

Numerical Weather Prediction at NIMH

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1. Operational Suite

Two canonical configurations are run at 00, 06, 12 and 18 UTC:

ALADIN-BG (5/105)

AROME-BG(2.5/90)

- dx = 5km (256x200)
- lev = 105
- LBC from ARPEGE
- dx = 2.5 km (320x240)- lev = 90
- LBC from ALADIN-BG

2. Operational Cluster

Scientists from the "Numerical Modeling" section administrate and maintain the WOLF (Weather Operational Numerical Forecast) cluster. WOLF is made up of 17 nodes, QNAP and server that hosts virtual machines hosting computing access and monitoring services. This cluster of machines is managed by a central management module for all machines, including the management server. The seventeen "nodes" communicate during operation using means for multi-processor parallel communication between the nodes (Message Passing Interface -MPI), and the distribution of resources is carried out by SLURM system.



Fig.1. ALADIN-BG orography

3. Verification

- forecast range – 48 h



Fig.2. AROME-BG orography



Fig.3. WOLF cluster at NIMF

We use our automated scheme for forecast verification of models forecast of temperature and relative humidity at 2m, wind speed and direction at 10 m, and 6h/12h precipitation based on synoptic measurements.



4. NWP Forecast End-users

The main end-users at NIMH: forecasters, Section "Specilized and maritime forecast", Section "Hydrological forecast, Section "Agrometeorology", Section "Atmospheric Pollution Modelling", We serve about 10 public and private enterprises as BULATSA, ELECTROHOLD, ...



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File	Edit	View	Search Termin	al Help							
տր	dd	hh[UT] temp	relhum[%]	wind[m/s]	dir[deg]	tot	high	mid	low	precip[mm]
	21		3.171000	95.637001	1.589000	194.445999	0.000350	0.000350	0.000000	0.000000	
	21		4.967000	85.503998	1.031000	122.482002	0.004240	0.004240	0.000000	0.00000	0.00000
	21		8.156000	74.960999	1.989000	33.048000	0.000400	0.000400	0.000000	0.000000	0.00000
	21		9.793000	70.934998	2.955000	32.041000	0.000000	0.000000	0.000000	0.000000	0.00000
	21	10	11.645000	67.291000	2.942000	27.590000	0.000000	0.000000	0.000000	0.000000	0.00000
	21	11	13.354000	62.948002	2.482000	31.474001	0.000000	0.000000	0.000000	0.000000	0.00000
	21	12	14.609000	56.144001	1.498000	27.462999	0.000000	0.000000	0.000000	0.000000	0.00000
	21	13	15.209000	51.066002	1.079000	167.597000	0.000490	0.000490	0.000000	0.000000	0.00000
	21	14	14.894000	52.266998	2.135000	196.561005	0.000030	0.000030	0.000000	0.000000	0.00000
	21	15	13.531000	60.375000	2.725000	192.358002	0.000000	0.000000	0.000000	0.000000	0.000000
	21	16	11.250000	66.361000	2.874000	184.996002	0.000000	0.000000	0.000000	0.000000	0.00000
	21	17	9.838000	70.245003	2.901000	169.072006	0.010860	0.000000	0.010860	0.000000	0.00000
	21	18	8.924000	73.249001	3.203000	148.136002	0.249570	0.000000	0.249570	0.029080	0.038320
	21	19	8.489000	73.831001	2.942000	145.018005	0.212500	0.000000	0.212500	0.046540	0.026770
	21	20	8.367000	72.476997	2.753000	147.210007	0.000000	0.000000	0.000000	0.000000	0.000040
	21	21	8.231000	73.521004	2.445000	155.391998	0.000000	0.000000	0.000000	0.000000	0.000060
	21	22	8.138000	76.143997	2.048000	175.841995	0.043020	0.000000	0.043020	0.030540	0.015630
	21	23	7.811000	77.545998	1.252000	199.722000	0.051080	0.051080	0.043900	0.000000	0.011920
	22		7.247000	78.369003	0.599000	210.610992	0.361820	0.357940	0.349480	0.000000	0.000000
	22		6.815000	79.445000	0.179000	354.061005	0.283350	0.179790	0.283350	0.000000	0.000020
	22		5.563000	84.417000	0.897000	36.779999	0.014810	0.002170	0.013100	0.000000	0.000010
	22		4.672000	86.998001	1.054000	40.825001	0.087270	0.082360	0.000000	0.005330	0.000090
	22		4.151000	87.355003	0.900000	58.310001	0.463670	0.380500	0.033420	0.118830	0.000070
	22		3.858000	86.254997	0.633000	121.379997	0.571180	0.393410	0.201630	0.265120	0.000030
	22		3.749000	85.386002	1.037000	161.891998	0.448180	0.166780	0.317210	0.284850	0.00000
	22		5.603000	84.682999	0.390000	151.154007	0.571660	0.023890	0.546310	0.359390	0.000500
	22		8.207000	78.679001	1.525000	12.816000	0.672550	0.103230	0.591300	0.559870	0.178520
	22		9.449000	77.195000	2.202000	20.840000	0.991380	0.000000	0.738020	0.925840	0.733600
	22	10	9.186000	83.403999	2.884000	1.082000	0.999000	0.003650	0.910930	0.999000	1.266360
	22	11	6.277000	91.180000	3.622000	323.630005	0.999000	0.468430	0.998360	0.999000	1.581800
	22	12	5.248000	88.620003	3.615000	318.394989	0.999000	0.466680	0.921900	0.999000	2.028910
	22	13	4.421000	88.248001	3.515000	315.007996	0.999000	0.947630	0.915780	0.999000	1.264970
	22	14	3.854000	87.171997	3.615000	306.328003	0.999000	0.999000	0.999000	0.600660	0.928190
	22	15	3.349000	88.127998	3.043000	311.928009	0.999000	0.814220	0.999000	0.474890	1.271441
	22	16	2.814000	90.714996	2.496000	320.681000	0.999000	0.946280	0.999000	0.548740	1.683319



Fig.4. Mean monthly BIAS and RMSE for each synoptic station for March 2024 of ALADIN-BG and AROME-BG temperature at 2m

Total Cloud Cov	er 2024/04/13 06 UTC	
		Gusts

Fig.5. Some examples of operational post-processing depending of the needs of the end-users

5. Some specific NWP forecast postprocessing

- We developed a scheme for lighting probability forecast based on AROME-BG microphysics



- We developed a scheme for damaging frost probability forecast based on ML technique (Random Forest) using ALADIN-BG output as predictors



Fig.7. Tmin forecasted by ALADIN (left) and frost probability forecasted by our scheme (right) for 11/05/23. Stations with registered frost are indicated with black crosses

6. Some ongoing tests

We are running in parallel of the operational suite:

Fig.6. Lightning probability forecast on 01/07/21 based on AROME-BG and cases with detected by ATDnet flashes (red). Respective values of POD, FAR, PC and FBI are indicated for each hour of the forecast.

- AROME-BG using directly the LBC from ARPEGE, with 3h frequency;
- AROME-BG using LBC from IFS, with 3h frequency;
- AROME-BG using LBC from IFS, with 1h frequency;



Fig.8. T2m (left) and W10m (right) BIAS as a function of forecast range of AROME-BG using different LBCs for a case study 29/01/24.

