JOINT WMO TECHNICAL PROGRESS REPORT ON GLOBAL DATA PROCESSING AND FORECASTING SYSTEM AND NUMERICAL WEATHER PREDICTION RESEARCH ACTIVITIES FOR *2007*

NATIONAL WEATHER AND HYDROLOGICAL SERVICE
SENAMHI
PERU

1.   Summary of highlights

Last year the computing capacity has been improved to support the numerical prediction system, either in the numerical weather forecast, that implies a faster processing, as well as in the medium-range forecast, which implies faster calculations for high resolutions on basins also the participation in research projects on climate scenarios and early warning systems has served to strengthen such equipment.

In 2007 two projects on generation of climate change scenarios have been developed in major basins of our country, which have involved the use of our computational capacities and climate analysis.

2.   Equipment in use

Equipment for Numerical Weather Prediction:

- Cluster HP (8 nodes with the following characteristics :)
  - Head node (2):
    - HP ML330 Intel Xeon Processor 2.6 GHz. 512 KB cache, 1 GB RAM, 3x 36 GB HD, 2 NIC 10/100/1000.
    - HP ML350 Intel Xeon Processor 3.0 GHz. 1 GB RAM, HD 146 GB, 2 NIC 10/100/1000.
  - Slave Node (6):
    - HP DL140 (2) Intel Xeon Processor 2.8 GHz. 1 GB RAM, HD 80 GB, 2 NIC 10/100/1000.
- Sun Servers (4)

  - (2) SUN Fire V40z (4) AMD Opteron Dual Core 2.4 GHz. 1024 KB cache, 2 x 147 GB HD, 16 GB RAM, 4 NIC 10/100/1000
  - (2) SUN Fire X4200 (1) Dual Core AMD Opteron Processor 275, 2.2 GHz. 1024 KB cache, 2GB RAM, 2 NIC 10/100/1000

Equipment for Data Processing:

- Institutional Databases:

  - SUN SUNFIRE T2000 Processor Ultra SPARC 1 GHZ - 512 MB - 08 GB Ram (04) HDD 73 GB.
  - SUN ENTERPRISE 3500 1 GB RAM - 02 Processor 400 MHz - 04 HDD 18.2 GB

- Communication Servers:

- GVAR Servers
  - GOES 12: CPU P4- 2.4 MHZ - 36 GB de HDD- 256MB
  - GOES 10: CPUP II 800MHZ - 256MB -RAM - 80GB –HDD

- Automatic Stations Server
  - CPU PIV 3.0 GHZ - 1024 RAM - 36.6 GB Scsi

- FTP Server
  - HP PROLIANT ML 330/ 36Gb 512 MB - 36 GB HD SCSI

3. Data and Products from GTS in use

- Receiving data from GTS includes: SYNOP, TEMP, BUOY, METAR, GRID, TAF.

4. Forecasting system

4.1 System run schedule and forecast ranges

SENAMHI has several machines for running different kind of numerical models. Concerning the ETA model, we have a server which downloads grib files GFS from NOOA's servers using a set of shell scripts. We have a schedule of ftp connections during the night and then the model runs this data on a workstation. When the model has finalized, it sends the binary lat_lon files to a repository and send gif graphics to web site to be published. This task is done daily.

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

4.2.1 Model

4.2.2.1 In operation

The model "ETA" is the original from Yugoslavia, Belgrade University and was developed by the National Centers for Environmental Prediction (NCEP) of the United States. The implementation of the regional model ETA SENAMHI, given in March 1999, running as a test for several months on a workstation XP1000 ALPHA.

Today, the ETA model is running in an operational mode in the Numeric Prediction Center (NPC) of SENAMHI with a horizontal resolution of 22 km in Peru domain and 32 km in South America domain using the AVN outputs as initial and boundary conditions.

4.2.2 Operationally available NWP products

There are more than 31 items, including maps on meteorological variables and maps with combined variables at different levels according to the requested forecast service for their daily work in issuing forecasts. These products are available in the web page of SENAMHI, this process is automatic and daily.

4.3 LONG RANGE FORECAST (30 days up to two years) (Models, Ensembles, Methodology)

4.3.1 In Operation

The National Meteorology and Hydrology Service of Peru has continued with its operational work. In this way, the long range forecast with CCM3 deterministic model, CCM ensemble forecast, regional climate forecast with the system CCM-RAMS, have been continued and their products offered to the community.

4.3.2 Research performed in this field

Outstanding research and development activities related to the LRF specialized analysis forecast system in operational use have been performed in 2007. A Climate Scenarios project has been the activity in the 2007 year. A regional climate simulation for scenario A2 from the IPCC was done. Two basins were selected to define the domain. These domains are Alto Mayo and Santa. The project was a collateral institutional effort, SENAMHI was responsible for the numerical simulation of the atmosphere, and CONAM (The National Commission of Environment) was in charge of dealing with the project.

This scenario was developed using the RAMS model and the input data used was from the CCSM from NCAR. Hourly data was used to force the regional model, and the simulation was done from 1983 to 2003 and 2004 to 2035.

This simulation was performed in XEON cluster, consisting of six nodes Intel processors, 6 GB for disc memory. The simulation time was about six months.

4.3.3 Operationally available products

Ensembles Predictions System for Precipitation and other atmospheric variables for Venezuela, Bolivia, Colombia and Peru domains.

5. Verification of prognostic products

We continued this work analyzing the outputs of the CCM3 model with different boundary conditions as the lowest boundary in contact with the ocean: Climate Sea Surface Temperature (SST) observed SST and forecast. We has been conducting statistical validation (cross validated) using CPT (Climate Predictability Tools).

6. Plans for the future (next 4 years)

6.1   Planned research Activities in NWP and Long-range Forecasting

6.1.1 Planned Research Activities in NWP

We have assessed the need to implement a new operational model for weather forecasting, these activities has just been initiatied in 2008 with the implementation of WRF model and the initial testing for validation, while the operational model ETA continues generating products until the WRF has gone through a reasonable time validation to be considered as a new operating model of the Service.

6.1.2 Planned Research Activities in Long-range Forecasting

Next year analyzed variables are precipitation, temperature, and a special analysis of extreme events for temperature and rainfall for Peru and two selected basins . The final report could be finished in December 2008.

Moreover, SENAMHI continues with other activities related to long range forecast, these projects are: seasonal forecast with CCM deterministic model - MOS, CCM ensemble forecast – MOS, and WRF-CAM.

Some activities of regional climate scenarios have not been completed, so in future years we hope to continue to develop the next step in the climate change. It is very likely that this developed technique is applied in other basins as the Urubamba, Mantaro, Apurímac and Cusco.

7. References

ACUÑA, D. and CARRILLO, M. 2001: Analysis of the output of the CCM3 Model in Peru for the SST of the year 2000. Revista Científica N° 1-SENAMHI, Lima, Peru.
CARRILLO, Mauricio and BAZO, Juan. 2004: Dynamics of the Generation of Extreme Precipitation in the Northern of Peru. Gayana, vol 68, No.2, p.83-90.