

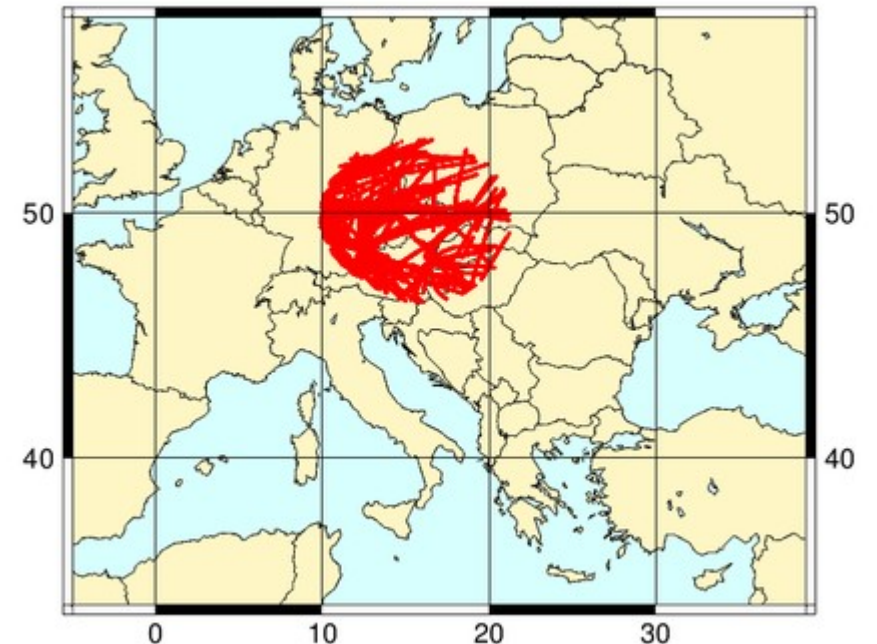
Investigation of the effect of Hungarian and Czech MODE-S dataset during data assimilation

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Experimental setup

- Two experiments with Czech and Hungarian Mode-S MRAR data
- Experimental period: 2019.12.01-19.
- All experiments based on the operational AROME-HU setup
- 4 runs a day (0, 6, 12 and 18 UTC)



Data coverage for the Czech Mode-S MRAR data

Meteorological situation in the experimental period

- Mostly anticyclonic weather
- Only a few days with greater amount of (frontal) precipitation
- Wind remained relatively weak throughout the whole period

Surface Variables

- Pointwise verification shows little effect on the forecast of the surface variables
- The experiment with Czech Mode-S data yielded the best results overall

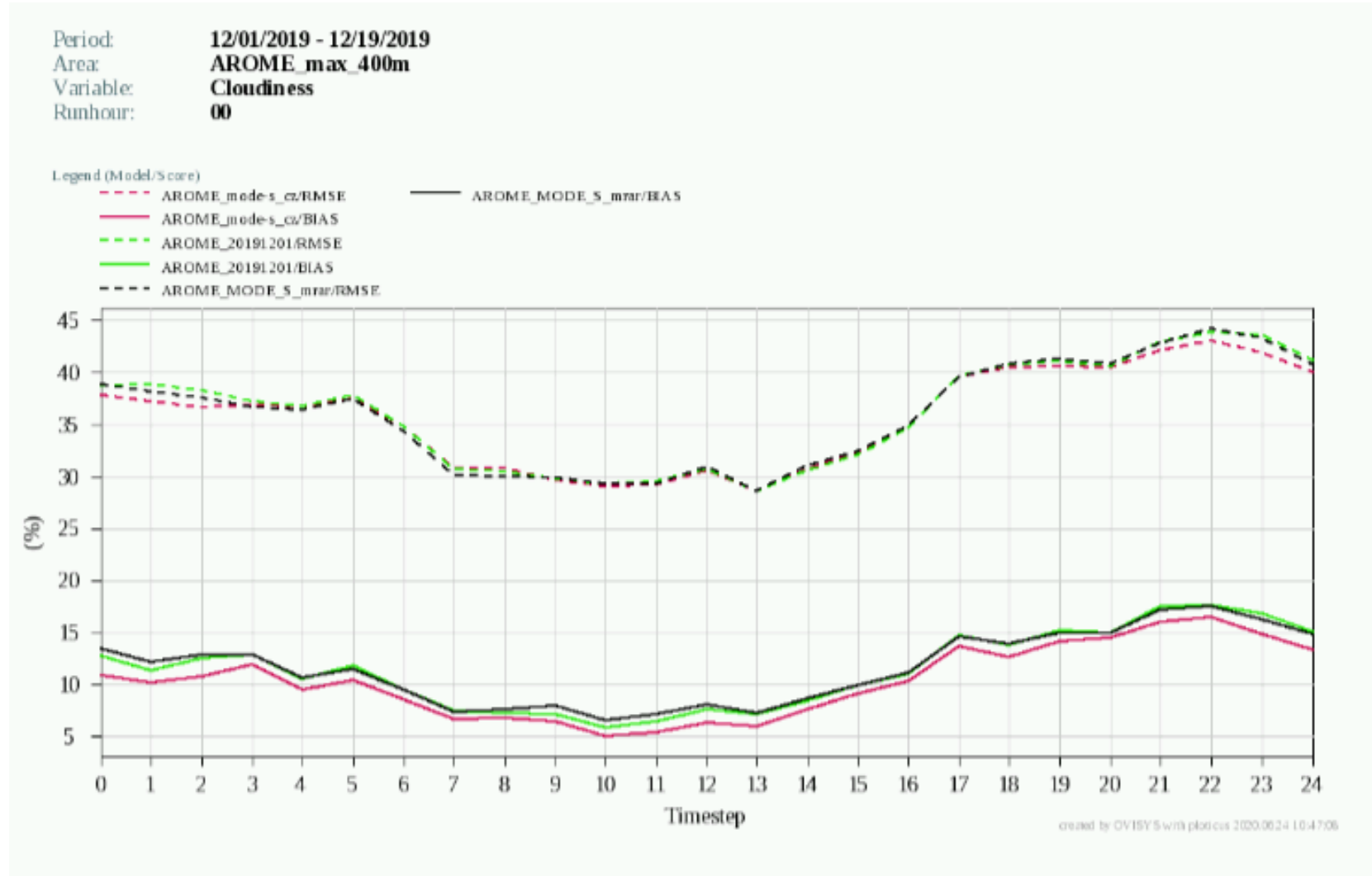
Surface Variables

Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

Red: AROME with Czech Mode-S data

Green: reference run



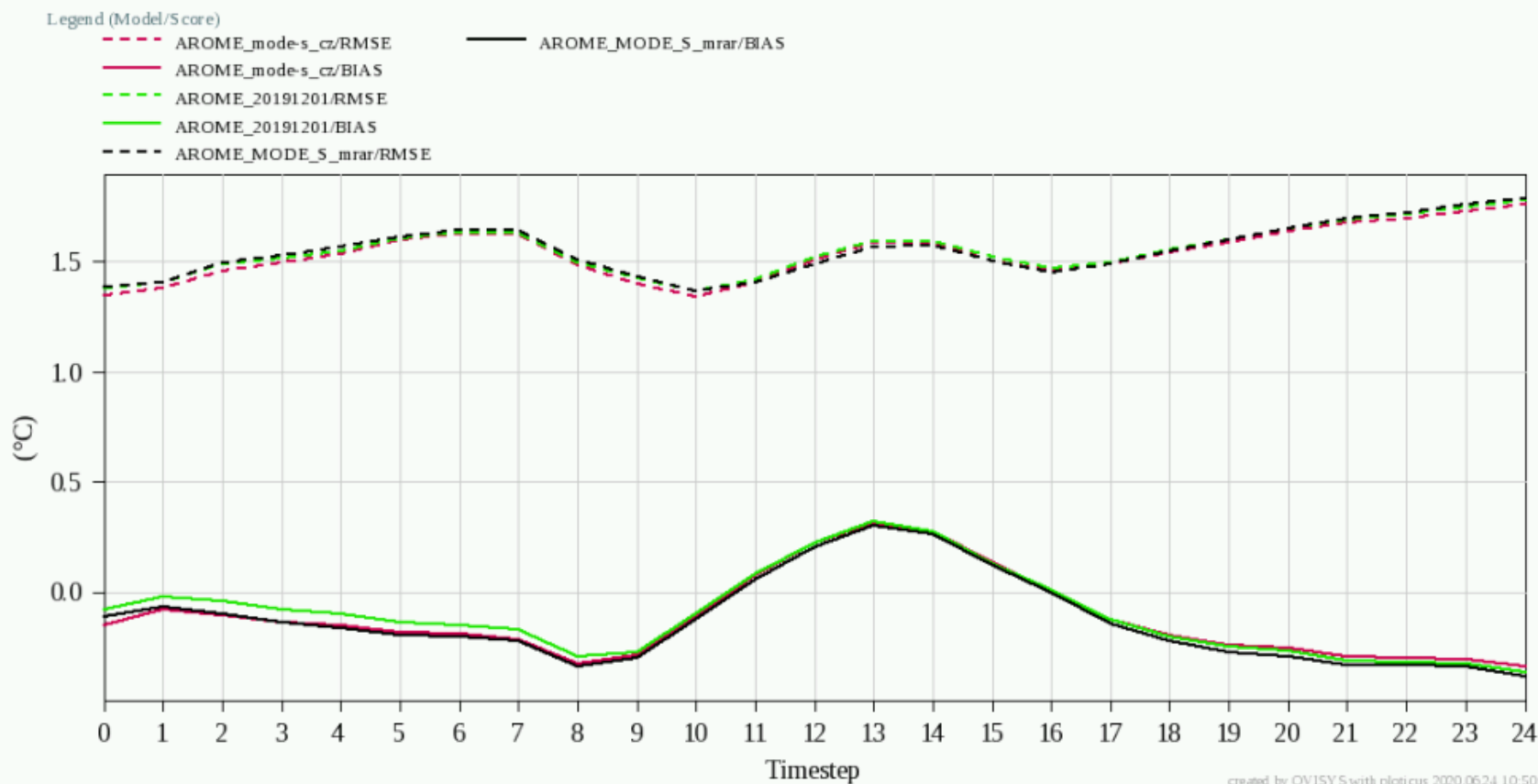
Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

Red: AROME with Czech Mode-S data

Green: reference run

Period: 12/01/2019 - 12/19/2019
Area: AROME_max_400m
Variable: Dewpoint
Runhour: 00



Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

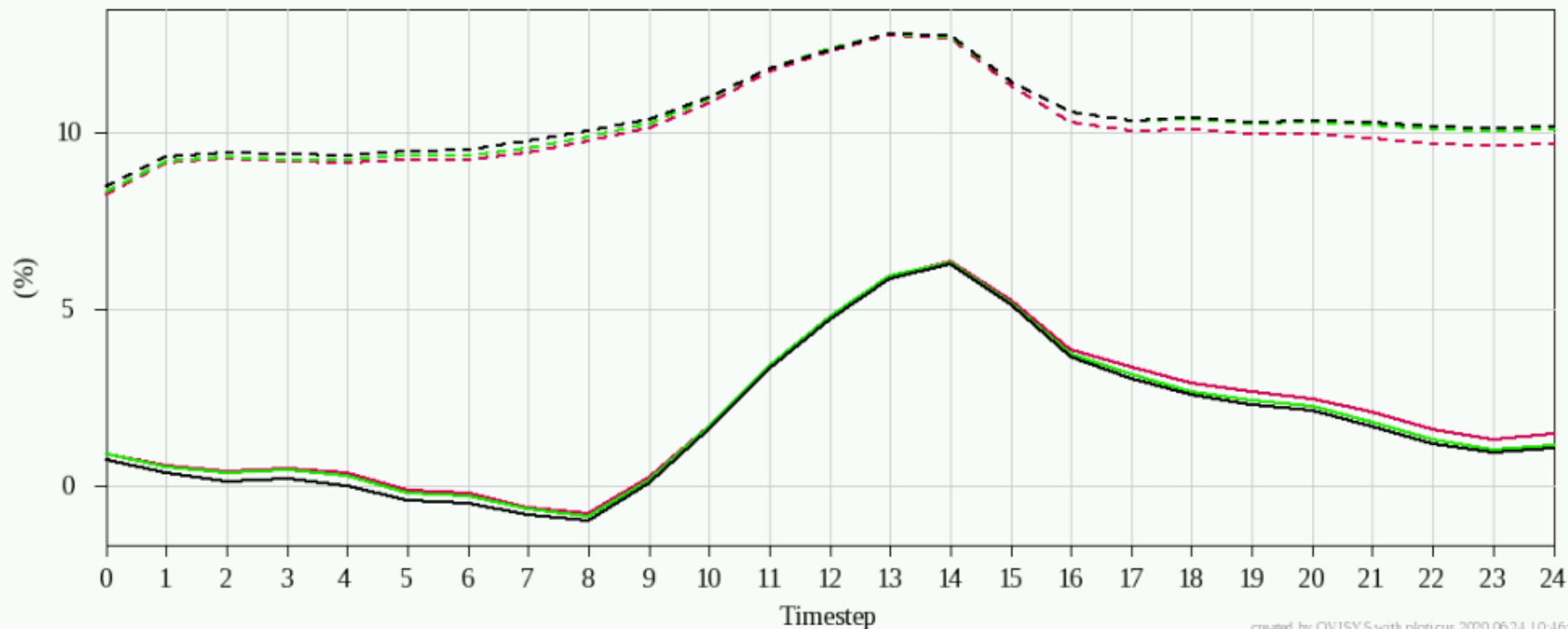
Red: AROME with Czech Mode-S data

Green: reference run

Period: 12/01/2019 - 12/19/2019
Area: AROME_max_400m
Variable: Relative humidity (2m)
Runhour: 00

Legend (Model/Score)

- AROME_mode-s_cz/RMSE
- AROME_mode-s_cz/BIAS
- AROME_20191201/RMSE
- AROME_20191201/BIAS
- AROME_MODE_S_mrar/RMSE
- AROME_MODE_S_mrar/BIAS



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Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

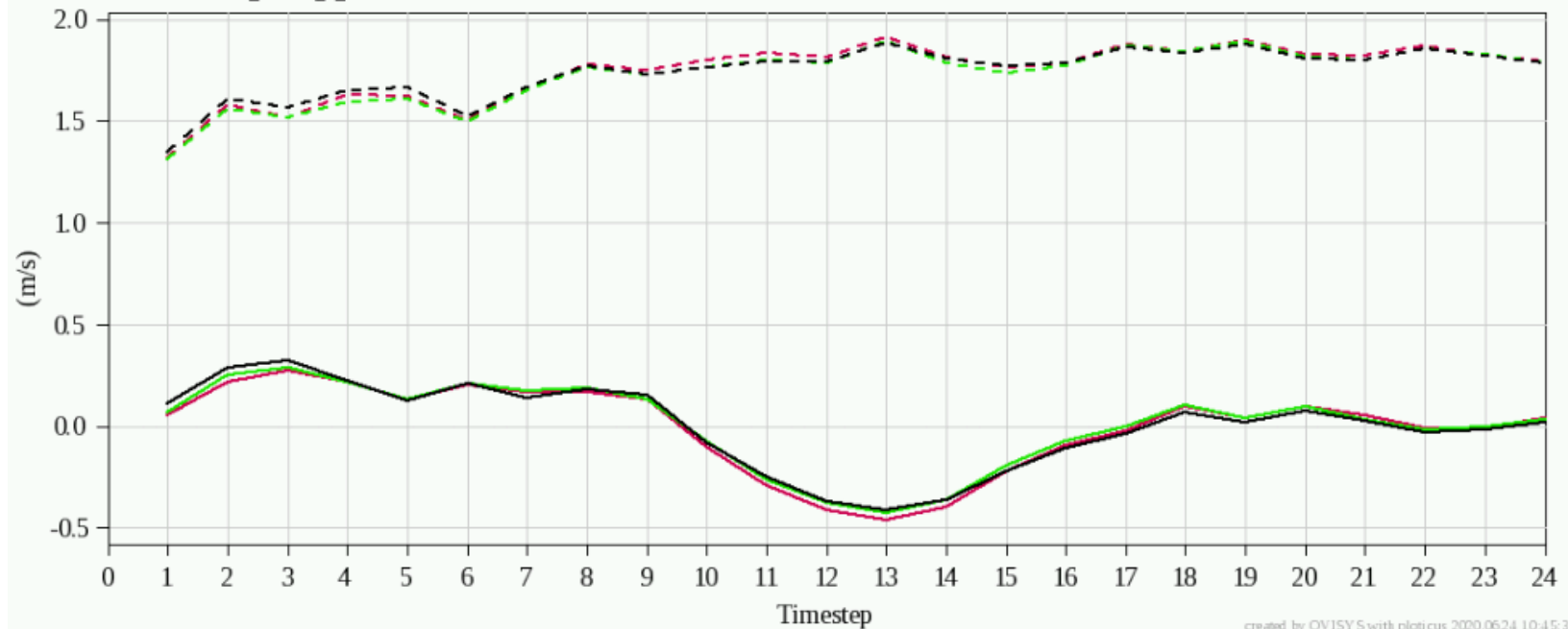
Red: AROME with Czech Mode-S data

Green: reference run

Period: 12/01/2019 - 12/19/2019
Area: AROME_max_400m
Variable: Wind gust
Runhour: 00

Legend (Model/Score)

- AROME_mode-s_cz/RMSE
- AROME_mode-s_cz/BIAS
- AROME_20191201/RMSE
- AROME_20191201/BIAS
- AROME_MODE_S_mrar/RMSE
- AROME_MODE_S_mrar/BIAS



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Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

Red: AROME with Czech Mode-S data

Green: reference run

Period: 12/01/2019 - 12/19/2019
Area: AROME_max_400m
Variable: Temperature (2m)
Runhour: 00



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Precipitation

- Some improvement can be detected for both experiments
- Better results regarding greater precipitation (especially with the Czech Mode-S data)

Period: 12/01/2019 - 12/19/2019
Area: AROME_max_400m
Variable: Precipitation (12 hour sum)
Timestep: 012
Score: ETS
Runhour: 00

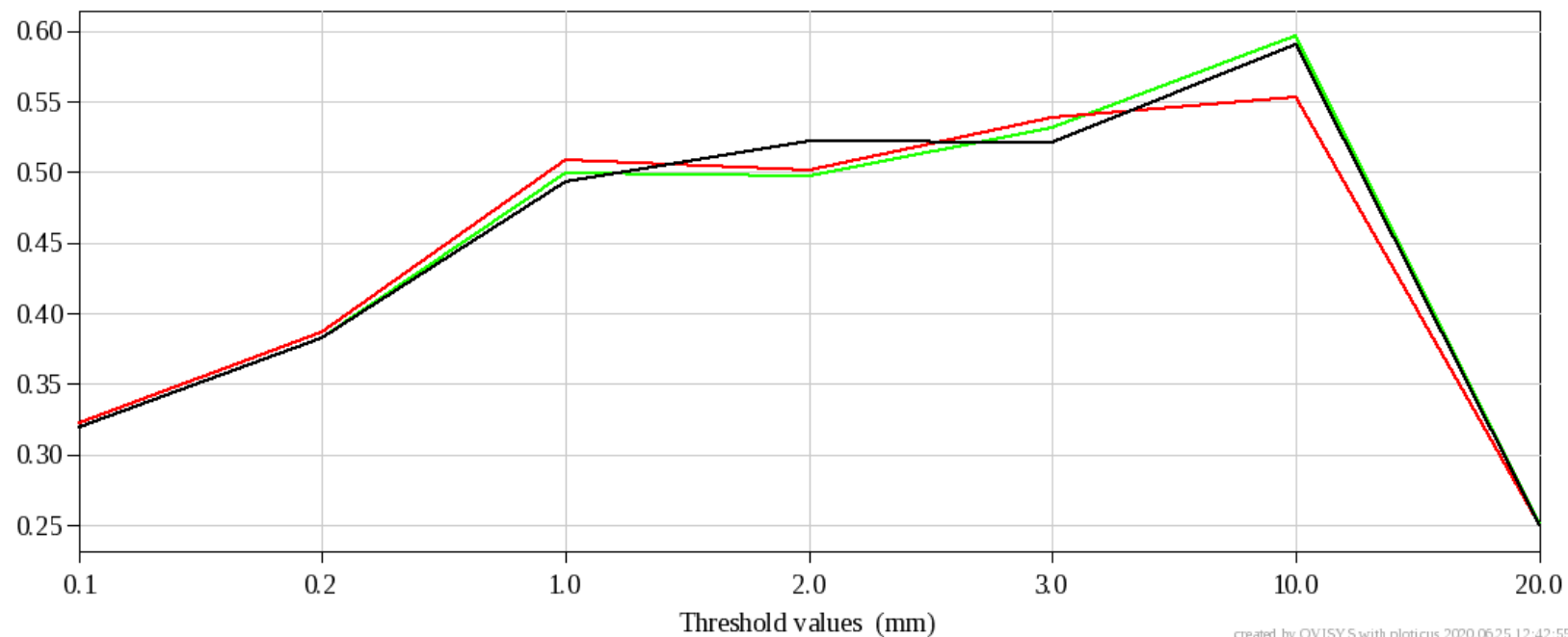
Solid line: ETS

Black: AROME with
Hungarian Mode-S
data

Red: AROME with
Czech Mode-S data

Green: reference run

AROME_20191201
AROME_mode-s_cz
AROME_MODE_S_mrar



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Period: 12/01/2019 - 12/19/2019
Area: AROME_max_400m
Variable: Precipitation (24 hour sum)
Timestep: 024
Score: ETS
Runhour: 00

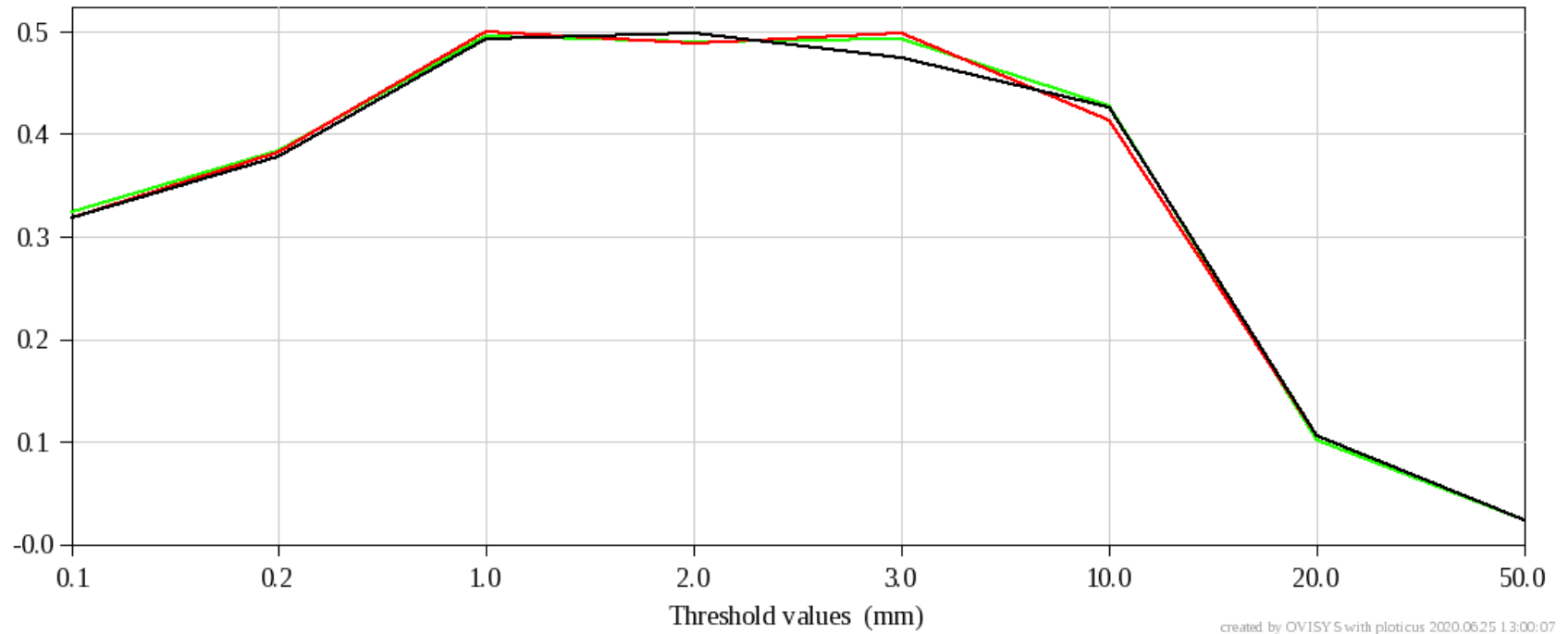
Solid line: ETS

Black: AROME with
Hungarian Mode-S
data

Red: AROME with
Czech Mode-S data

Green: reference run

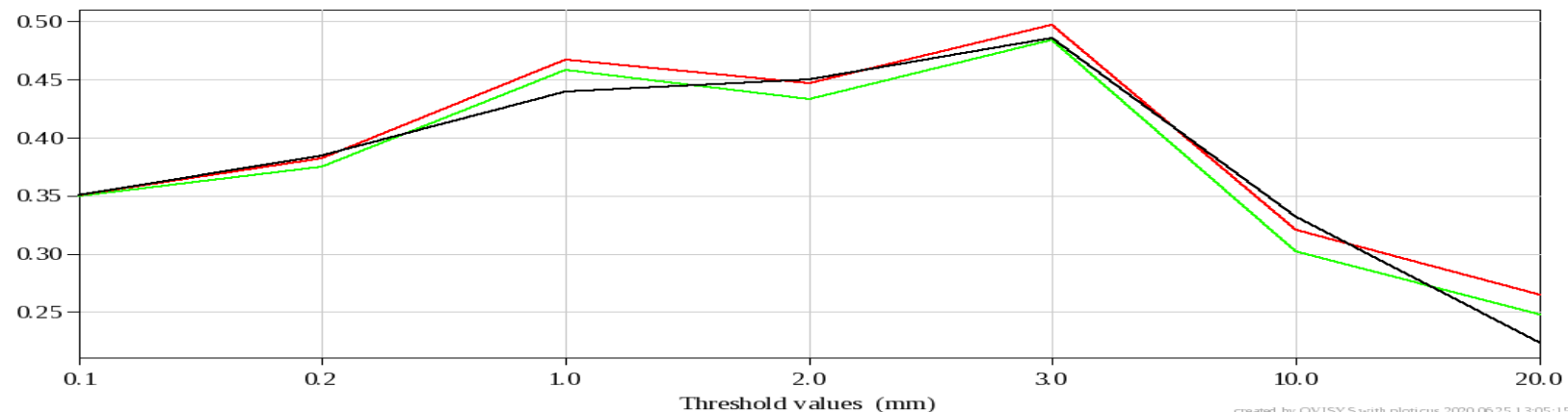
— AROME_20191201
— AROME_mode-s_cz
— AROME_MODE_S_mrar



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Period: **12/01/2019 - 12/19/2019**
 Area: **AROME_max_400m**
 Variable: **Precipitation (12 hour sum)**
 Timestep: **012**
 Score: **ETS**
 Runhour: **06**

AROME_20191201
 AROME_mode-s_cz
 AROME_MODE_S_mrar



created by OVISYS with ploticus 2020.06.25 13:05:15

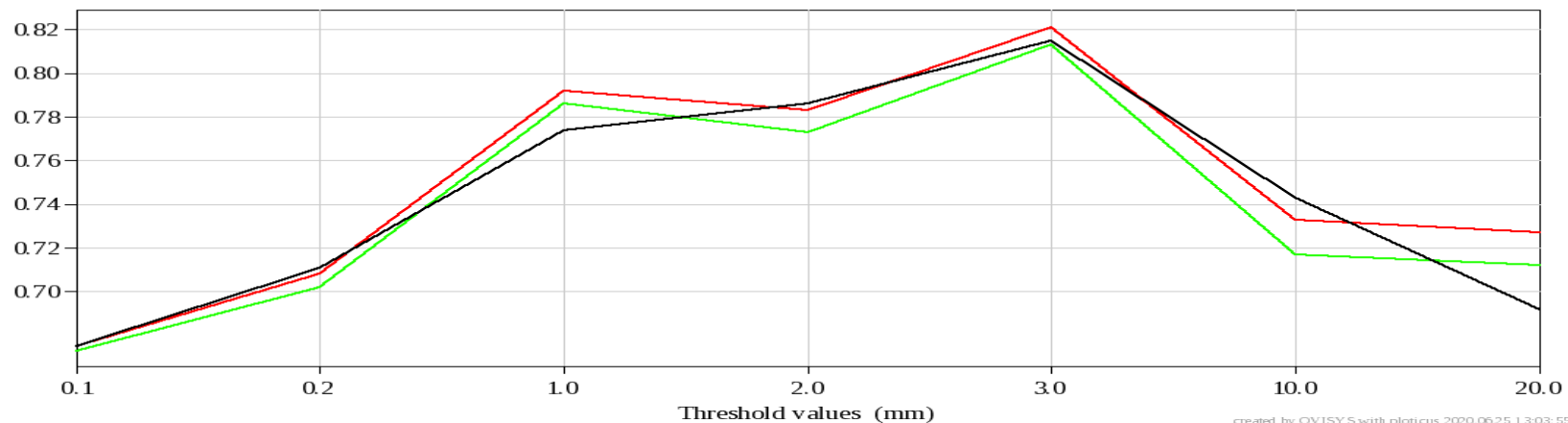
Black: AROME with Hungarian Mode-S data

Red: AROME with Czech Mode-S data

Green: reference run

Period: **12/01/2019 - 12/19/2019**
 Area: **AROME_max_400m**
 Variable: **Precipitation (12 hour sum)**
 Timestep: **012**
 Score: **SEDI**
 Runhour: **06**

AROME_20191201
 AROME_mode-s_cz
 AROME_MODE_S_mrar

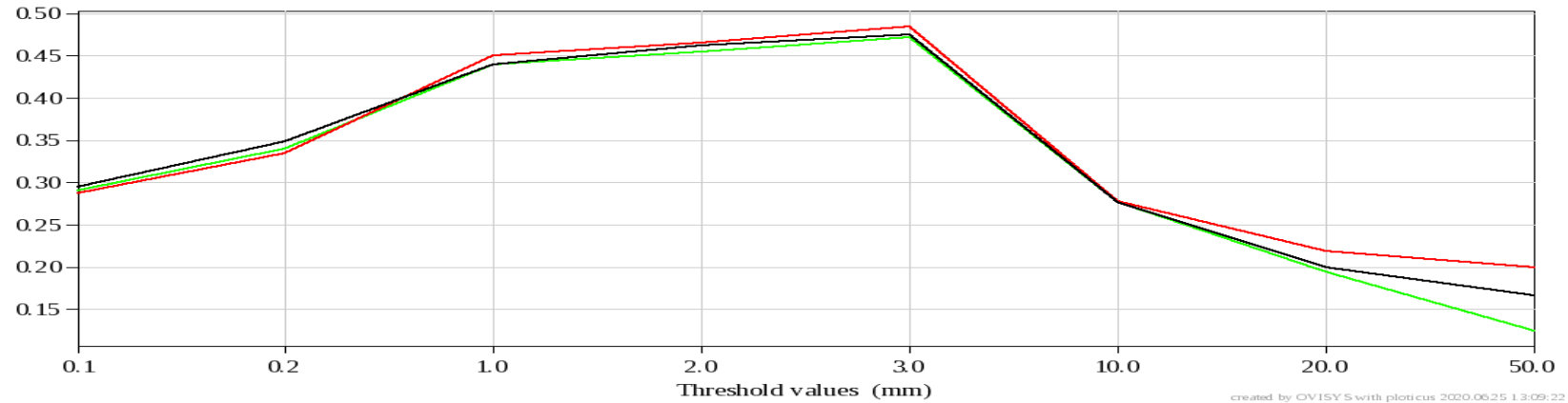


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Period: 12/01/2019 - 12/19/2019
 Area: AROME_max_400m
 Variable: Precipitation (24 hour sum)
 Timestep: 024
 Score: ETS
 Runhour: 06

AROME_20191201
 AROME_mode-s_cz
 AROME_MODE_S_mrar



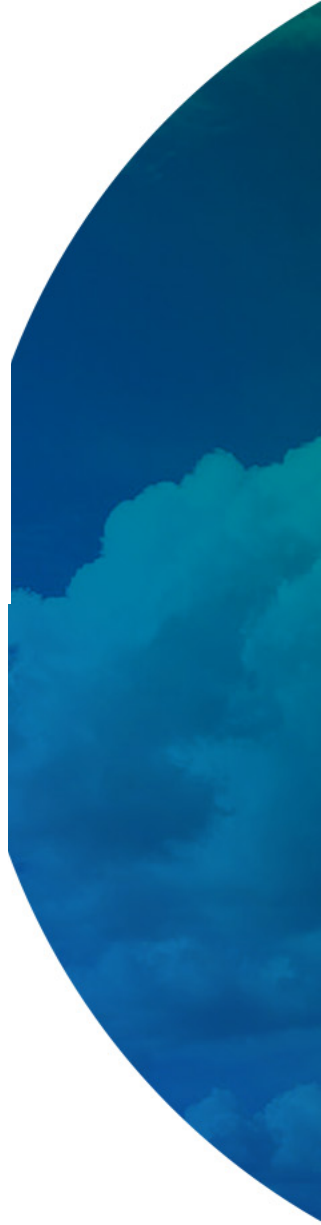
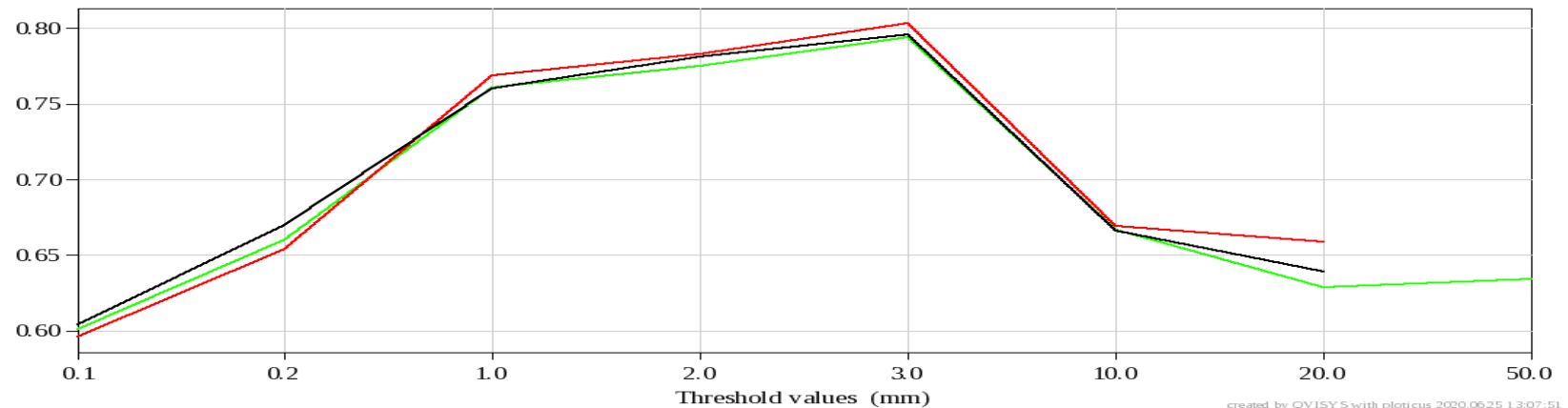
Black: AROME with Hungarian Mode-S data

Red: AROME with Czech Mode-S data

Green: reference run

Period: 12/01/2019 - 12/19/2019
 Area: AROME_max_400m
 Variable: Precipitation (24 hour sum)
 Timestep: 024
 Score: SEDI
 Runhour: 06

AROME_20191201
 AROME_mode-s_cz
 AROME_MODE_S_mrar



Future plans

- New experiment with the Czech Mode-S MRAR dataset for a summer period (June 2020)
- Implementing the Czech Mode-S MRAR data in the operational setup

Hungarian MODE-S dataset

Experiment using the raw dataset in the AROME model for the period 25/11/2019 - 09/03/2020 (cutted by the COVID-19 -caranteen), only through the data assimilation cycle -> ecma.full.dat files -> input for whitelist procedure

Statistical-based correction on the dataset to select the good-quality measurements among the raw MODE-S dataset
-> whitelisting

Experiment with the whitelisted dataset for the period 25/11/2019-19/12/2019, with forecast



Whitelist criteria



	Hungary			Czech Republic			Slovakia		
	Mean	Standard deviation	Number of measurements	Mean	Standard deviation	Number of measurements	Mean	Standard deviation	Number of measurements
Temperature	2K	2K	3000	1K	2K	3000	1K	2K	1000
Wind-speed	40 m/s	13 m/s	3000	1 m/s	5 m/s	3000	1 m/s	5 m/s	1000
Wind-direction	10 deg	100 deg	3000	10 deg	100 deg	3000	10 deg	100 deg	1000

Number of MODE-S observations before and after whitelisting

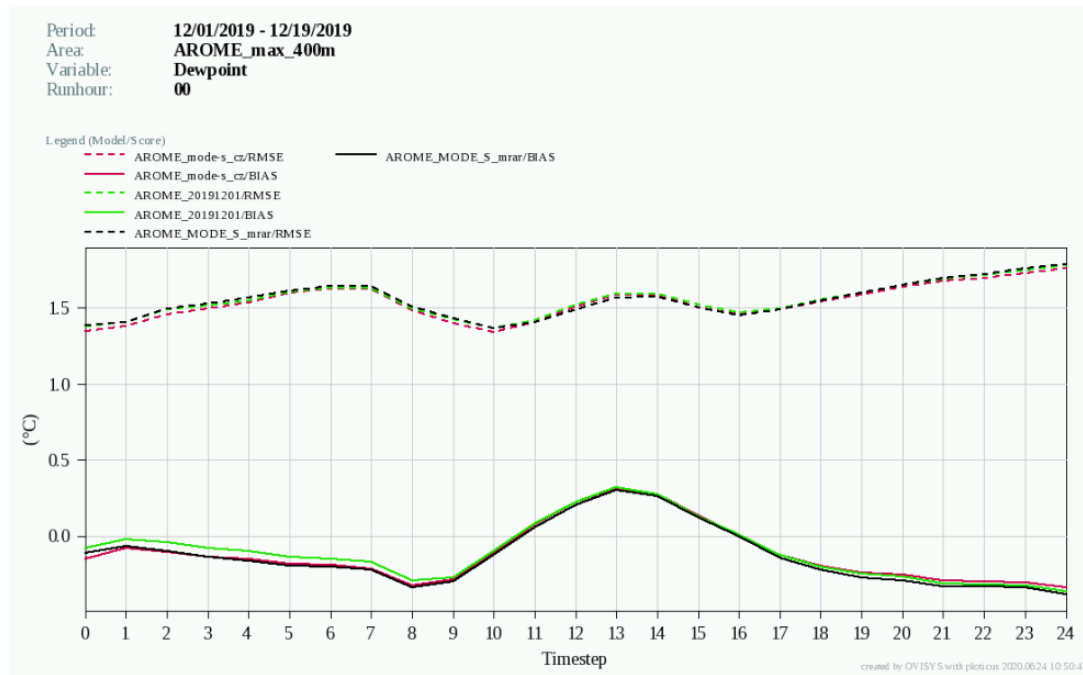
Run (01-12-2019)	Number of original observations	Number of selected observations (after whitelisting)
00 UTC	0	0
03 UTC	2712	1356
06 UTC	9189	3063
09 UTC	28644	7161
12 UTC	66795	13359
15 UTC	54126	9021
18 UTC	19908	2844
21 UTC	24840	3105

Number of aircraft measurements

Run (01-12-2019)	Number of assimilated MODE-S observations		Number of assimilated AMDAR observations	
	Temperature	Wind	Temperature	Wind
00 UTC	-	-	8	16
03 UTC	90	8	168	336
06 UTC	237	124	613	1222
09 UTC	120	146	747	1462
12 UTC	469	472	1449	2884
15 UTC	296	412	934	1840
18 UTC	102	54	780	1538
21 UTC	53	-	633	1248



Before whitelisting



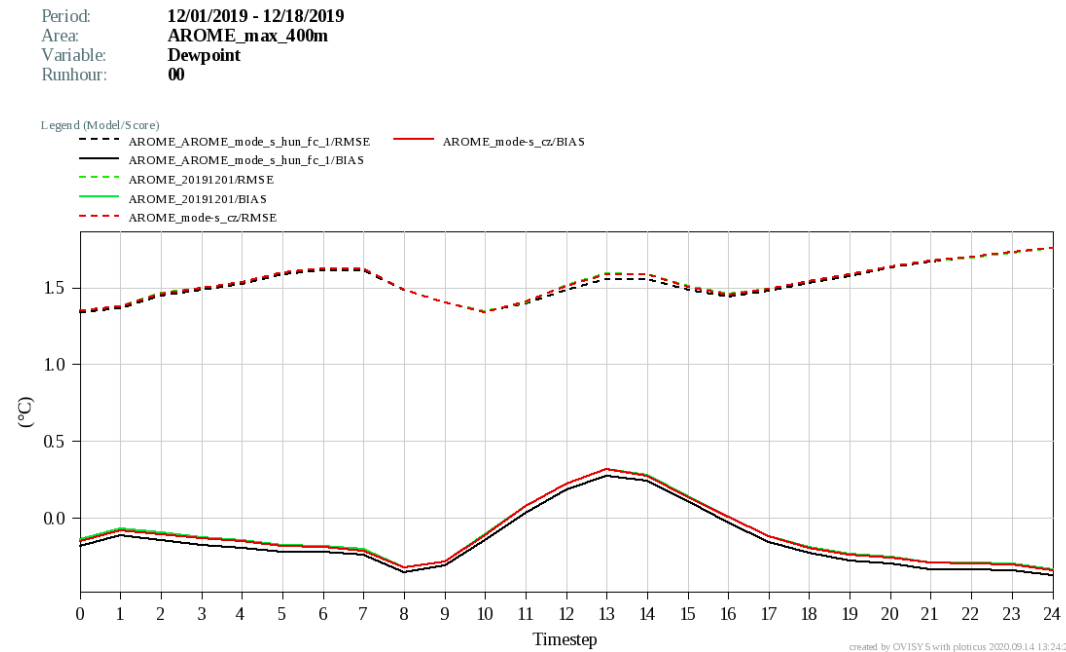
Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

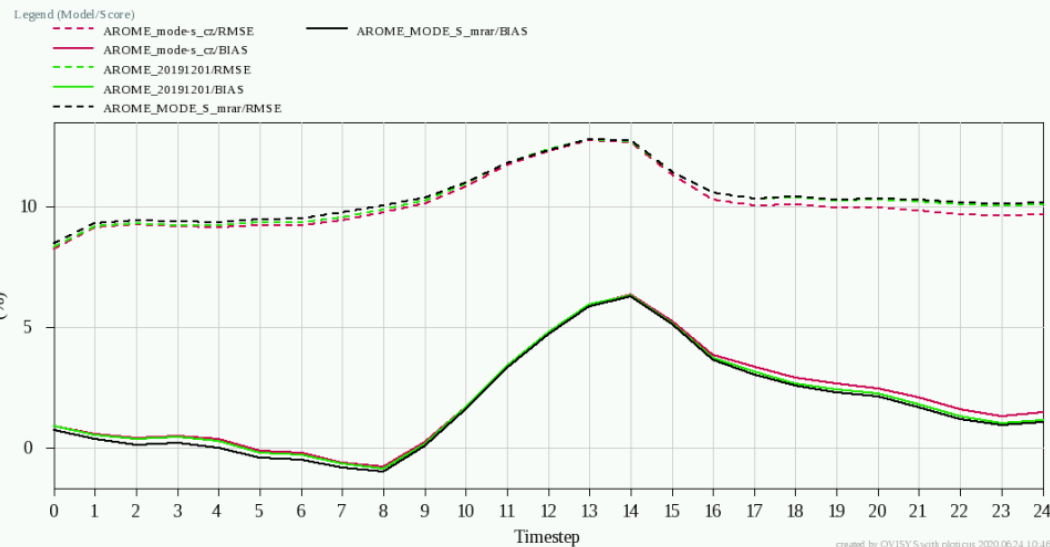
Red: AROME with Czech Mode-S data

Green: reference AROME-HU

After whitelisting



Period: 12/01/2019 - 12/19/2019
Area: AROME_max_400m
Variable: Relative humidity (2m)
Runhour: 00



Before whitelisting

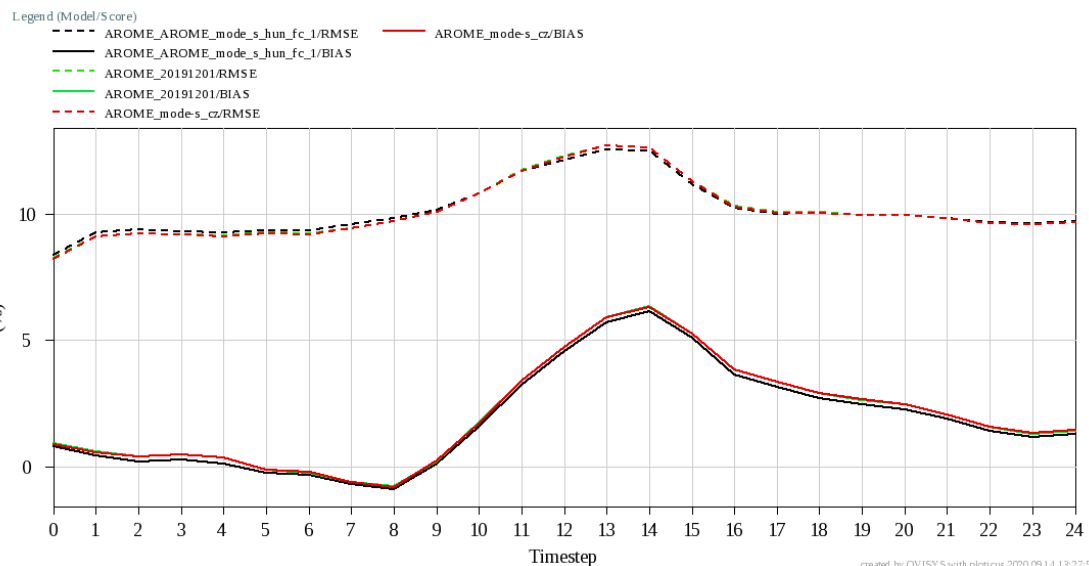
Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

Red: AROME with Czech Mode-S data

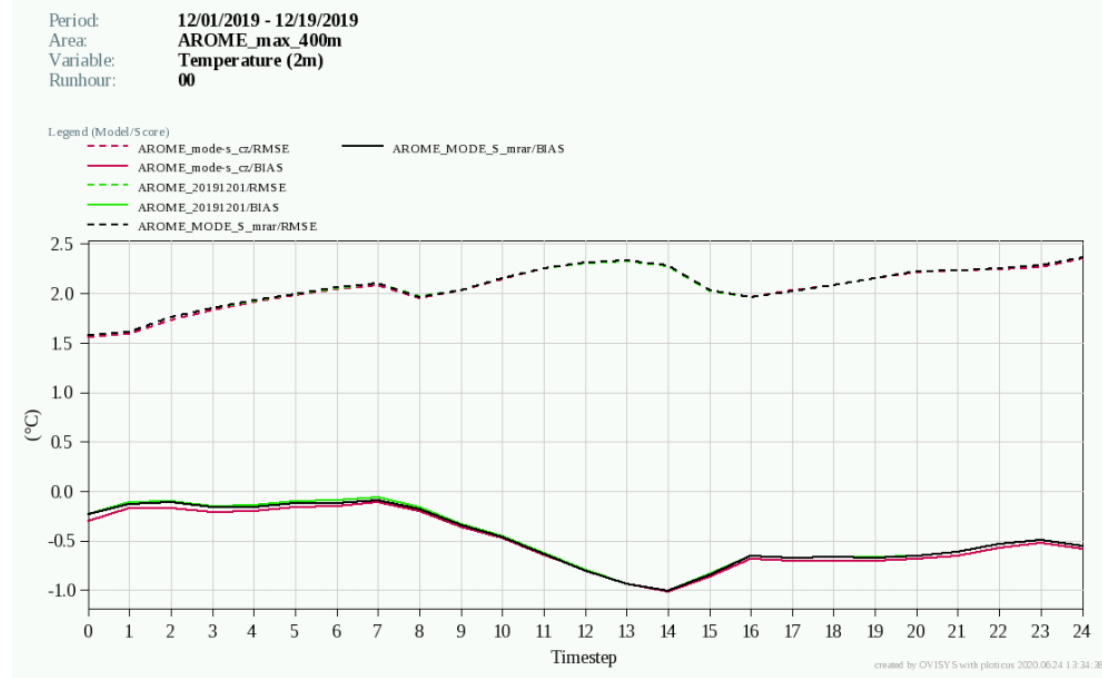
Green: reference AROME-HU

Period: 12/01/2019 - 12/18/2019
Area: AROME_max_400m
Variable: Relative humidity (2m)
Runhour: 00



After whitelisting

Before whitelisting



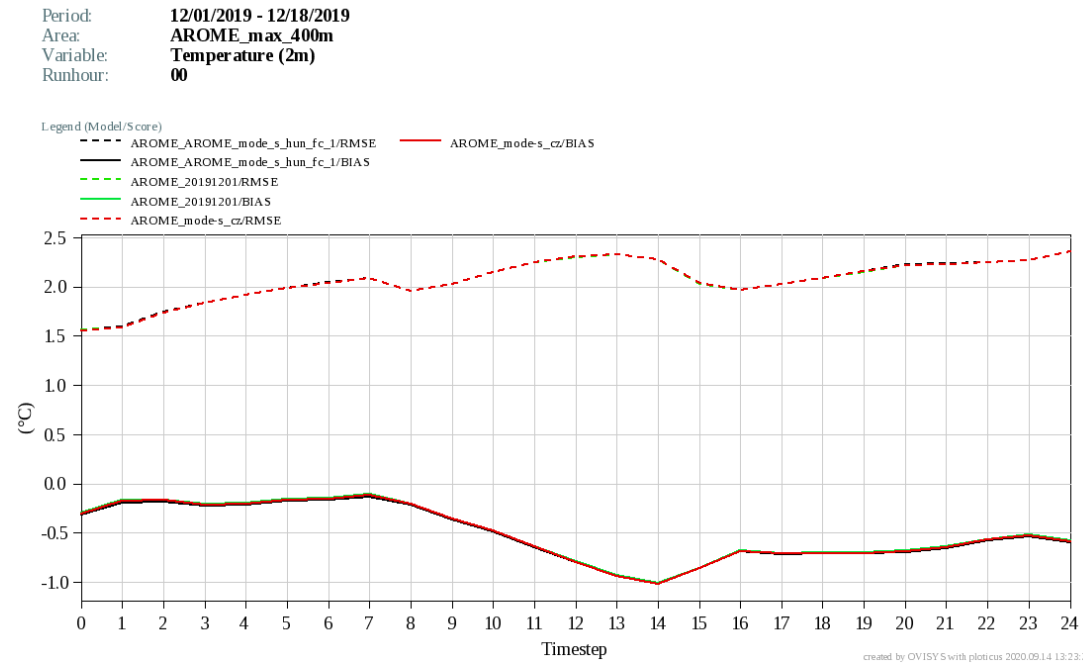
Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

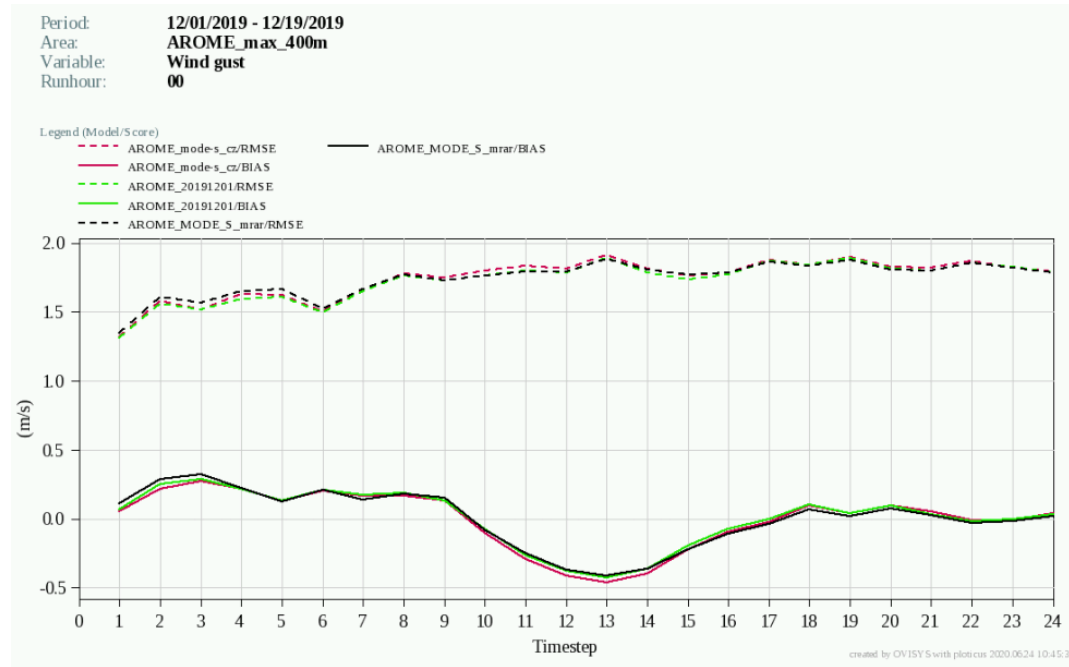
Red: AROME with Czech Mode-S data

Green: reference AROME-HU

After whitelisting



Before whitelisting



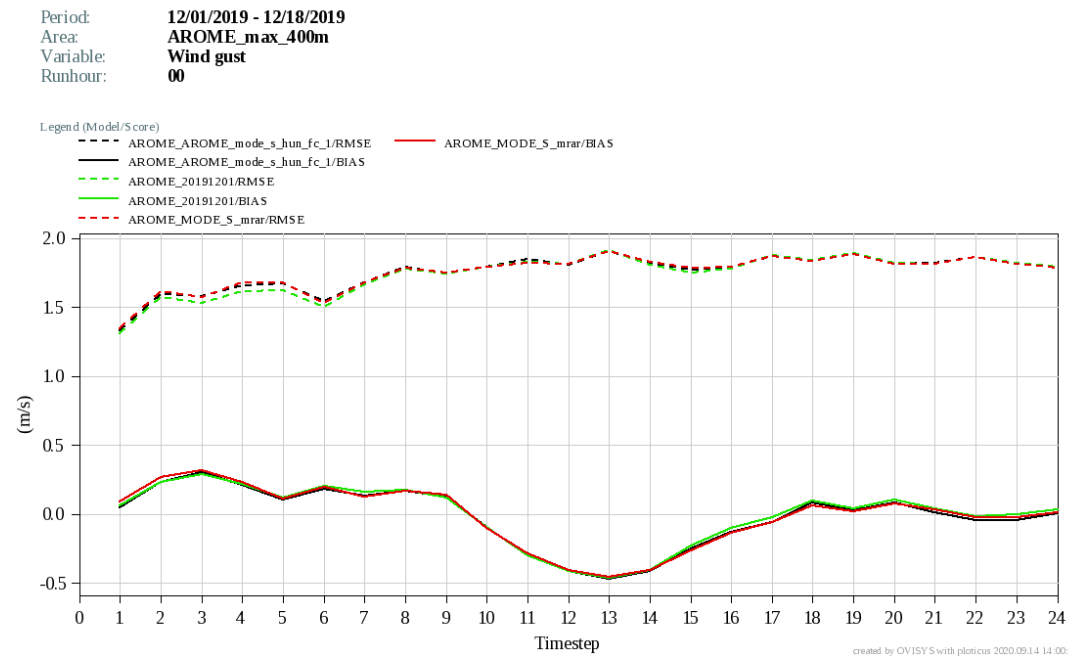
Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

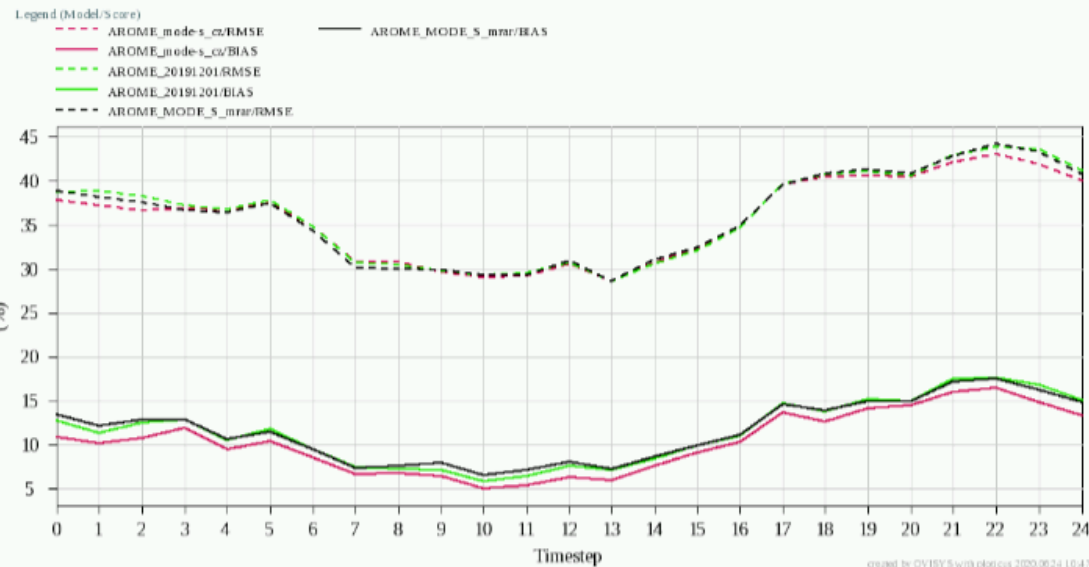
Red: AROME with Czech Mode-S data

Green: reference AROME-HU

After whitelisting



Period: 12/01/2019 - 12/19/2019
Area: AROME_max_400m
Variable: Cloudiness
Runhour: 00



Before whitelisting

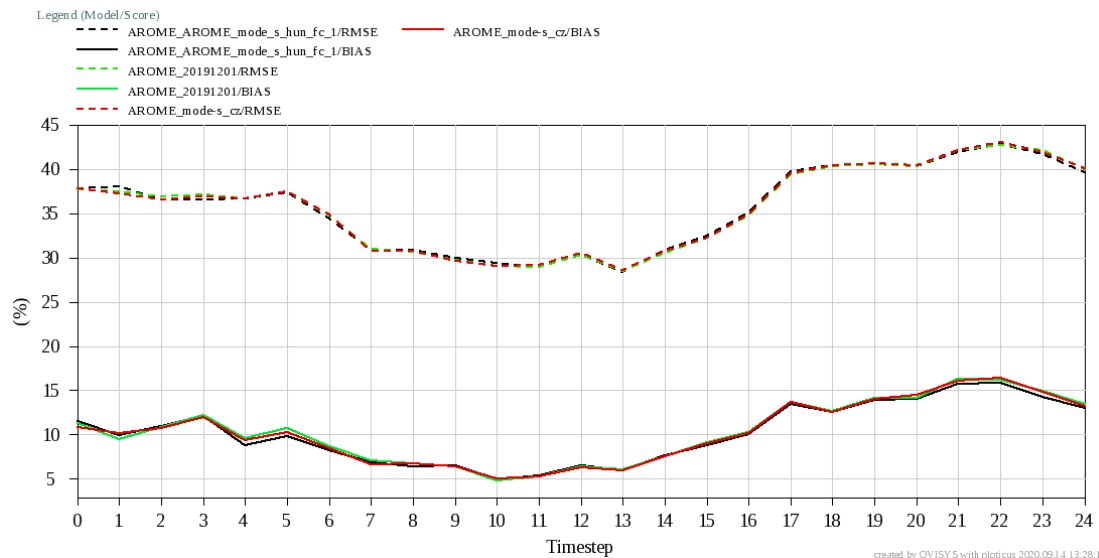
Solid line: BIAS, dotted line: RMSE

Black: AROME with Hungarian Mode-S data

Red: AROME with Czech Mode-S data

Green: reference AROME-HU

Period: 12/01/2019 - 12/18/2019
Area: AROME_max_400m
Variable: Cloudiness
Runhour: 00



After whitelisting

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Future plans

- Further experiments are to be conducted with the Hungarian Mode-S data (whitelisting problems) (+ *finish running the AROME - forecasts until 09/03/2020.*)

Thank you for your
attention!

