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

ALGERIA

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1. Summary of highlights

The major changes in data processing and forecasting system during the year 2007, at the National Meteorological Forecasting Centre of Algiers are as follow:
- Use of the of ALADIN cycle 32t1
- Use of some additional ALADIN outputs as CAPE and Potential Vorticity
- Use of WAM (wave model) with ALADIN 10 m winds as inputs
- Elaboration of a new web page to visualise the ALADIN outputs
- Publication of two articles in the ALADIN newsletter N° 32
- Publication of two articles in the ALADIN newsletter N° 33

2. Equipment in use

- Two commutation systems of messages and processing (Messir) working on hot stand-by mode, dedicated to :
  - Exchange of data and products in TCP/IP and ftp modes
  - Aeronautical and satellite products (RETIM 2000, SADIS and MSG)

- More than thirty personal computers (Pentium IV) under Windows and Linux are used at the national meteorological centre of Algiers.

3. Data and Products from GTS in use

- Synop + ship : 8416 messages
- TEMP + TEMP/ship + Pilot : 977 messages
- Satob : 1635 messages
- GRIB Météo France : 1738
- GRIB KWBC : 2400
- GRIB EGRR : 9726
- GRIB ECMWF : 1828
- Aeronautical charts T4 (Wafs Exeter and KWBC)
- T4 received via RETIM and SADIS

4. Forecasting system

The forecasting system at the national meteorological centre of Algiers is based on the following models: Arpège as a GFS and ALADIN/Algérie as a LAM with an horizontal resolution of 12 km. The LAM model Eta/Algérie with an horizontal resolution of 36 km is also under use. Other models as the ones of: ECMWF, KWBC, UKMO, Eta/Greece and some EPS fields are also under use.

4.1 System run schedule and forecast ranges

The Limited Area Models ALADIN/Algérie and ETA/Algérie are used in operational way. The two models are launched twice a day (00 and 12 UTC). ALADIN/Algérie model is coupled with Arpège, and is integrated until 48 hours. Eta/Algérie model is coupled with the NCEP model and is integrated until 72 hours. A daily update of the two models is done on the following web site: www.meteo.dz.
An extended version of ETA model up to the golf of Guinea is also daily updated on the web site. This version is called Eta-Afrique.

4.2 Medium range forecasting system (4-10 days)

The models which are used to elaborate the medium range forecasts are: Arpège and ECMWF in addition to EPS providing from several centres. Other models as GFS (NCEP) are also used.

4.2.1 Data assimilation, objective analysis and initialization

4.2.1.1 In operation

Not available yet

4.2.1.2 Research performed in this field

Observation Data Base and quality control of the observations, under development.

4.2.2 Model

4.2.2.1 In operation

The models which are under use at the National Forecasting Meteorological Centre of Algiers are:

1) Eta model

MODEL:	ETA/Algérie: Limited Area Model based on eta (η) coordinate
Basic equations	Primitive Equations
Independent variables	Latitude, Longitude, eta (η) and time
Dependent variables	Temperature, horizontal wind components, specific humidity, pressure and turbulent kinetic energy.
Numerical technique	Finite difference method
Horizontal	Janjic scheme Upstream advection used at near boundaries
Vertical	Euler backward time scheme. Centred differences in space for all quantities except humidity Upstream spatial differencing for humidity.
Time	Split-explicit time differencing
Integration domain	18° W to 18° E 17° N to 47° N
Horizontal and vertical resolution, time step	Horizontal : 36 km Vertical: 24 levels Time step: 120 s
Orography, gravity wave drag	Silhouette mountains
Horizontal diffusion	Nonlinear fourth order diffusion is applied to the historical variables T, q, u and v after each adjustment time step
Vertical diffusion	Mellor-Yamada hierarchy
Planetary boundary layer	Mellor-Yamada level 2.5
Treatment of sea surface, earth surface and soil	Surface layer : Monin-Obukhov similarity theory Janjic scheme for parameterization of surface processes Land-Air Parameterization scheme (LAPS) from Novi Sad University
Radiation	GFDL radiation scheme
Convection (deep and shallow)	Betts and Miller scheme
Atmospheric moisture	Zhao&al for large scale precipitation Betts and Miller scheme modified by Janjic for convective precipitation
Boundaries	Downloaded from NCEP
Albedo	climatology
SST Analysis	Downloaded from NCEP

2) ALADIN model

MODEL:	ALADIN/Algérie: **A**ire **L**imitée **A**daptation **D**ynamique développement **IN**ternational.

	In the frame of the ALADIN Consortium.
Basic equations	Primitive Equations system
Independent variables	Horizontal wind vector, temperature, specific humidity and surface pressure
Dependent variables	Vertical velocity and density
Numerical technique	Spectral
Horizontal	Spectral and uses bi-Fourier horizontal transforms on a bi-periodic domain
Vertical	Hybrid coordinate (s,p) from Simmons and Burridge (1981).
Time	Semi-Lagrangian
Integration domain	11° W to 17° E 18° N to 47° N
Horizontal and vertical resolution, time step	Horizontal : 12 km Vertical : 46 levels Time step : 415 s
Orography, gravity wave drag	The orography of this model is computed from the data base GTOPT30, using a variational technique that strongly reduces the noise associated to Gibbs waves. The gravity waves drag takes into account some anisotropy, blocking and mid-tropospheric effects.
Horizontal diffusion	Implicit in spectral space and incorporating an orography dependant correction
Vertical diffusion	Scheme linked with PBL
Planetary boundary layer	ECMWF method (Louis et al. 1981) with several enhancements in the stable case.
Treatment of sea surface, earth surface and soil	An improved version of ISBA (Interaction Soil Biosphere Atmosphere) scheme is used, including an explicit parametrisation of soil freezing. Six prognostic variables are handled by ISBA. Soil characteristics (texture, depth) are point-dependent. Vegetation characteristics are point and month-dependent.
Radiation	Highly simplified scheme (inspired by Ritter and Geleyn 1992) called at every time-step in every grid-point.
Convection (deep and shallow)	Mass-flux scheme (Bougeault 1985) enhanced with : - The Gregory-Kershaw treatment of momentum transport by cumulus - A treatment of the moist adiabatic computation consistent with the previous point - A downdraft parametrisation - Vertically variable entrainment and detrainment rates - A parametrisation of the selective effect of entrainment leading to a warmer upper part of the single cloud ascent
Atmospheric moisture	Specific humidity is the variable: no storage of the condensate; evaporation of the falling rain; treatment of the ice-phase
Boundaries	Coupled with ARPEGE
Albedo	climatology
SST Analysis	Coupled with ARPEGE

4.2.2.2 Research performed in this field

Some researches are performed in the improvement of the dust concentrations forecasts, with the modification of:

- potential dust sources over the Sahara
- modification of the critical velocity taking into account the diameter of the dust particles
- Coupling surface fluxes with ALADIN

4.2.3 Operationally available Numerical Weather Prediction Products

ALADIN Model	
Horizontal resolution	12 km
Domain	15N – 48 N ; 20 W - 20 E
Validity	00-48 h
Available products Output frequency: every 03 hours	- total precipitation - convective precipitation - snow height - MSLP - 10 m wind - 2 m temperature - Cl - Cm - Ch - Maximum temperature - minimum temperature - Z+T + RH 850, 700 and 500 hPa - Z + wind 300 hPa - Z + wind 200 hPa **Derived fields** - Thickness 1000/700 hPa - Thickness 1000/500 hPa - PV 315 K - PV 330 K - θ'w 700 hPa - θ'w 850 hPa - K index - Latent instability 1000/850 hPa, 850/700 hPa, 700/500 hPa - CAPE - Vertical velocity 850 hPa - Vertical velocity 700 hPa

ETA Model	
Horizontal resolution	**36 km**
Domain	18 W - 18 E ; 17 N - 47 N
Validity	00-72 hours
NWP Products	- Z+T 1000, 850, 700, 500, 300, 200 hPa - RH 850, RH 700 hPa - Vertical velocity : 850, 700 hPa - MSLP - Temperature 2m - DC (Dust concentration), - Nebulosity, - Visibility reduced by - Latent instability 1000/850 hPa - Latent instability 850/700 hPa - Latent instability 700/500 hPa - K Index - Potentiel vorticity 315 K - Potentiel vorticity 330 K - Surface humidity convergence

	- 850 hPa humidity convergence - Tetae surface - Tetae 850 hPa - Total precipitation - Convective precipitations

4.2.4 Operational techniques for application of NWP products *(MOS, PPM, KF, Expert Systems, etc..)*

4.2.4.1 In operation

None

4.2.4.2 Research performed in this field

MOS under development

4.2.5 Ensemble Prediction System (EPS)

4.2.5.1 In operation

None

4.2.5.2 Research performed in this field

None

4.2.5.3 Operationally available EPS Products

The ones from the great major as NCEP

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

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation

Not available yet - ALADIN model is coupled with Arpège

4.3.1.2 Research performed in this field

Observation data base and quality control of the observations under development.

4.3.2 Model

4.3.2.1 In operation

As in 4.2.2

4.3.2.2 Research performed in this field

In the frame of ALADIN Consortium's research programme for 2008, the effort will be done on the assimilation of satellite (ATOVS, SEVERI) and radar data.

4.3.3 Operationally available NWP products

As in 4.2.3

4.3.4 Operational techniques for application of NWP products

4.3.4.1 In operation

None

4.3.4.2 Research performed in this field

none

4.3.5 Ensemble Prediction System

4.3.5.1 In operation

none

4.3.5.2 Research performed in this field

none

4.3.5.3 Operationally available EPS Products

The ones of the major centres as NCEP

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

4.4.1 Nowcasting system

4.4.1.1 In operation

Not yet

4.4.1.2 Research performed in this field

The Algerian Met service plans to build a nowcasting system based on satellite and radar data and very high resolution model outputs

4.4.2 Models for Very Short-range Forecasting Systems

4.4.2.1 In operation

ALADIN/Algérie model with outputs frequency every three (03) hours up to 48 hours
ETA/Algérie model with outputs frequency every six (06) hours up to 72 hours

4.4.2.2 Research performed in this field

Combining high resolution model outputs with satellite and radar data to build a very short-range forecasting system with one hour frequency outputs.

4.5 Specialized numerical predictions

WAM model is under use with ALADIN/Algérie 10 m winds as input data, the model is integrated up to 48 hours

4.5.1 Assimilation of specific data, analysis and initialization (where applicable)

4.5.1.1 In operation

none

4.5.1.2 Research performed in this field

none

4.5.2 Specific Models

4.5.2.1 In operation

none

4.5.2.2 Research performed in this field

Assimilation of satellite and radar data.

4.5.3 Specific products operationally available

Dust concentration converted to visibility.
Significant height and direction of the swell, over the western part of the Mediterranean sea.

4.6 Extended range forecasts (ERF) *(10 days to 30 days)*

4.6.1 Models

4.6.1.1 In operation

none

4.6.1.2 Research performed in this field

none

4.6.2 Operationally available NWP model and EPS ERF **products**

none

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

4.7.1 In operation

none

4.7.2 Research performed in this field

None

4.7.2 Operationally available EPS LRF products

none

5. Verification of prognostic products

5.1

- 24 hours verification statistics
- Model : ALADIN/Algérie

		Jan. 2007	Feb. 2007	Mar. 2007	Apr. 2007	May 2007	Jun. 2007	Jul. 2007	Aug. 2007	Sep. 2007	Oct. 2007	Nov. 2007	Dec. 2007
MSLP	RMSE	0.92	0.87	1.40	1.50	1.01	0.88	1.00	1.1	1.06	0.90	0.93	0.99
	BIAS	0.28	0.13	0.05	0.06	0.00	-0.21	-0.09	-0.02	0.09	0.23	0.28	0.39
	MAE	0.73	0.67	0.87	0.92	0.76	0.72	0.77	0.84	0.81	0.72	0.73	0.78
	AC	0.98	0.98	0.88	0.89	0.98	0.96	0.94	0.94	0.95	0.96	0.98	0.98
Temperature at 850 hPa	RMSE	0.69	0.59	1.42	1.46	0.83	0.74	0.85	0.94	0.88	0.75	0.70	0.69
	BIAS	-0.27	-0.30	-0.30	-0.12	-0.17	-0.21	0.03	0.05	0.02	-0.02	-0.03	-0.09
	MAE	0.55	0.53	0.84	0.84	0.64	0.61	0.67	0.71	0.66	0.58	0.48	0.53
Geopotential at 850hPa	RMSE	4.48	4.26	17.96	11.74	4.88	3.57	4.73	5.02	4.86	6.37	5.12	4.77
	BIAS	1.76	0.47	5.20	2.37	1.07	-1.12	-2.01	-0.79	-0.33	3.60	0.21	1.64
	MAE	3.53	3.89	9.15	6.89	3.74	2.95	3.85	3.93	3.78	5.18	4.27	3.79
Temperature at 500 hPa	RMSE	0.59	0.46	1.21	1.56	0.75	0.62	0.71	0.78	0.73	0.75	0.59	0.66
	BIAS	-0.27	-0.01	-0.15	-0.28	-0.32	-0.23	-0.27	-0.3	-0.34	-0.30	-0.15	-0.17
	MAE	0.55	0.43	0.74	0.88	0.57	0.51	0.56	0.61	0.58	0.59	0.48	0.51
Geopotential at 500 hPa	RMSE	6.60	3.68	28.10	23.84	7.23	6.10	6.17	6.16	6.06	6.49	6.22	6.64
	BIAS	0.81	-0.97	1.35	-2.24	-2.73	-4.56	-3.85	-2.88	-3.06	0.84	-0.93	-0.21
	MAE	4.92	3.29	12.24	10.91	5.53	5.18	5.01	4.89	4.89	5.09	5.78	5.14
Component of wind (u) at 850 hPa	RMSE	1.64	1.57	3.08	3.01	2.47	2.19	2.46	2.68	2.59	2.26	1.87	1.75
	BIAS	-0.20	0.32	0.03	0.13	0.25	0.29	0.24	0.14	0.26	0.24	0.15	0.12
	MAE	1.22	1.41	1.97	2.06	1.83	1.76	1.89	2.01	1.95	1.73	1.46	1.33
Component of wind (v) at 850 hPa	RMSE	1.51	1.20	3.13	2.67	2.41	2.19	2.42	2.68	2.68	2.22	1.89	1.75
	BIAS	0.03	0.15	0.17	0.21	0.24	0.09	0.03	0.19	0.20	0.07	0.10	0.07
	MAE	1.14	1.08	1.94	1.87	1.76	1.73	1.84	2.00	2.01	1.70	1.45	1.31

- 48 hours verification statistics
- Model : ALADIN/Algérie

		Jan. 2007	Feb. 2007	Mar. 2007	Apr. 2007	May 2007	Jun. 2007	Jul. 2007	Aug. 2007	Sep. 2007	Oct. 2007	Nov. 200 7	Dec 2007
MSLP	RMSE	1.15	1.13	1.60	1.68	1.30	1.13	1.25	1.38	1.29	1.17	1.20	1.25
	BIAS	0.32	0.06	-0.06	0.06	-0.08	-0.43	-0.22	-0.15	-0.07	0.26	0.31	0.45
	MAE	0.91	0.87	1.09	1.11	1.01	0.94	0.99	1.08	1.01	0.93	0.95	0.99
	AC	0.95	0.91	0.87	0.82	0.96	0.91	0.87	0.90	0.95	0.92	0.95	0.96
Temperature at 850 hPa	RMSE	0.96	0.77	1.55	1.77	1.15	1.12	1.17	1.24	1.13	1.09	0.97	0.95
	BIAS	-0.34	-0.34	-0.51	-0.12	-0.44	-0.48	-0.11	0.01	-0.06	-0.08	-0.05	-0.09
	MAE	0.76	0.65	1.05	1.11	0.90	0.91	0.93	0.96	0.86	0.85	0.74	0.73
Geopotential at 850hPa	RMSE	7.84	5.58	20.17	15.24	7.41	5.97	6.57	7.63	7.39	8.96	7.19	8.05
	BIAS	4.06	4.05	6.04	6.49	0.84	-0.83	-0.67	1.48	0.88	4.21	1.39	2.41
	MAE	6.21	5.06	11.81	9.76	5.89	4.74	5.28	6.05	5.57	7.23	5.63	6.46
Temperature at 500 hPa	RMSE	0.96	0.76	1.49	1.76	1.02	0.87	0.98	1.00	0.97	1.11	0.86	1.06
	BIAS	-0.10	-0.20	-0.30	-0.44	-0.52	-0.28	-0.4	-0.42	-0.38	-0.46	-0.05	-0.23
	MAE	0.71	0.61	1.02	1.11	0.79	0.72	0.78	0.80	0.75	0.86	0.74	0.79
Geopotential at 500 hPa	RMSE	12.52	7.53	30.03	28.27	11.68	9.50	8.14	9.08	9.86	10.66	9.77	13.72
	BIAS	3.04	4.08	0.47	0.07	-5.62	-6.28	-4.09	-1.19	-2.41	-0.02	-0.08	0.28
	MAE	9.14	6.31	16.09	14.66	9.11	7.57	6.39	7.07	7.20	8.29	7.65	10.53
Component of wind (u) at 850 hPa	RMSE	2.10	1.96	3.62	3.56	3.02	2.74	3.08	3.25	3.15	2.97	2.41	2.39
	BIAS	-0.11	0.08	0.01	0.20	0.42	0.22	0.29	-0.10	0.29	0.24	0.17	0.04
	MAE	1.57	1.55	2.49	2.58	2.24	2.22	2.39	2.49	2.38	2.28	1.83	1.81
Component of wind (v) at 850 hPa	RMSE	1.98	1.52	3.43	3.30	3.02	2.81	2.98	3.28	3.26	2.90	2.45	2.41
	BIAS	-0.04	0.38	0.15	0.17	0.13	0.01	0.07	0.43	0.42	0.02	0.14	0.06
	MAE	1.49	1.34	2.35	2.41	2.25	2.24	2.29	2.49	2.46	2.21	1.83	1.81

5.2 Research performed in this field

Verification of both ETA and ALADIN models

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

In the frame of the ALADIN Consortium, the Algerian Met service expect to install and to implement the ALADIN chain based on the ALADIN 3Dvar and ALADIN model. This will be done after the installation of the supercomputer dedicated to numerical weather prediction. A Doppler radar will be installed before the end of the first half 2008. After the implementation of AROME model, which is a very high resolution model, the Algerian met service will effectively take part in the achievement of the research plans established every year by the ALADIN Consortium.

6.1 Development of the GDPFS

6.1.1 After the installation of the ALADIN chain, the Algerian Met service expect to install and to implement AROME model. In addition, researches on the assimilation of satellite and radar data and raingauges provided by automated stations, will be conducted.

6.1.2 The Algerian Met service expects to build a nowcasting system based on : very high resolution model outputs, satellite and radar data.

6.2 Planned research Activities in NWP, Nowcasting and Long-range Forecasting

Nowcasting system combining satellite plus radar data with short range high resolution model outputs.

6.2.1 Planned Research Activities in NWP

Improvement of dust concentration forecasts, build of observation data base, assimilation of satellite and radar data.

6.2.2 Planned Research Activities in Nowcasting

Build of nowcasting system based on satellite and radar data and high resolution model outputs with a frequency outputs of one hour.

6.2.3 Planned Research Activities in Long-range Forecasting

None

7. References

ALADIN Newsletters: http://www.cnrm.meteo.fr/aladin/newsletters/newsletters.htm

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