WDS/DPFS/GDPFS-NWP_2013

ANNUAL JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA PROCESSING AND FORECASTING SYSTEM (GDPFS) AND NUMERICAL WEATHER PREDICTION (NWP) RESEARCH ACTIVITIES FOR 2013

ALGERIA

Office National de la Météorologie
01, Avenue Khemisti BP 153
16100 Dar El Beida Alger Algérie
http:// www.meteo.dz

1. Summary of highlights

The major changes in data processing and forecasting system during the year 2013, at the National Meteorological Forecasting Centre of Algiers are as follow:
- Acquisition of an IBM brand computer
- Installation and implementation of the computer dedicated to Numerical Weather Prediction
- Implementation of ALADIN model (cycle 38) on the computer (12 km Horizontal resolution)
- Implementation of ALADIN/dust
- Implementation of AROME model (03 km horizontal resolution)

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 with two SADIS systems and four MSG systems.
  - IBM computer with a pick power of 10 Tf

- More than thirty working stations dedicated to the forecasters.

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 Eumetsat 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 and AROME/Algérie as a LAM with an horizontal resolution of respectively 12 km and 03 km. Other models as the ones of: ECMWF, KWBC, UKMO, Eta/Greece and some EPS fields and Epsgrams and the Extreme Forecast Index (EFI) from ECMWF are also under use.

4.1 System run schedule and forecast ranges

The Limited Area Models ALADIN/Algérie, AROME/Algérie and WRF are used in operational way. The tree models are launched twice a day (00 and 12 UTC). ALADIN/Algérie model is coupled with Arpège/IFS, and

is integrated until 48 hours. AROME/Algérie model is coupled with ALADIN/Algérie and is integrated until 48 hours. A daily update of the two models is done on the intranet web site.

4.2 Medium range forecasting system (4-10 days)

The models which are used to elaborate the medium range forecasts are: Arpège and ECMWF. 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

- ALADIN/Algérie: 12km, 70 levels, hydrostatic, 00 to 48 hours.
- AROME/ALgérie**:** 03 km, 46 levels, non hydrostatic, 00 to 48 hours.
- Wrf/Algérie: 16 km, 40 levels, mainly non hydrostatic, 00 to 48 hours.

4.2.2.2 Research performed in this field

Research is performed in the improvement of the dust concentration forecasts in ALADIN, with the implementation of ALADIN/dust, and its use in operational way after validation.

4.2.3 Operationally available Numerical Weather Prediction Products

as in 4.3.3

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

none

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 centres as ECMWF

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

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation

none

4.3.1.2 Research performed in this field

Observation data base is under development.

4.3.2 Model

4.3.2.1 in operation

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 - RH at 2m - Gust Wind at 10m **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

4.3.1.2 In the frame of ALADIN Consortium's research programme for 2014, the effort will be done on the building a nowcasting system.

4.3.2 Model

4.3.2.1 In operation

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

1) 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

4.3.2.2 Research performed in this field

Researches are performed to improve the forecasted dust concentration in ETA model and coupling surface fluxes with ALADIN model.

2) AROME/Algérie model

Geographycal domain	31 27 N – 37 40 N 02 50 W - 08 40 E
Horizontal resolution	03 km
Number of vertical levels	49
Main characteristics of dynamics and physical parametrizations	Non-hydrostatic, explicitly resolved deep convection, parametrized shallow convection
Initial conditions	Dynamical adaptation without assimilation
Lateral boundary conditions	ALADIN/ALgérie model
Forecast range	00 UTC: +48 h Outputs : every one hour

4.3.3 Operationally available NWP products

4.3.3.1 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 - RH at 2m - Gust Wind at 10m **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

4.3.3.2 AROME	
Horizontal resolution	**03 km**
Domain	31 27 N – 37 40 N - 02 50 W - 08 40 E
Validity	00-48 h
Available products Output frequency: every 01 hour	- convective precipitation - snow height - MSLP - 10 m wind - 2 m temperature - Cl - Cm - Ch - Maximum temperature - minimum temperature - RH at 2m - Gust Wind at 10m

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

Adaptation of some products as Potential Vorticity, and CAPE

4.3.5 Ensemble Prediction System

4.3.5.1 in operation

Use of the ECMWF's EPSgrams

4.3.5.2 Research performed in this field

None

4.3.5.3 Operationally available EPS Products

EPSgrams and EFI from ECMWF

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 implemented a very high resolution model with 03 km horizontal resolution with is combined with satellite and radar pictures.

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
AROME/Algérie model with outputs frequency every one (01) hour up to 48 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.

4.5 Specialized numerical predictions

WAM model is under use with ALADIN/Algérie's 10 m winds as input data, and 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
Assimilation of satellite data.

4.5.2 Specific Models

4.5.2.1 In operation
none

4.5.2.2 Research performed in this field
none

4.5.3 Specific products operationally available

Implementation of ALADIN/dust to the forecast of dust concentration converted to visibility.

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 Verification of ALADIN/Algérie for 2013

.24H verification statistics
.Model : ALADIN/ALGERIE

		May 2013	June 2013	July 2013	August 2013	Sep 2013	Oct 2013	Nov 2013	Dec 2013
MSLP	RMSE	1.20	3.09	1.30	3.09	0.73	1.08	0.73	0.66
	BIAS	0.61	-0.50	0.71	-0.50	0.52	0.35	0.52	0.38
	MAE	0.98	2.19	0.88	2.19	0.61	0.72	0.61	0.55
T 2m	RMSE	1.84	2.58	1.74	2.58	1.33	1.52	1.33	1.31
	BIAS	0.24	0.82	0.34	0.82	0.34	0.51	0.34	0.22
	MAE	1.33	2.00	1.33	2.00	1.02	1.16	1.02	1.02
U 10m	RMSE	1.52	2.52	1.72	2.52	1.34	1.49	1.34	1.28
	BIAS	0.31	0.21	0.21	0.21	0.02	0.31	0.02	0.46
	MAE	1.39	1.93	1.29	1.93	1.03	1.13	1.03	1.02
V 10m	RMSE	1.75	2.31	1.65	2.31	0.75	1.33	0.75	0.76
	BIAS	0.51	-0.76	-0.61	-0.76	-0.08	0.01	-0.08	-0.02
	MAE	1.29	1.76	1.09	1.76	0.60	0.82	0.60	0.60
Temperature at 850 hPa	RMSE	2.13	3.47	2.03	3.47	0.54	1.31	0.54	0.60
	BIAS	-0.39	-0.49	-0.49	-0.49	-0.01	0.20	-0.01	0.11
	MAE	1.06	2.50	1.06	2.50	0.41	0.66	0.41	0.46
Geopotential at 850 hPa	RMSE	8.32	6.24	8.32	6.24	5.85	6.62	5.85	5.39
	BIAS	4.01	-6.58	4.01	-6.58	4.32	3.76	4.32	3.61
	MAE	6.02	8.60	6.02	7.50	4.89	5.22	4.89	4.56
Temperature at 500 hPa	RMSE	1.23	2.13	1.23	2.13	0.53	0.87	0.53	0.56
	BIAS	-0.41	-0.84	-0.41	-0.84	-0.08	-0.04	-0.08	-0.15
	MAE	0.79	1.59	0.79	1.59	0.40	0.54	0.40	0.43
Geopotential at 500 hPa	RMSE	9.74	9.83	9.74	9.83	5.97	10.96	5.97	6.39
	BIAS	-3.06	-7.76	-3.06	-7.76	3.21	3.93	3.21	2.39
	MAE	8.95	7.10	8.95	7.10	4.66	5.61	4.66	5.10
Component of wind (u) at 850 hPa	RMSE	3.01	5.19	3.01	5.19	1.66	2.24	1.66	1.56
	BIAS	0.60	1.69	0.60	1.69	0.13	0.34	0.13	0.18
	MAE	2.14	3.88	2.14	3.88	1.25	1.61	1.25	1.20
Component of wind (v) at 850 hPa	RMSE	3.02	5.00	3.02	5.00	1.70	2.14	1.70	1.52
	BIAS	0.13	0.08	0.13	0.08	-0.01	-0.06	-0.01	0.08
	MAE	2.06	3.73	2.06	3.73	1.26	1.53	1.26	1.15

. 48H verification statistics
. Model : ALADIN/ALGERIE

		May 2013	June 2013	July 2013	August 2013	Sep 2013	Oct 2013	Nov 2013	Dec 2013
MSLP	RMSE	1.22	1.33	1.53	3.09	1.22	1.32	1.02	0.99
	BIAS	0.26	0.46	0.95	-0.18	0.28	0.36	0.62	0.49
	MAE	0.81	0.71	1.13	2.25	0.82	0.91	0.83	0.80
T 2m	RMSE	1.78	1.59	1.90	2.63	1.59	1.69	1.52	1.46
	BIAS	0.55	0.58	0.33	0.80	0.43	0.52	0.31	0.22
	MAE	1.22	1.23	1.48	2.07	1.19	1.29	1.16	1.13
U 10m	RMSE	1.57	1.47	1.89	2.58	1.57	1.67	1.51	1.43
	BIAS	0.17	0.38	0.17	0.17	0.27	0.29	0.01	0.43
	MAE	1.15	1.18	1.45	2.00	1.24	1.26	1.15	1.13
	RMSE	1.42	1.29	1.85	2.42	1.53	1.52	0.93	0.92

V 10m	BIAS	-0.03	-0.11	-0.75	-0.87	-0.21	-0.01	-0.08	0.06
	MAE	1.12	1.22	1.30	1.89	1.02	1.02	0.74	0.72
	RMSE	1.58	1.55	2.18	3.53	1.54	1.55	0.78	0.88
Temperature	BIAS	0.18	0.14	-0.63	-0.59	0.12	0.14	-0.02	0.16
at 850 hPa	MAE	0.79	0.89	1.26	2.59	0.89	0.89	0.59	0.67
Geopotential	RMSE	8.46	8.56	9.91	8.15	8.58	8.56	7.98	8.06
at 850 hPa	BIAS	3.57	3.47	5.53	-4.35	3.43	3.47	5.04	4.80
	MAE	6.25	6.35	7.60	8.17	6.35	6.35	6.53	6.69
Temperature	RMSE	1.05	1.07	1.40	2.19	1.07	1.07	0.78	0.87
at 500 hPa	BIAS	-0.15	-0.13	-0.55	-0.91	-0.13	-0.13	-0.15	-0.18
	MAE	0.63	0.73	0.97	1.67	0.73	0.73	0.59	0.65
Geopotential	RMSE	5.76	5.86	4.02	6.93	3.86	5.86	7.00	8.28
at 500 hPa	BIAS	2.67	2.66	-4.01	-7.35	2.66	2.66	3.50	2.90
	MAE	8.48	8.45	8.80	7.46	8.45	8.45	6.92	8.44
Component	RMSE	2.71	2.81	3.48	5.29	2.82	2.81	2.31	2.13
of wind (u)	BIAS	0.32	0.42	0.75	1.73	0.43	0.42	0.05	0.16
at 850 hPa	MAE	2.05	2.06	2.59	4.04	2.05	2.06	1.75	1.63
Component	RMSE	2.61	2.71	3.44	5.04	2.72	2.71	2.29	2.08
of wind (v)	BIAS	-0.14	-0.05	0.14	0.05	-0.04	-0.04	-0.07	-0.07
at 850 hPa	MAE	1.89	1.99	2.48	3.81	1.97	1.99	1.72	1.58

5.2 Research performed in this field

Verification of both ALADIN and AROME models

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

After the installation of the supercomputer and the implementation of ALADIN and AROME models, with respectively 12 km and 03 kms horizontal resolution, in the frame of the ALADIN Consortium. The Algerian met service expects to enhance the computing power to run AROME model with 2 km or less horizontal resolution to build a nowcasting system.

6.1 Development of the GDPFS

6.1.1 Researchs in forecasting the dust cycle are 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

Dust concentration, nowcasting system and the use of probabilistic forecasts.

6.2.1 Planned Research Activities in NWP

Improvement of dust concentration forecasts, observation data base.

6.2.2 Planned Research Activities in Nowcasting

Build of nowcasting system based.

6.2.3 Planned Research Activities in Long-range Forecasting

Use of AROME model with 01 km horizontal resolution

7. References

User Guide to ECMWF forecast products, 2007 : Anders Persson, Federico Grazzini

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

Morand, P., and C. Priou, 1995: Guide à l'usage des utilisateurs Arpège N°18

Yessad, K., 2005: Basics about ARPEGE/IFS, ALADIN and AROME in the cycle 30 of ARPEGE