Status of Numerical Weather Prediction in Morocco (2018)

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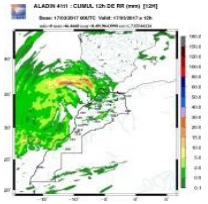
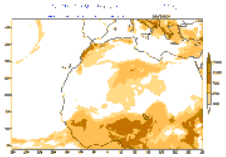
ALADIN/AROME Configurations without Data Assimilation

ALADIN :



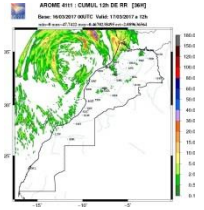
Coupling model : Arpège
Coupling frequency : 3h
Time step : 450s
Forecast range : 72h
Horizontal resolution:10km
Number of points : 320x320
Vertical Levels : 60
Cycle : 36t1, 38t1 (with Surfex)
For cy41t1 :
Horizontal Resolution : 7.5km
Number of points : 400x400
Vertical levels : 70
Time step : 300s

NORAF :



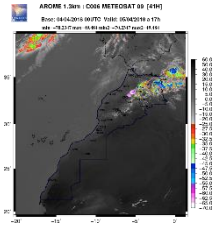
Horizontal resolution : 18km
Number of points : 324x540
Coupling frequency : 6h
Time step : 600s
Vertical Levels : 70
Cycle: cy41t1

AROME :



Coupling model : ALADIN 10km
Coupling frequency : 1h
Time step : 60s
Forecast range : 48h
Horizontal resolution : 2.5km
Number of points : 800x800
Vertical Levels : 60 (90 for cy41t1)
Cycle : 38t1 and cy41t1

AROME Benchmark



Coupling model : ALADIN 7.5km
Coupling frequency : 1h
Time step : 50s
Forecast range : 48h
Horizontal resolution : 1.3km
Number of points : 1800x1800
Vertical Levels : 90
Cycle : cy41t1

Configurations with data assimilation

Local Data handling

The following actions are achieved:

1. Getting data from GTS (in BUFR format) for SYNOP, TEMP and AMDAR data
2. Producing local BUFR from GPS (seen on 2nd poster)
3. Storing these data in a local database
4. Convert GTS data to ODB format (via BATOR).
5. Check the content of the resulting ODB by Mandalay

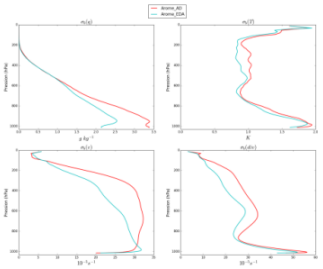
Data Assimilation suite in AROME

3DVAR for upper air analysis
Ensemble B matrix
Cycle 41t1 for AROME (2.5kmXL90)
Assimilation of conventional, GPS and ATOVS data
3h cycling

Background-error covariances for AROME

The first version of the backgound-error covariances for AROME-Maroc was calculated using AROME forecast ensemble coupled to Arpège in dynamic adaptation mode (Arome_AD).

The operational version is computed using an ensemble-assimilation-based method with six independent perturbed assimilation cycles (Arome_EDA).

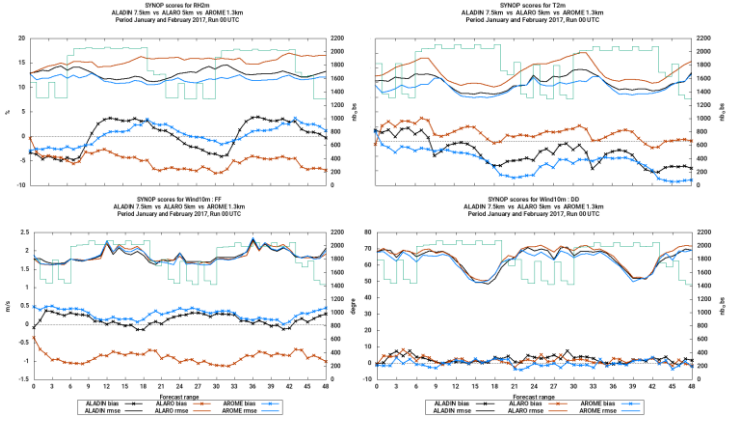


Vertical profile of the standard deviation of specific humidity (q), temperature (t), vorticity (v) and divergence (div) for Arome_AD and Arome_EDA.

Scores for Aladin 7.5km vs Alaro 5km vs Arome 1.3km :

The Bias and RMSE scores calculated over the period of two months (January and February 2017) are shown for ALADIN 7.5km, ALARO 5km and AROME 1.3 km. The parameters T2m, RH2m, speed and direction at 10m are compared to synoptic observations.

In general, the RMSE of AROME 1.3km seems to be the better one compared with other models in particular for T2m and RH2m.



Fog forecasting at kilometric scale by AROME Cy41t1 (1.3km)

Fog simulations have been performed over a small domain containing the main national airports, using AROME Cy41t1 (1.3km, L90). The fog layer is identified based on liquid water content (LWC) à 5m. Systematic numerical simulations over a winter season (2016-2017) indicate the AROME's ability to capture the fog occurrence with a relatively high false alarm rate. This high rate is due to the overestimation of fog forecasting over some synoptic stations. Besides, diagnostic of weaknesses and strengths of this fog forecast system shows that it underestimates the 2m-temperature early in the night and overestimates the 2m-relative humidity in the low levels of the atmosphere while it captures well the wind speed at 10m.

Visibility prediction based on AROME (2.5km) outputs using machine-learning regression

An estimated visibility product over the north of Morocco, from AROME Cy38t1 outputs using machine learning-regression, has been developed. The performance of the developed model has been assessed, over the continental part only, based on real data collected at 37 synoptic stations over 2 years (march 2015 – march 2017). Results analysis points out that the performance of the developed model for estimating visibility does not depend on daytime or nighttime; thus, it is insufficient to develop one model based on data covering the whole day. Besides, it is found that this model has shown a strong ability to differentiate between visibilities occurring during daytime and nighttime. However, the KDD-developed model have shown low performance of generality across time. The performance evaluation indicates a bias of -9m, a mean absolute error of 1349m with 0.87 correlation and a root mean-square error of 2150m.