NWP Activities in TUNISIA

National Institute of Meteorology

Department of Research and Development

المعهد الوطني للرصد الجوي

ALADIN

ALADIN

After beeing developed on Météo-France computers, the new version of ALADIN-Tunisia with SURFEX has been run successfully in Tunis on a HP research machine.

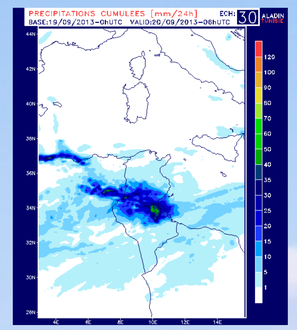

Figure 1: Total 24h accumulative rain for September 19th 2013 ALADIN 7.5km

Table 1 : ALADIN-Tunisia Model Setup

Parameter	Value
Model Version	CY38t1_bf.03
Resolution	7.5 km
Levels	70
Area	130 x 169
Boundaries	ARPEGE
Time step	450 s
Starting times	00 HTC

AROME

The AROME-Tunisia related activity made a new step by developping the 1.3 km version which is actually installed on Météo-France computers.

This version was considered to prepare the necessary Benchmark to dimension the future HPC at INM. The following table indicates the main caracteristics of the new AROME-Tunisie 1,3km version.

Table 2 : AROME-Tunisia Model Setup

Parameter	Value
Model Version	CY38t1op2
Resolution	1.3 km
Levels	90
Area	1000 x 1400
Boundaries	ARPEGE
Time step	45 s
Starting times	00 HTC

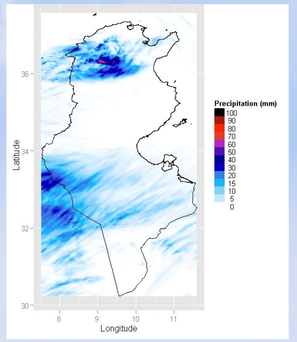

Figure 2: Total 24h accumulative rain for Mai 19th 2015 AROME 1.3km

HARMONIE

A new version of HARMONIE model over Tunisian domain has been developed. The main characteristics of this version are summarized in the following table:

First successful experiments of the new version are being run in Tunisia on a HP research machine.

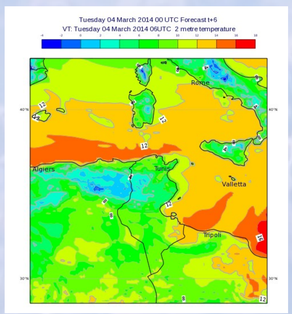

Figure 3: 2 metre temperature over Tunisia domain HARMONIE 2.5km

Table 3 : HARMONIE-Tunisia Model Setup

Parameter	Value
Model Version	CY38t1_bf.03
Resolution	2.5 km
Levels	70
Area	600 x 720
Boundaries	ALADIN
Physics	AROME
Starting times	00 UTC

New Operational Verification System

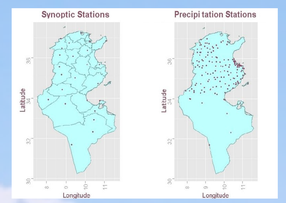

Figure 4a: Tunisia synoptic and pluviometric stations

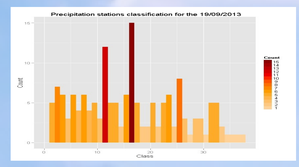

Figure 4b: Spatial classification of pluviometric Stations

The new verification system of ALADIN operational model in Tunisia consists on comparing and verifiying forecast data against GFS analysis 0.5° and synoptic stations data.
The verification is performed for four parameters; Temperature, Precipitation, Wind velocity and Relative Humidity.

The verification of the precipitation is performed for the 24 hour accumulated amount from 06 UTC to O6 UTC. The necessary observation data is collected from a network of 26 synoptic stations (Figure 4a-Left) and about 300 climatologic and pluviometric stations (Figure 4a-Right).
The verification domain was classified into different areas according to the geographic distribution of the stations. The current classification relies on the criteria of spatial homogeneity (Figure4b).

Different classifications and control areas based on homogeneous fixed verification grid at different scales (0.1°, 0.5°,1°), are applied on the verification procedure. Further spatial scores are being integrated to the operational system.

Precipitation

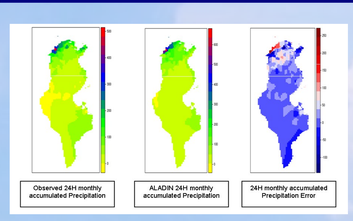

Figure 5 : Monthly 24H (from 6H to 06H) accumulated precipitation of, respectevely from left to right, Observation, ALADIN and their Error (Forecast-Observation)

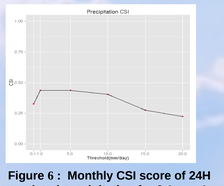

Figure 6 : Monthly CSI score of 24H accumulated precipitation for 0.1mm, 1mm, 5mm, 10mm, 15mm and 20mm thresholds

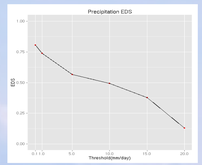

Figure 7 : Monthly EDS score of 24H accumulated precipitation for 0.1mm, 1mm, 5mm, 10mm, 15mm and 20mm thresholds

Temperature

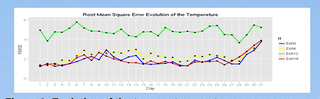

Figure 8: Evolution of the temperature root mean square error of ALADIN vs analysis at 0H, 6H, 12H and 18H

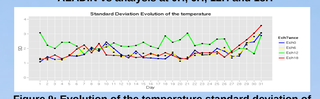

Figure 9: Evolution of the temperature standard deviation of ALADIN vs analysis at 0H, 6H, 12H and 18H

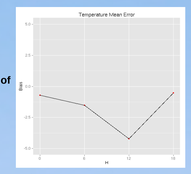

Figure 10: Temperature mean error of ALADIN vs Analysis at 0H, 6H, 12H and 18H

Wind

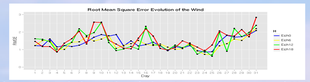

Figure 11: Evolution of the wind root mean square error of ALADIN vs analysis at 0H, 6H, 12H and 18H

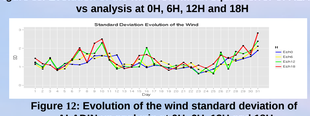

Figure 12: Evolution of the wind standard deviation of ALADIN vs analysis at 0H, 6H, 12H and 18H

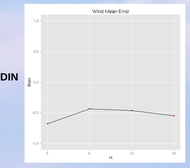

Figure 13: Wind mean error of ALADIN vs Analysis at 0H, 6H, 12H and 18H

Relative Humidity

Figure 14: Evolution of the relative humidity root mean square error of ALADIN vs analysis at 0H, 6H, 12H and 18H

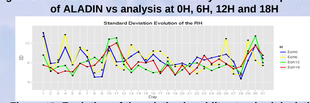

Figure 15: Evolution of the relative humidity standard deviation of ALADIN vs analysis at 0H, 6H, 12H and 18H

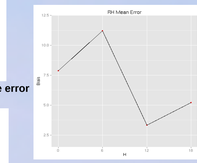

Figure 16: Relative humidity mean error of ALADIN vs Analysis at 0H, 6H, 12H and 18H

Models intercomparison – Study of the September 19th 2013 Convective System

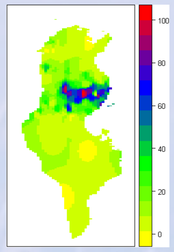

Figure 17: 24H observed precipitation

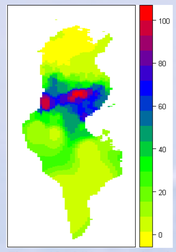

Figure 18: 24H accumulated precipitation - ALADIN operational suite 12.5km

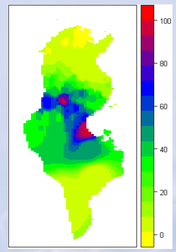

Figure 19: 24H accumulated precipitation - ALADIN 7.5km

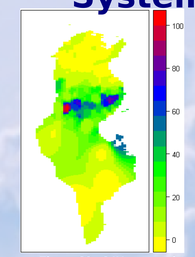

Figure 20: 24H accumulated precipitation - AROME 2.5km model

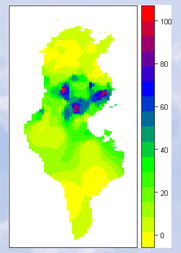

Figure 21: 24H accumulated precipitation - HARMONIE 2.5km model

A special interest was accorded to the prediction of convective rain systems since Tunisia is caracterized by a high frequency of convective situations, which may generate flash-floods especially in the interseason periods, as was the case of September 19th 2013 inondation. Therefore, different numerical models were applied in order to investigate their performence on such situation.

The actual case study was based on the comparison of simulated 24h accumulated precipitation (from 6H to 06H) against observation data which was collected from more than 300 pluviometric stations.
Four numerical models were considered during this case study; Operational ALADIN-Tunisia suite (12.5km), ALADIN-Tunisia (7.5km with SURFEX), AROME-Tunisia (2.5km) and HARMONIE-Tunisia (2.5km).

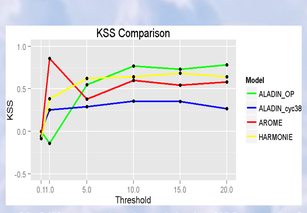

Figure 22: 24H accumulated precipitation KSS score for 0.1mm, 1mm, 5mm, 10mm, 15mm and 20mm thresholds

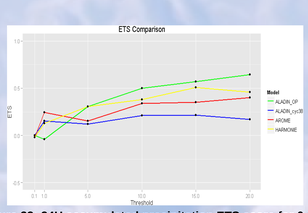

Figure 23: 24H accumulated precipitation ETS score for 0.1mm, 1mm, 5mm, 10mm, 15mm and 20mm thresholds

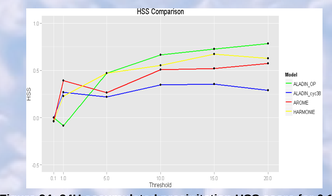

Figure 24: 24H accumulated precipitation HSS score for 0.1mm, 1mm, 5mm, 10mm, 15mm and 20mm thresholds

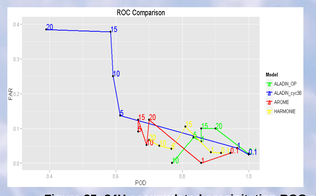

Figure 25: 24H accumulated precipitation ROC score