

PP C2I: ICON Implementation Status @NMA & Verification Results

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(THEN) Previous Activities

- **Implementation of ICON + ICON_TOOLS** on our old IBM platform
- **Set-up of ICON-LAM** for Romanian territory at 7 km resolution on a similar (slightly larger) domain as the operational COSMO-7km
 - Initial and LBC data from ICON global (same as operational COSMO-7km)
 - 00UTC run / 78 forecast hours
- **Output**
 - model, pressure and height levels, regular lat/lon grid (netcdf) – operational use
 - regular lat/lon grid grib2 output to test in VERSUS
 - 48 forecast hours – output on native grid, LBC for ICON-LAM-2.8km (grib2)
- **First verification activities** (selected cases)

(NOW) Current Activities

ICON Implementation Status @NMA - Operational

Implementation on our new LENOVO platform

- Compiler – gnu-6.5.0
- openmpi-3.1.1
 - × libxml2-2.7.2
 - × zlib-1.2.11
 - × szip-2.1.1
 - × hdf5-1.10.2
 - × netcdf-4.6.3 + netcdf-f-4.4.5
 - × eccodes-2.13.0 for ICON
 - × grib_api for DWD lcontools

Set-up of ICON-LAM for Romanian territory at 2.8 km resolution, instead of 7km.

(NOW) Current Activities

- **Set-up of ICON-RO_2p8**

- Integration domain slightly reduced compared to 7km (due to computational resources)
- Initial & LBC data from ICON global (same as ICON-7km tested & operational COSMO-7km)
- **00UTC run / 78 forecast hours (operational) | 12UTC run / 174 forecast hours (in preparation)**
- $\text{dt}_{\text{time}} = 24\text{s} / \text{dt}_{\text{rad}} = 720\text{s} / \text{dt}_{\text{conv}} = 120\text{s}$

Output

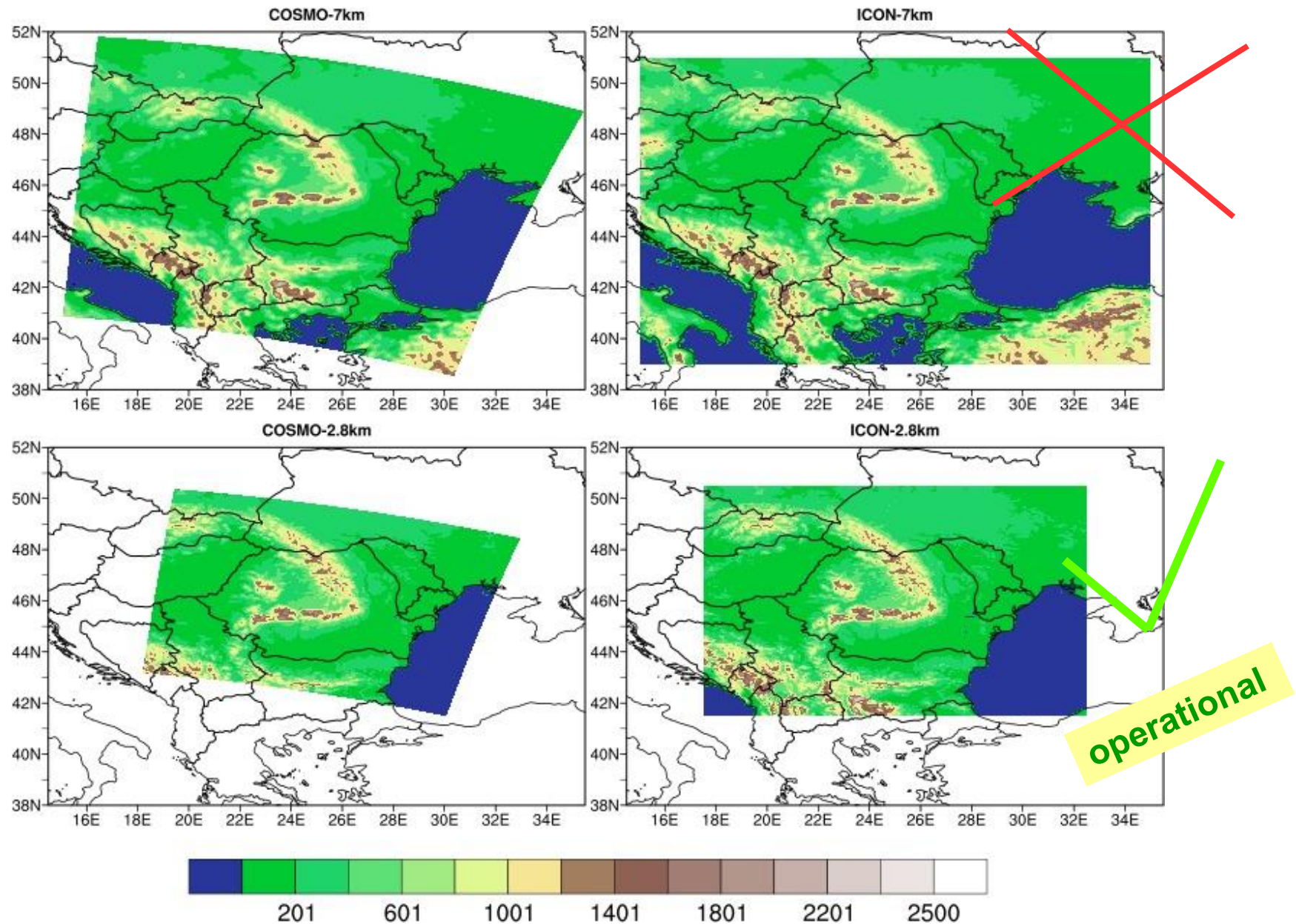
- model, pressure and height levels, regular lat/lon grid (netcdf) – operational use
- model levels, regular lat/lon grid (grib2) – verification

- **Graphics - NCL**

(NOW) Current Activities

- Set-up of ICON-RO_2p8

	COSMO-2.8km	ICON-2.8km
Grid points	105 051 (361x291)	147 260
Vertical levels	50	65
Time step	25s	24s
Forecast range	30 hours	78 hours



Computational Aspects

→ Tests performed on the new HPC (processors Xeon Gold 6130)

Model	Comp. Flags	No. Cores	I/O	30h forecast	78h forecast
COSMO-2.8km	O3	10x32		~20min	
ICON-RO2p8 (Oper)	O2, -fbacktrace -fbounds-check -fstack-protector-all -finit-real=nan -finit-integer=-2147483648 -finit-character=127	10x30	10	~50 min	~125 min
ICON-RO2p8	O3, -fbacktrace -finit-real=nan -finit-integer=-2147483648 -finit-character=127	10x30	10	~35 min	~ 85 min
ICON-RO2p8	O3, -fbacktrace -finit-real=nan -finit-integer=-2147483648 -finit-character=127	10x31	10	~34 min	
ICON-RO2p8	O3, -fbacktrace -finit-real=nan -finit-integer=-2147483648 -finit-character=127	10x31	4 or 2	Crash (also 10x32 in any config)	
ICON-RO2p8	O3 no debug block	10x31	10	~ 30 min	~82 min
ICON-RO2p8	O3 no debug block	10x30	10	~ 30 min	between 65 - 75 min

operational

operational

Thanks @Daniel Rieger

Test Cases

3-6 February 2020 (particularly of interest: very strong wind)

- precipitation
- snow depth
- 10m wind speed & direction / 10m wind gust

3-5 May 2020 (particularly of interest: precipitation)

- precipitation
- 2m temperature

6-8 August 2020 (particularly of interest: temperature and wind)

- 2m temperature
- 10m wind speed

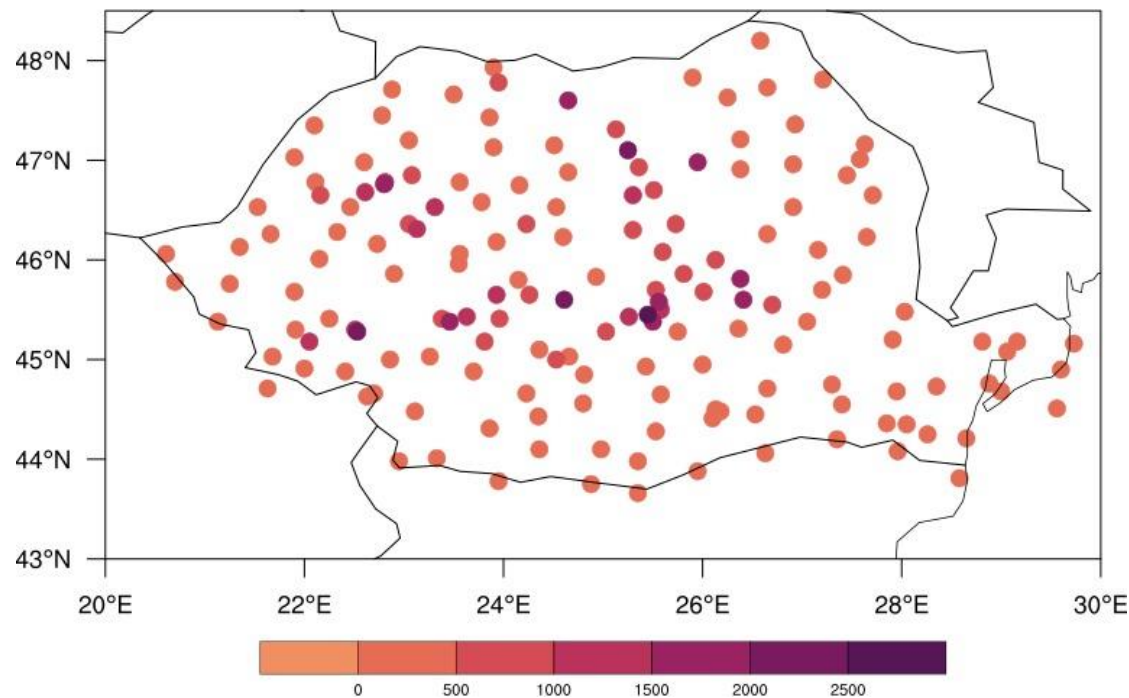
Validation for **June 2020** (using MEC+Rfdbk)

Scores computed with MEC+Rfdbk

Thanks @F. Fundel and H. Reich

Test Case 3-6 February 2020 (very strong wind)

SYNOP observations (all Romanian stations) & Radar data for the test cases



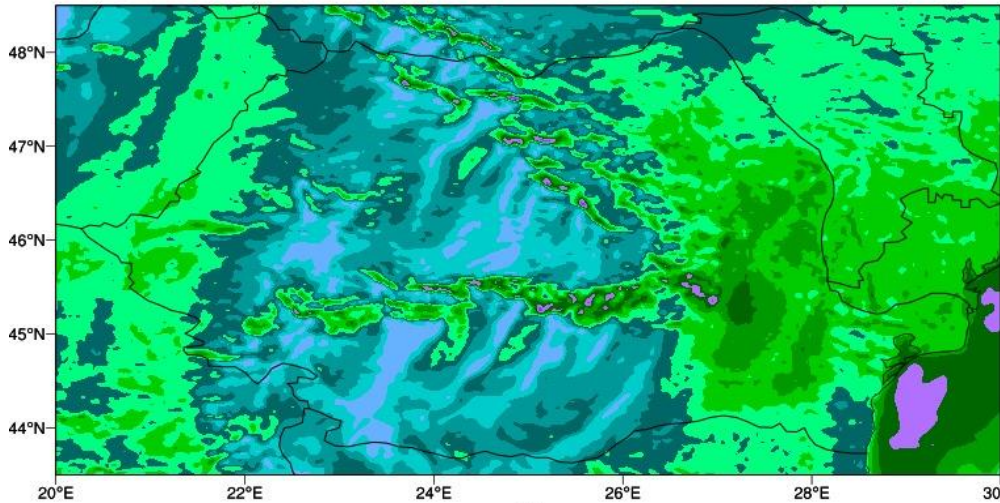
Test Case 3-6 February 2020 (very strong wind)

ICON-2.8km: 10m Wind Speed

Initial 03.02.2020, 00UTC

+69h

Valid 05.02.2020, 21UTC

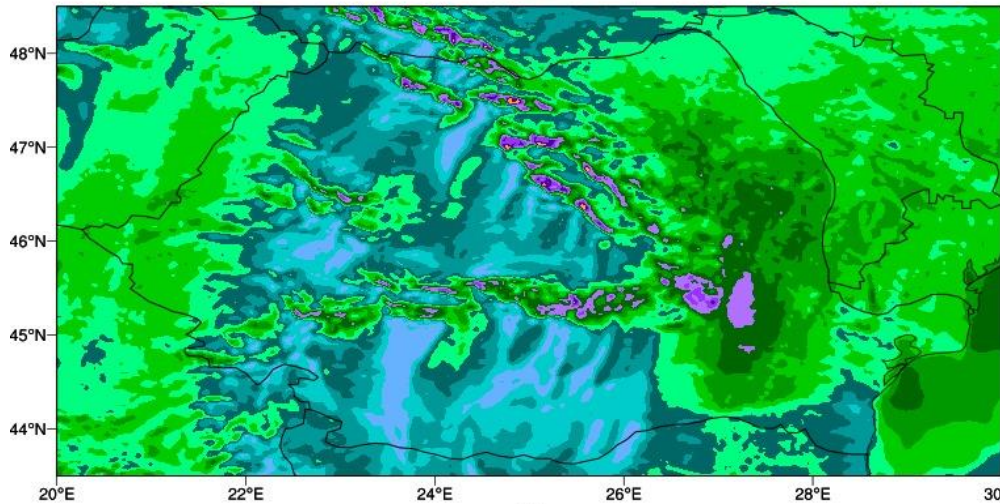


ICON-2.8km: 10m Wind Speed

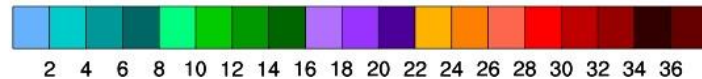
Initial 04.02.2020, 00UTC

+45h

Valid 05.02.2020, 21UTC



cm

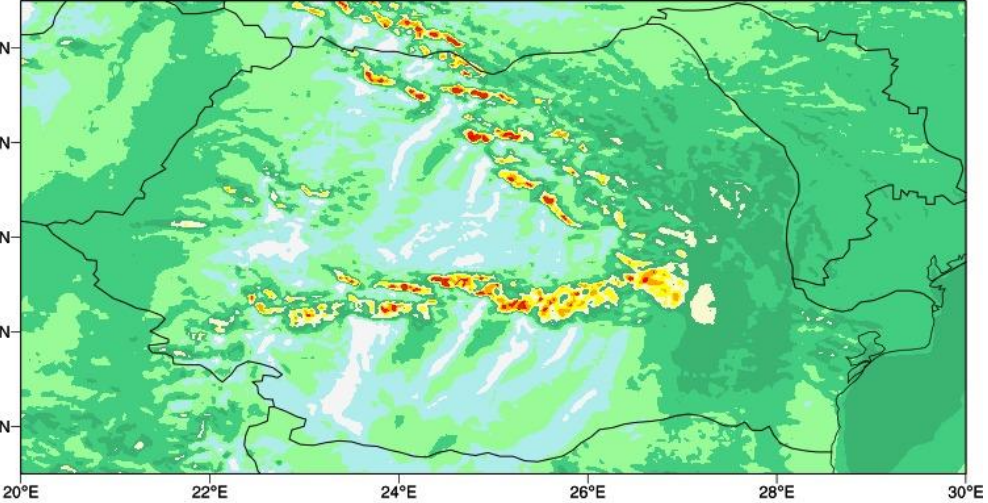


ICON-2.8km: 10m Wind Gust

Initial 03.02.2020, 00UTC

+69h

Valid 05.02.2020, 21UTC

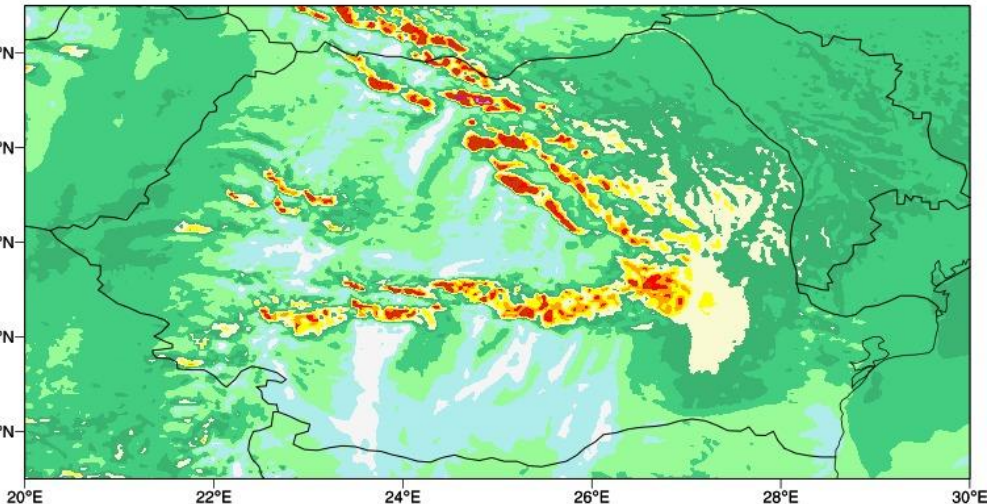


ICON-2.8km: 10m Wind Gust

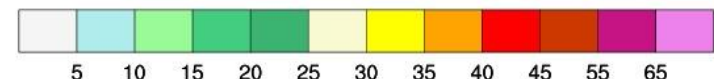
Initial 04.02.2020, 00UTC

+45h

Valid 05.02.2020, 21UTC



cm



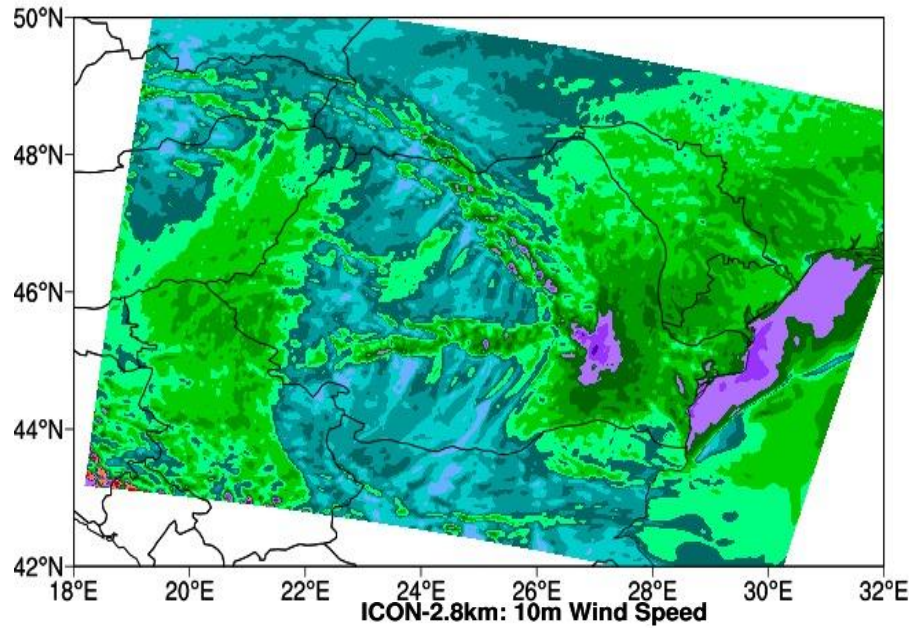
Test Case 3-6 February 2020 (very strong wind)

COSMO-2.8km: 10m wind speed

Initial 05.02.2020, 00UTC

+21h

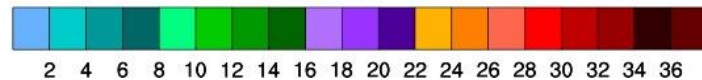
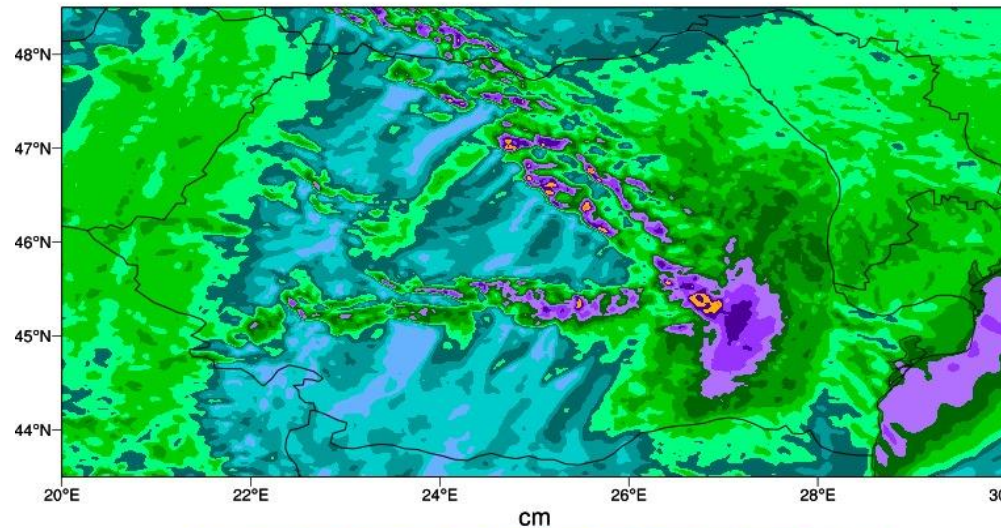
Valid 05.02.2020, 21UTC



Initial 05.02.2020, 00UTC

+21h

Valid 05.02.2020, 21UTC

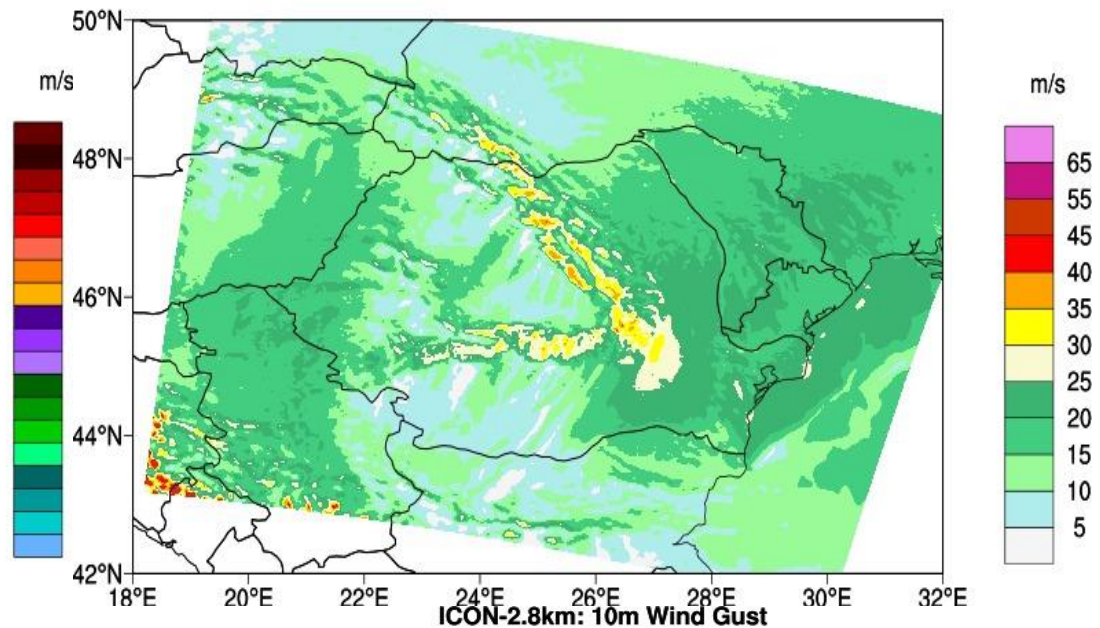


COSMO-2.8km: Rafala la 10m

Initial 05.02.2020, 00UTC

+21h

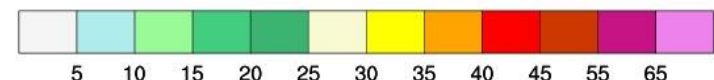
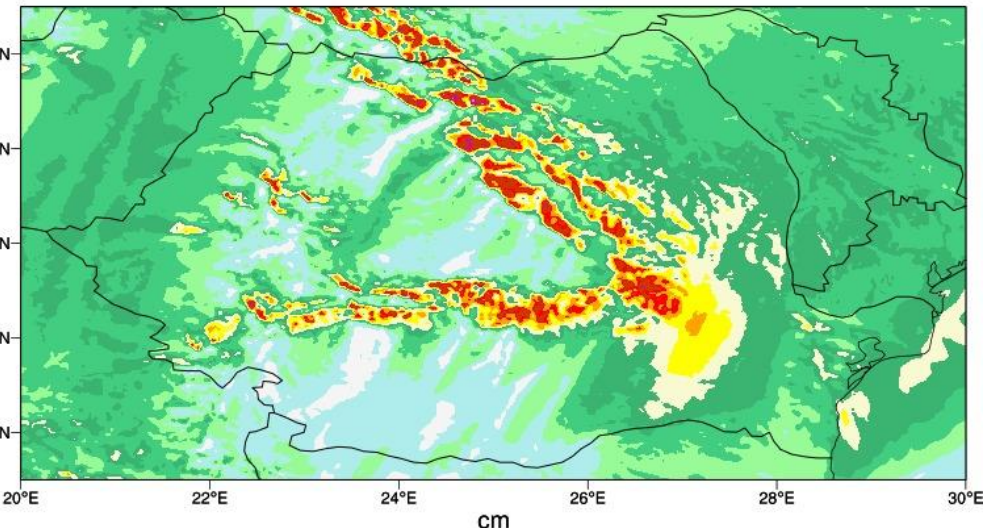
Valid 05.02.2020, 21UTC



Initial 05.02.2020, 00UTC

+21h

Valid 05.02.2020, 21UTC



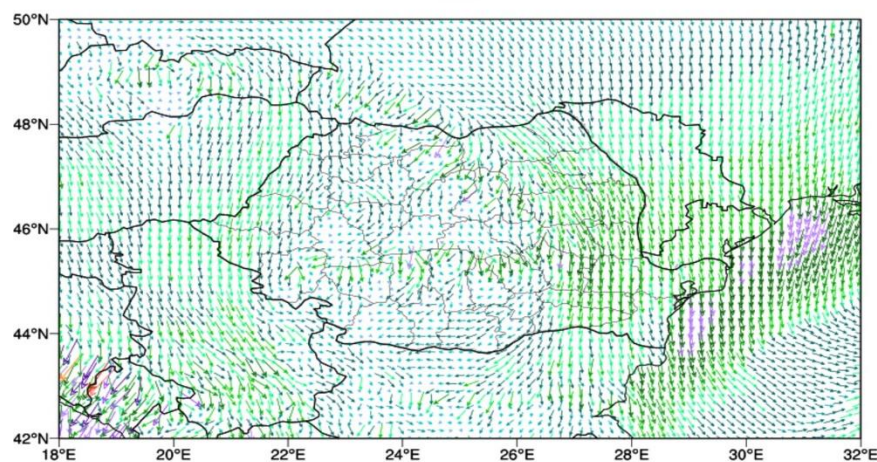
Test Case 3-6 February 2020 (very strong wind)

ICON-2.8km: Vantul la 10m

Baza 03.02.2020, 00 UTC

+69h

Valid 05.02.2020, 21 UTC

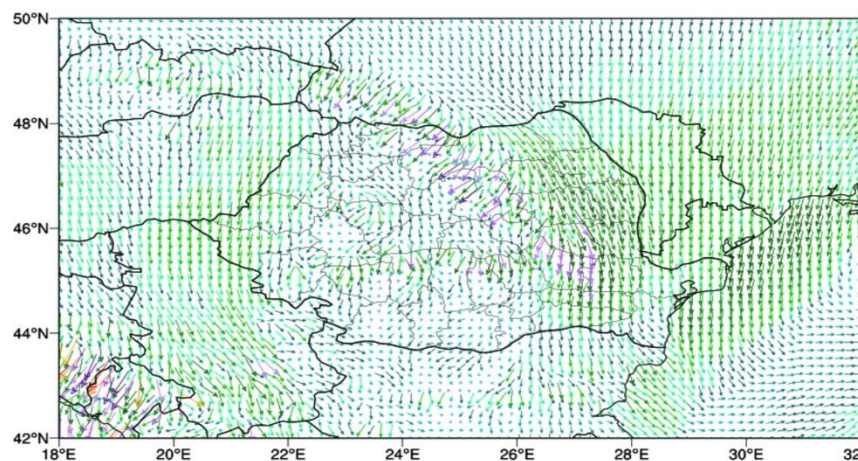


ICON-2.8km: Vantul la 10m

Baza 04.02.2020, 00 UTC

+45h

Valid 05.02.2020, 21 UTC

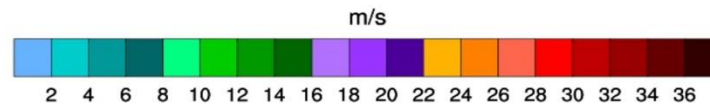
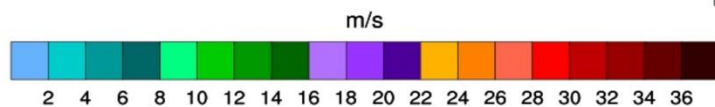
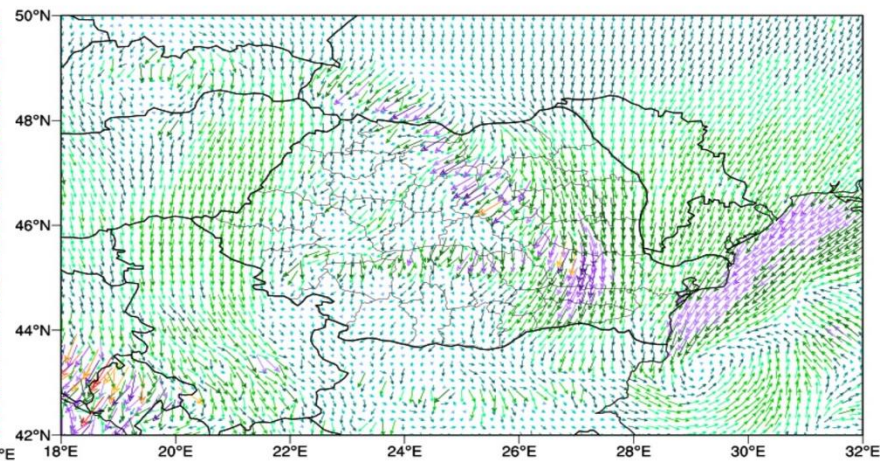


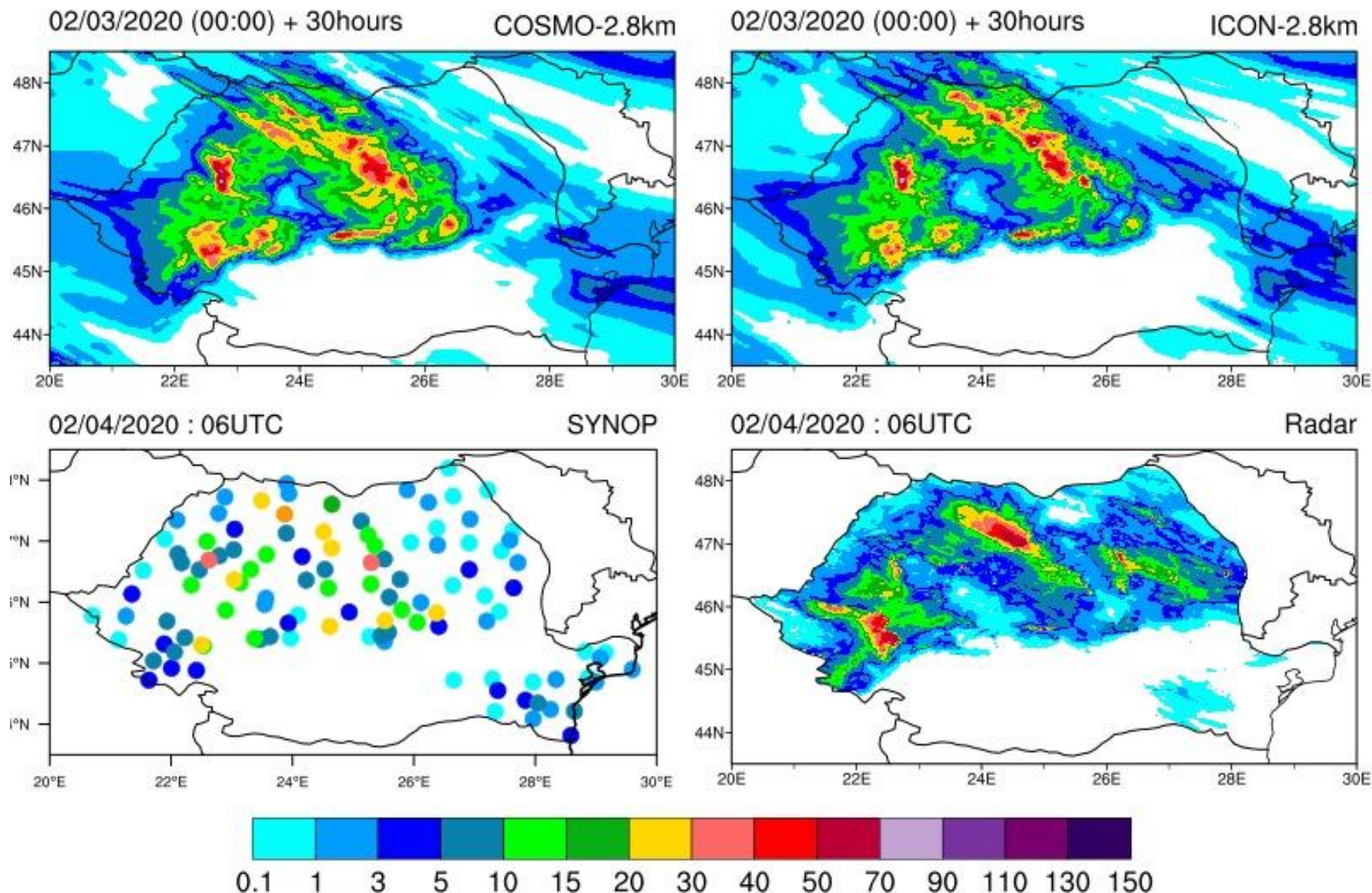
ICON-2.8km: Vantul la 10m

Baza 05.02.2020, 00 UTC

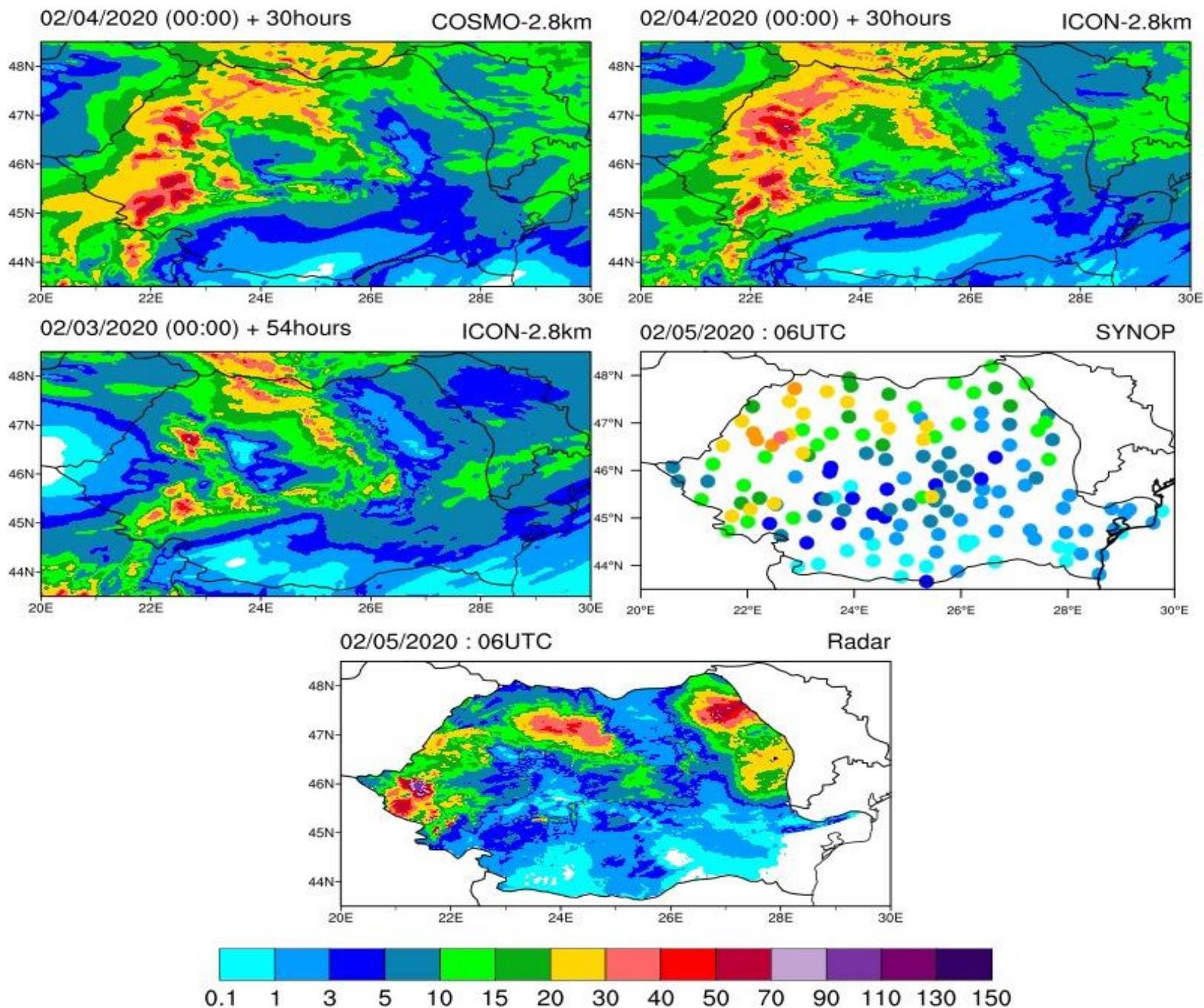
+21h

Valid 05.02.2020, 21 UTC





Cumulated precipitation (24h)



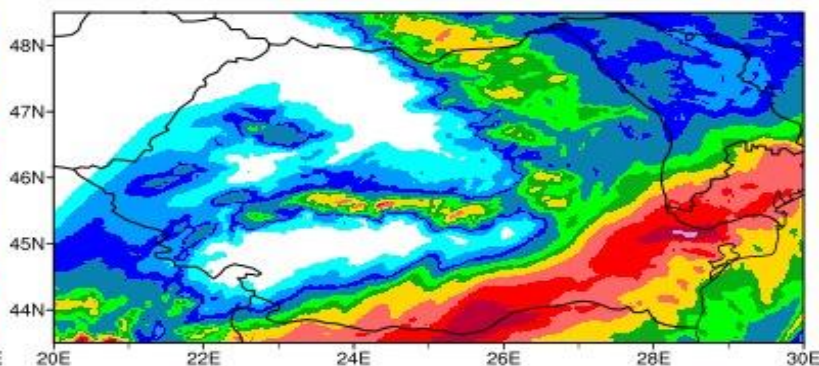
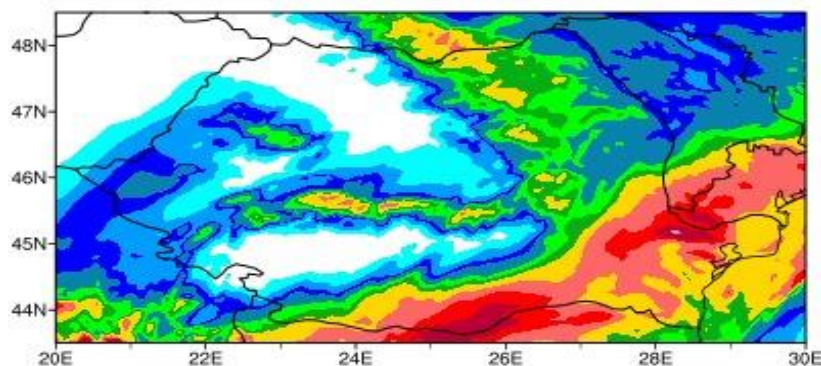
Cumulated precipitation (24h)

02/05/2020 (00:00) + 30hours

COSMO-2.8km

02/05/2020 (00:00) + 30hours

ICON-2.8km

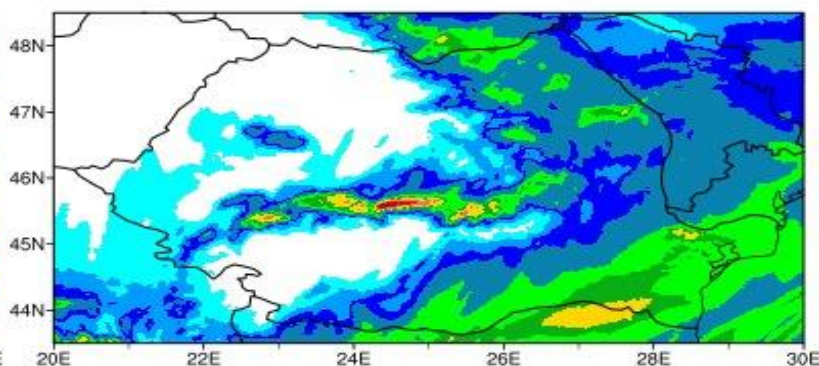
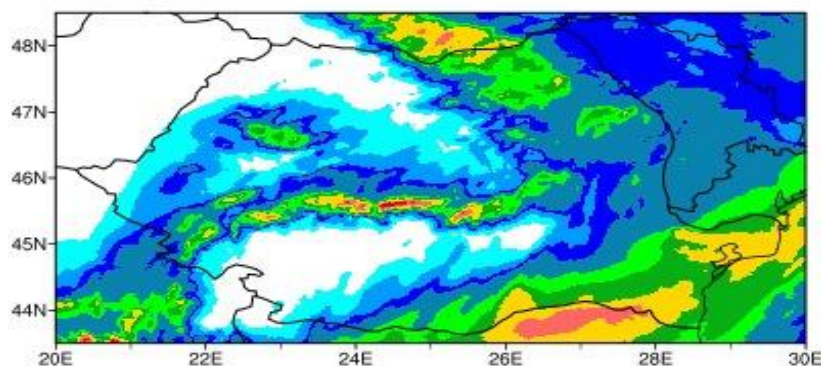


02/04/2020 (00:00) + 54hours

ICON-2.8km

02/03/2020 (00:00) + 78hours

ICON-2.8km

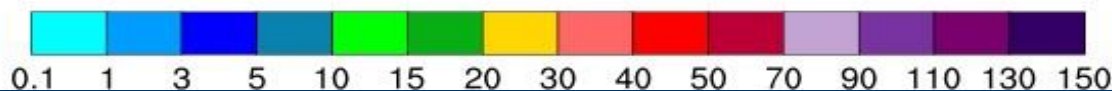
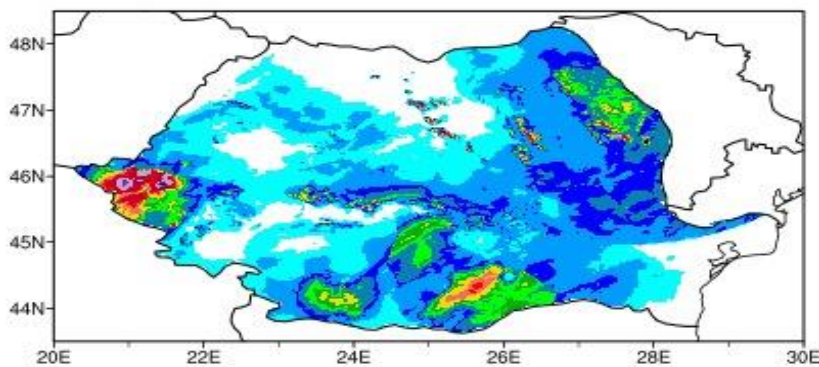
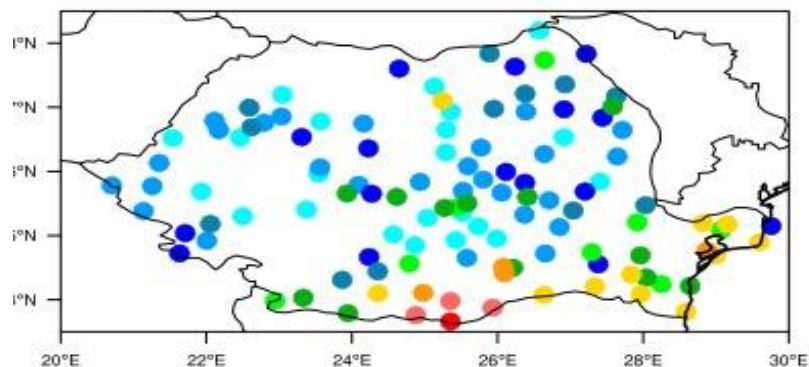


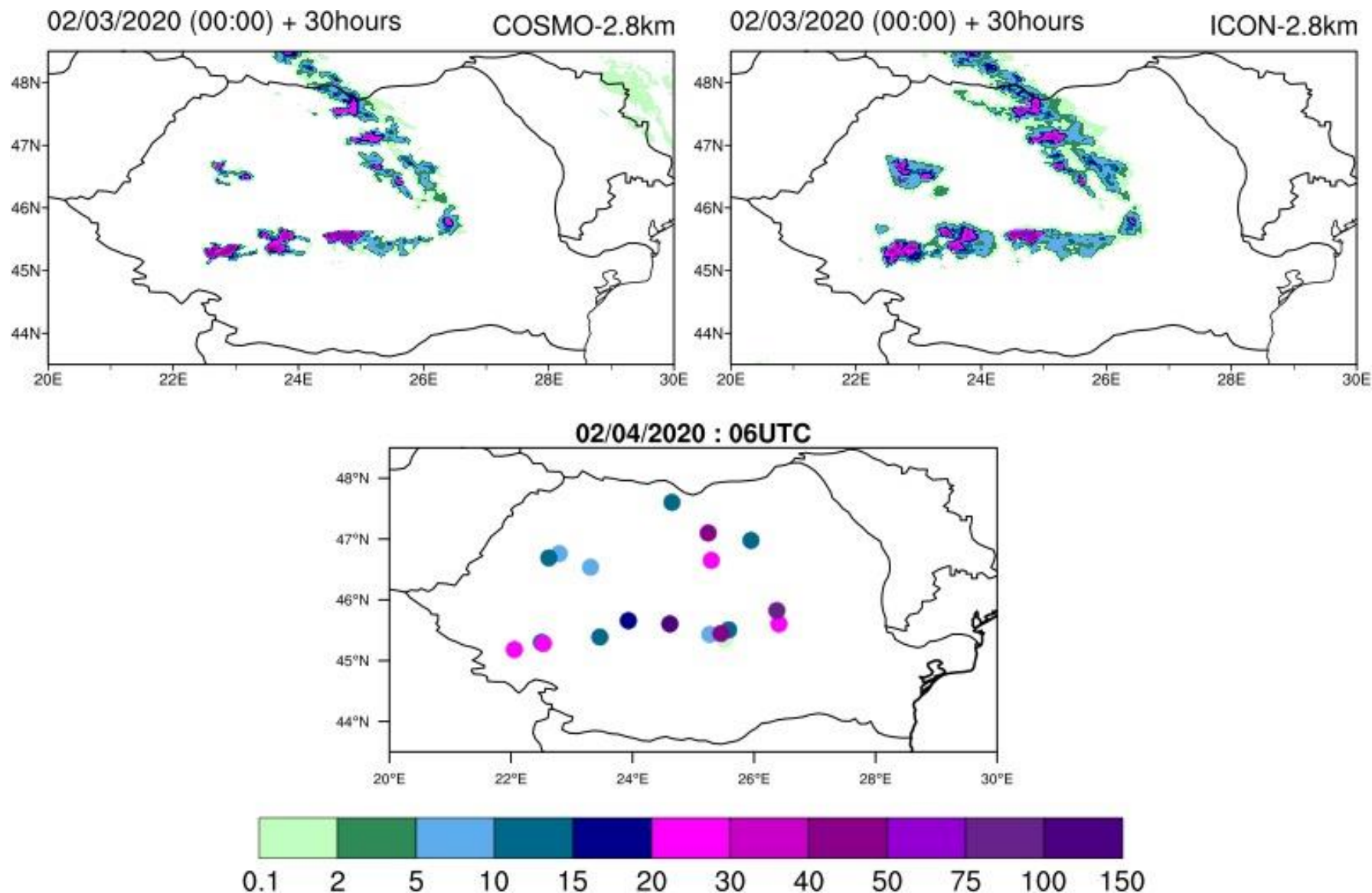
02/06/2020 : 06UTC

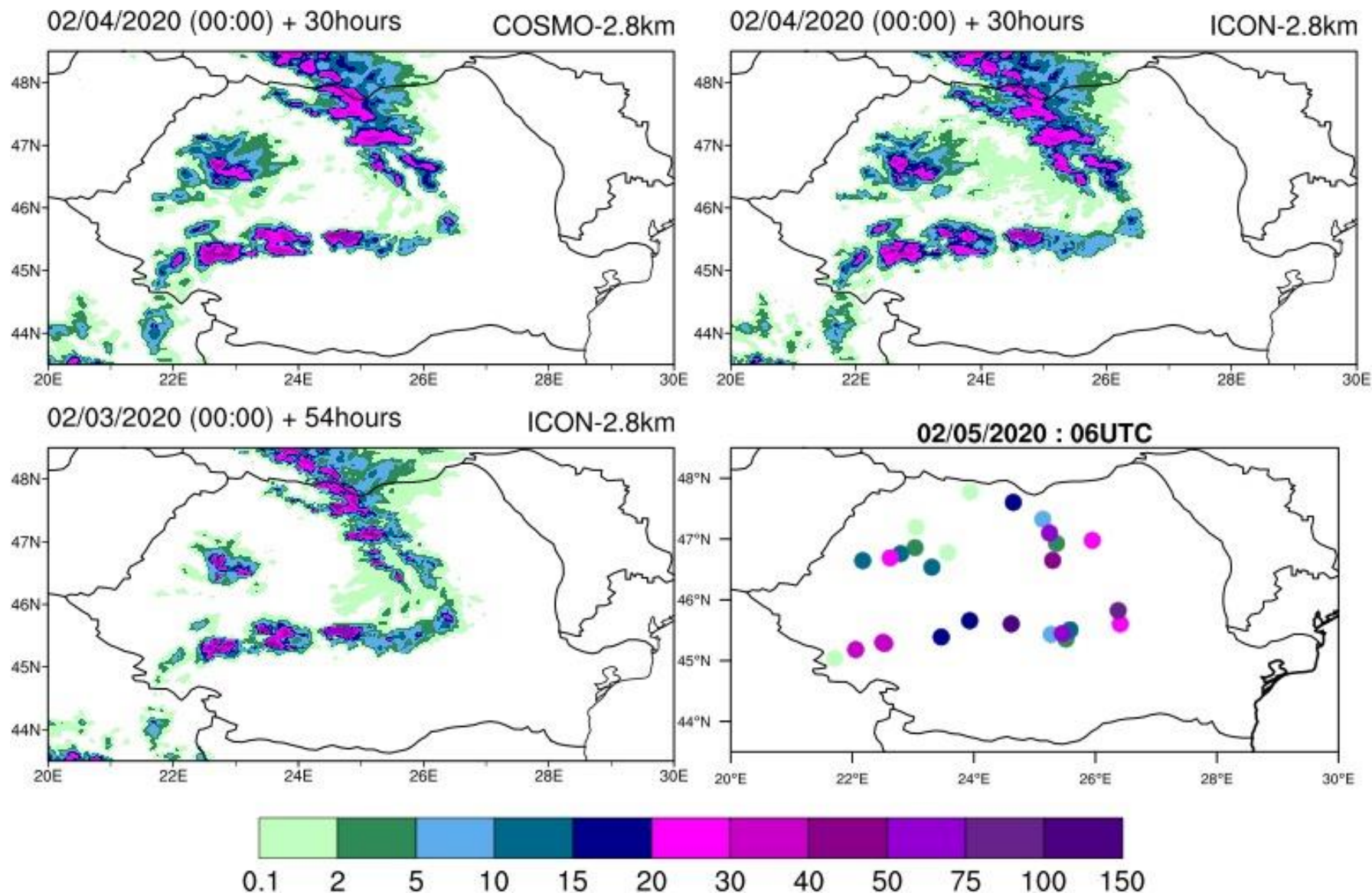
SYNOP

02/06/2020 : 06UTC

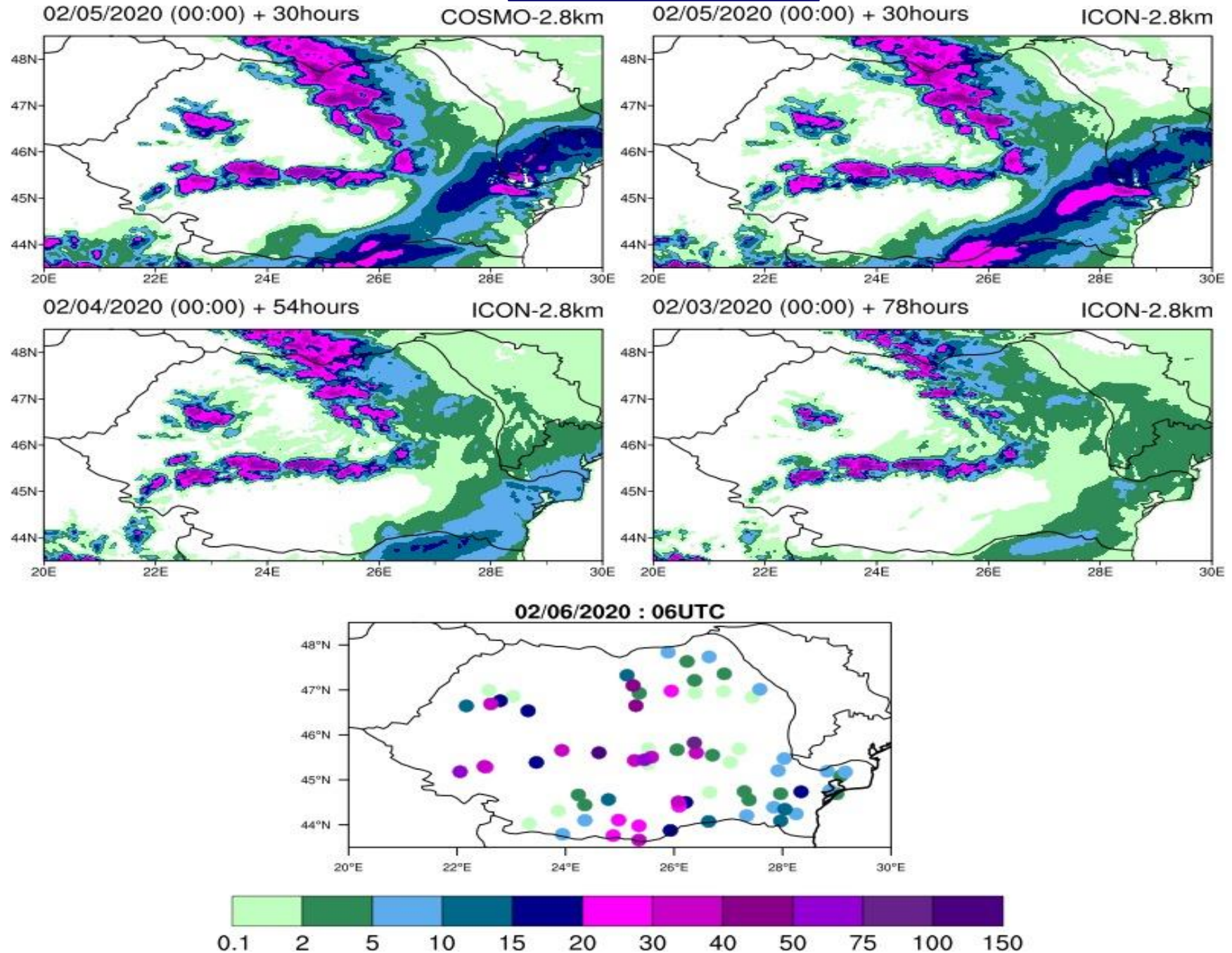
Radar



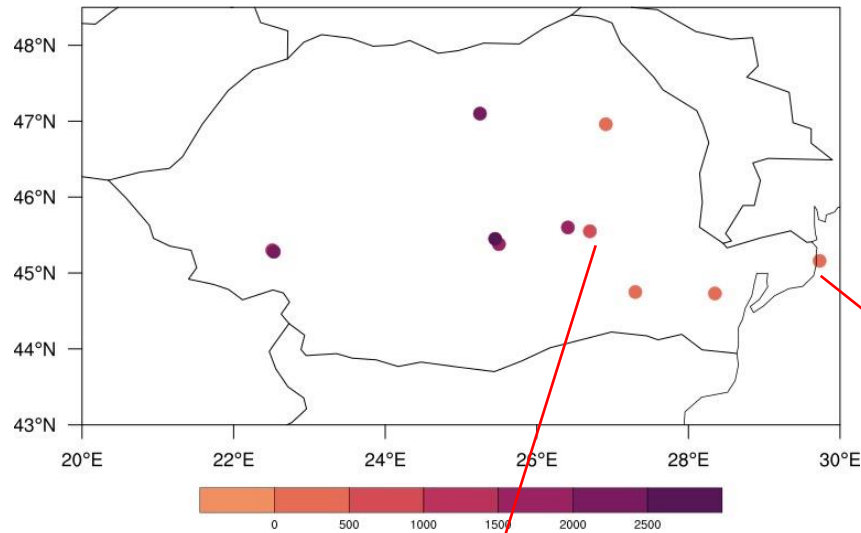




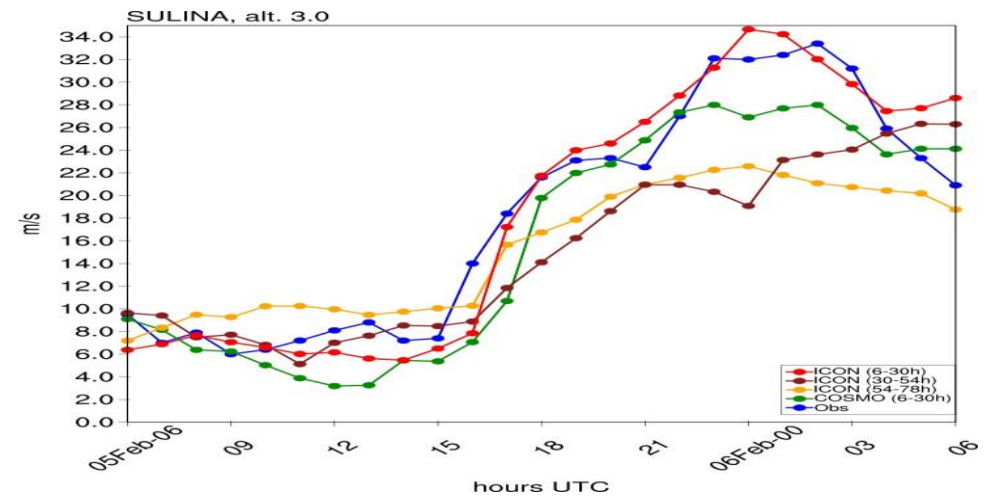
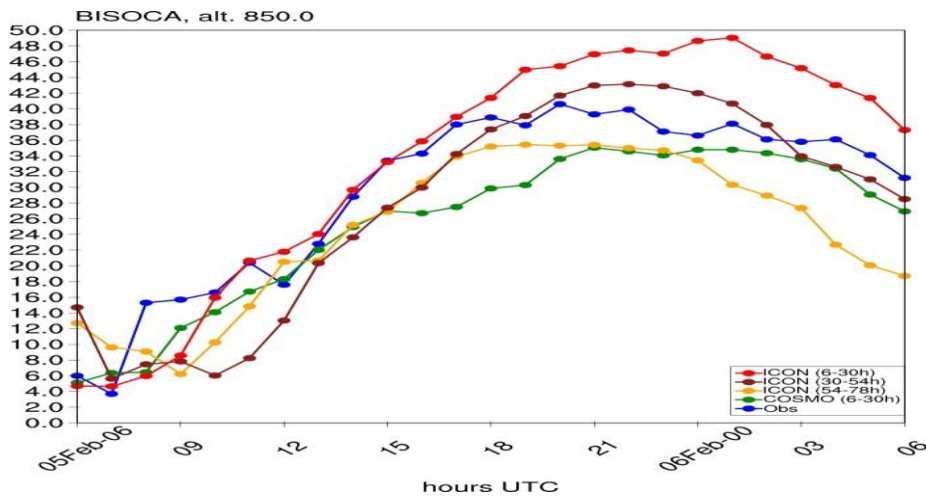
Snow depth



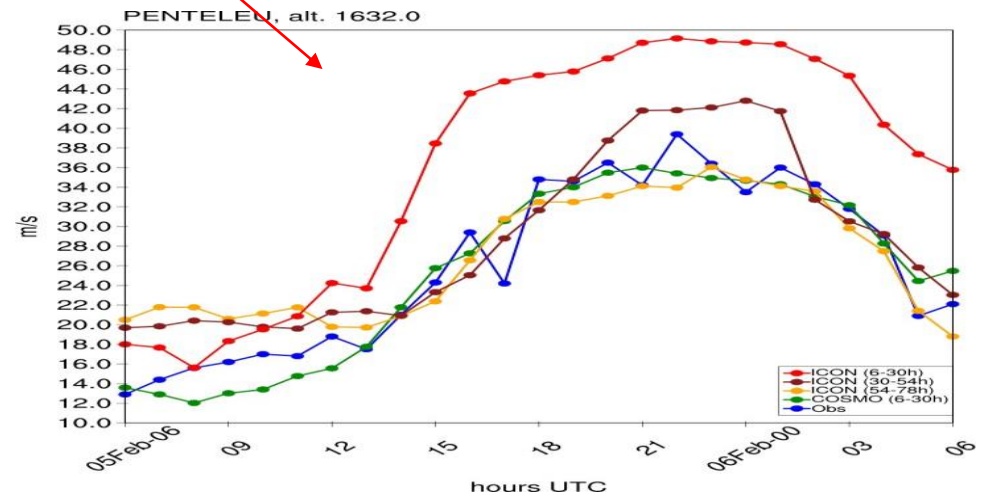
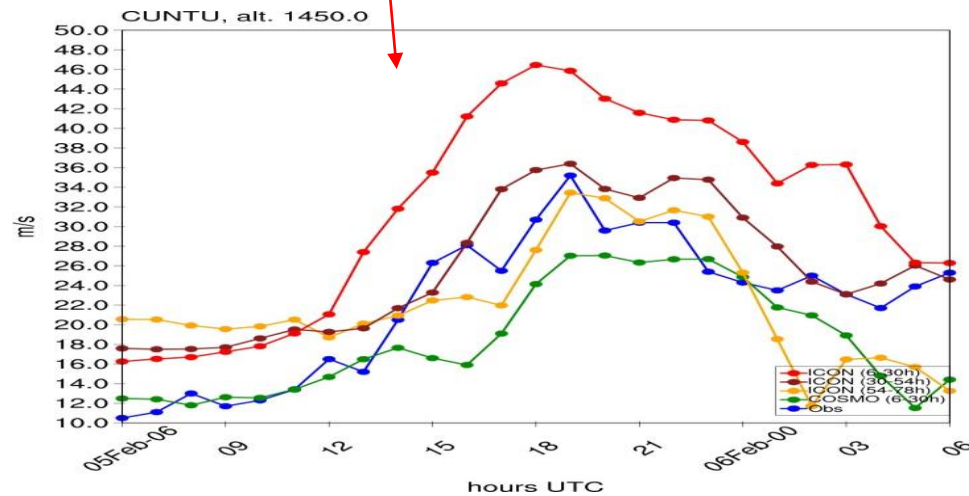
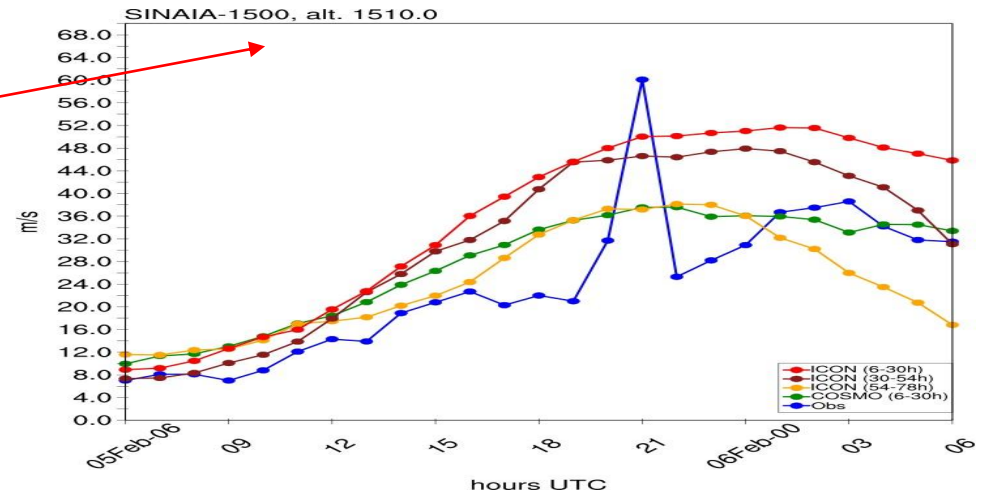
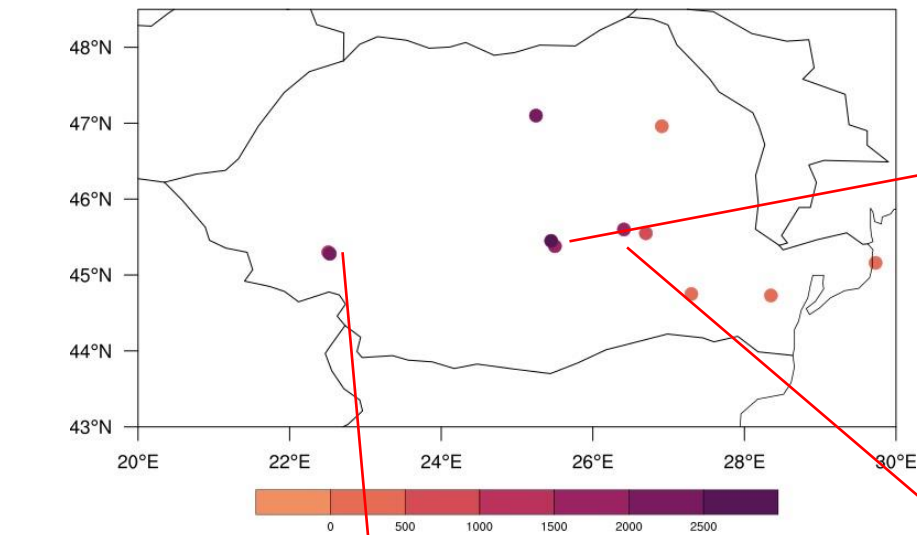
10m Wind Gust



Stations where sustained wind was registered for several hours
5Feb:06UTC – 6Feb:06UTC



10m Wind Gust



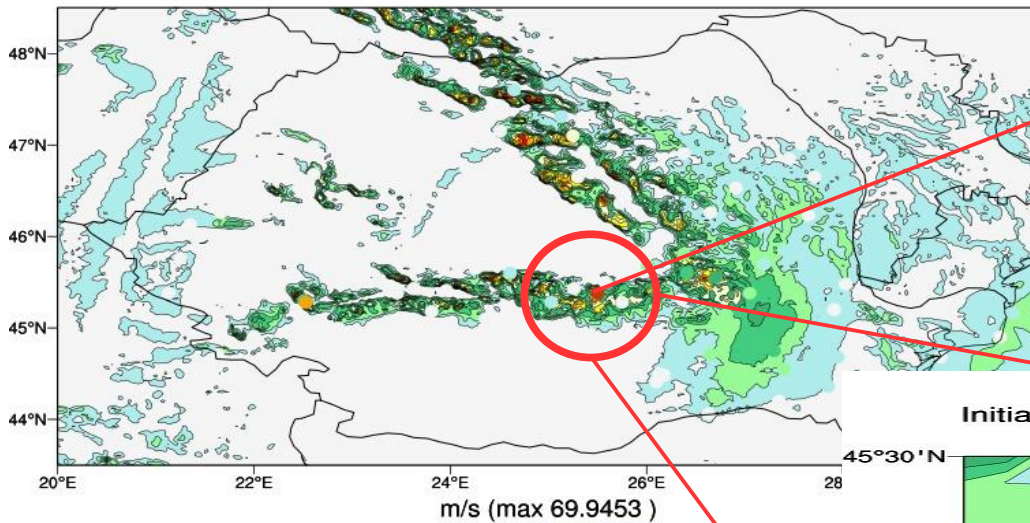
10m Wind Gust

ICON-2.8km: 10m Wind Gust

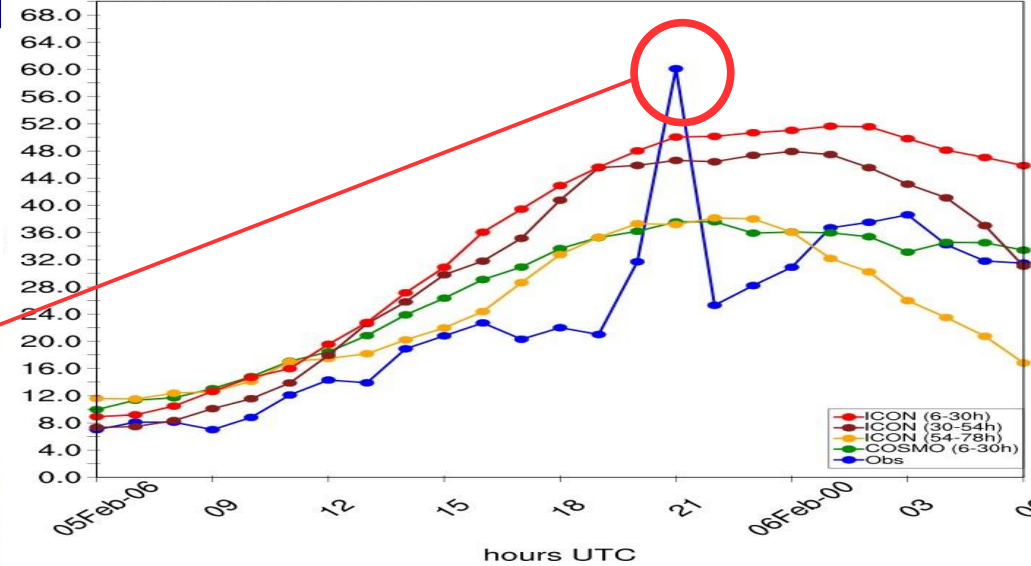
Initial 05.02.2020, 00UTC

+21h

Valid 05.02.2020, 21UTC



SINAIA-1500, alt. 1510.0

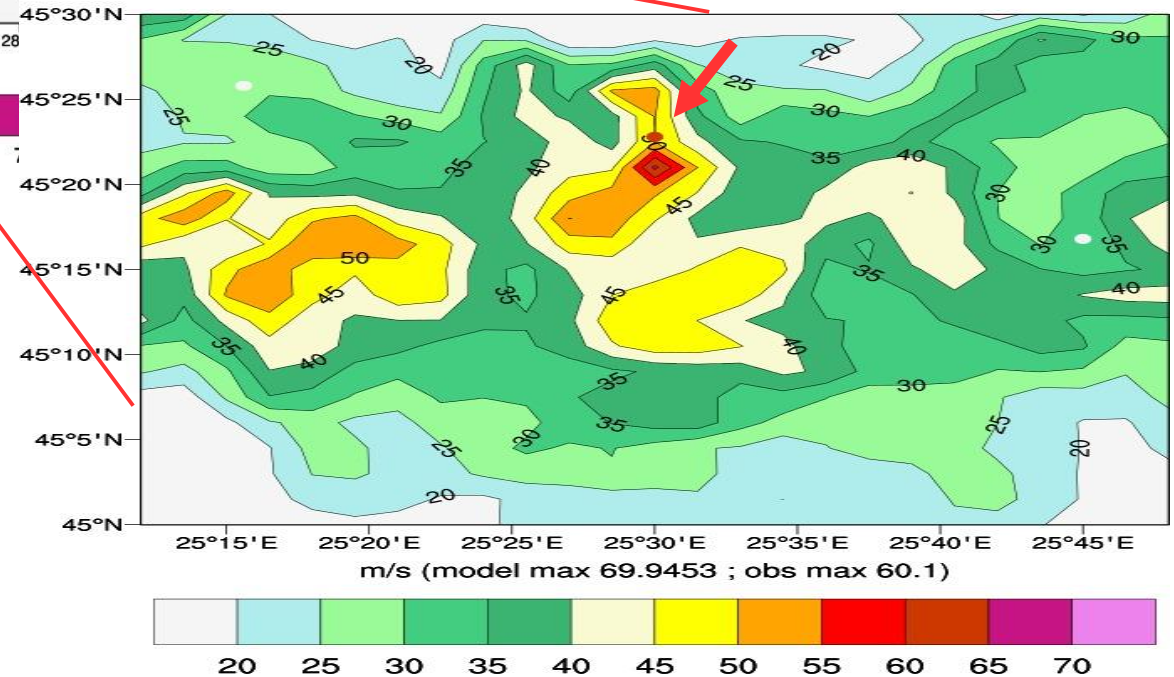


ICON-2.8km: 10m Wind Gust

Initial 05.02.2020, 00UTC

+21h

Valid 05.02.2020, 21UTC

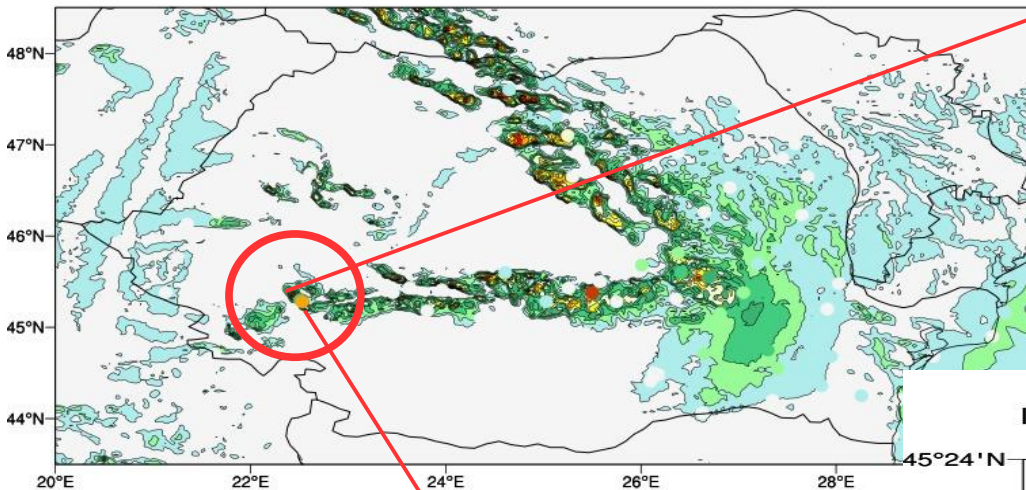


ICON-2.8km: 10m Wind Gust

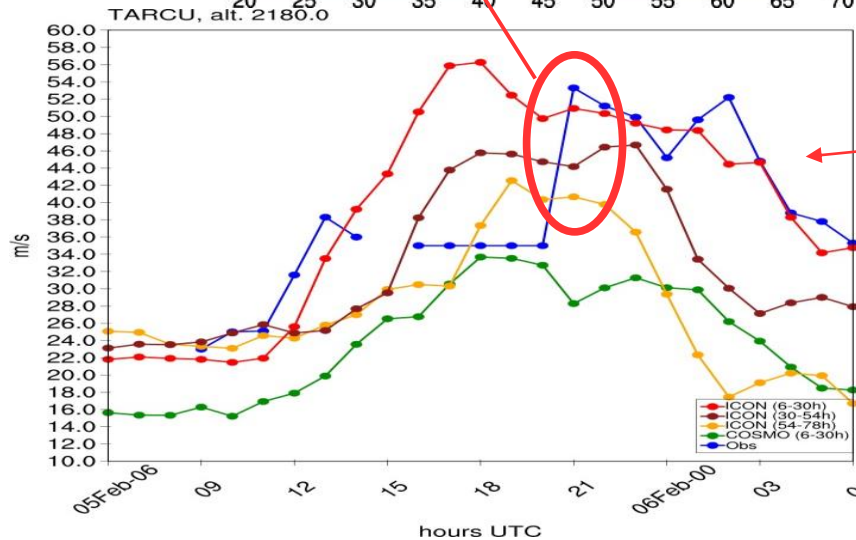
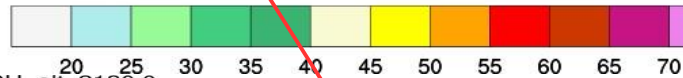
Initial 05.02.2020, 00UTC

+21h

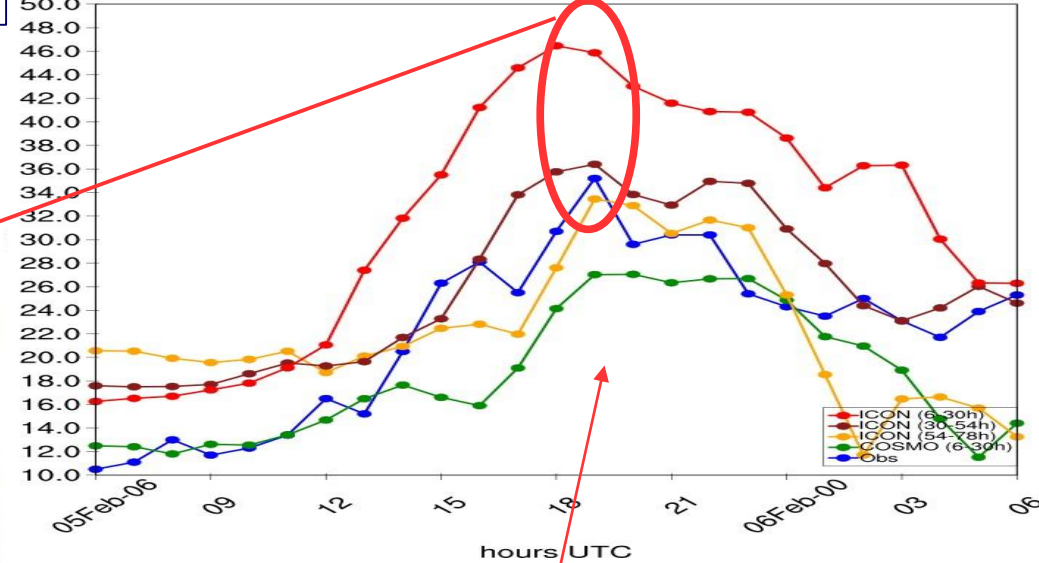
Valid 05.02.2020, 21UTC



m/s (max 69.9453)



CUNTU, alt. 1450.0

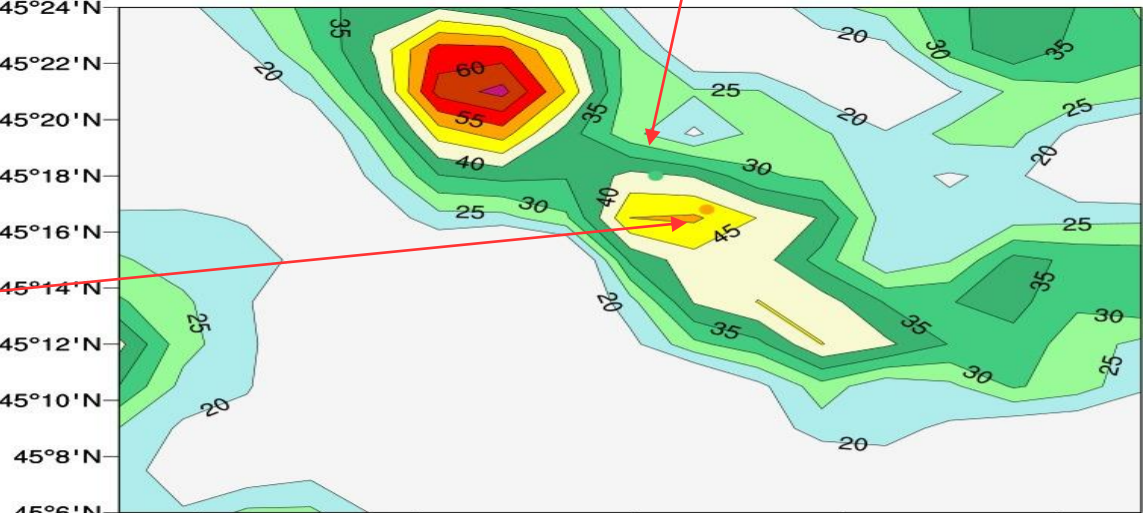


ICON-2.8km: 10m Wind Gust

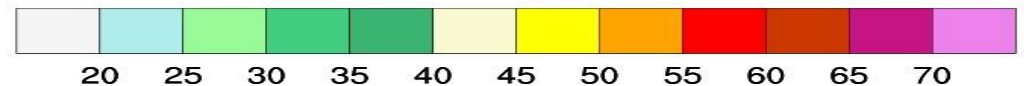
Initial 05.02.2020, 00UTC

+21h

Valid 05.02.2020, 21UTC

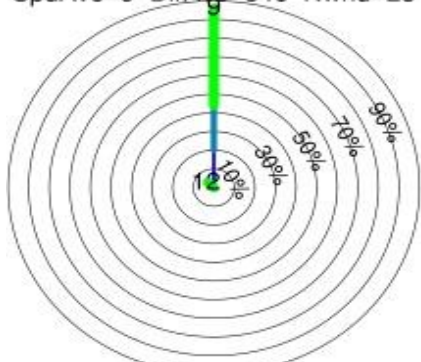


m/s (model max 69.9453 ; obs max 60.1)

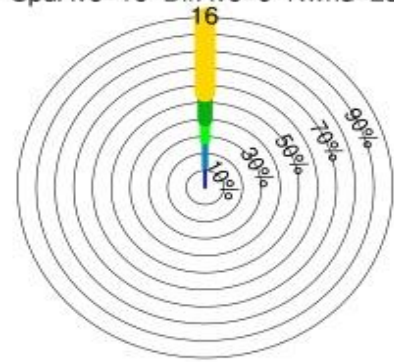


SINAIA-1500

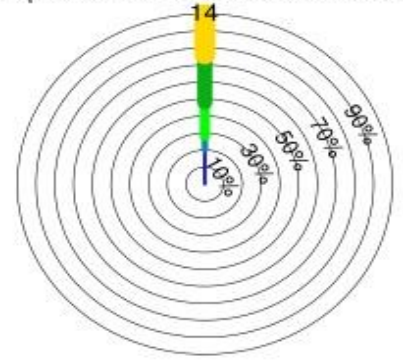
COSMO(6-30h)
SpdAve=9 DirAve=346 Nwnd=25



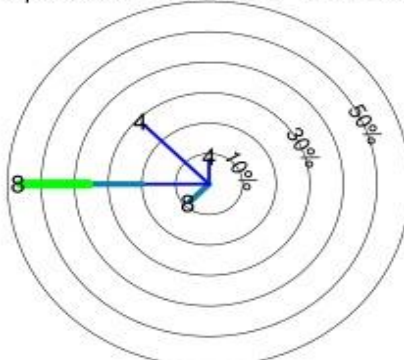
ICON(6-30h)
SpdAve=16 DirAve=9 Nwnd=25



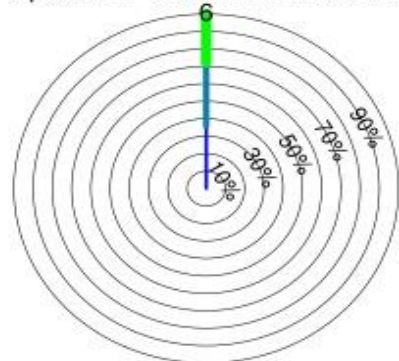
ICON(30-54h)
SpdAve=14 DirAve=4 Nwnd=25



ICON(54-78h)
SpdAve=6 DirAve=275 Nwnd=25

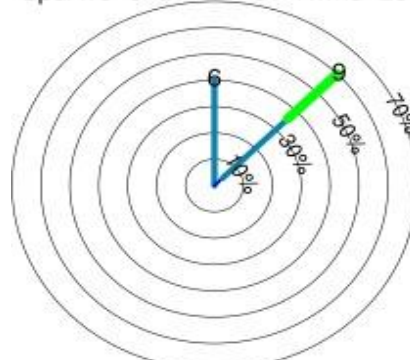


SpdAve=6 DirAve=15 Nwnd=25

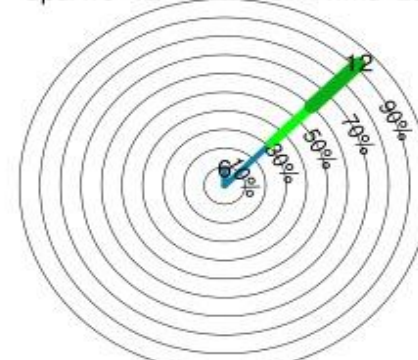


CUNTU

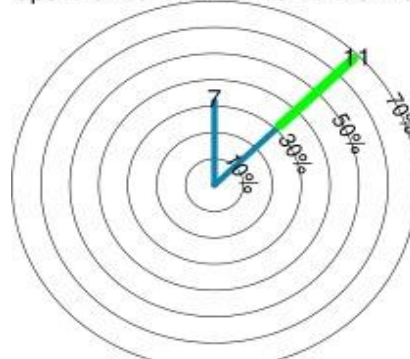
COSMO(6-30h)
SpdAve=8 DirAve=31 Nwnd=25



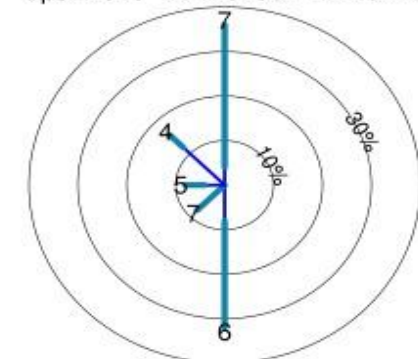
ICON(6-30h)
SpdAve=12 DirAve=51 Nwnd=25



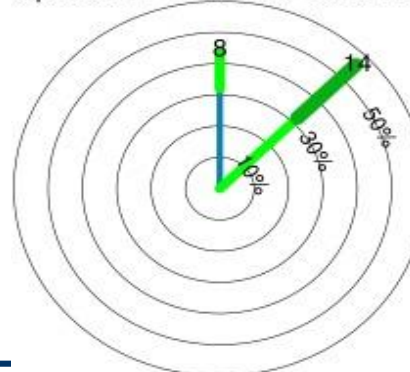
ICON(30-54h)
SpdAve=10 DirAve=40 Nwnd=25



ICON(54-78h)
SpdAve=6 DirAve=307 Nwnd=25



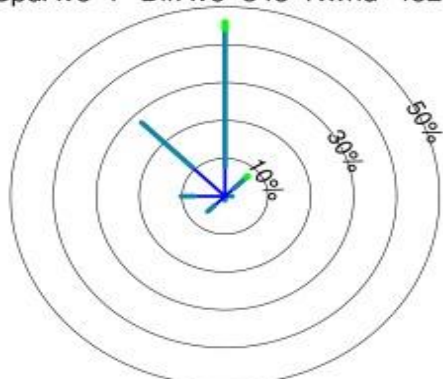
SpdAve=11 DirAve=28 Nwnd=25



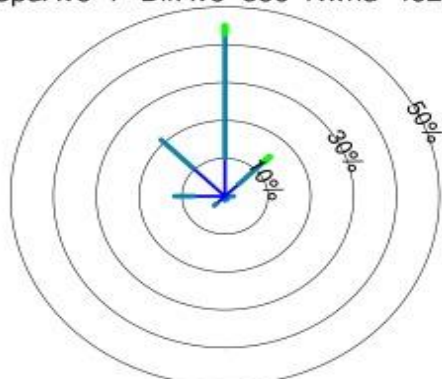
5Feb:06UTC

6Feb:06UTC

COSMO(6-30h)
SpdAve=7 DirAve=345 Nwnd=4828

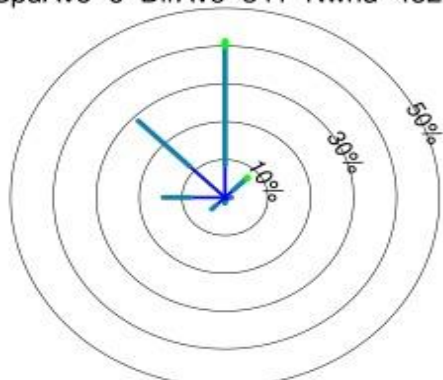


ICON(6-30h)
SpdAve=7 DirAve=356 Nwnd=4828

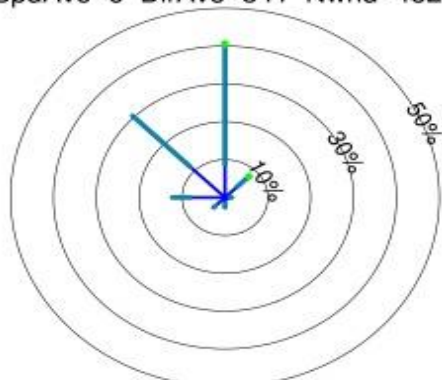


SYNOP observations
All Romanian stations

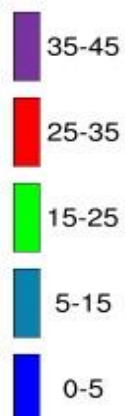
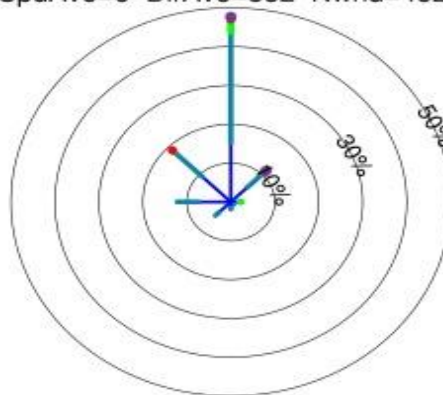
ICON(30-54h)
SpdAve=6 DirAve=341 Nwnd=4828



ICON(54-78h)
SpdAve=6 DirAve=341 Nwnd=4828



SpdAve=6 DirAve=352 Nwnd=4828



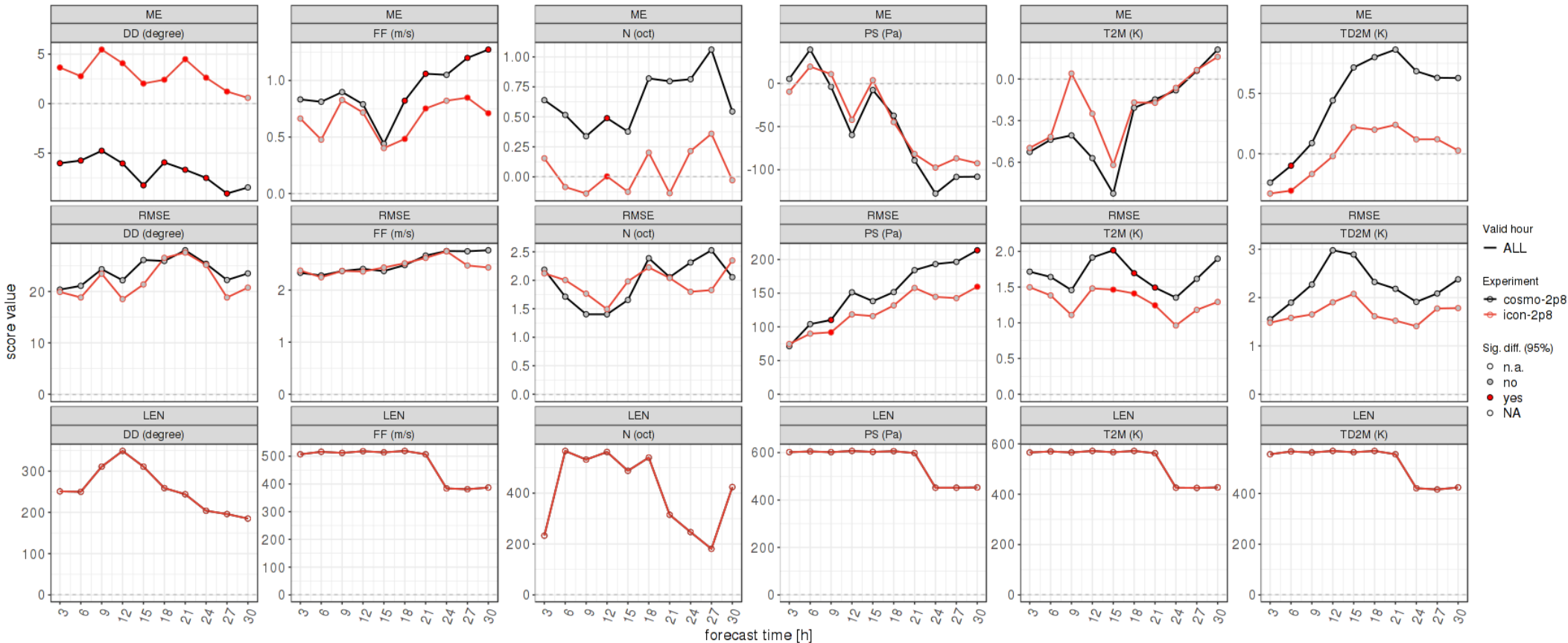
5Feb:06UTC – 6Feb:06UTC

Verification Scores 3-6 February 2020

COSMO-2.8 (black) vs. ICON-2.8 (red)
Forecast 30h

SYNOP observations
All Romanian stations

2020/02/03-03UTC - 2020/02/06-21UTC
INI: 00 UTC, DOM: ALL, STAT: ALL

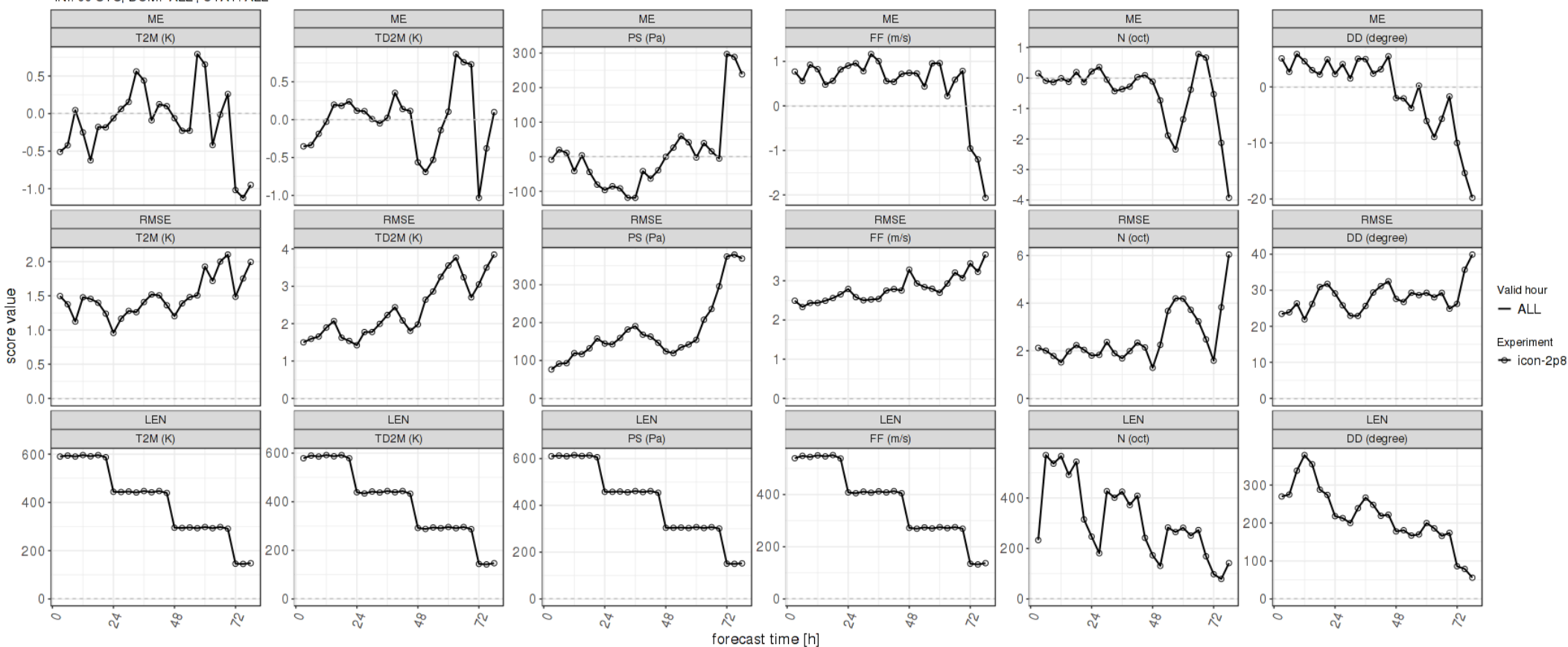


Verification Scores 3-6 February 2020

ICON-2.8 - Forecast 72h

SYNOP observations All Romanian stations

2020/02/03-03UTC - 2020/02/06-21UTC
INI: 00 UTC, DOM: ALL, STAT: ALL

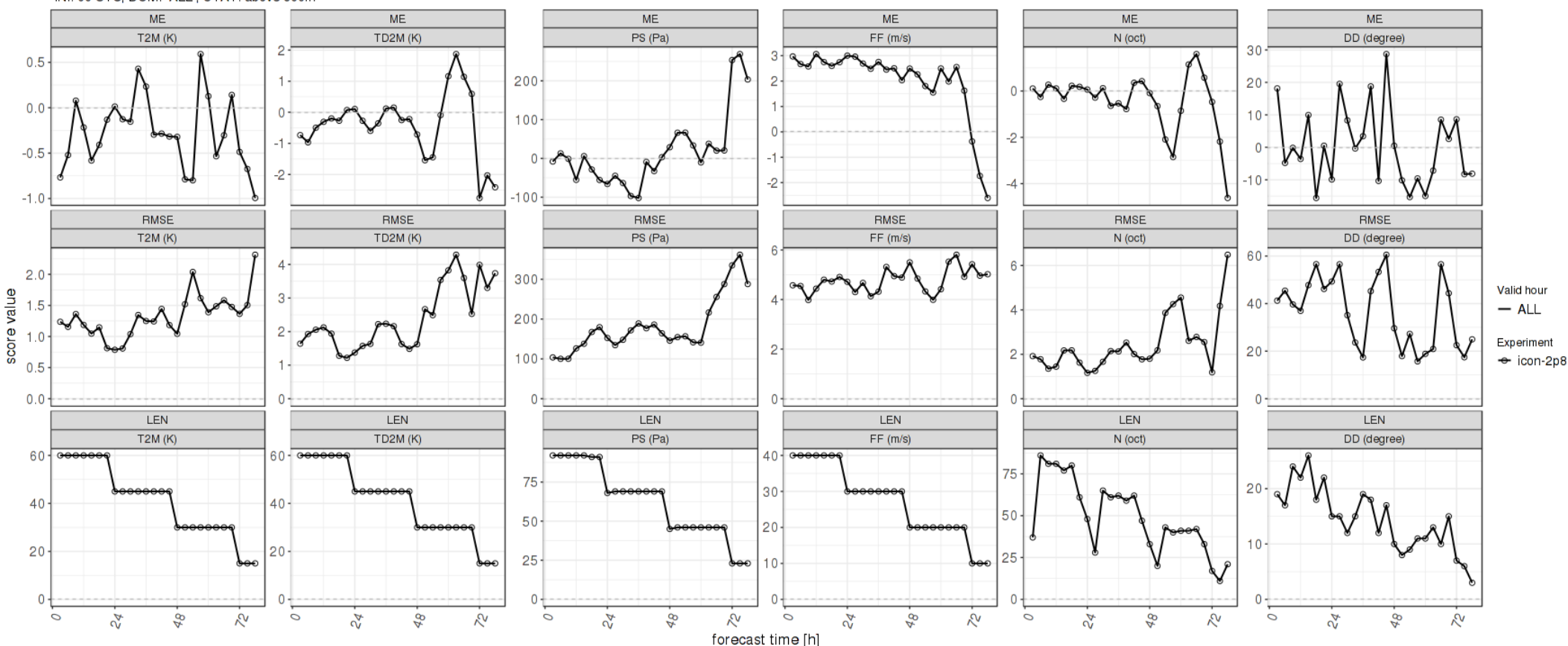


Verification Scores 3-6 February 2020

ICON-2.8 - Forecast 72h

SYNOP observations Romanian stations altitude > 800m (mountainous)

2020/02/03-03UTC - 2020/02/06-21UTC
INI: 00 UTC, DOM: ALL, STAT: above 800m



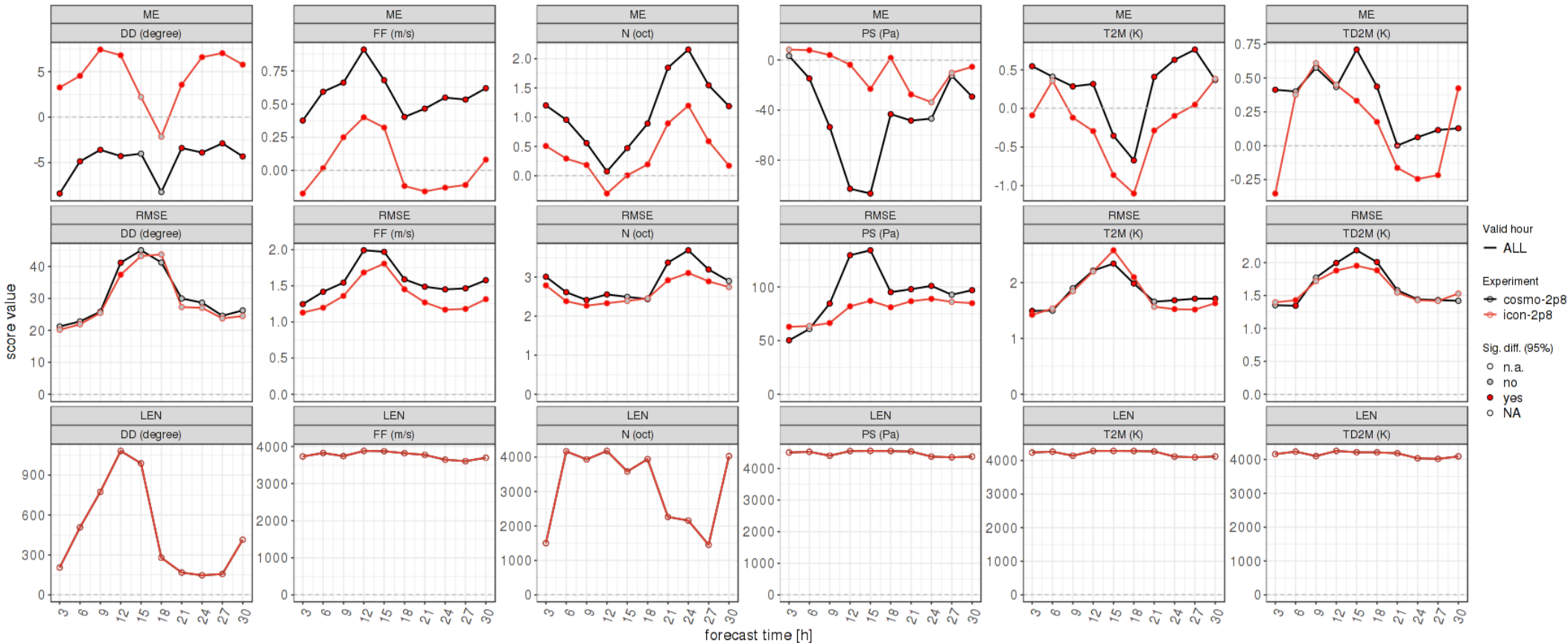
Verification Scores

June 2020

COSMO-2.8 (black) vs. ICON-2.8 (red)
Forecast 30h

SYNOP observations
All Romanian stations

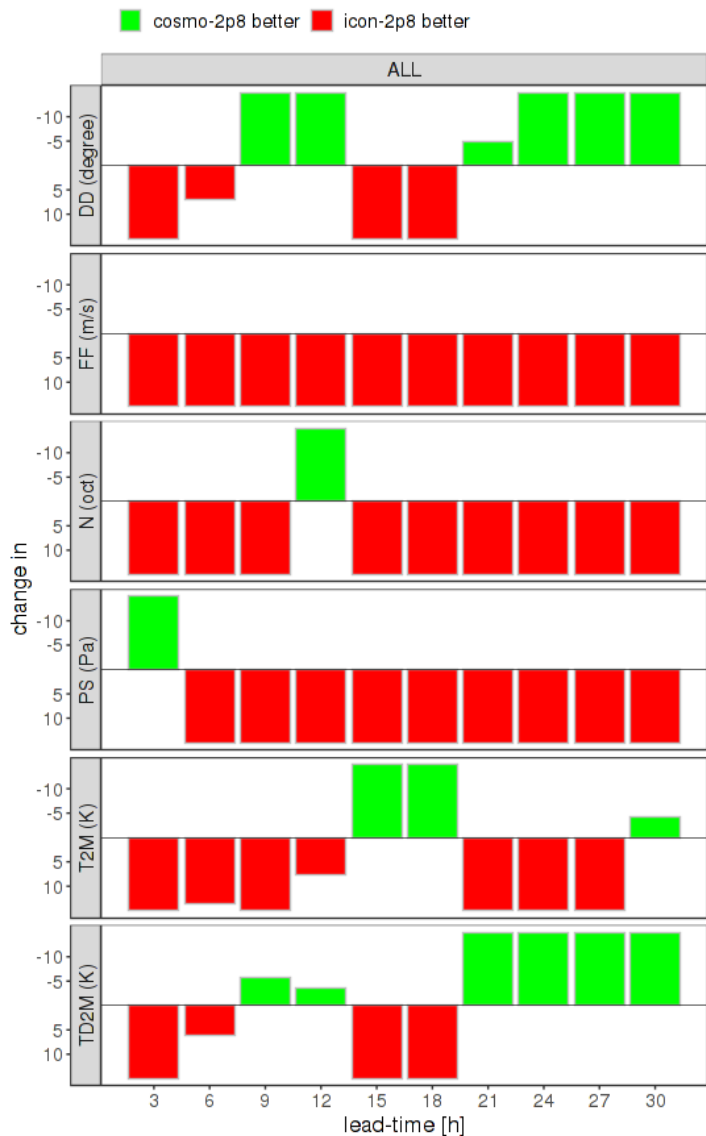
2020/06/01-03UTC - 2020/06/30-21UTC
INI: 00 UTC, DOM: ALL, STAT: ALL



Verification Scores

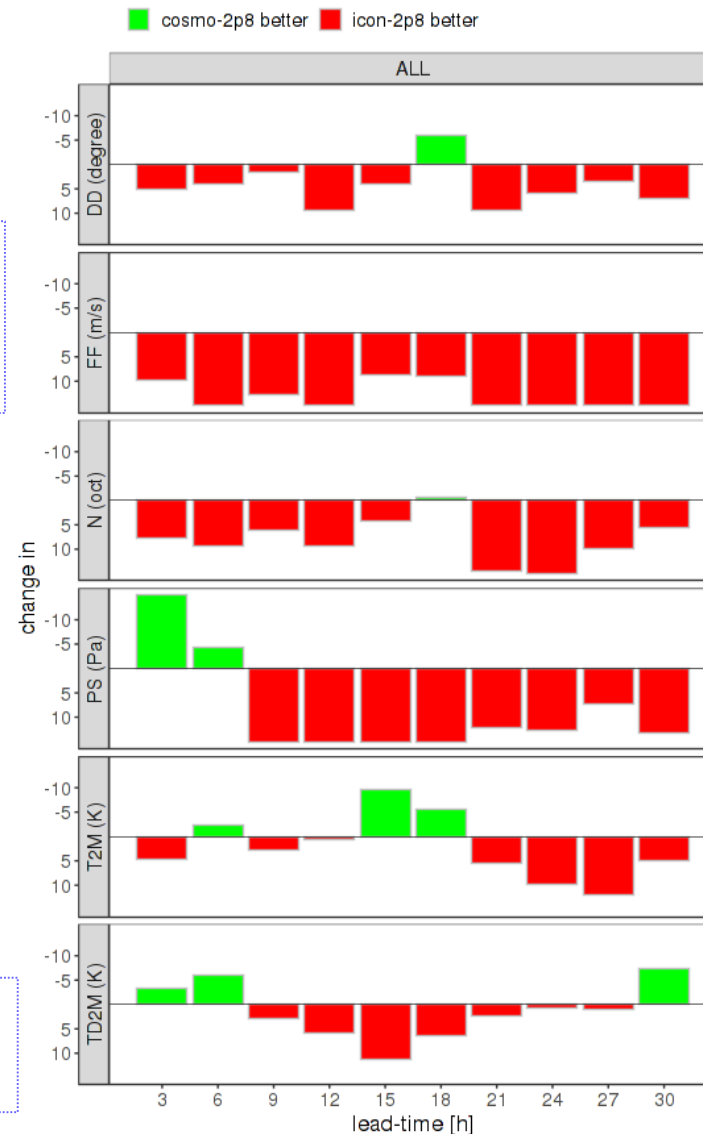
June 2020

Forecasts initialized from 2020/06/01 to 2020/06/30
Reduction of ME [%]



COSMO-2.8 (green)
ICON-2.8 (red)
Forecast 30h

Forecasts initialized from 2020/06/01 to 2020/06/30
Reduction of RMSE [%]



SYNOPSIS observations
All Romanian stations

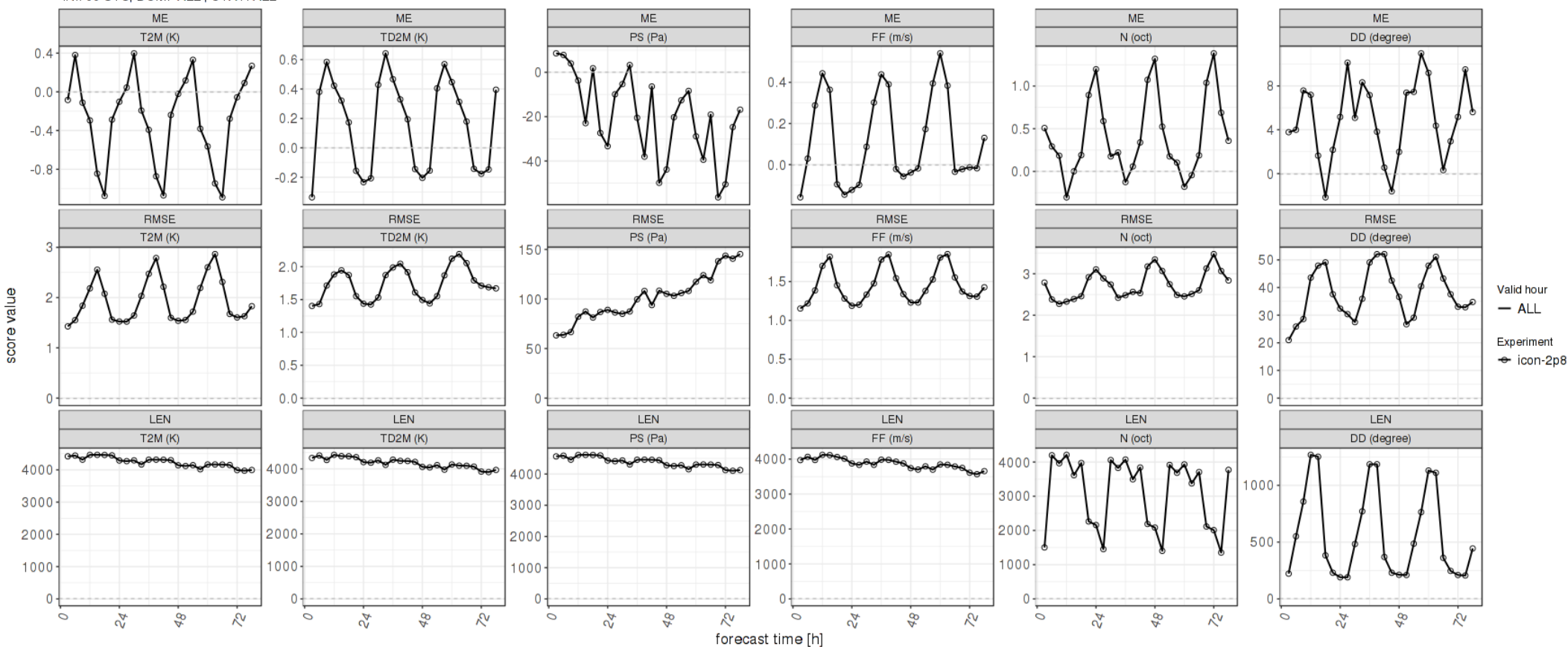
Verification Scores

June 2020

ICON-2.8 (red) - Forecast 72h

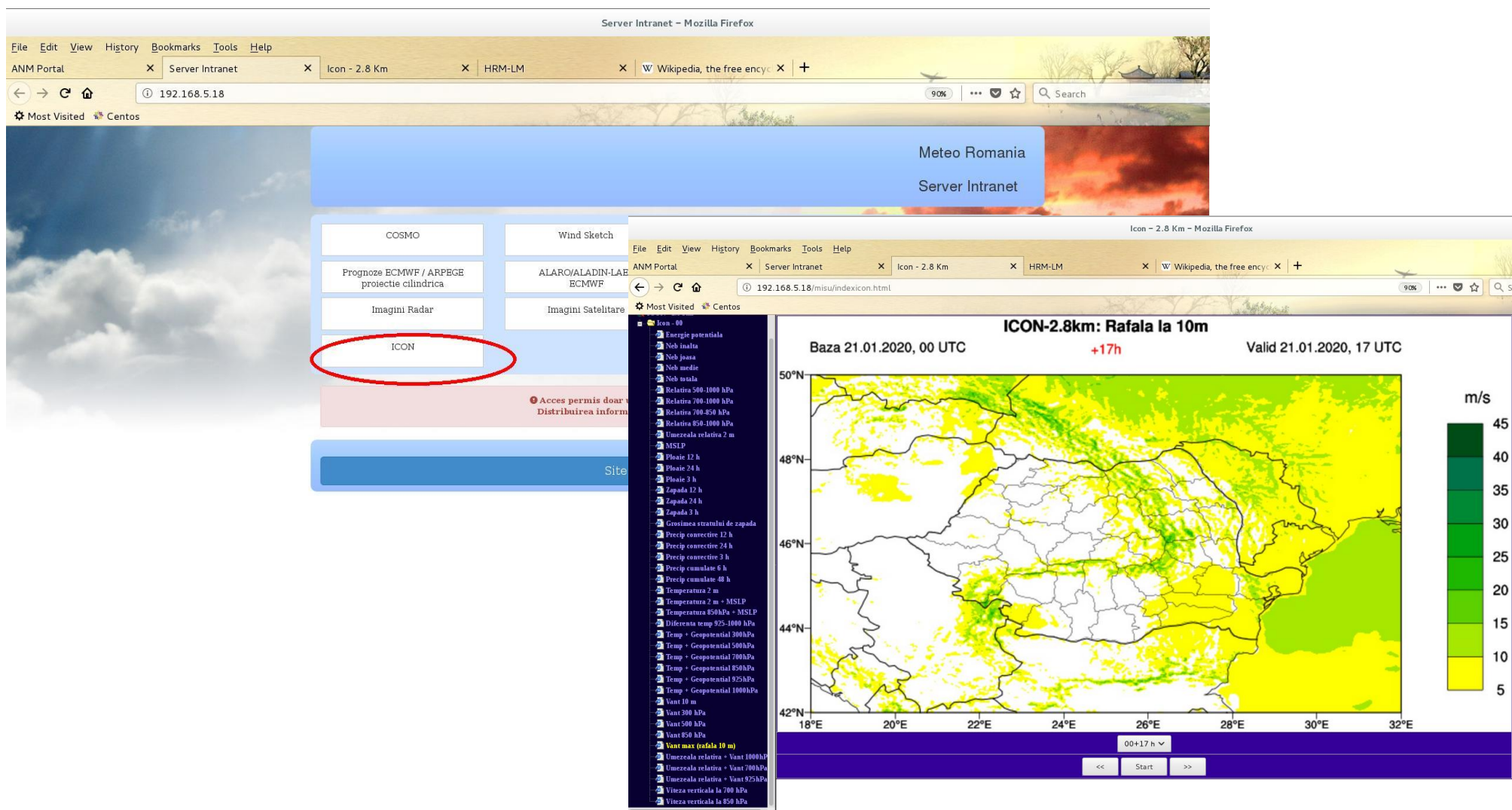
SYNOP observations
All Romanian stations

2020/06/01-03UTC - 2020/06/30-21UTC
INI: 00 UTC, DOM: ALL, STAT: ALL



(NOW) Current Activities

ICON-RO_2p8km (00UTC) is operational (December 2019)!



Thank you for the attention!