological Center Buenos Aires (CMRE BUENOS AIRES) has been running an operational regional ten levels primitive equations model since April 1998 (ARPE). An upgrade of the ETA model used at this center since 1999, called ETA SMN, is running daily since September 2002, and in an operational way, since January 2003. Fields obtained from these models are available on the Internet.

Major changes in 2003 are:

December 2002: Four R10000 processors were added to the Origin 2000 allowing running the high resolution ETA SMN model with a regional domain generating four days of forecasts.

January 2003: An upgrade of the ETA model, called ETA SMN, started to run on operational basis twice a day. The model domain covers the southern region of South America and the resolution is significantly improved, now 30km.

An additional run with a different domain was executed to collaborate with SALLJEX experiment.

February 2003: A lower resolution (50km) ETA model but with a domain covering much of South America, oceans and Antarctica is running operationally twice a day.

March 2003: Some time specific parameters of the ETA SMN model were changed which resulted on an improvement of the model forecast.

Analyzed and forecasted fields from the ARPE model are used in a precipitation model that involves the pixel information from satellite data. Results are available on the Internet web page.

May 2003: Wave model using initial and boundaries conditions from the ARPE model runs daily for every the 00 and 12Z cycles and outputs are being stored for verifications.

June 2003: ETA SMN model outputs are available on the Internet/Intranet web pages for public use.

July 2003: The ETA SMN finally replaces the old version of the ETA model.

September 2003: Internet 2 is available for downloading GRIB and GRIB2 data from NCEP ftp server.

II. Equipment in use at the center for operational tasks

Function	Computer	CPUs/ Processor	Memory	Disk Storage
Communications and Data quality control system	SG CHALLENGE S Series	1 R4400 200MHz	256MB	2 GB system disk External 4 x 4 GB SCSI disk
Arpe Model/ Wave model	SG INDIGO^2 IMPACT	1 R10000 175MHz	128MB	2 GB system disk External 2 x 9 GB SCSI disk
ETA SMN	SG ORIGIN 2000	8 R10000 250 MHz	1400MB	9 GB system disk External 3 x 9 GB, 1 x 36 GB SCSI disk

Other peripheral equipment and systems are used for database purposes. The National Weather Office is operating with two databases, the operative one, Ideafix, and Oracle. While the latter is used at the present time for historical datasets, work is in progress to replace the operative database with Oracle.

III. Quality control System

Synop and Temp data received at the center are permanently checked for formal and consistencies errors. Buoys, Satem and Satob data are only checked for formal errors. Manual corrections are done when necessary. Other validity checks are performed by the model objective analysis.

IV. Research and development in Data Assimilation and Numerical Forecasting

Model ARPE
Implemented operationally the first time by the Bureau of Meteorology of Australia and adapted later for routine forecasting at New Zealand Meteorological Service. It was adapted to our region by the C.I.M.A. Group from the University of Buenos Aires directed by Dr. M. Nuñez.

Equations: primitive hydrostatic equations
Initialization: vertical mode initialization scheme
Solution technique: a semi-implicit time difference scheme
Physical processes: surface fluxes of momentum, heat and moisture, large scale and convective precipitation, surface temperature and diurnal cycle.
Grid Resolution: 150 Km on the horizontal and 10 levels in the vertical.
Coordinate system: sigma coordinate in the vertical
Forecast period: 36 hours

Objective analysis: a successive correction one (Cressman). The analyzed variables are geopotential heights, temperature, humidity and wind components for ten pressure levels (1000, 850, 700, 500, 400, 300, 250, 200, 150 and 100 hPa); temperature, pressure and humidity at surface and tropopause pressure level.
Data assimilation: performed every twelve hours. The first guess field is generally the twelve hours one predicted by the model in the previous run and in case of model divergence, the climatological field for that month.
Data used: SYNOP, TEMP, BUOYS, SATEM, SATOB and GRID

ETA SMN model
The development of this model began en 1972 by Fedor Mesinger and Zaviša Janjic at the University of Belgrade and the Federal Hydrometeorological Institute of Yugoslavia. During the last decades, the major developments and improvements were done at the National Centers of Environmental Prediction (NCEP).

Equations: Primitive hydrostatic equations. Nonhydrostatic version included
Grid: Arakawa E-grid in horizontal, Lorenz grid in the vertical.
Resolution: 40km on the horizontal and 38 layers on the vertical.
Solution technique: Split-explicit time differencing, Arakawa-type in space.
Coordinate system: rotated spherical coordinates in horizontal; eta (step mountain) coordinate in vertical. Sigma coordinate version of the model is available.
Physical processes: surface fluxes over land and water; land surface schemes; multilayer soil/vegetation/snowpack land surface model; subgrid mixing; cumulus parameterizations; radiation parameterization; stable precipitation parameterization.
Data used: Data from the GFS model.
Forecast period: 96 hours.

V. Applications of NWP products.

ARPE model
Six different fields (surface pressure and 1000/500 hPa thickness, 850 hPa geopotential and dew point, 500 hPa geopotential and temperature, 500 hPa vertical wind component, 250 hPa geopotential and wind speed, tropopasuse height and temperature are actualized in the National Weather Service Intranet network twice a day. Horizontal and vertical interpolations are made to obtain analyzed horizontal wind components and temperature fields every two degrees of latitude and longitude and forecasted fields every six hours at the seven flight levels used in our country and this information is also sent to the National Weather Service web page as well as to the Intranet network and actualized twice a day.

Monthly anomaly fields at all levels are obtained and analyzed.

ETA SMN model
Precipitation fields, surface pressure, surface temperature and surface winds are actualized in the Internet daily while a complete set of fields, including meteograms for selected cities, are available on the Intranet network.

VI. Plans for future research and development activities.

Eventually replace the ARPE model with the ETA SMN model, keeping the same domain and significantly improve the resolution. Before the final switch from the ARPE to the ETA model is accomplished, verifications and comparisons of the performance from both models have to be studied and evaluated.

Different approaches to model verifications procedures are being produced and results will be studied. Variables of interests are precipitation and temperature near the ground. Other commonly used variables for verifications will be studied as well.

Adapt a suitable assimilation and objective analysis scheme to the ETA SMN model.

Use the outputs of the ETA SMN model as initial conditions for the Sea Wave model, replacing the ARPE model.

Run a nested model from the ETA SMN with a higher resolution and smaller domain centered at the area of most economical interest on the region.

Generate forecasts for major cities in BUFR format from the ETA SMN model.

Use of a model for trajectory and dispersion of volcanic ashes in support of the Volcanic Ashes Advisory Center Buenos Aires.

VII. Development in objective interpretation and verification procedures including performance statistics.

Objective verification of forecast products continued during 2003. 24 hr Geopotential Heights forecasts RMSE (root mean square root) are shown in table 1 for the 500 hPa level. The area of coverage is regional and period considered is from September 2002 to August 2003.

Table 1: Forecasts against Analysis

ARPE model													
RMSE	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**2002/2003**
500 hPa Height (m)	15,6	25,4	16,2	20,0	27,2	23,4	26,2	28,9	18,3	17,2	15,4	14,2	21,3

Verifications of temperature forecasts from the ARPE and ETA SMN model are shown in table 2 as well as analysis RMSE from both models. Model ETA outperformed the ARPE model on the forecasts even though the analyses from the ARPE model are in general more accurate.

Table 2. ARPE and ETA SMN temperature forecasts against rawinsonde. Period: April 2003.

RMSE	Analysis against observation		24hr Forecasts against respective analysis		24hr Forecast against observation	
	ARPE	ETA SMN	ARPE	ETA SMN	ARPE	ETA SMN
1000 hPa	1,75	1,39	2,58	2,79	2,01	2,12
700 hPa	0,96	1,81	2,39	1,12	2,11	2,00
500 hPa	1,15	2,11	2,07	1,25	1,65	2,75
300 hPa	1,47	2,32	3,74	1,05	3,50	2,36
100 hPa	2,86	2,08	5,44	1,13	5,43	2,06

Nine years of analyzed fields using the five levels model and five years (1998-2003) of analyzed fields using the ten levels model (including the operational visualization of meteorological fields using the GRADS software) are available in this Center.

VIII. Other items

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SMN Scientific Group: Lic. L. Rosso, M. Suaya and M. Gatto.