Impact of Background Model to the GII Processing

EUMETSAT study

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Final presentation, 05 February 2015, EUMETSAT

Outlines

Aim of the study

Presenting the results through a case study - 02 August 2014

- Task2 – impact of the actual NWP forecast differences
- Task1 – impact of the vertical and horizontal resolution of the NWP data

Additional material

Comparison with radiosonde data

Conclusions

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Conclusions

The GII algorithm retrieves pre-convective environment parameters
(moisture content and atmospheric instability) from
SEVIRI IR channel (WV6.2, WV7.3, IR8.7, IR10.8, IR12.0, IR13.4) measurements

Physical retrieval scheme

Much more unknowns (~90) , than measurements (6)
-> many possible solutions
-> something is needed as background constraint

The GII algorithm uses the following inputs:
- SEVIRI IR channel measurements and
- NWP model data (short-term forecast data: moisture and temperature profiles, …)
- Cloud mask

Those results are looked for, which are close both to the forecast and to the measurements

-> the final solution will retain certain features of the background.

Our task was to **study the impact of the forecast model to the GII results**

HOW FAR THE FORECAST MODEL IMPACTS THE GII RESULTS?

Tasks:

1. Analyse the effect of the **horizontal and vertical resolution** of the NWP model
2. Analyse the effect of the **actual forecast differences** calculated by different NWP models (e.g. differences in the exact location of strong gradients, or convergence lines, or in the actual extreme values, …)

↓

GII program was installed at the Hungarian Meteorological Service and adapted to be able to work with different NWP data - ECMWF, ALADIN/HU, AROME models

Strategy

To run the GII algorithm with different NWP inputs (ECMWF, ALADIN, AROME) for selected cases and analyse the differences

Choosing test cases:
The forecasted Total Precipitable Water (TPW) and K-index fields were analysed looking for similarities and differences (at cloud-free areas)

For the test cases:
We run the GII algorithm with the

- (BT rms threshold) = 1000 to get the forecasted parameters in satellite projection and at the slot time
- (BT rms threshold) = 1.5 to get the satellite corrected parameters

Fields to compare:

Total and Layer precipitable water and K-Index derived from the

- NWP inputs,
- Satellite corrected fields,
- Radiosonde data.

The NWP models:

	ECMWF	ALADIN	AROME
	Hydrostatic	Hydrostatic	Non-hydrostatic
Area	Global	Central-Europe	Carpathian Basin
Horizontal resolution	0.25°	0.1°	0.025°
Vertical resolution (number of levels)	137	49	60
Run at ….	ECMWF	OMSZ	OMSZ

ALADIN/HU and AROME are run at the Hungarian Meteorological Service
(with ECMWF as lateral boundary condition)

Task 2

Analyse the effect of the actual forecast differences calculated by different NWP models

Strategy

We run the GII algorithm with three different NWP models (ECMWF, ALADIN, AROME) for selected cases - where the models produce significant differences in the moisture or instability fields in cloud free areas

We needed NWP data at fixed pressure levels

- ECMWF data were downloaded from ECMWF MARS database
- ALADIN/HU and AROME were re-run for the selected cases and post-processed to interpolate the data for the 25 fixed pressure levels

We used all three model data at the same 25 vertical levels:

1000, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, 10, 7, 5, 3, 2, 1 hPa

Task 1

Analyse the effect of the horizontal and vertical resolution of the NWP model

Strategy

We run the GII algorithm with **ALADIN** model, but use the data with different vertical and horizontal resolutions.

To analyse the effect of the vertical resolution we used:

- ALADIN data at 25 levels and
- ALADIN data at 43 (RTTOV) levels

To analyse the effect of the horizontal resolution we used:

- ALADIN data at 43 levels with the original horizontal resolution 0.1° and
- ALADIN data at 43 levels with decreased horizontal resolution 0.2°

Retrieved parameters:

Water vapour content

- Total Precipitable Water (TPW)
- Low-layer Precipitable Water (LL): surface – 850 hPa
- Mid-layer Precipitable Water (ML): 850-500 hPa
- High-layer Precipitable Water (ML): above 500 hPa

Stability indeces

- K-index (KI)
- Lifted index (LI)

The retrieval is possible only for cloud-free areas:

MPEF Cloud Mask was used

Test cases			
29	July	2012	Convergence line ahead front, severe convective system
05	August	2012	weak pressure gradient forces, severe convection
20	June	2013	Germany: Convergence line + front, severe convection Carpathian basin: edge of a NE-European cyclone
02	**August**	**2014**	Weak pressure gradient forces, anticyclone to the northeast (upper air vortex)
14	August	2014	Front across the Carpathian Basin
20	August	2014	Front across the Carpathian Basin
22	August	2014	Post-frontal situation
03	September	2014	Convergence line over Spain, weakening cyclon to east
08	September	2014	Carpathian basin: Convergence line, single cell convection, weak pressure gradient forces
09	September	2014	weak pressure gradient forces, waving frontal zone approaching in the evening

Several slots were processed per day.

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Task1 – impact of the vertical and horizontal resolution of the NWP data

Additional material

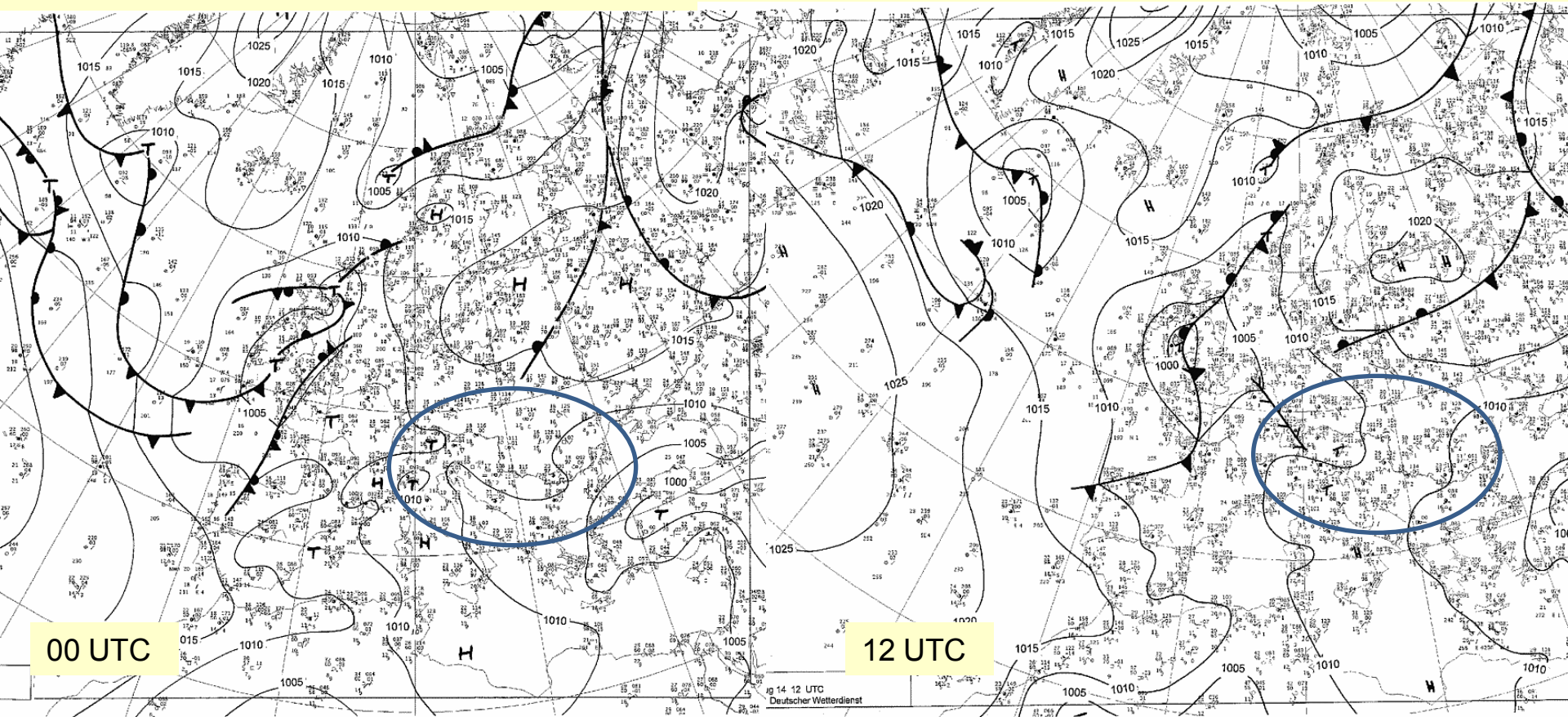
Comparison with radiosonde data

Summary, conclusions

02 August 2014

No fronts in the Carpathian basin
Synoptic environment characterized by weak pressure gradient forces,
anticyclone to the northeast
(upper air vortex)

Several thunderstorms occurred in the Carpathian basin



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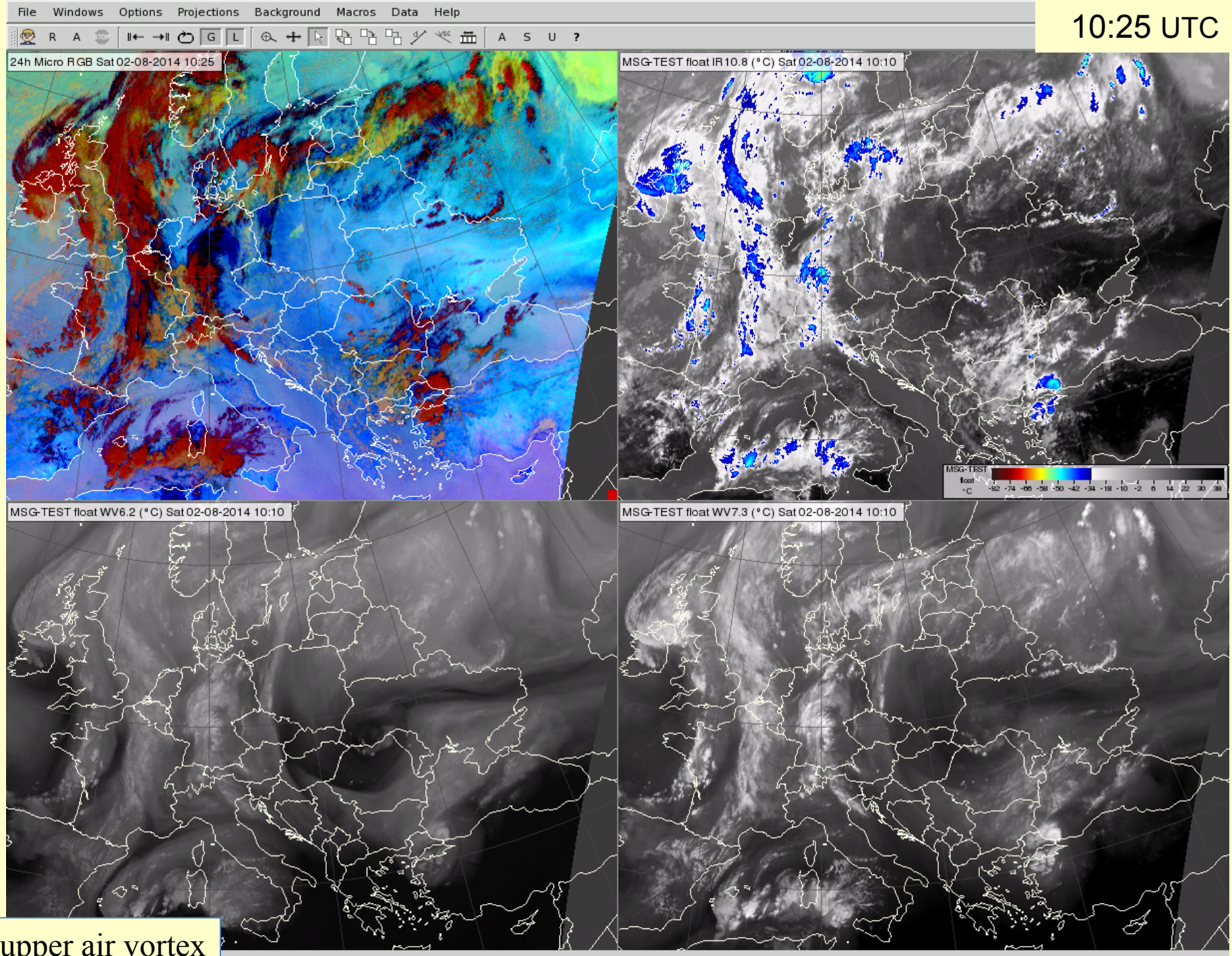
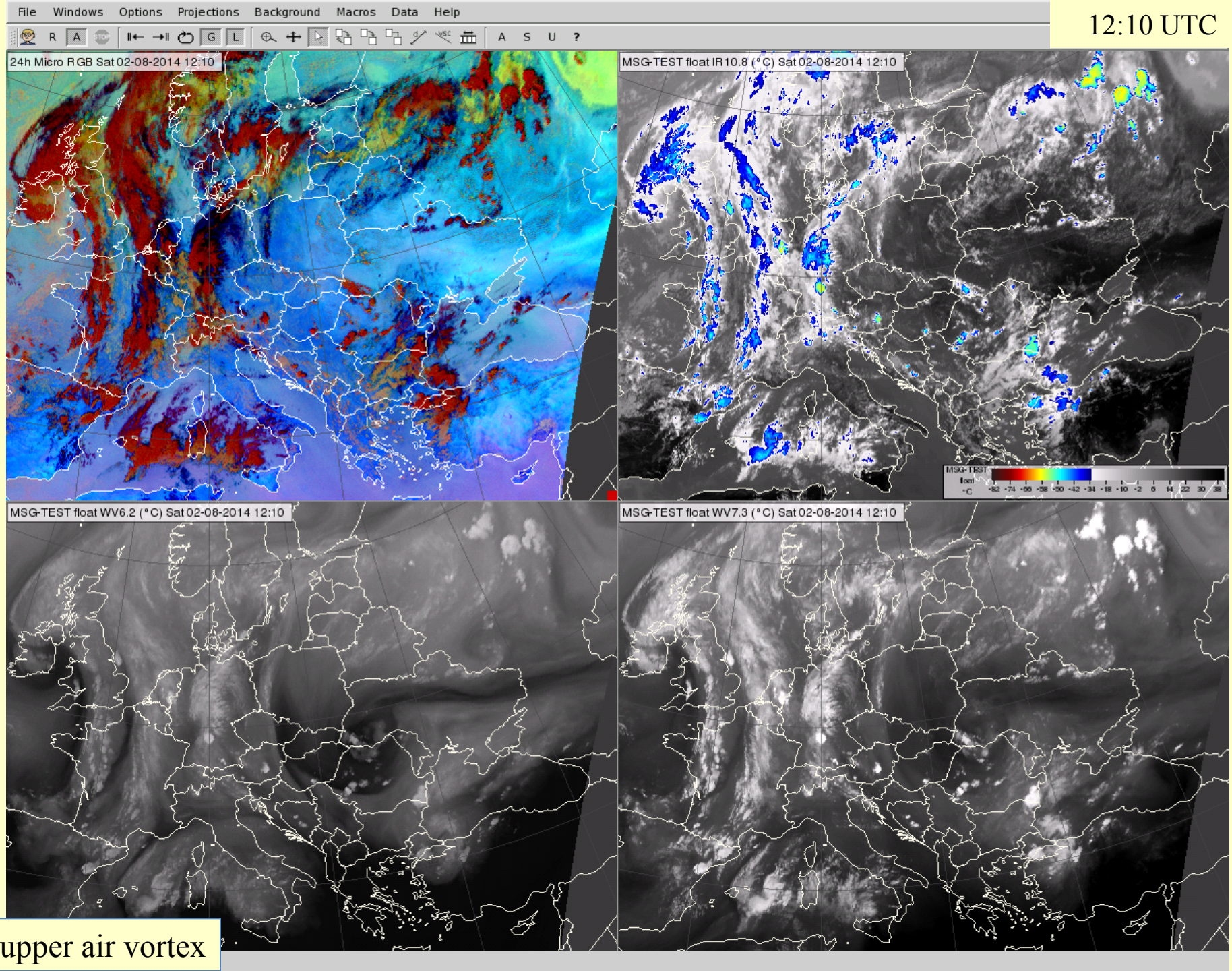


upper air vortex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12:10 UTC
24h Micro RGB Sat 02-08-2014 12:10
MSG-TEST float IR10.8 (°C) Sat 02-08-2014 12:10
MSG-TEST float WV6.2 (°C) Sat 02-08-2014 12:10
MSG-TEST float WV7.3 (°C) Sat 02-08-2014 12:10
upper air vortex

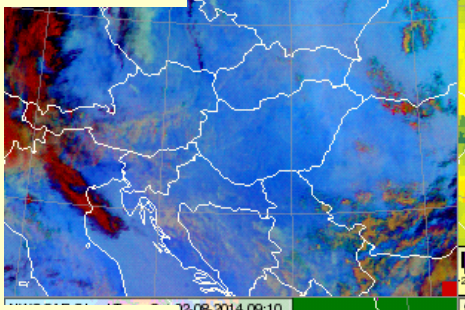
Task 2
Analysing the effect of the actual NWP forecast differences

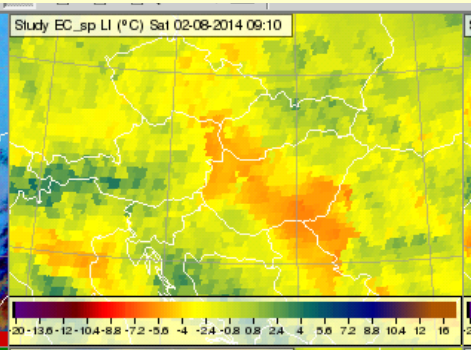
NWP input was:
ECMWF
ALADIN
AROME

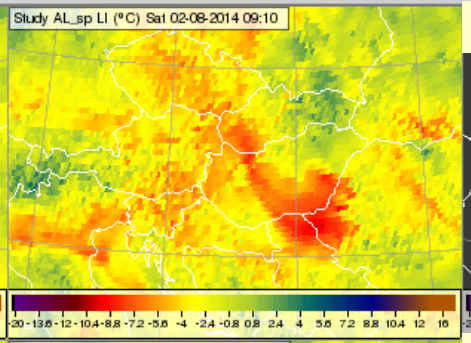
All at 25 pressure levels

9 UTC ECMWF ALADIN AROME

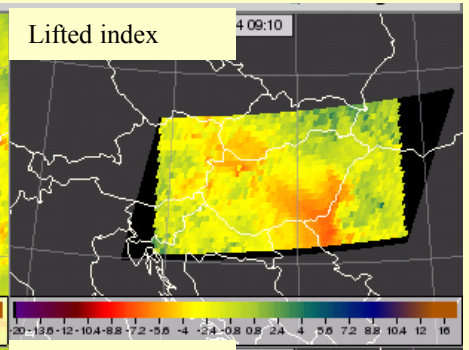
24h Micro RGB







Lifted index



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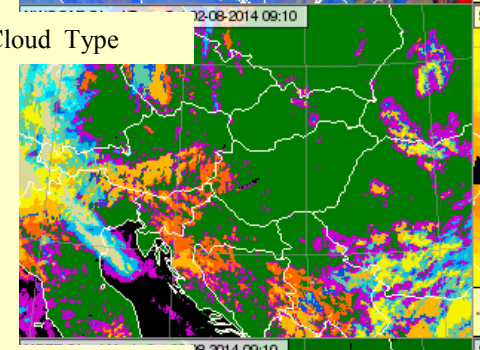
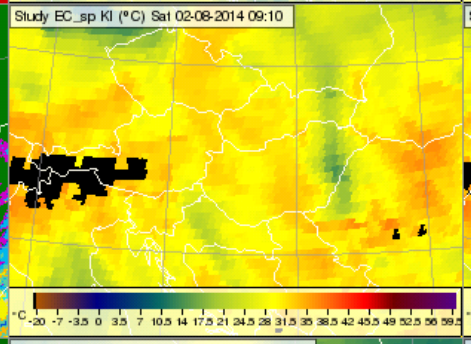
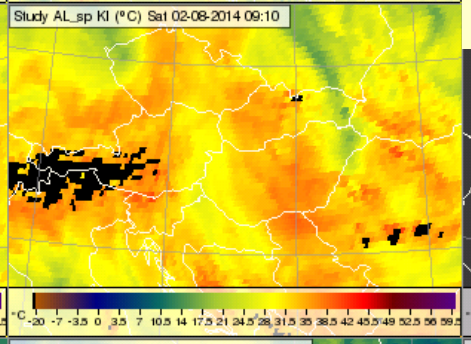
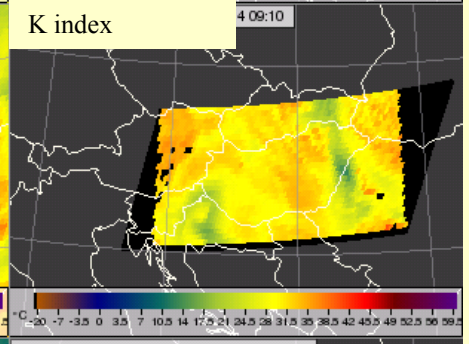


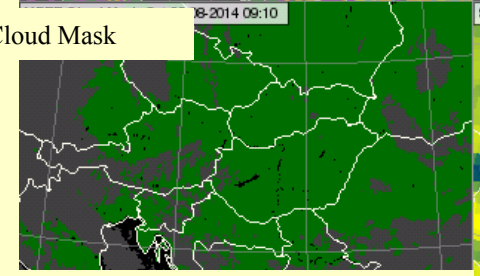


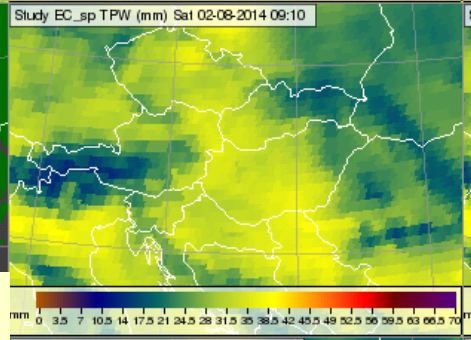


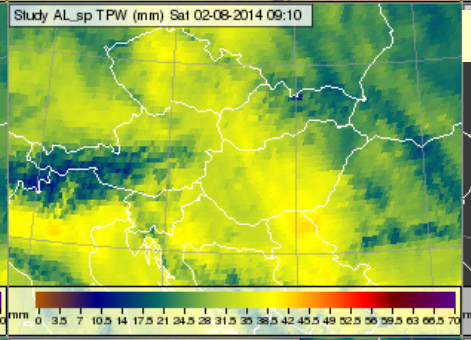
K index



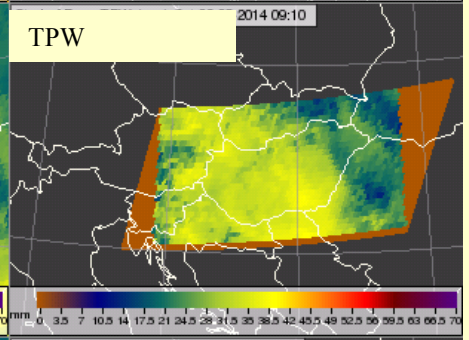
Cloud Mask

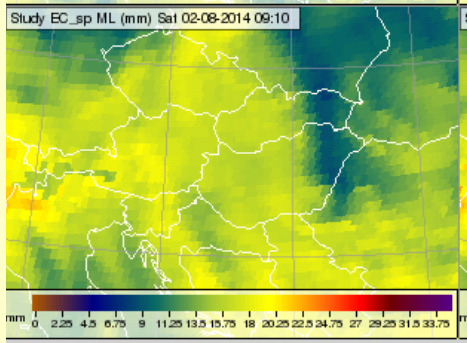


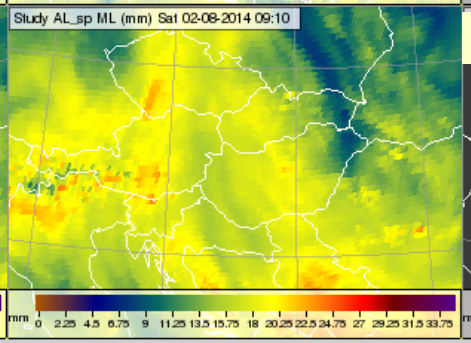




TPW







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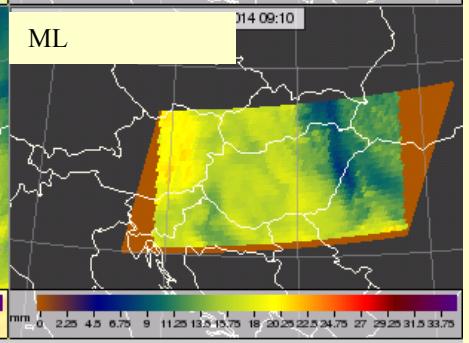


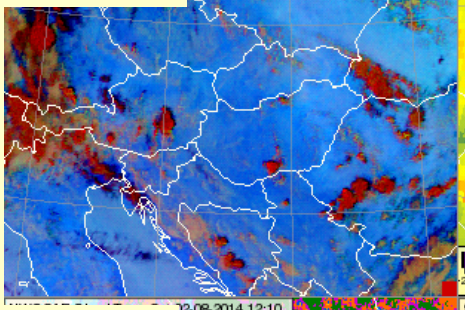
Comparison of the **forecasted** fields

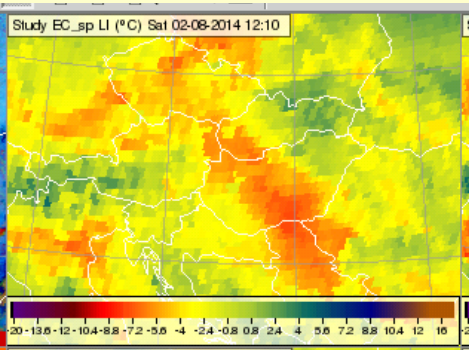
There were differences between the NWP forecasts, but not huge differences. Same structure

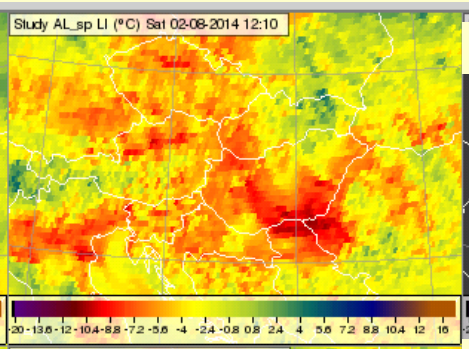
ALADIN forecasted more moist and unstable condition

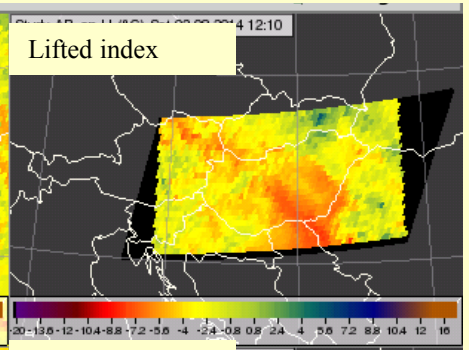
12 UTC ECMWF ALADIN AROME

24h Micro RGB

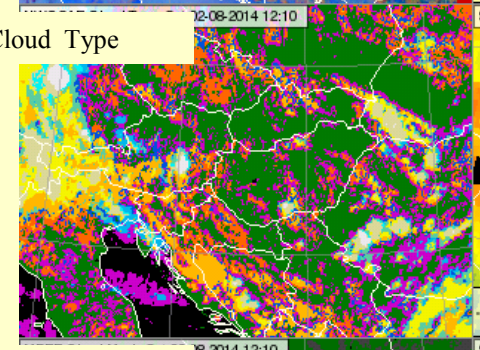


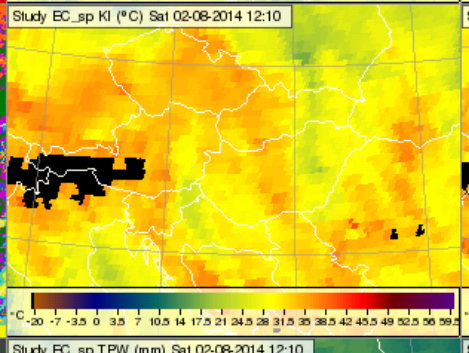


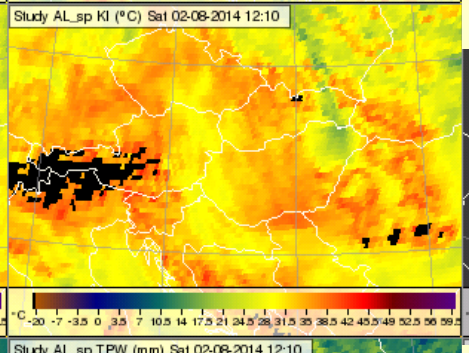


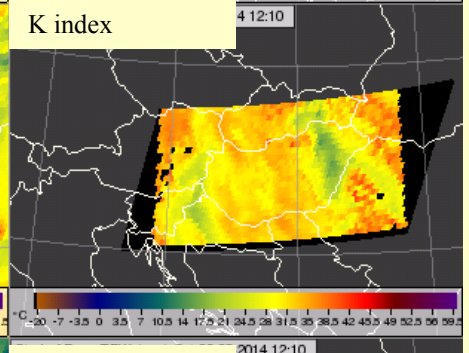


Cloud Type

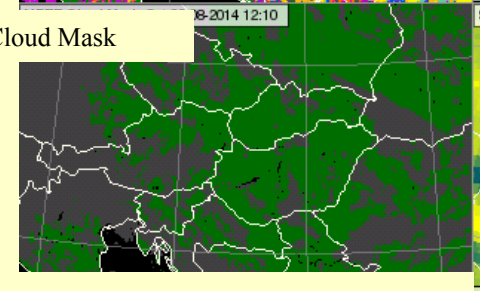


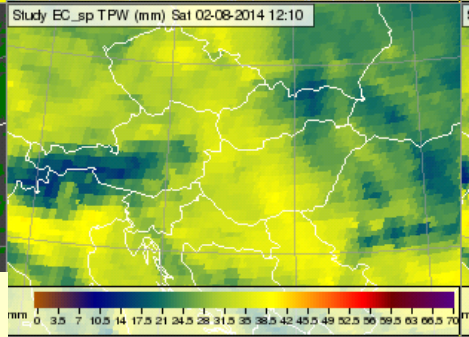


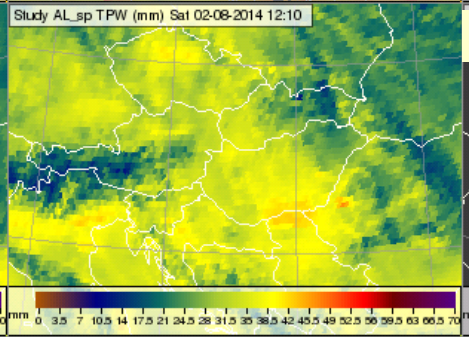


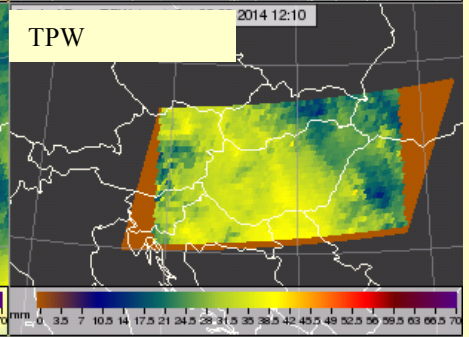


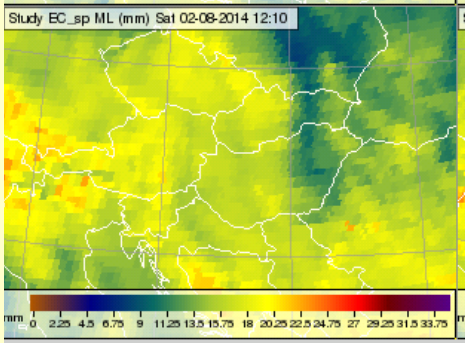
Cloud Mask

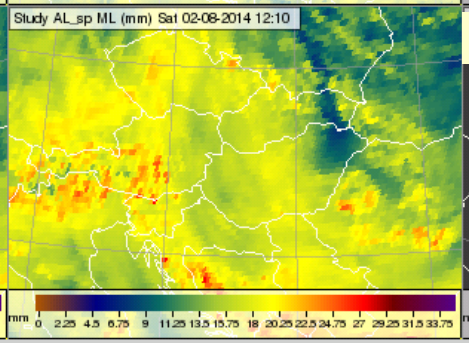


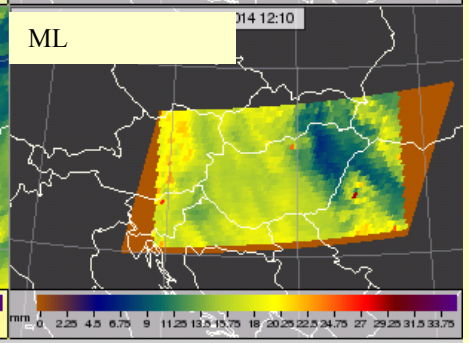










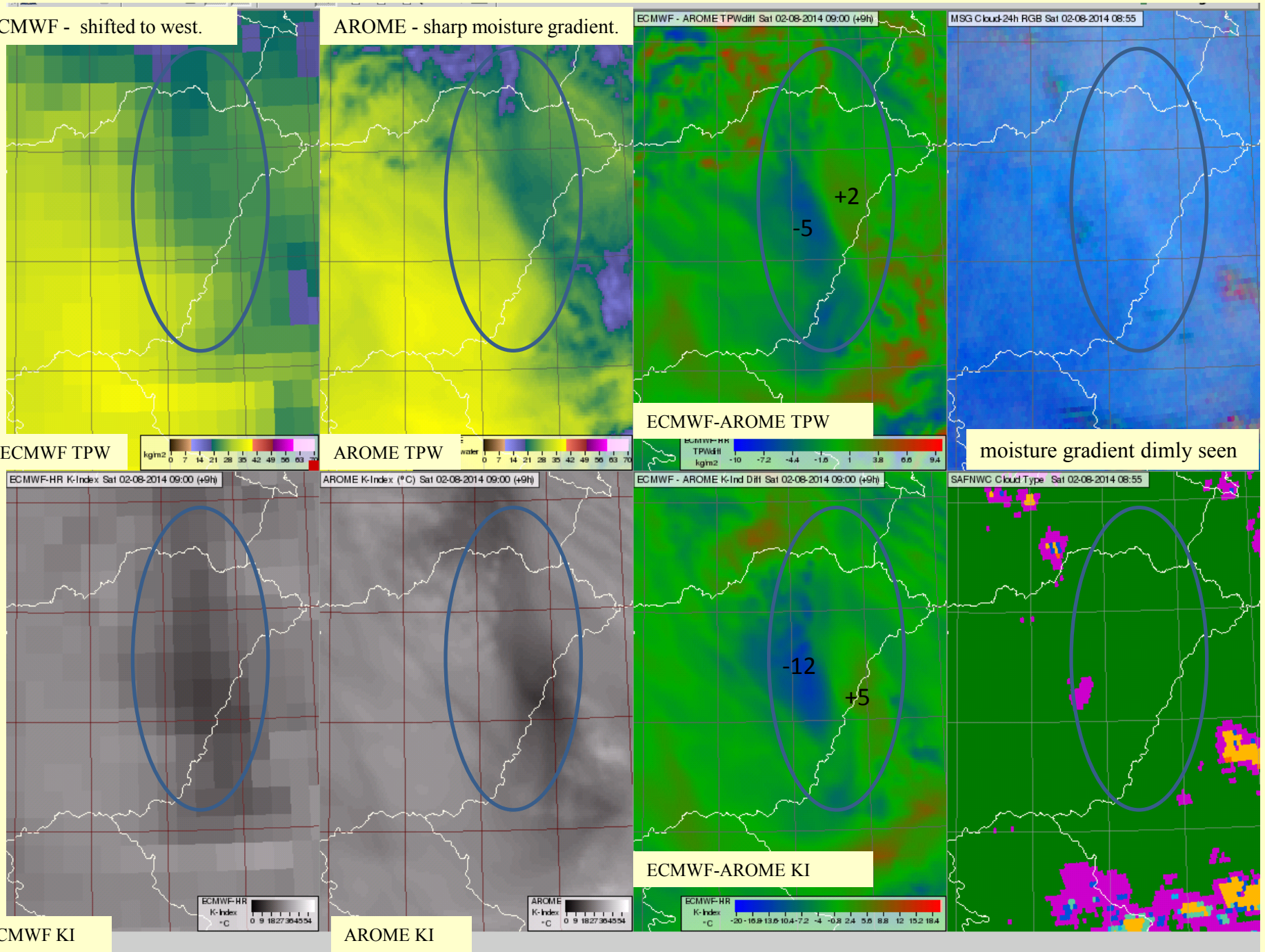


Comparison of the **forecasted** fields

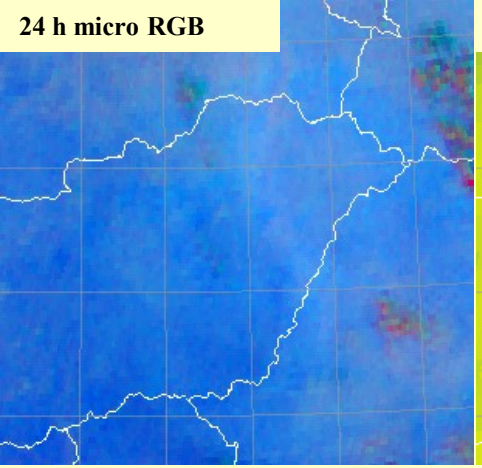
There were differences between the NWP forecasts, but not huge differences. Same structure

ALADIN forecasted more moist and unstable condition

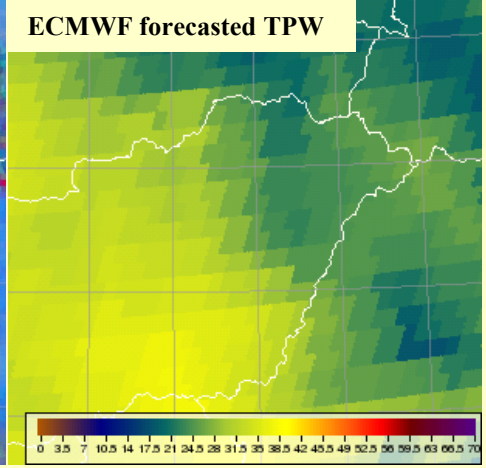
ECMWF and AROME in their original spatial resolution. This was used to select this day as a test case. 09 UTC



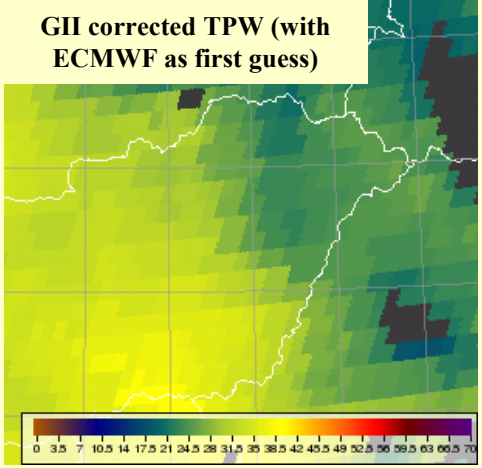
24 h micro RGB



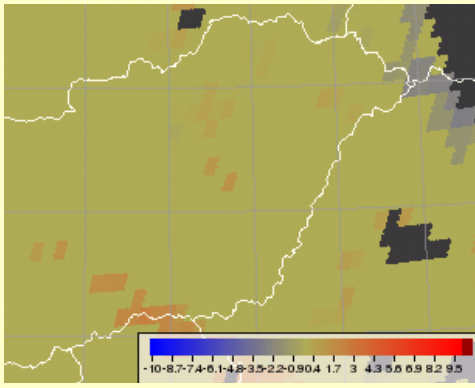
ECMWF forecasted TPW



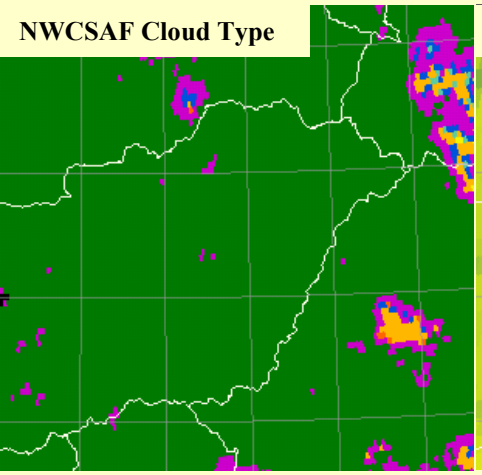
GII corrected TPW (with ECMWF as first guess)



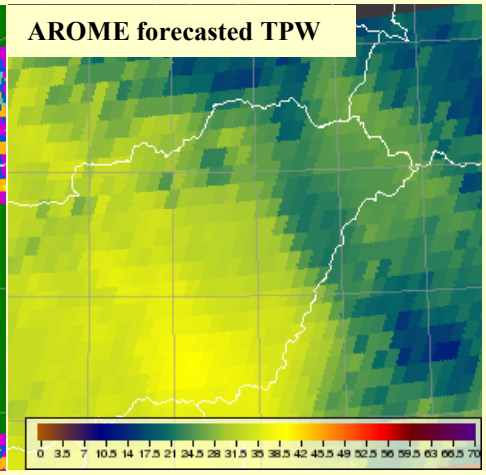
sat correction = GII corrected – ECMWF forecasted TPW



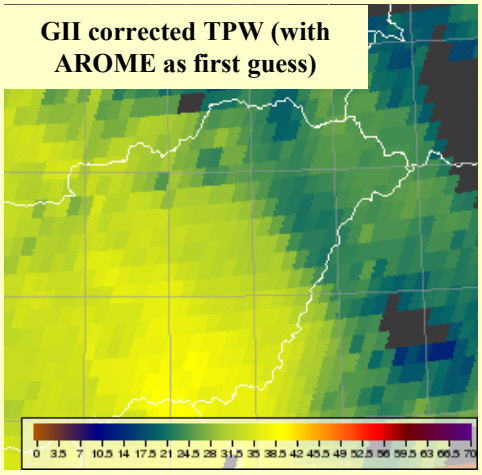
NWCSAF Cloud Type



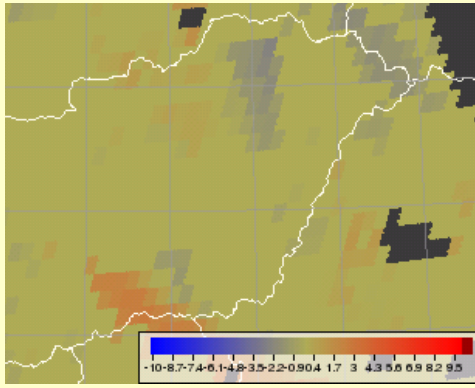
AROME forecasted TPW



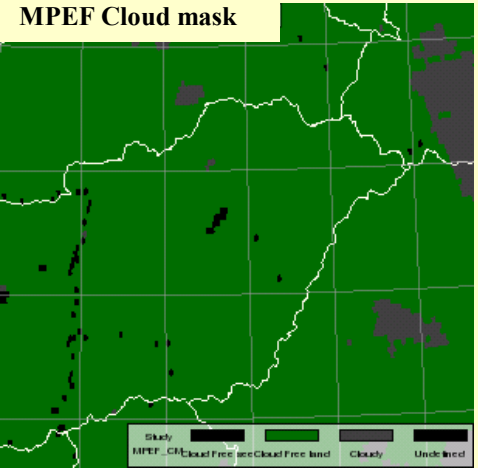
GII corrected TPW (with AROME as first guess)



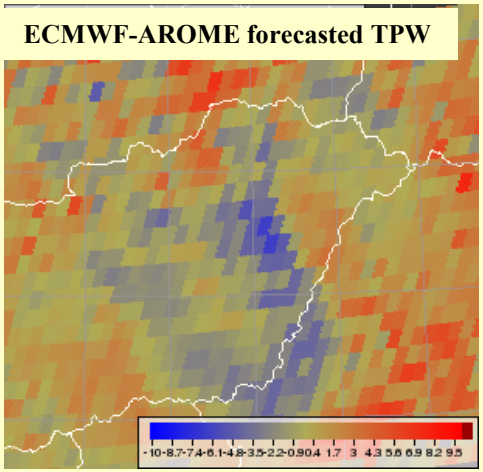
sat correction = GII corrected – AROME forecasted TPW



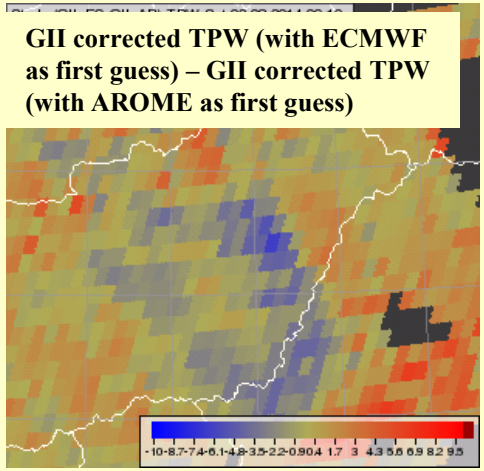
MPEF Cloud mask



ECMWF-AROME forecasted TPW

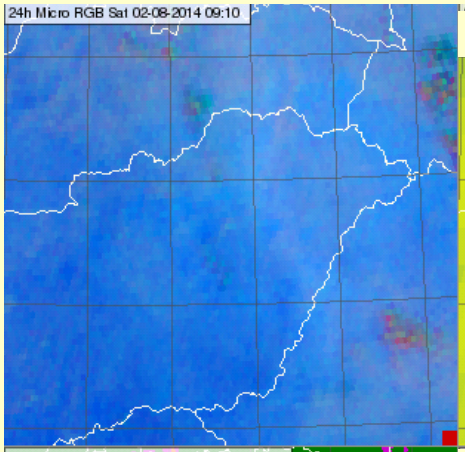


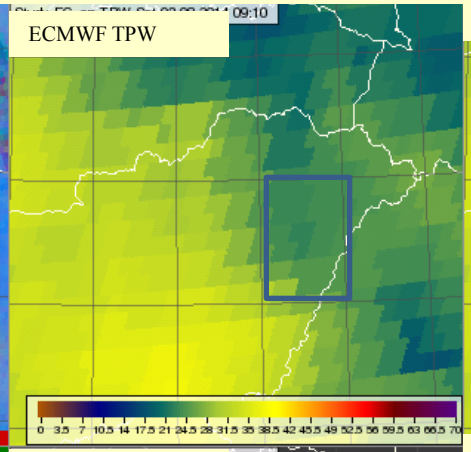
GII corrected TPW (with ECMWF as first guess) – GII corrected TPW (with AROME as first guess)

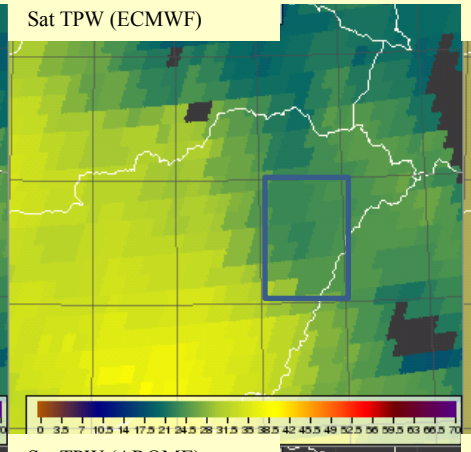


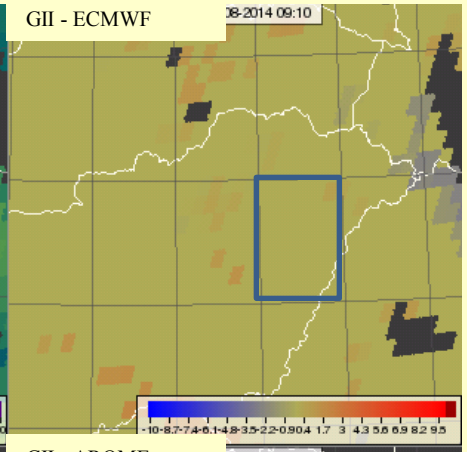
TPW 09:10 UTC

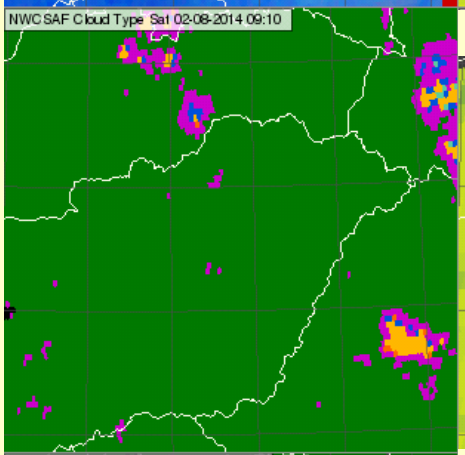
ECMWF and AROME forecasted and GII corrected TPW, 09 UTC

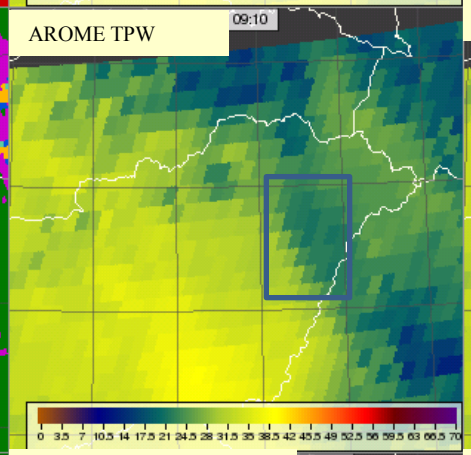


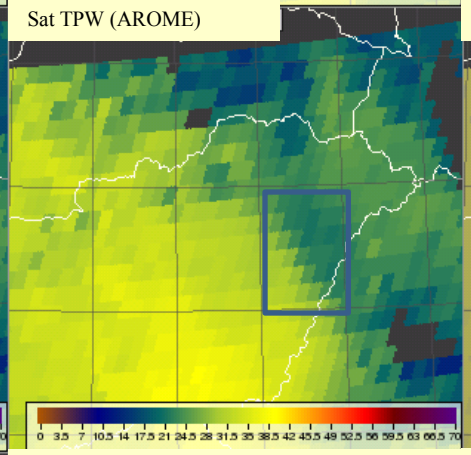


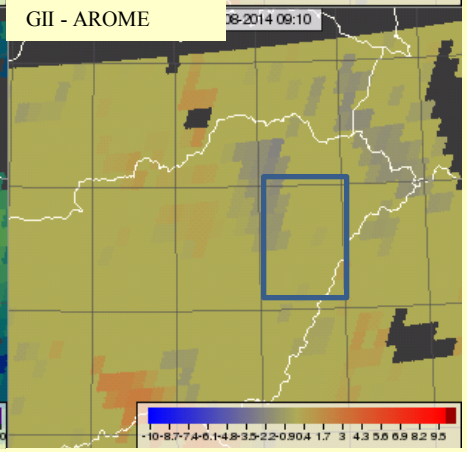


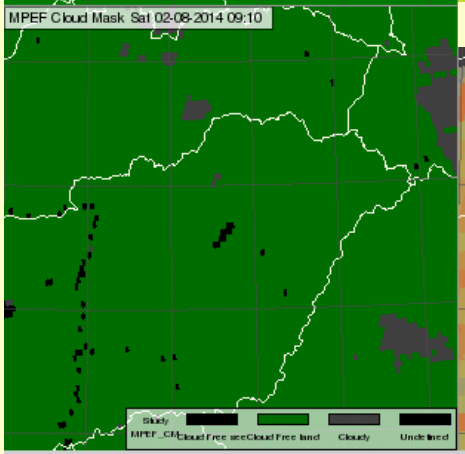


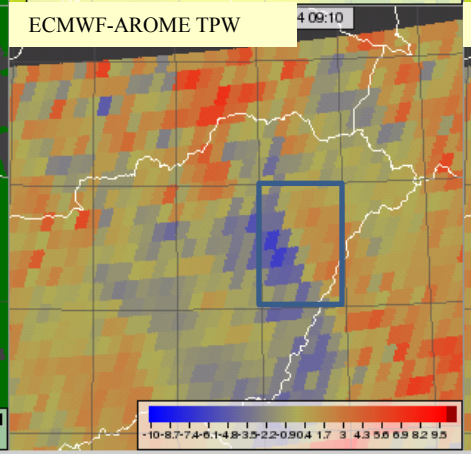


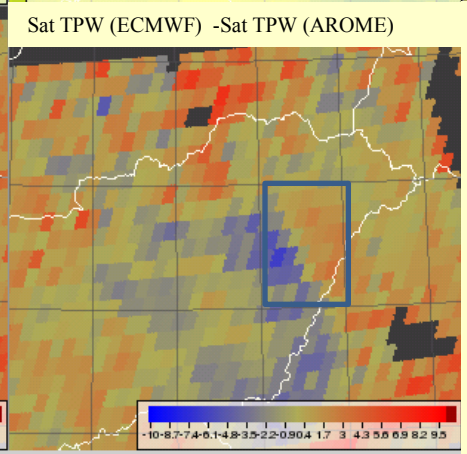












<u>About the area in the square:</u>

We expected that the satellite retrieval would modify this region.

However, …

GII algorithm **does** correction in **some areas**.

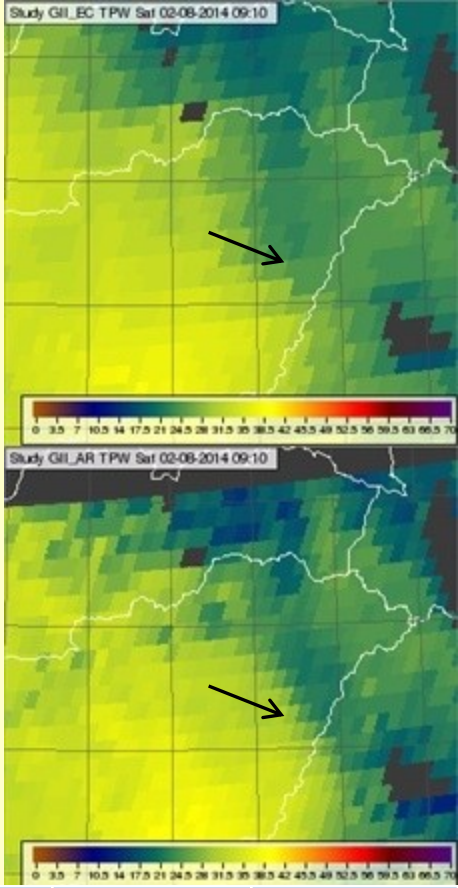
It **does not correct all differences**

2014.08.02. 09:10 UTC

	TPW [mm]	Sat corr TPW
EC	**26.2**	0
ALADIN	29.1	0
AROME	**30.5**	0

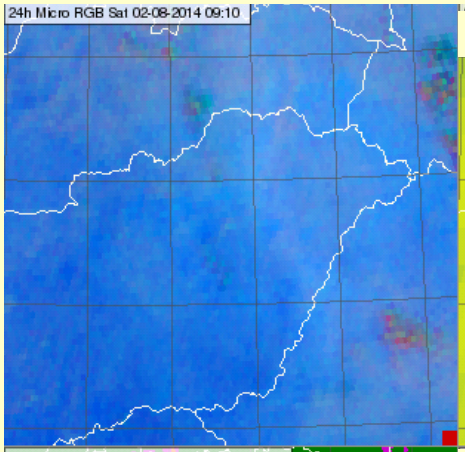
In the pixel indicated by the arrow the forecasted TPW difference was **4.3 mm**. However, NO correction was performed as the simulated BTs in the SEVIRI channels were close to the measured ones.

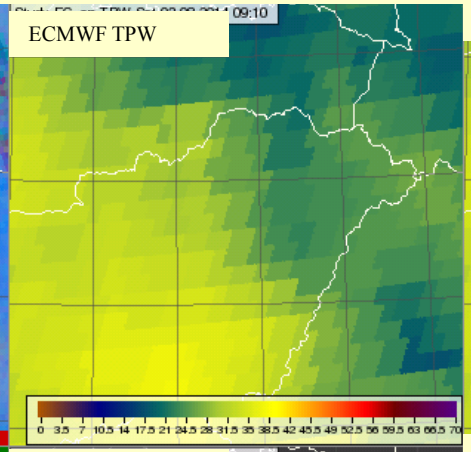
The itaration starts if the RMS of the measured and simulated BT differences is higher than a threshold (1.5).

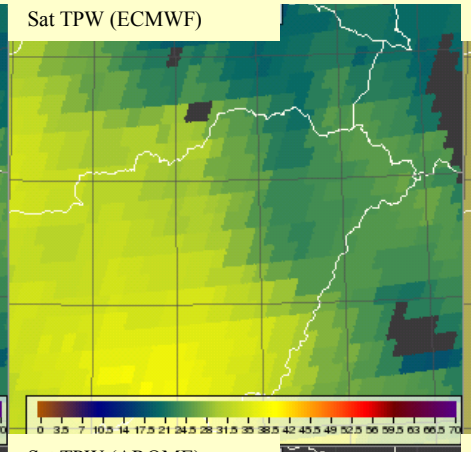


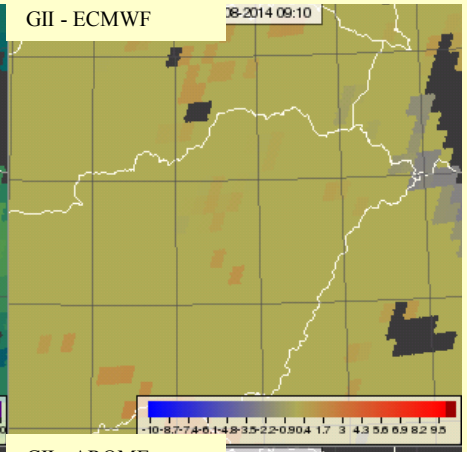
	WV6.2	WV7.3	IR8.7	IR10.8	IR12.0	IR13.4	RMS
Measured BT	**240.5**	**258.3**	**294.8**	**297.4**	**294.4**	**266.0**	
Simulated BT using ECMWF profiles	240.9	259.3	294.8	297.8	295.0	267.6	0.83
Simulated BT using ALADIN profiles	241.0	258.1	294.1	296.7	293.0	266.4	0.74
Simulated BT using AROME profiles	239.8	259.2	294.6	296.9	293.3	266.4	0.71

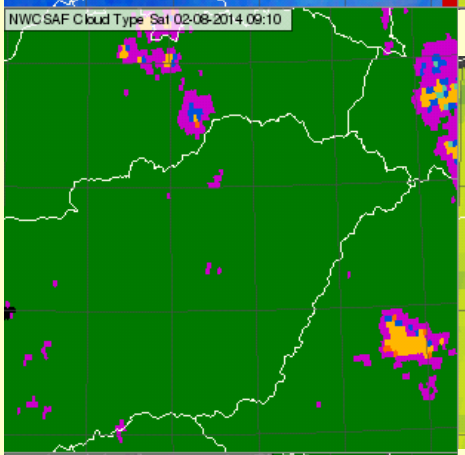
ECMWF and AROME forecasted and GII corrected TPW, 09 UTC

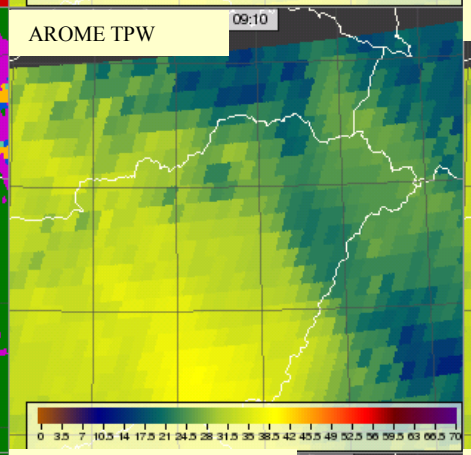


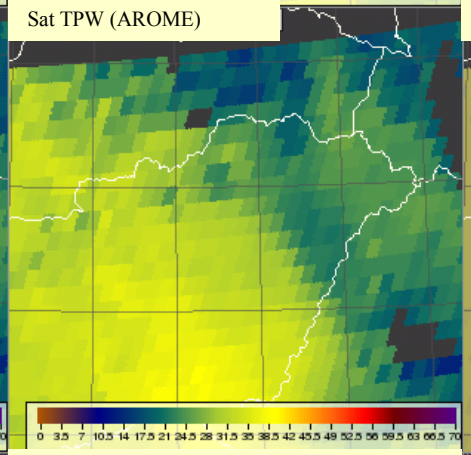


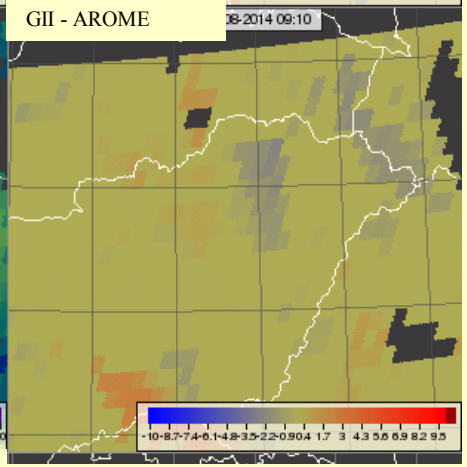


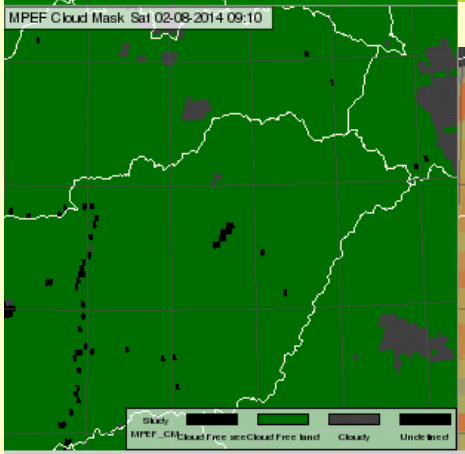


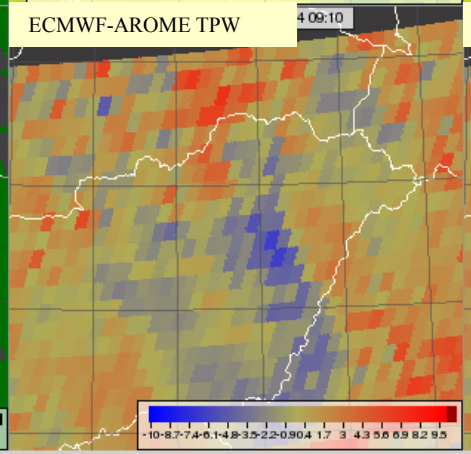


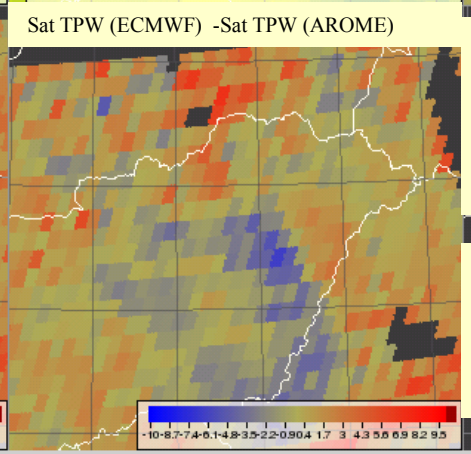








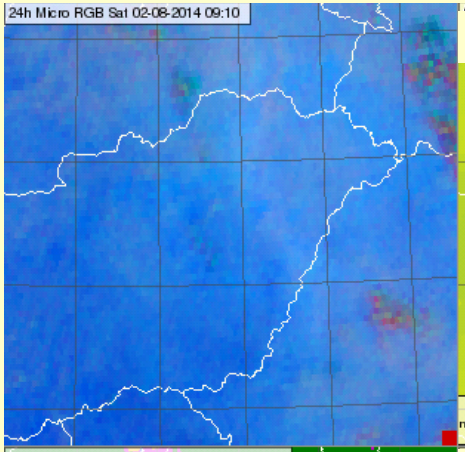


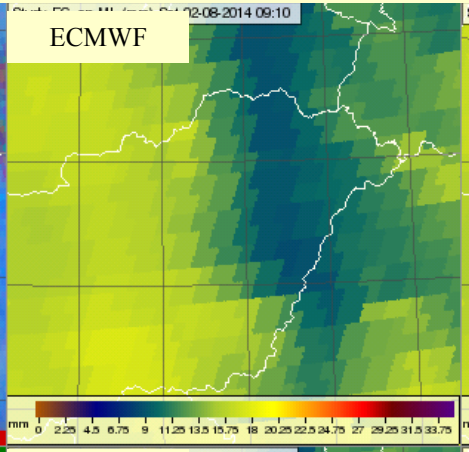


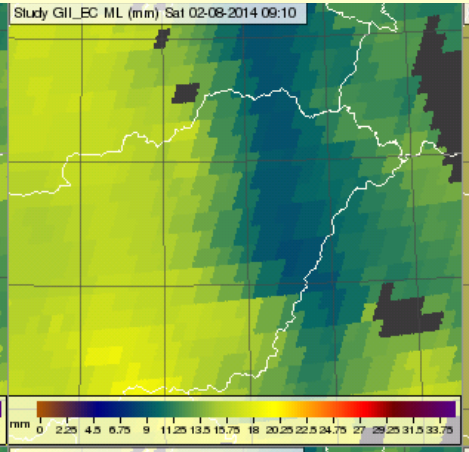
In this area at that time
Forecasted TPW: 20-37 mm
|GII corr| < 3 mm
|NWP diff | < 7 mm

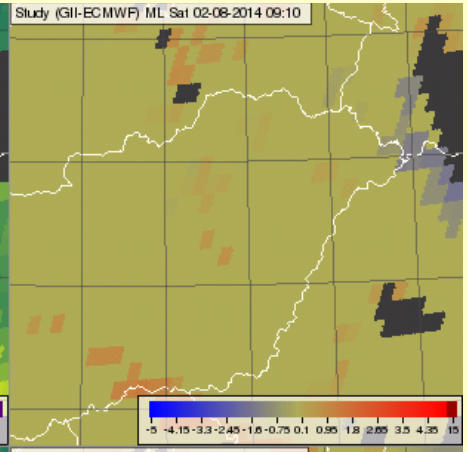
Usually: GII correction is less than the NWP differences

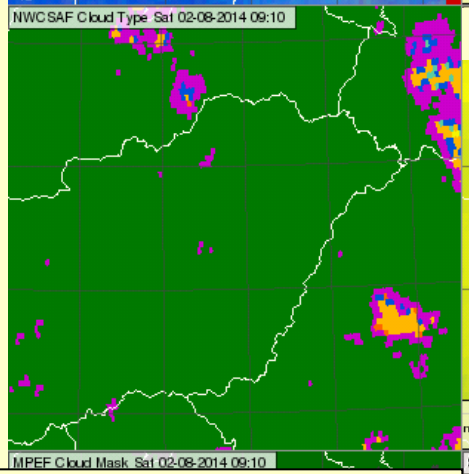
ECMWF and ALADIN forecasted and GII corrected **ML**, 09 UTC

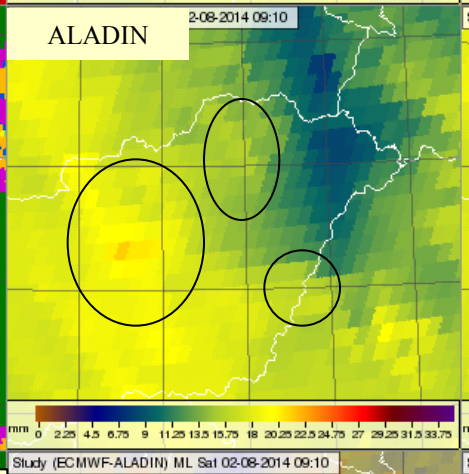


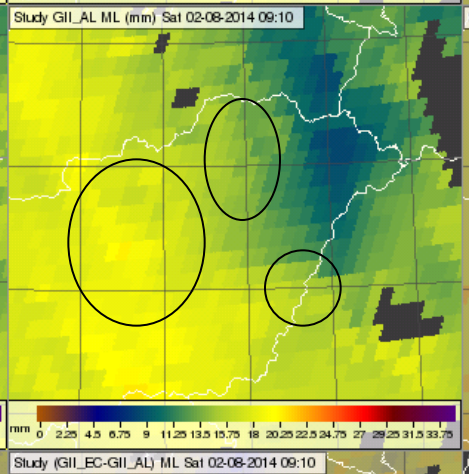


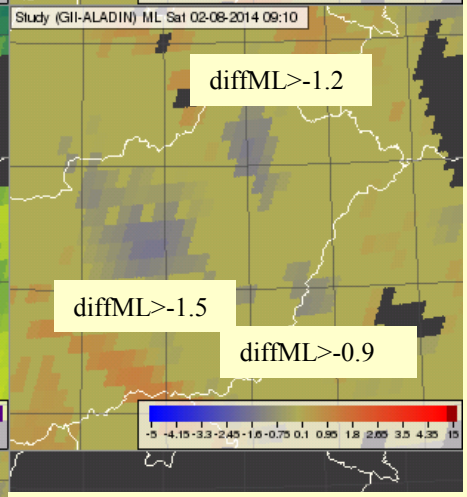


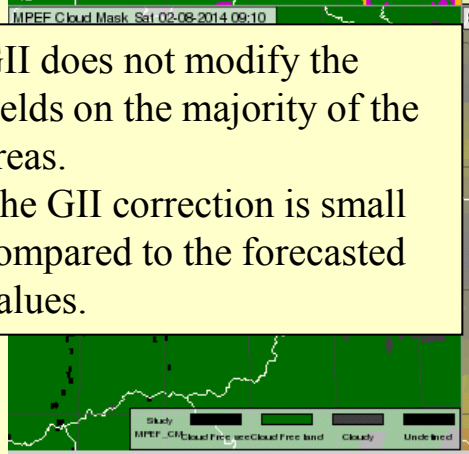


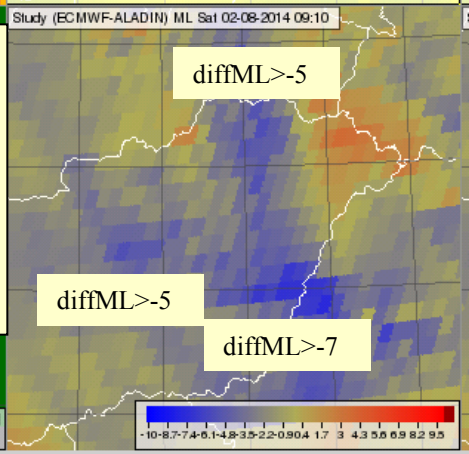


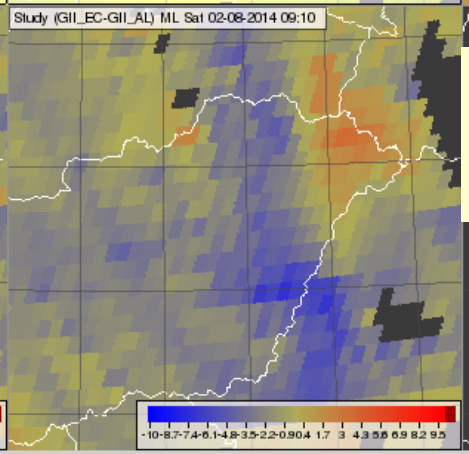


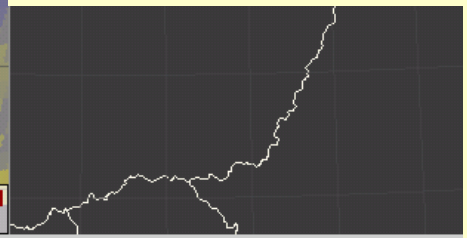












GII does not modify the fields on the majority of the areas.
The GII correction is small compared to the forecasted values.

GII correction is less than (comparable to) the forecast difference.

Ranges of the values for this day (Europe 8-20 UTC).

	TPW range [mm]		ML range [mm]		K-index range [C]	
forecasted	17	43	9	26	16	40
GII correction	-7	+4	-4	+3	-6	+5
Difference between the forecasted fields	-10	+13	-10	+7	-12	+8

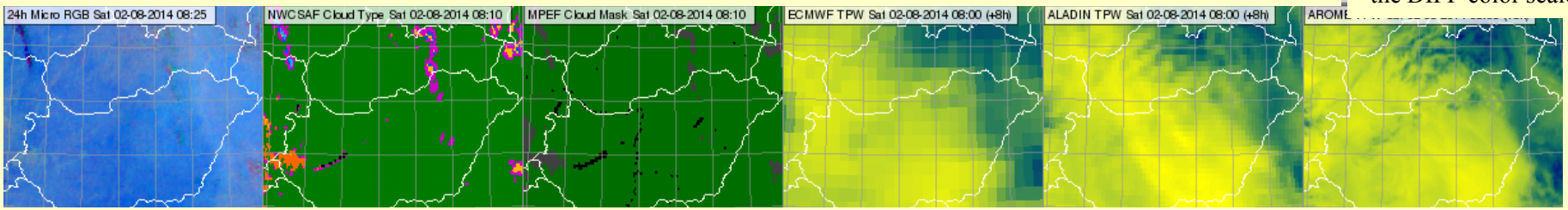
The ranges were similar for the other days as well.

The satellite correction is

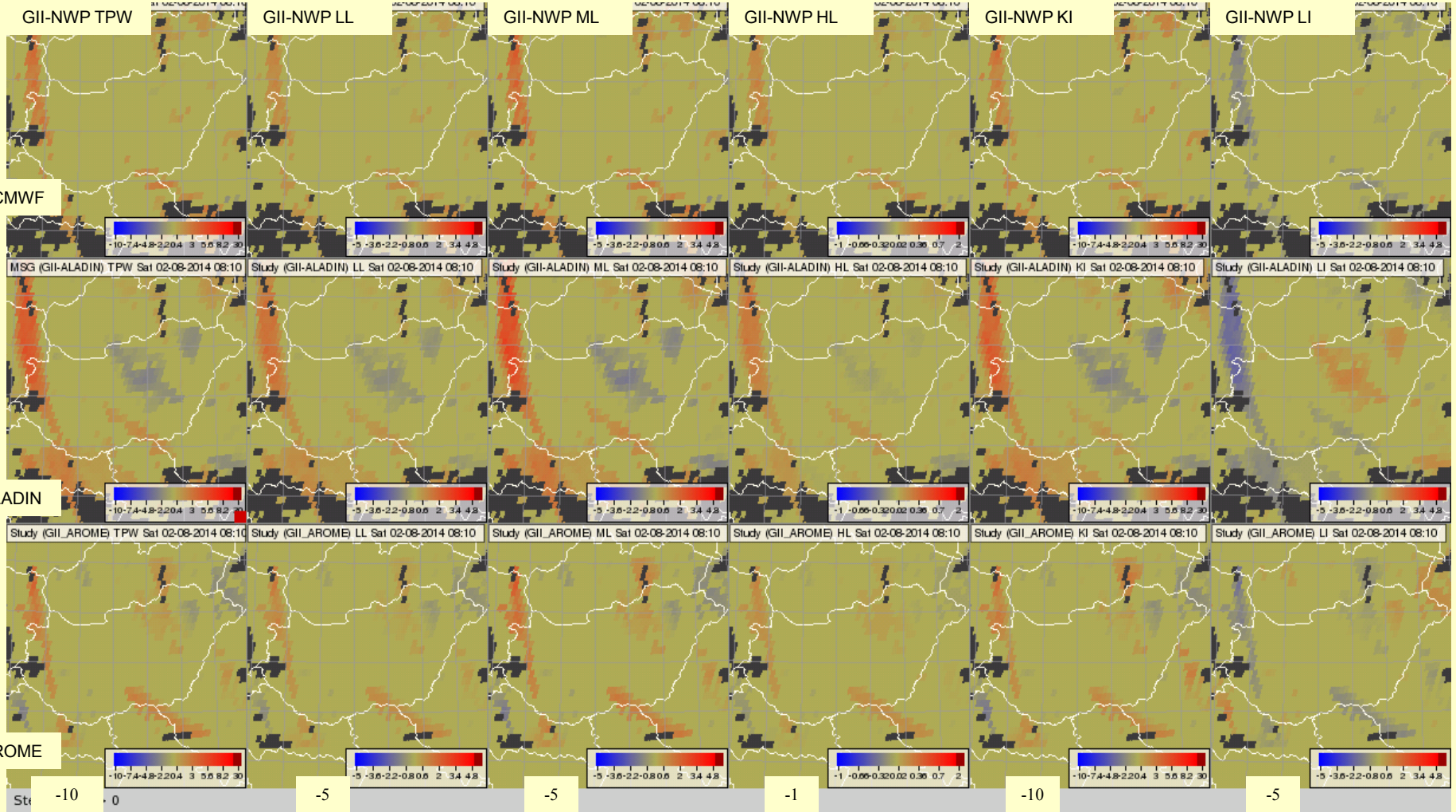
- not huge compared to the forecasted values.
- smaller than, (comparable to) the differences between ALADIN, ECMWF and AROME forecasted fields.

Satellite corrections for all retrieved parameters 08:10 UTC

Different ranges of the DIFF color scale!



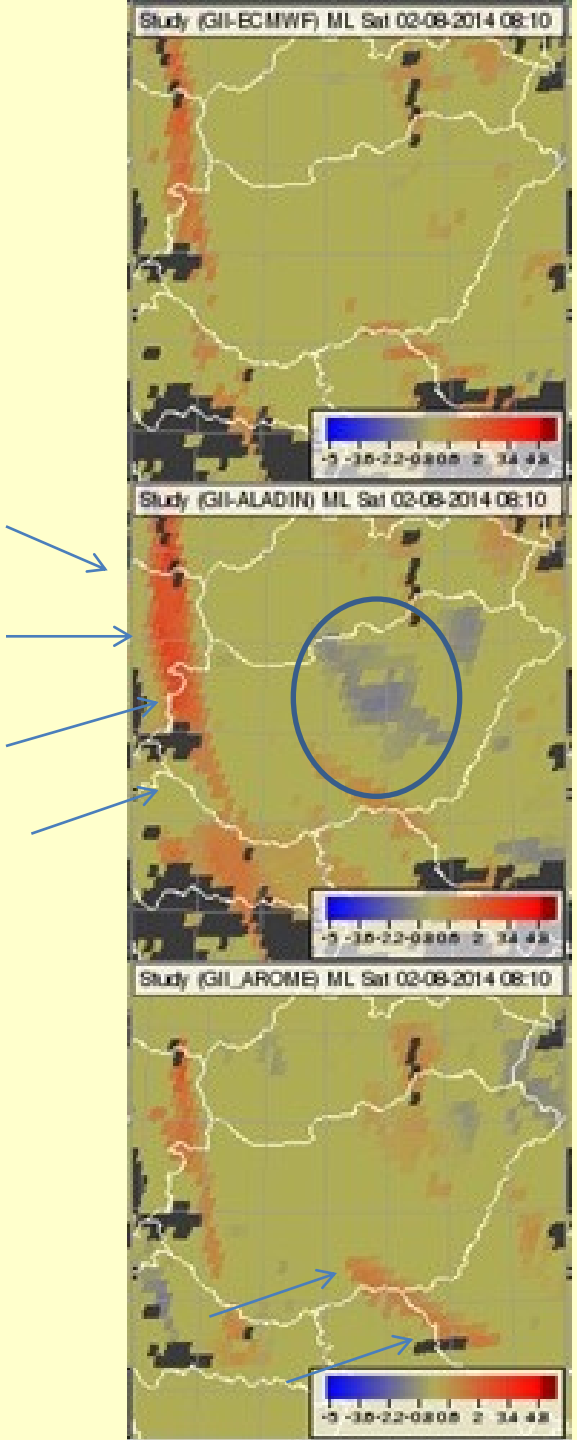
The GII corrections (the <u>location</u> and the <u>shape</u> of the patches) are similar in all three layers and also for the instability indices. → The 'satellite corrections' seem to be 'smoothed' - for the same NWP model



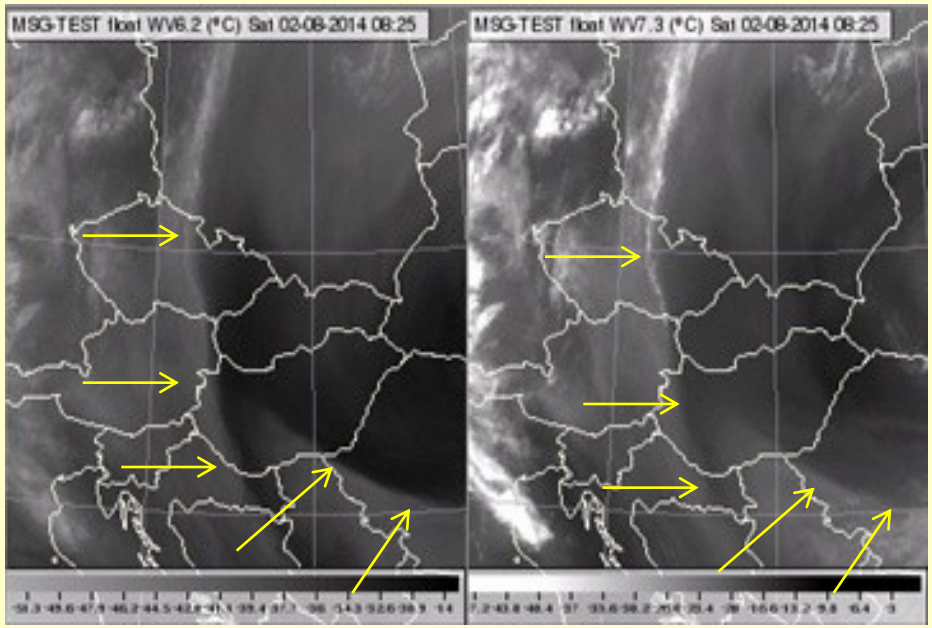
Some ‘correction patches’ are present for all three NWP inputs, some others are not.

•‘Correction patches’ , which are present for all three model inputs indicate some features which is missing or shifted in all three NWP models - It might be an increased/decreased moisture band or very thin cirrus cloud.

•‘Correction patches’, which are present only in one row – like the patch indicated by the circle – might be due to the differences between the NWP models.

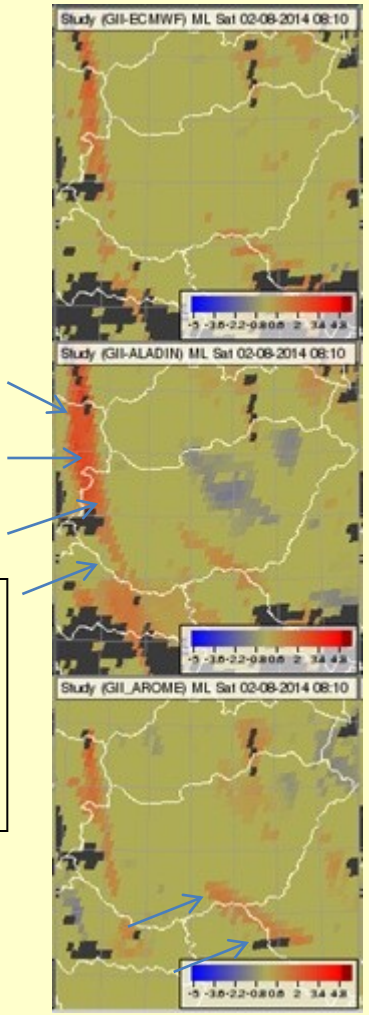


Why do these ‘red band’ appear in the difference images?



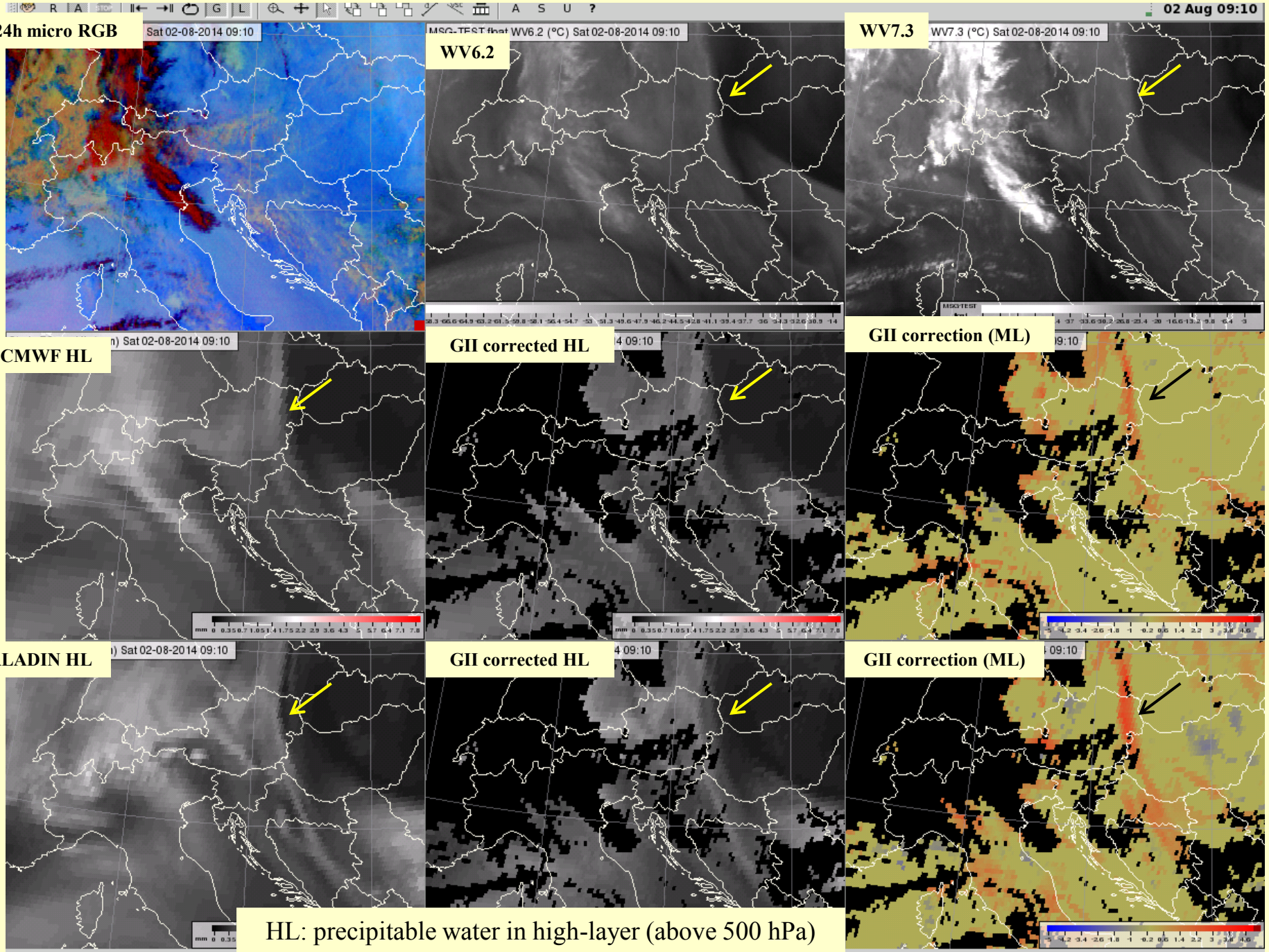
WV images - visual information on high-, mid-layer moisture structure.

Do they indicate some features which are missing or shifted in all three NWP models?



See the moisture boundaries indicated by yellow arrows in the WV6.2 and WV7.3 images.
These boundaries are about the same locations (shapes) as the ‘red bands’ indicated by blue arrows in the difference images.

The moisture boundaries in the WV images are located slightly more to east than forecasted.

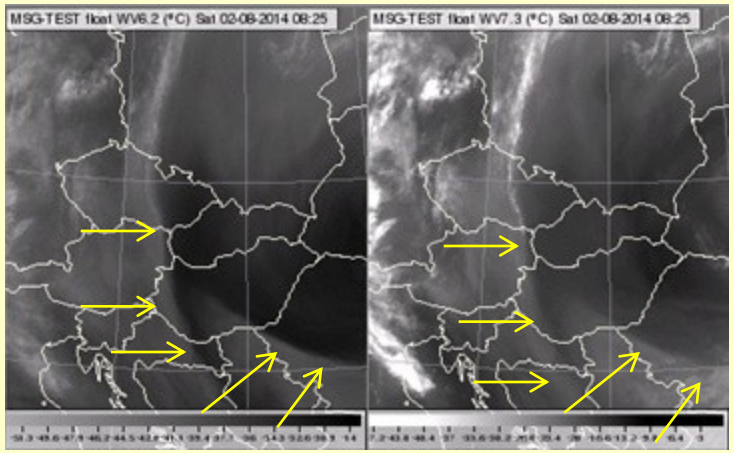


02 August 2014 09:10 UTC

Pixel	WV6.2	WV7.3	IR8.7	IR10.8	IR12.0	IR13.4	RMS
Measured BT	232.8	252.1	290.3	292.5	289.3	263.5	
Simulated BT with ECMWF profiles	238.2	255.6	290.4	292.5	289.0	264.6	2.7
Simulated BT with GII corrected ECMWF profiles	234.9	253.4	291.0	292.4	288.5	264.0	1.1
Simulated BT with ALADIN profiles	238.6	255.8	291.7	294.1	290.6	265.5	3.1
AL Simulated BT with GII corrected ALADIN profiles	235.0	253.1	290.8	292.6	288.9	264.3	1.1
Simulated BT with AROME profiles	237.3	256.1	290.2	292.5	289.3	264.7	2.5
Simulated BT with GII corrected AROME profiles	234.2	253.7	290.9	292.5	288.7	264.0	1.0

In the pixel indicated by the arrow the GII algorithm increased the forecasted TPW values , for all three models.

Highest differences between the simulated and measured BTs were found in the WV channels



We can see this moisture boundary in mid-, and high-layers. It is shifted compared to the forecast

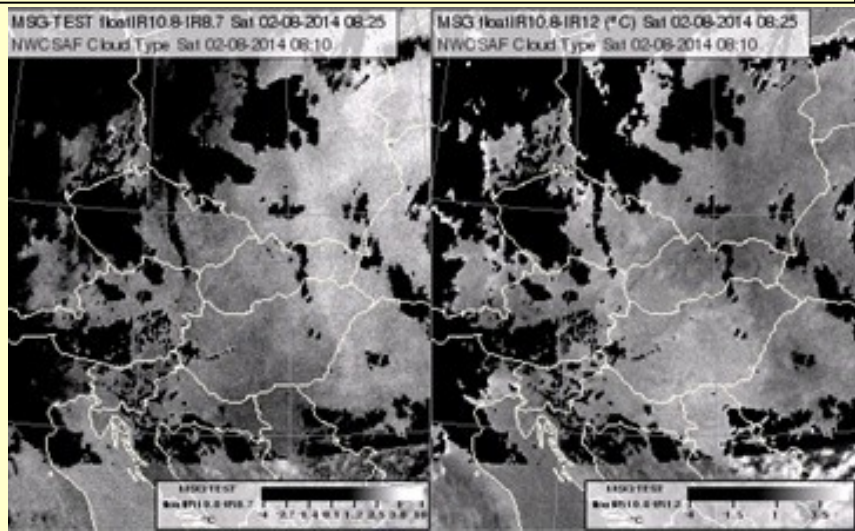
→

Increasing the moisture in mid and high layers in this 'red band' seems to be is reasonable.

GII increased the moisture in low layer as well.
This might be not reasonable.

We visualised the (IR10.8-IR8.7) and the (IR10.8-IR12) BTD differences and the 24 hour Microphysics RGB (which includes the same BTDs) to see 'something' about low layers in SEVIRI data.

These moisture boundaries are not seen in these images.



GII correction patches appearing NOT in all three models

This might related with NWP differences.

How can we conclude whether GII improved the forecasts?

If the GII correction works well ->

We expect that the satellite corrected fields became 'closer' to each other than the forecasted fields were.

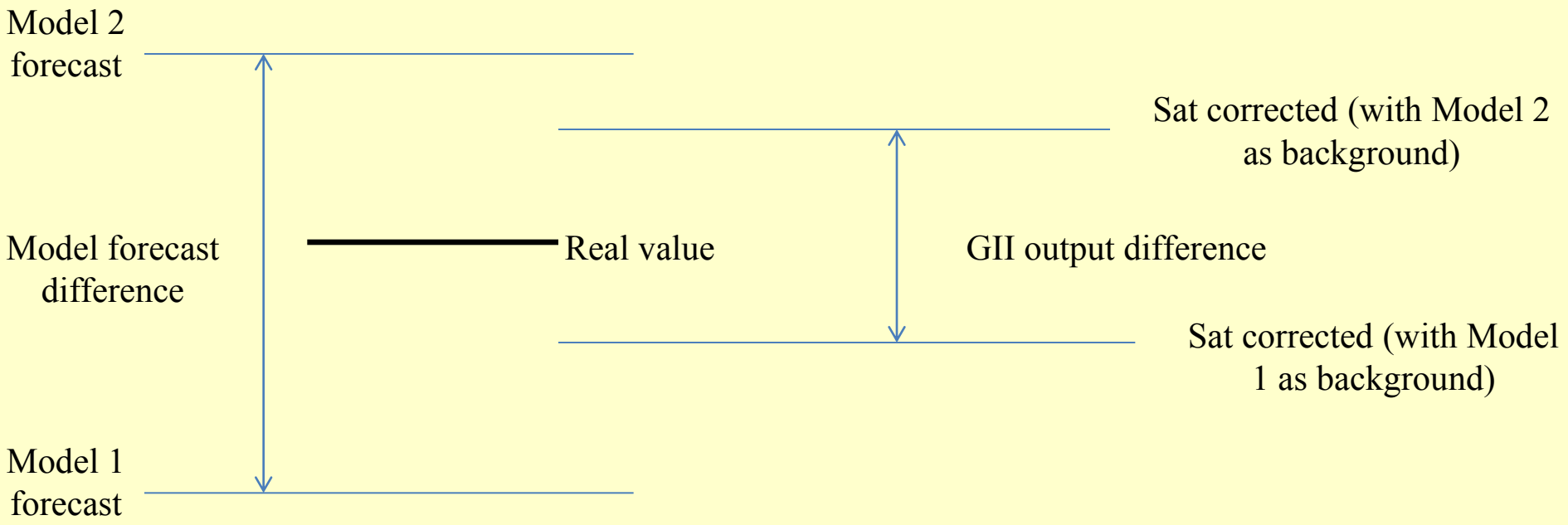
Why?

- The NWP forecasts have differences.
- The GII outputs are supposed to be 'closer' to the real field than the NWP forecast.

--->

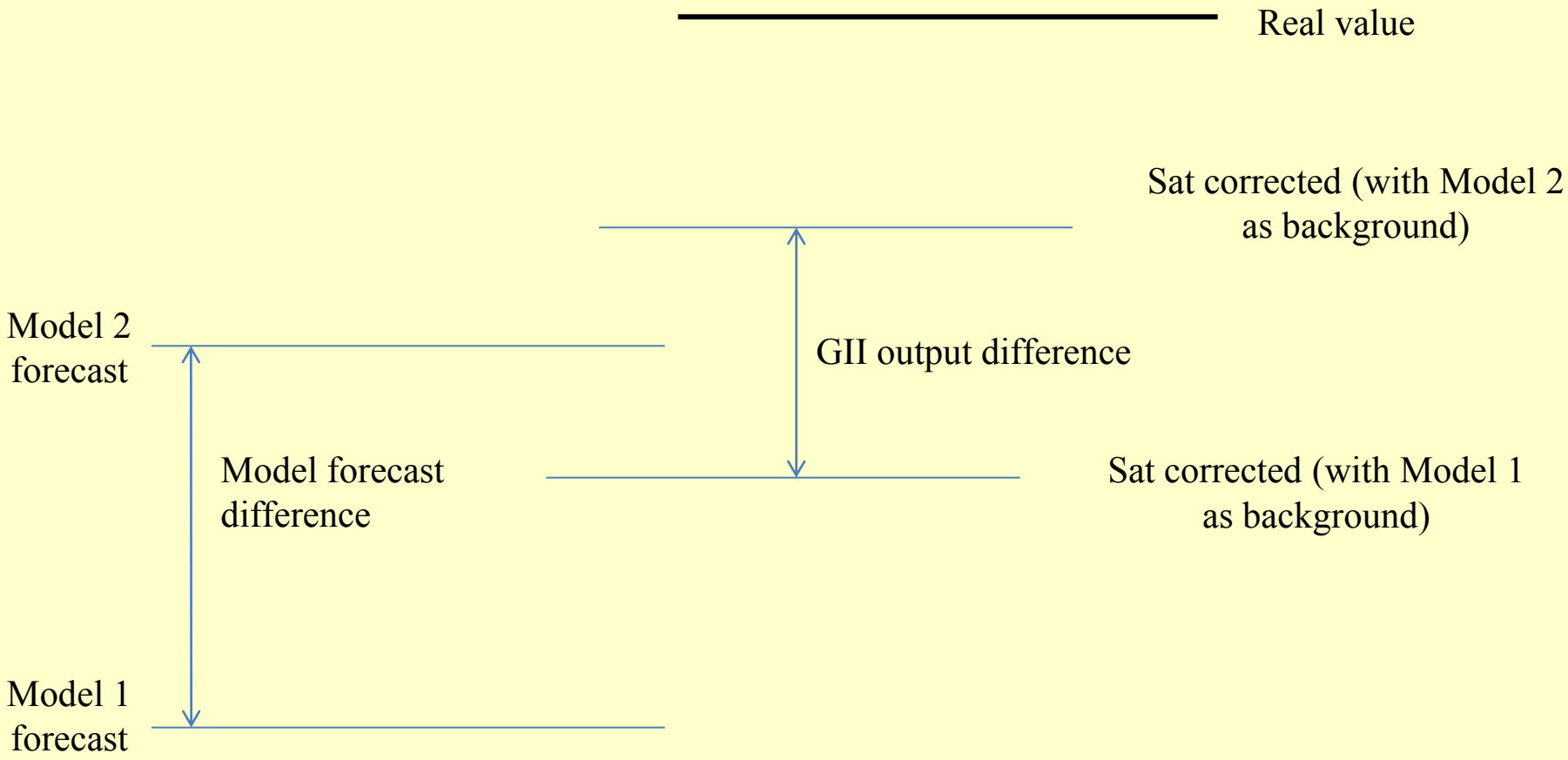
- the satellite corrected fields should be 'closer' to each other than the NWP input.

We expect that the satellite corrected fields became 'closer' to each other than the forecasted fields were.



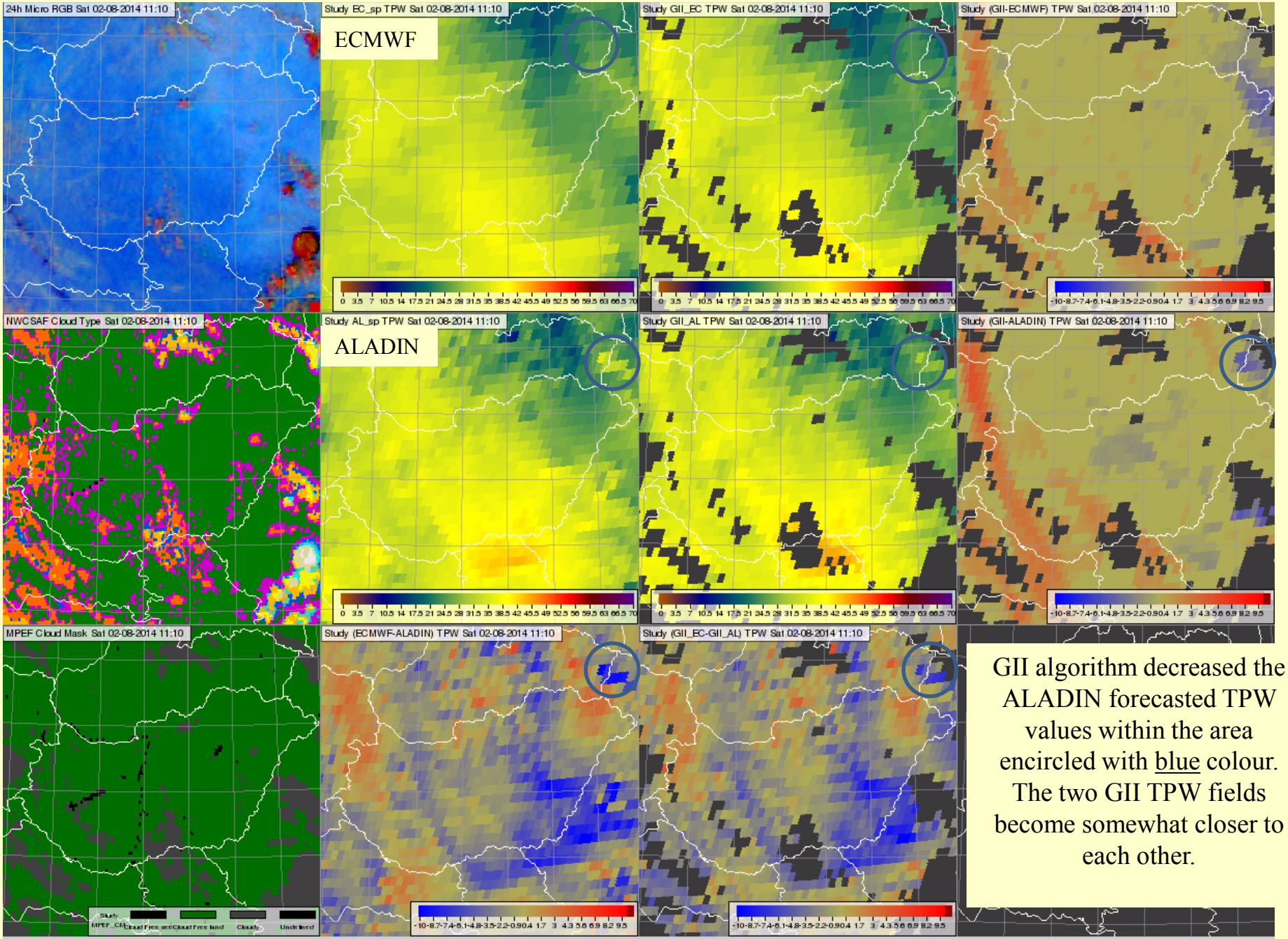
There are other possibilities.

Are the satellite corrected fields 'closer' to each other than the forecasted fields?



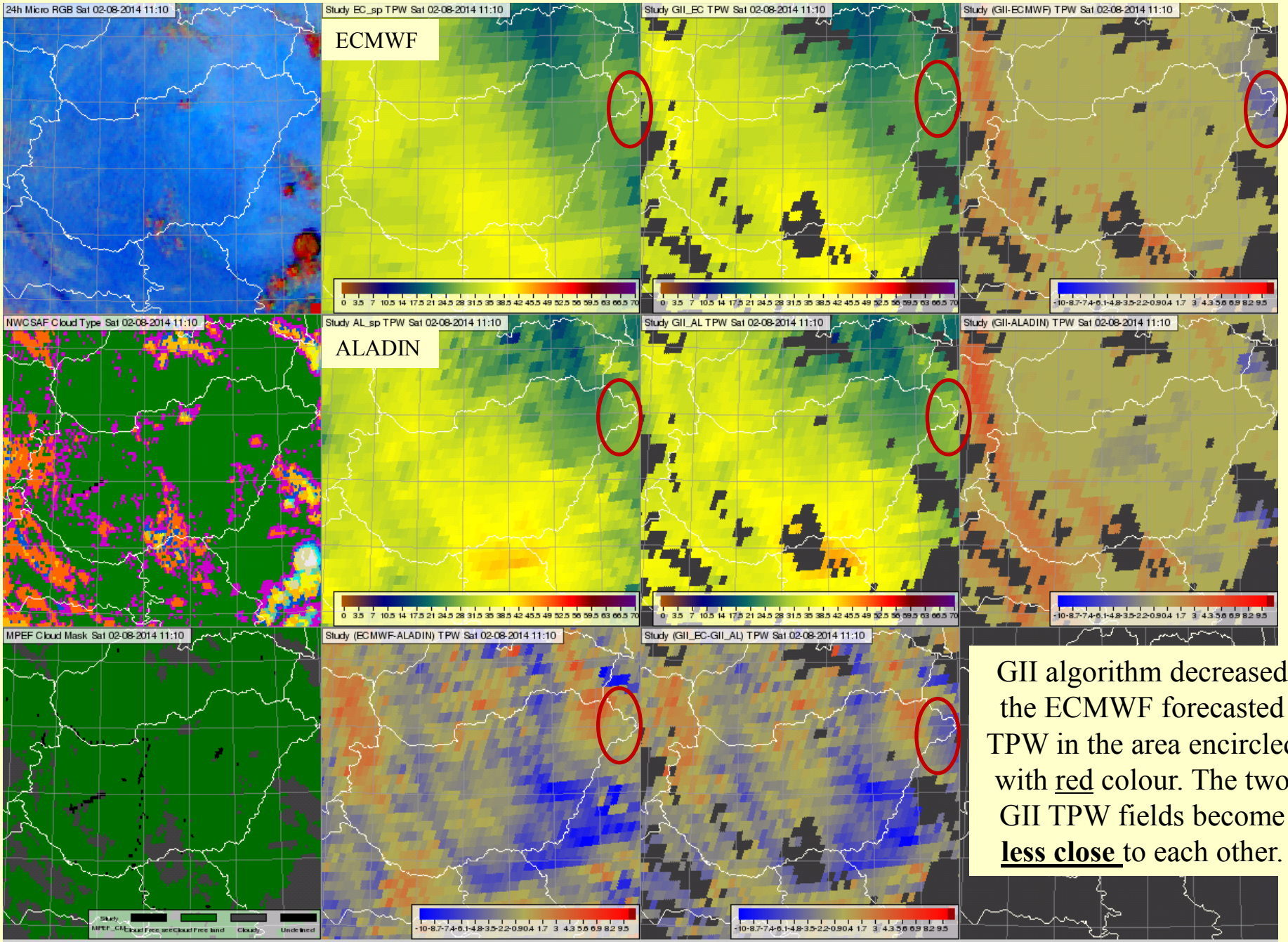
There are other possibilities.

11 UTC forecasted TPW GII corrected TPW GII-NWP TPW



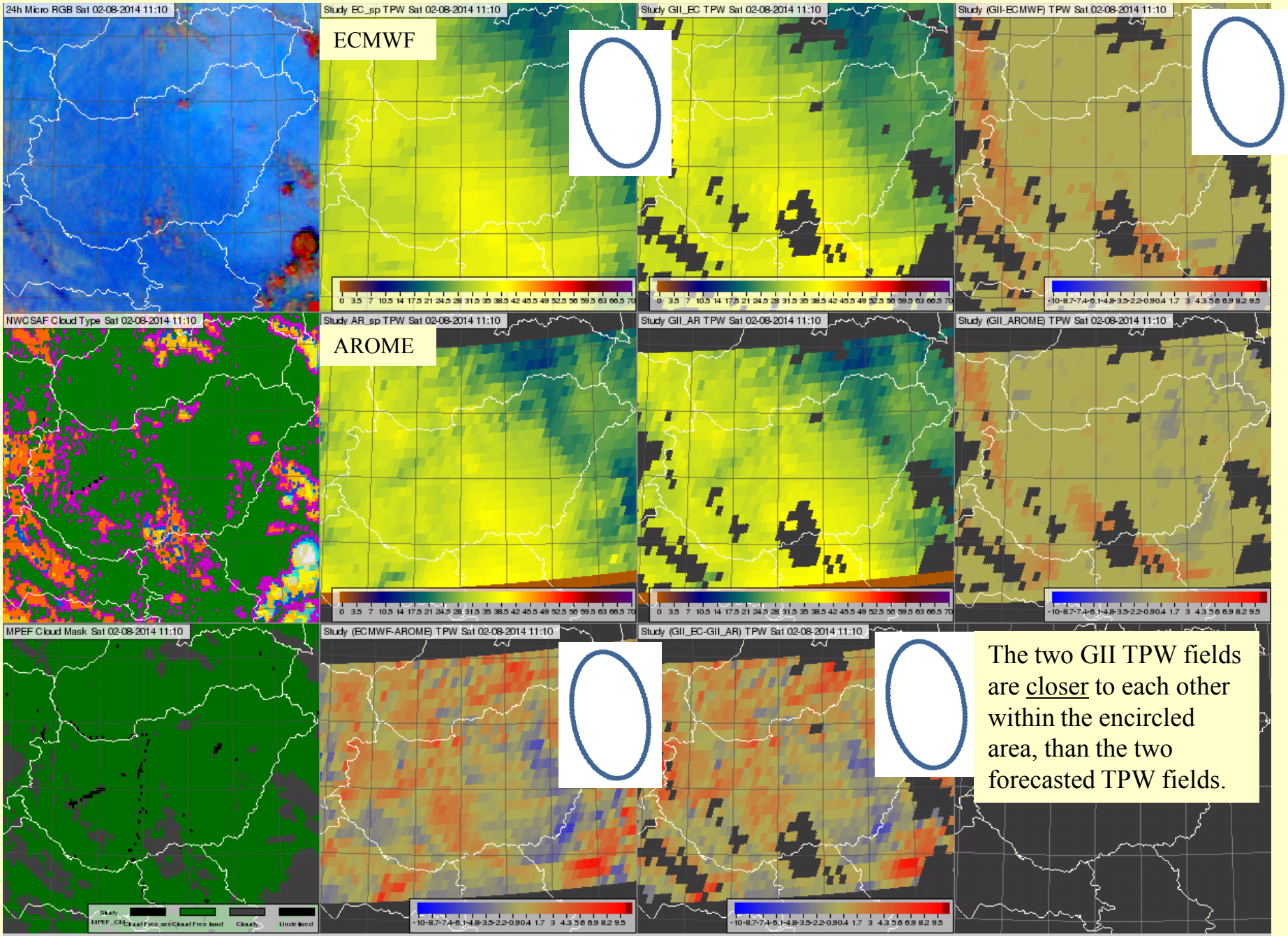
GII algorithm decreased the ALADIN forecasted TPW values within the area encircled with blue colour. The two GII TPW fields become somewhat closer to each other.

11 UTC | forecasted TPW | GII corrected TPW | GII-NWP TPW



GII algorithm decreased the ECMWF forecasted TPW in the area encircled with red colour. The two GII TPW fields become **less close** to each other.

11 UTC forecasted TPW GII corrected TPW GII-NWP TPW

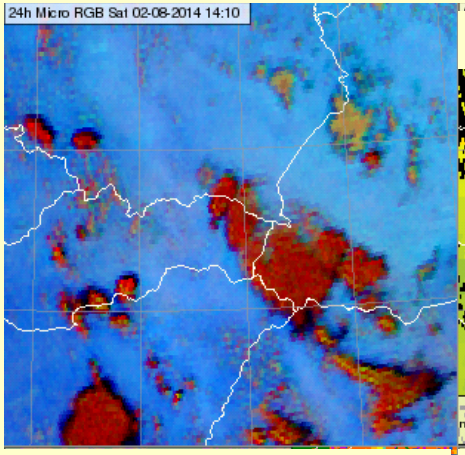


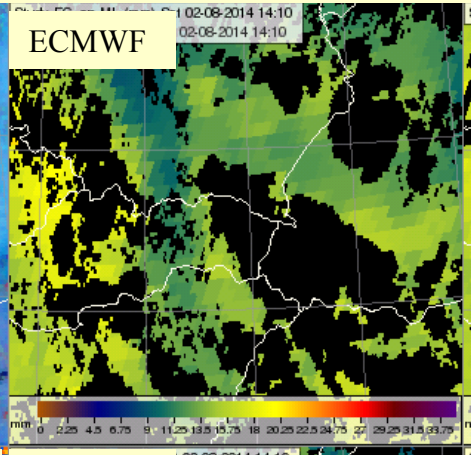
14 UTC

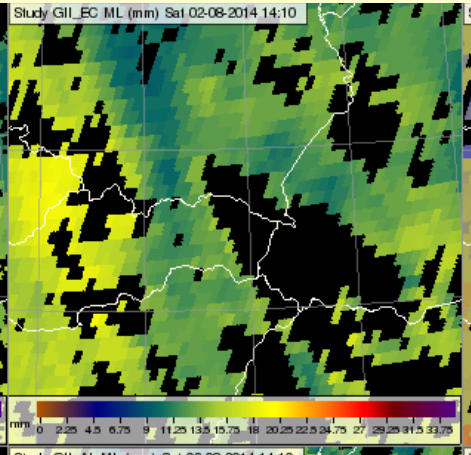
forecasted ML

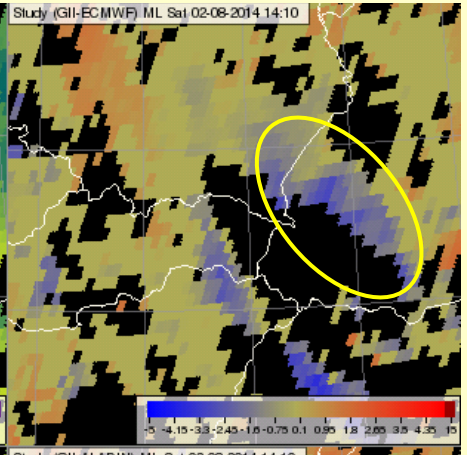
corrected ML

GII correction

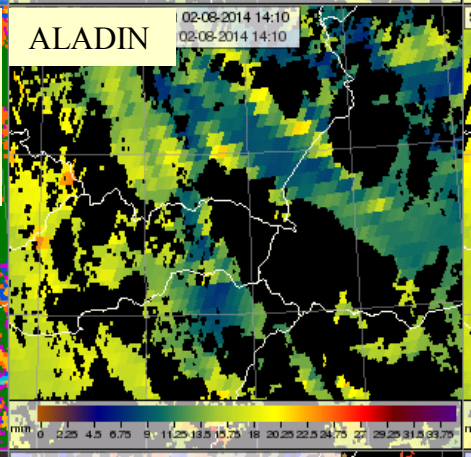


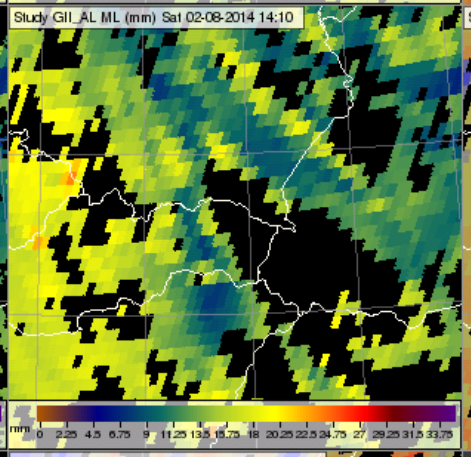


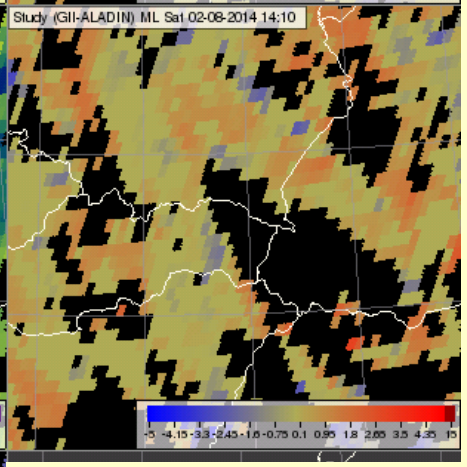


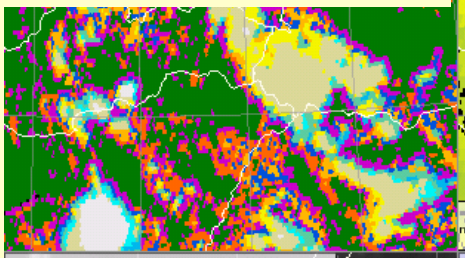


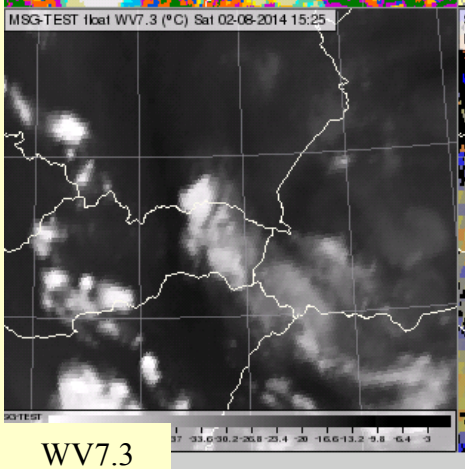
We overlaid the cloud mask on the forecasted ML image as well to help the visual orientation.



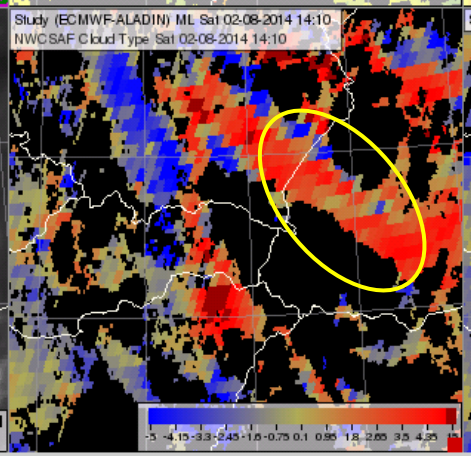


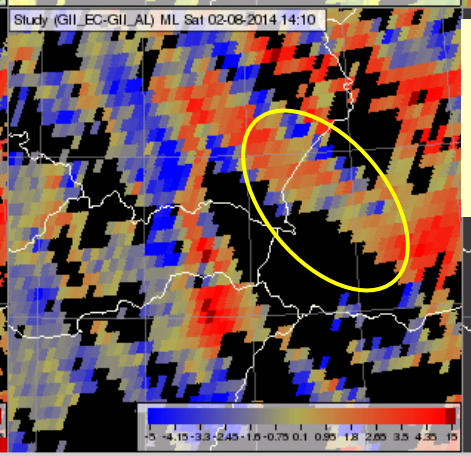




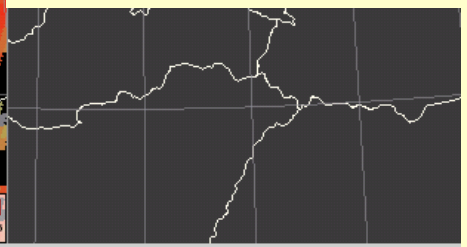


WV7.3





The two GII TPW fields are <u>closer</u> to each other within the encircled area, than the two forecasted TPW fields.

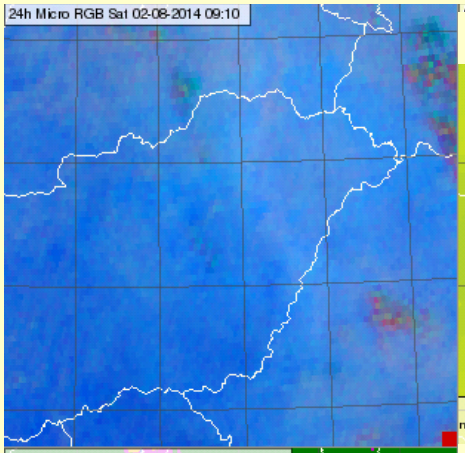


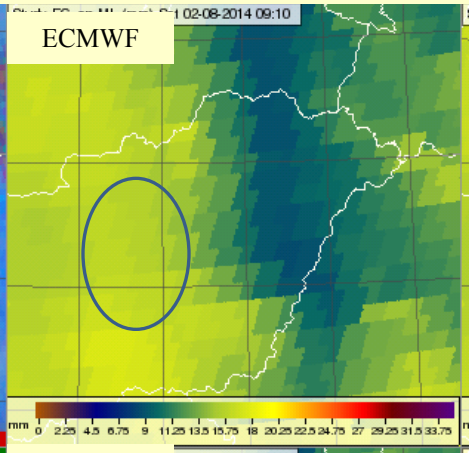
9 UTC

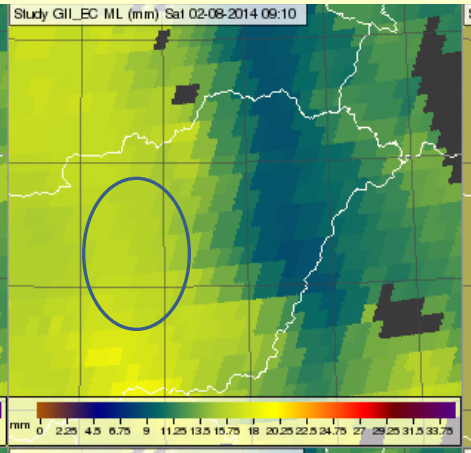
forecasted ML

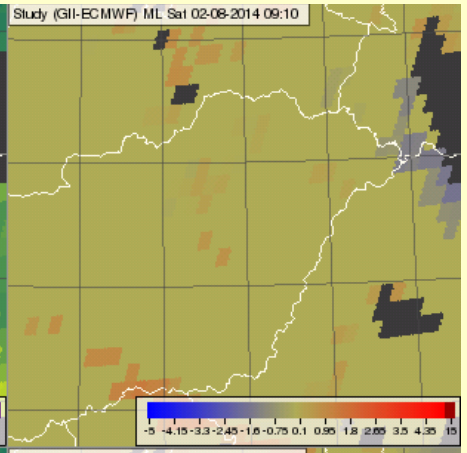
GII corrected ML

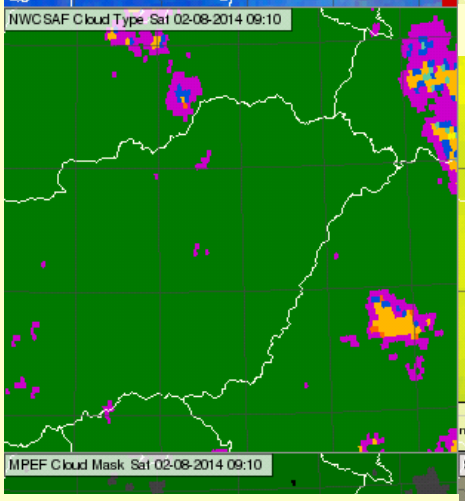
GII-NWP TPW

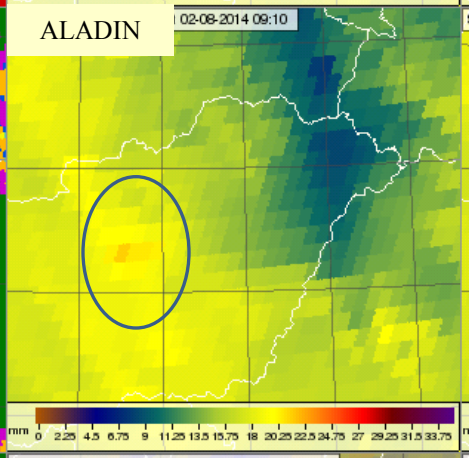


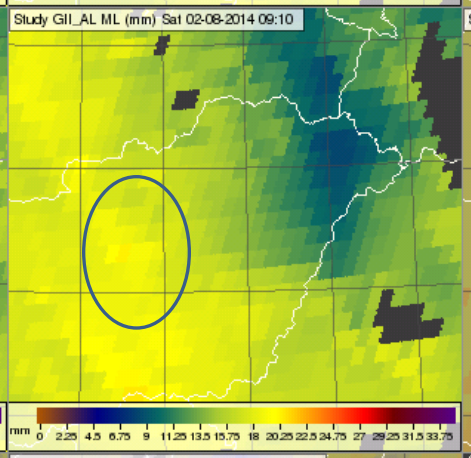


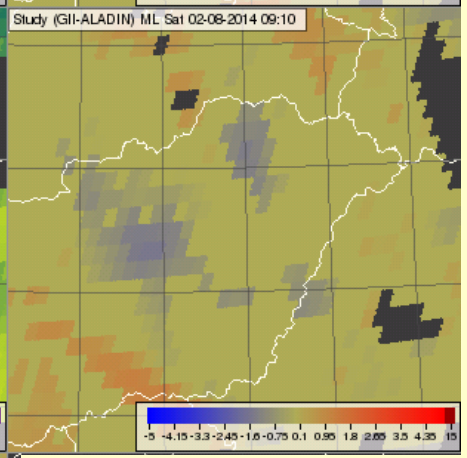


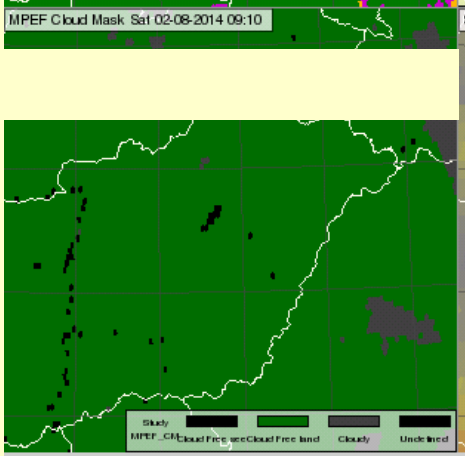


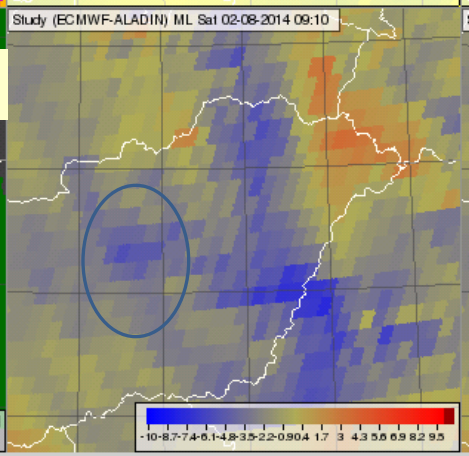


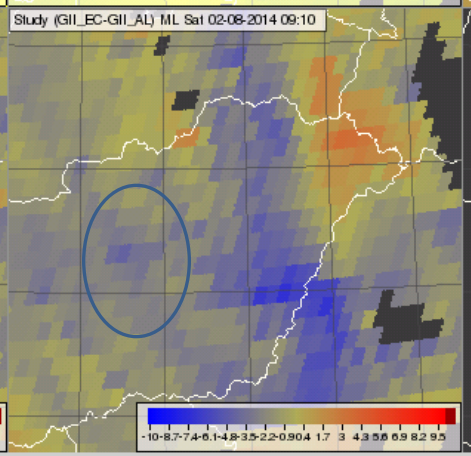


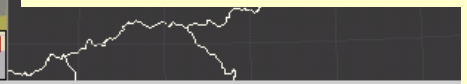












<u>GII correction patches appearing NOT in all three models.</u>

The corrected fields are closer to each other than the forecasted fields.

Task 1

Analysing the effect of the vertical resolution of the NWP forecast

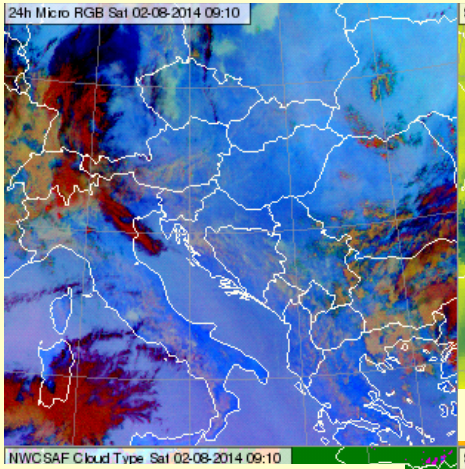
NWP input was:

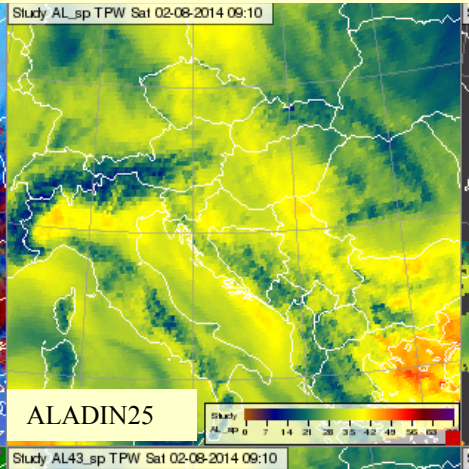
- ALADIN at 25 pressure levels
- ALADIN at 43 pressure levels

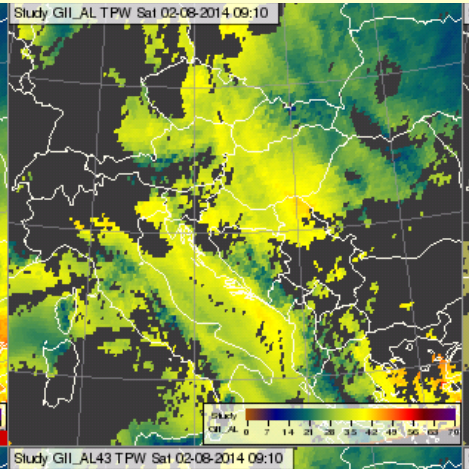
Same spatial resolution (latitude longitude grid 0.1 °)

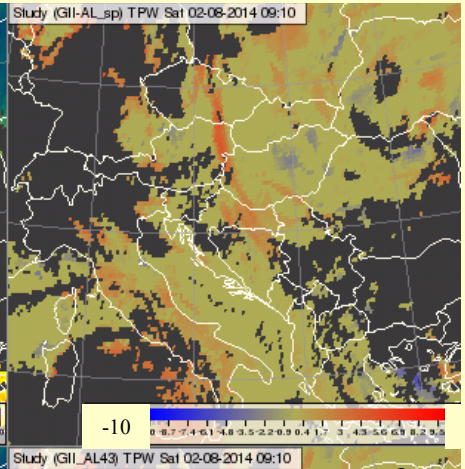
ALADIN model data are calculated on 49 model levels
During the post processing the humidity (Q) and temperature (T) profiles were interpolated to 25, 43 fix pressure levels.
GII used these 25/43 level profile data as input. Both from the input and output Q and T profiles integrated water vapour content and stability indices were derived and compared.

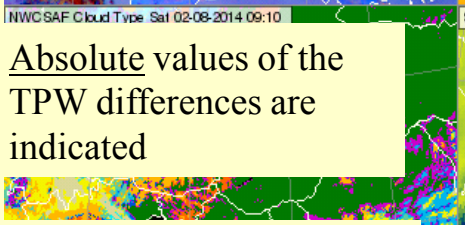
8 UTC | forecasted TPW | GII corrected TPW | GII correction



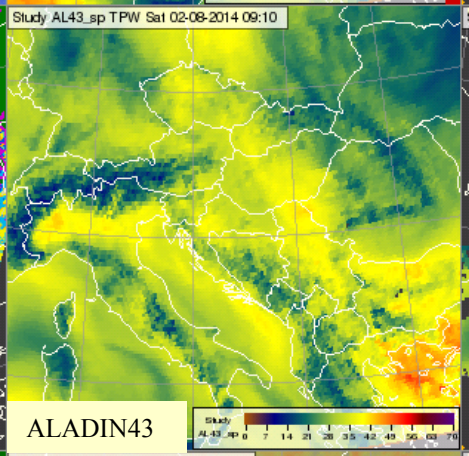


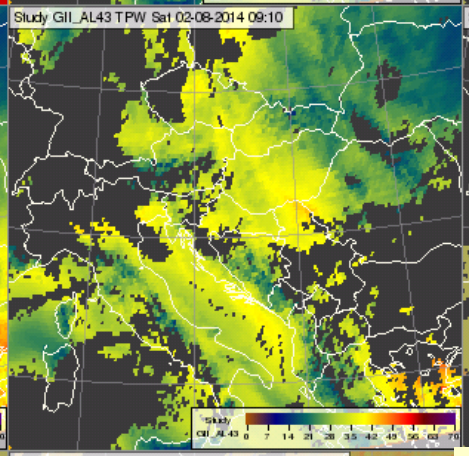


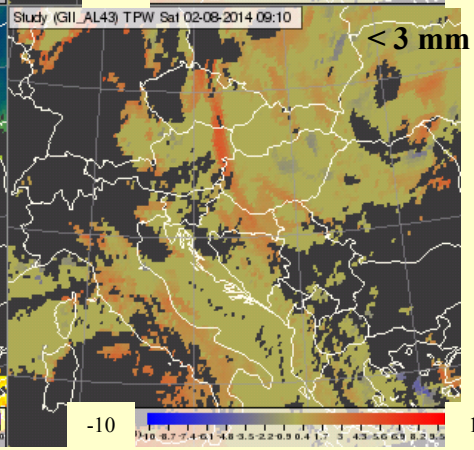




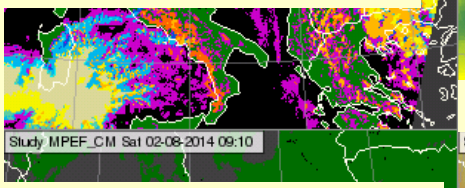
Absolute values of the TPW differences are indicated

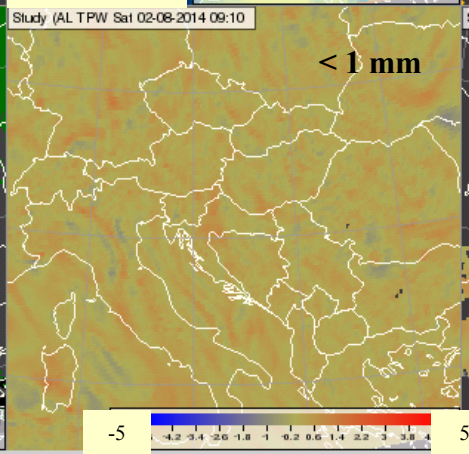


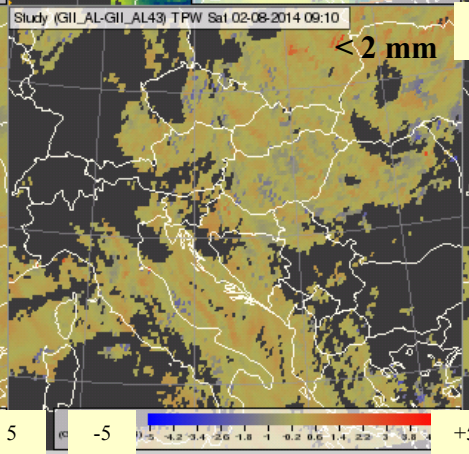




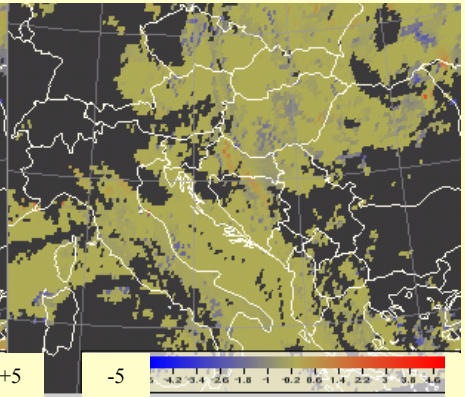
The range of the colour scales are different.







Difference of the GII corrections



The satellite retrieving modifies the ALADIN25 TPW and ALADIN43 TPW fields in **similar** ways, but **NOT identically**. Higher differences between GII corrected fields than between the forecasts.

8 UTC | forecasted TPW | GII corrected TPW | GII correction

Reasons:

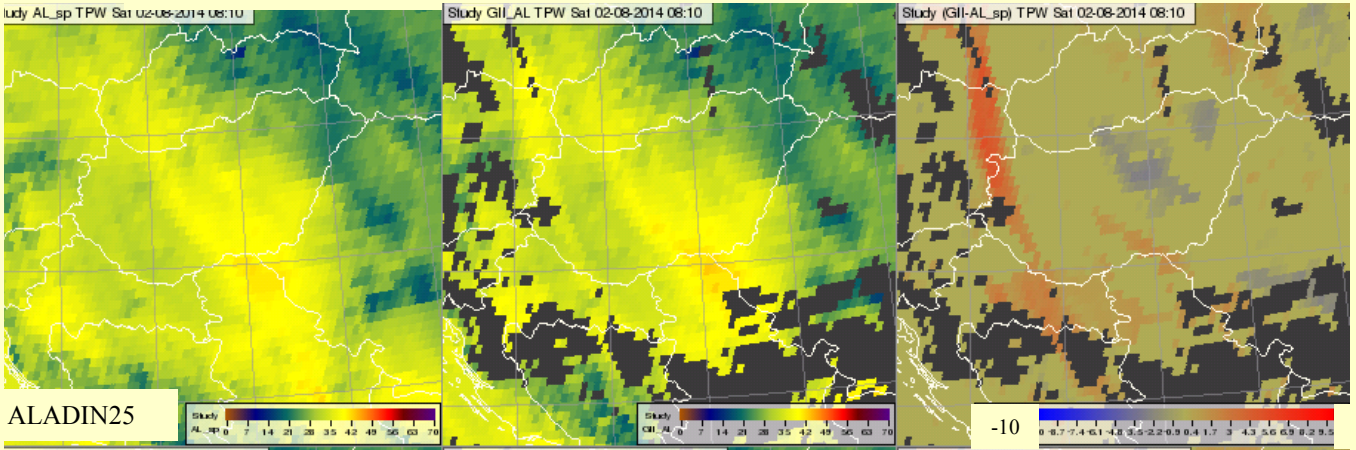
•GII algorithm <u>interpolate the profiles</u> from the ‘X’ input levels to the 43 RTTOV levels. The uncertainty of this interpolation impact the exact shape of the forecasted profiles

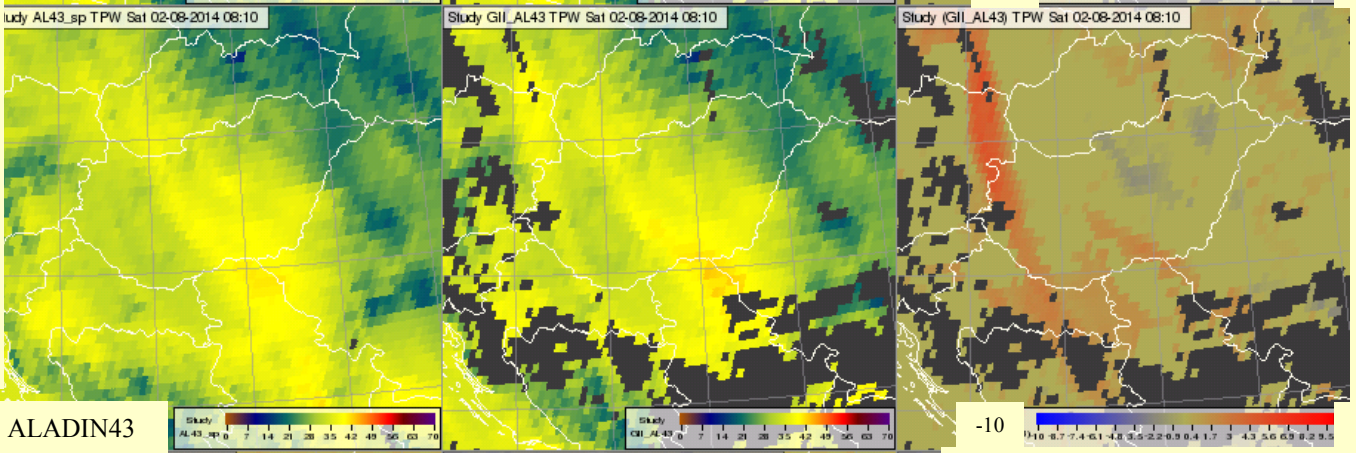
•GII correction is performed if the RMS of the simulated BTs are higher than a fix <u>threshold.</u>

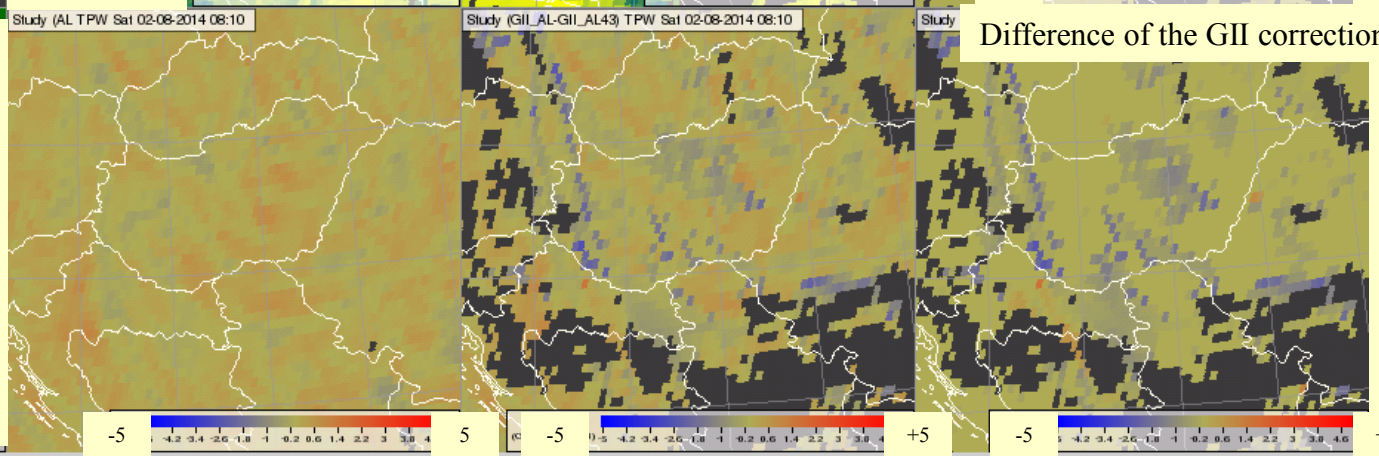
The satellite retrieving modifies the ALADIN25 TPW and ALADIN43 TPW fields in **<u>similar</u>** ways, but **<u>NOT identically</u>**.

Neither the area nor the values are the same.

-> Contours in the ‘difference of the GII corrections’ image



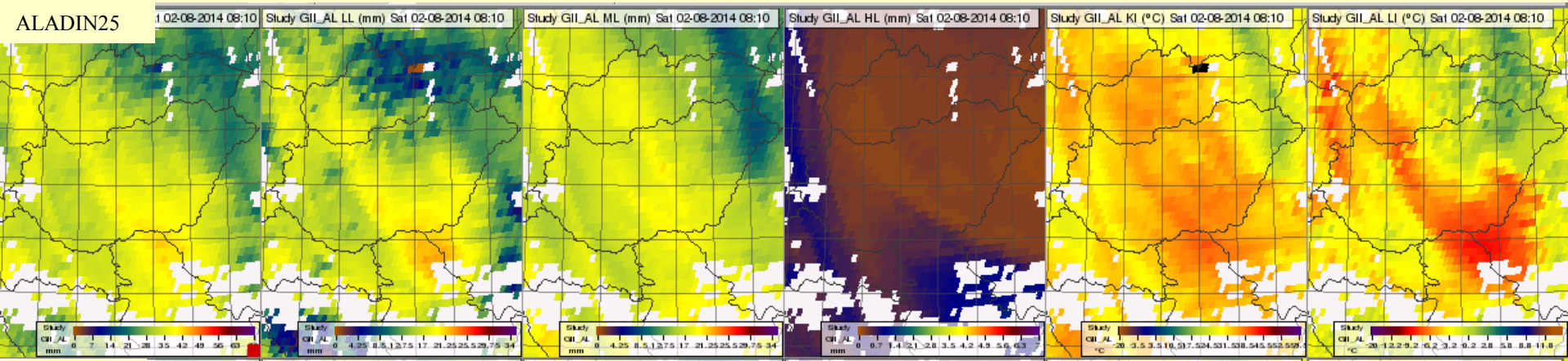




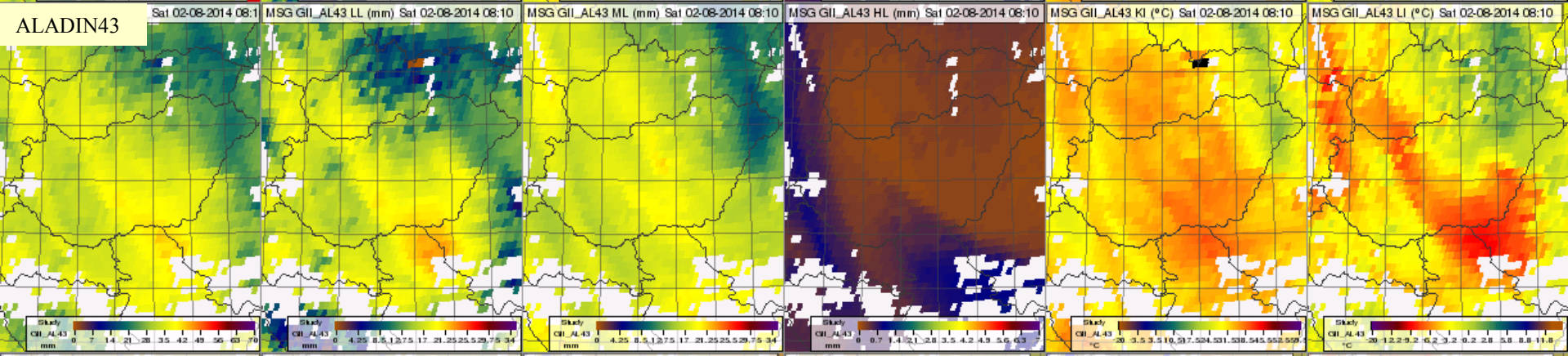
Difference of the GII corrections

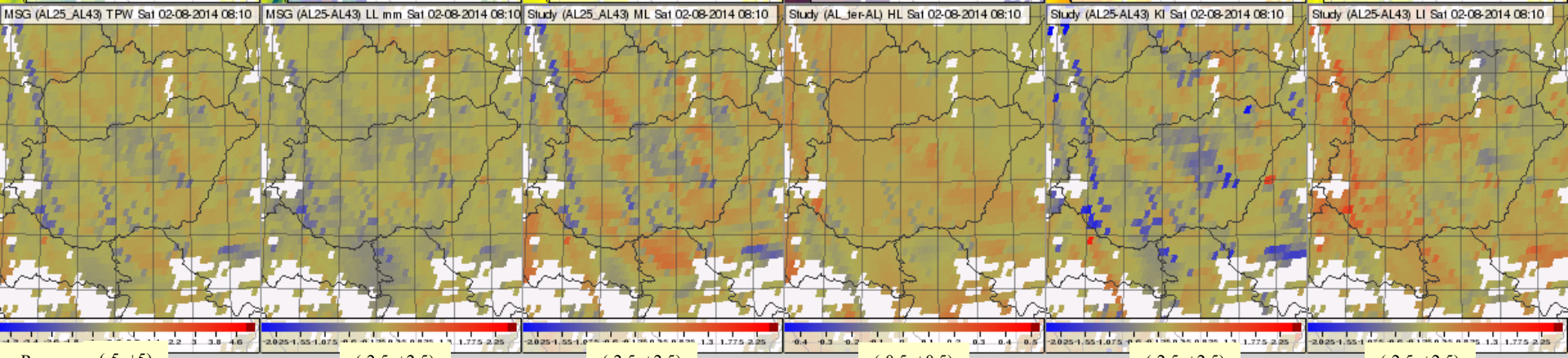
Total PW	Low Layer PW	Mid Layer PW	High Layer PW	K-index	Lifted index

ALADIN25



ALADIN43





Range	(-5, +5)	(-2.5, +2.5)	(-2.5, +2.5)	(-0.5, +0.5)	(-2.5, +2.5)	(-2.5, +2.5)

Task 1

Analysing the effect of the spatial resolution of the NWP forecast

NWP input was:
Same vertical resolution: 43 pressure levels

different spatial resolution:
- ALADIN, latitude longitude resolution = 0.1 degree
- ALADIN, latitude longitude resolution = 0.2 degree

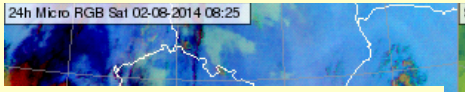
ALADIN model run with its original 0.1 degree spatial resolution.
Later - The spatial resolution was decreased for 0.2 degree.
GII used the original and decreased spatial resolution data as input.
Both from the input and output Q and T profiles integrated water vapour content and stability indices were derived and compared.

8 UTC

forecasted TPW

GII corrected TPW

GII correction



Different vertical resolution caused little difference in the forecasted fields. In some pixels the GII correction increased considerably (~doubled) the difference.

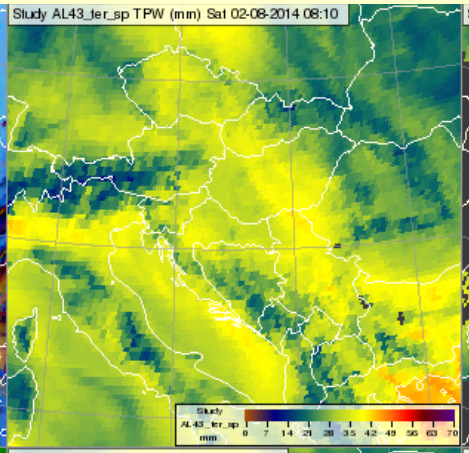
Here, the range of the difference is high. GII does not increase it considerably.

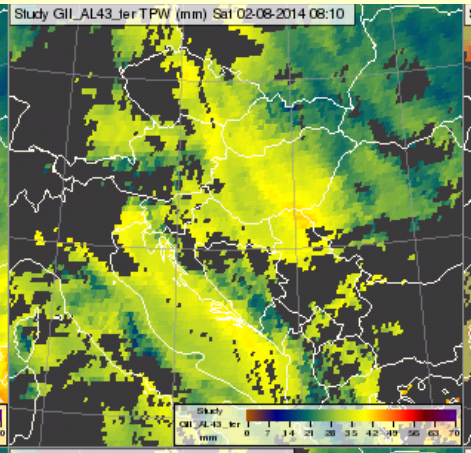
Noise like structure in the difference images - effect of inhomogeneity - caused by mountains or by the field itself.

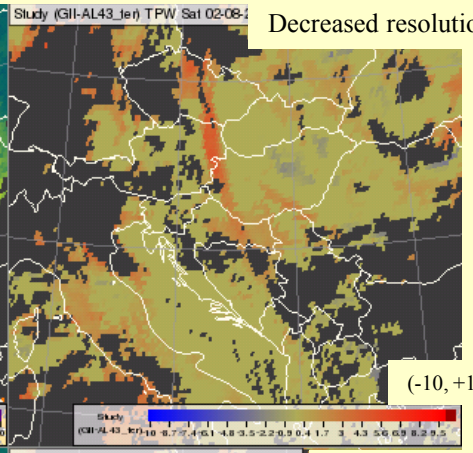
The amplitude depends on the inhomogeneity.

•LL and TPW fields are inhomogeneous on the mountainous region. Over mainland the amplitude is smaller.

•The amplitude of Diff ML is also low – no mountainous effect.

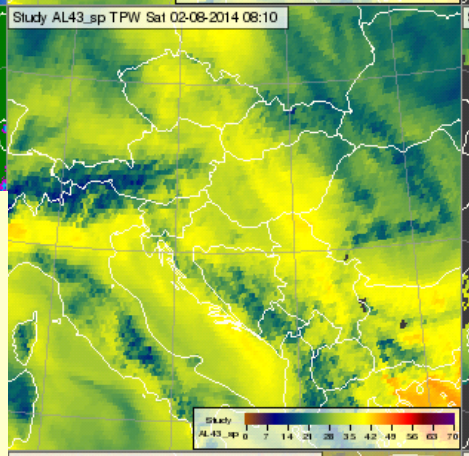


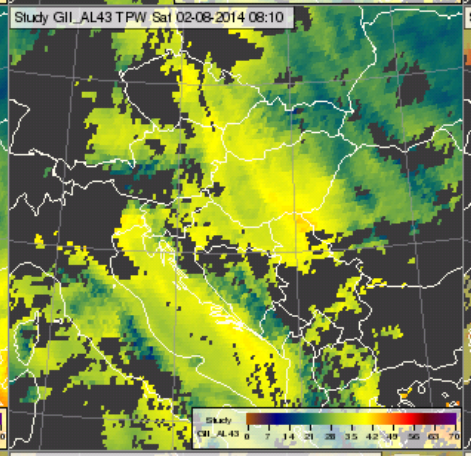


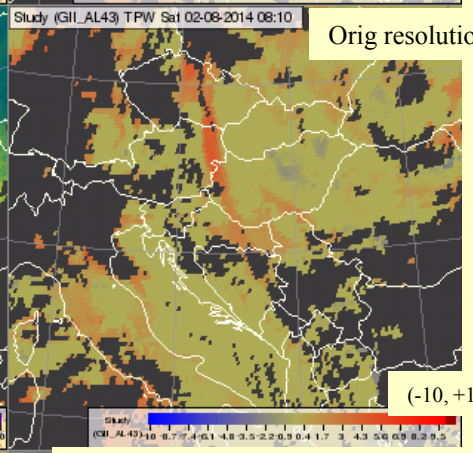


Decreased resolution

(-10, +10)

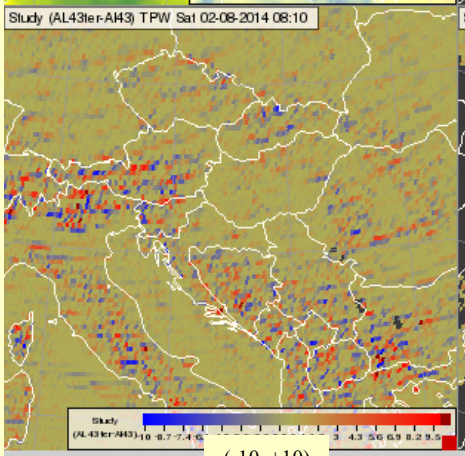


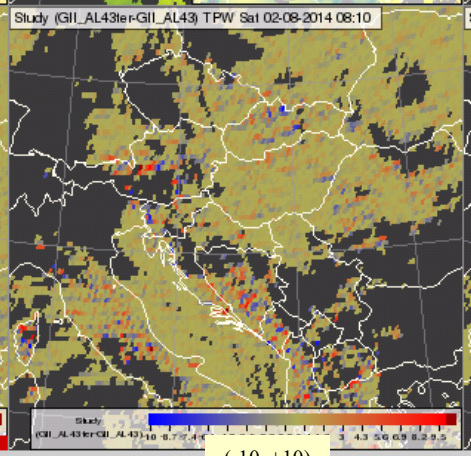


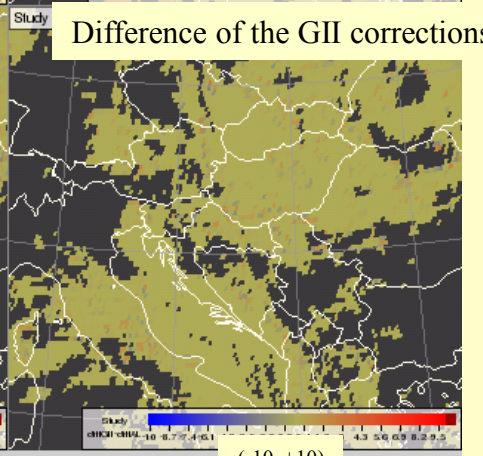


Orig resolution

(-10, +10)





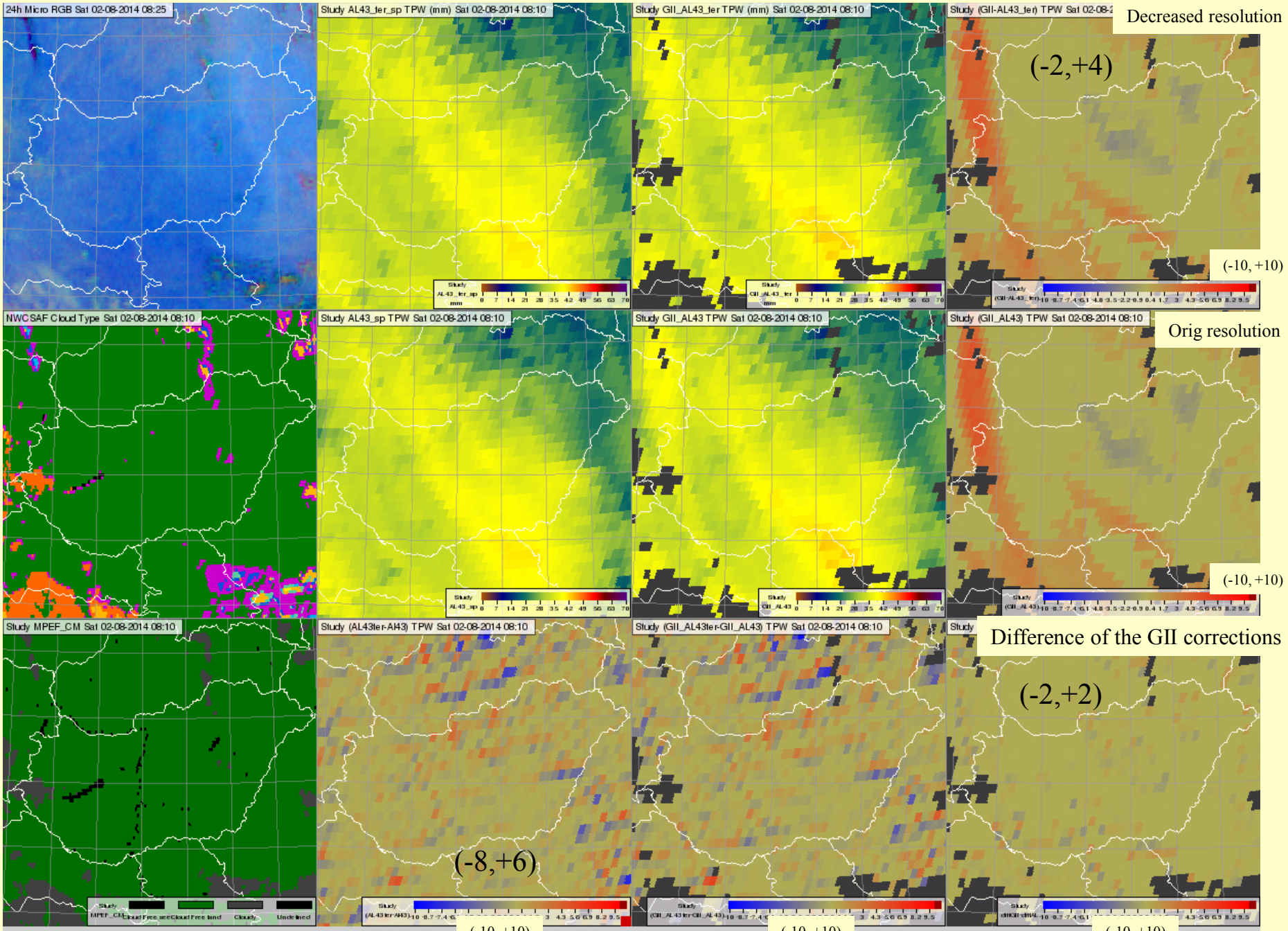


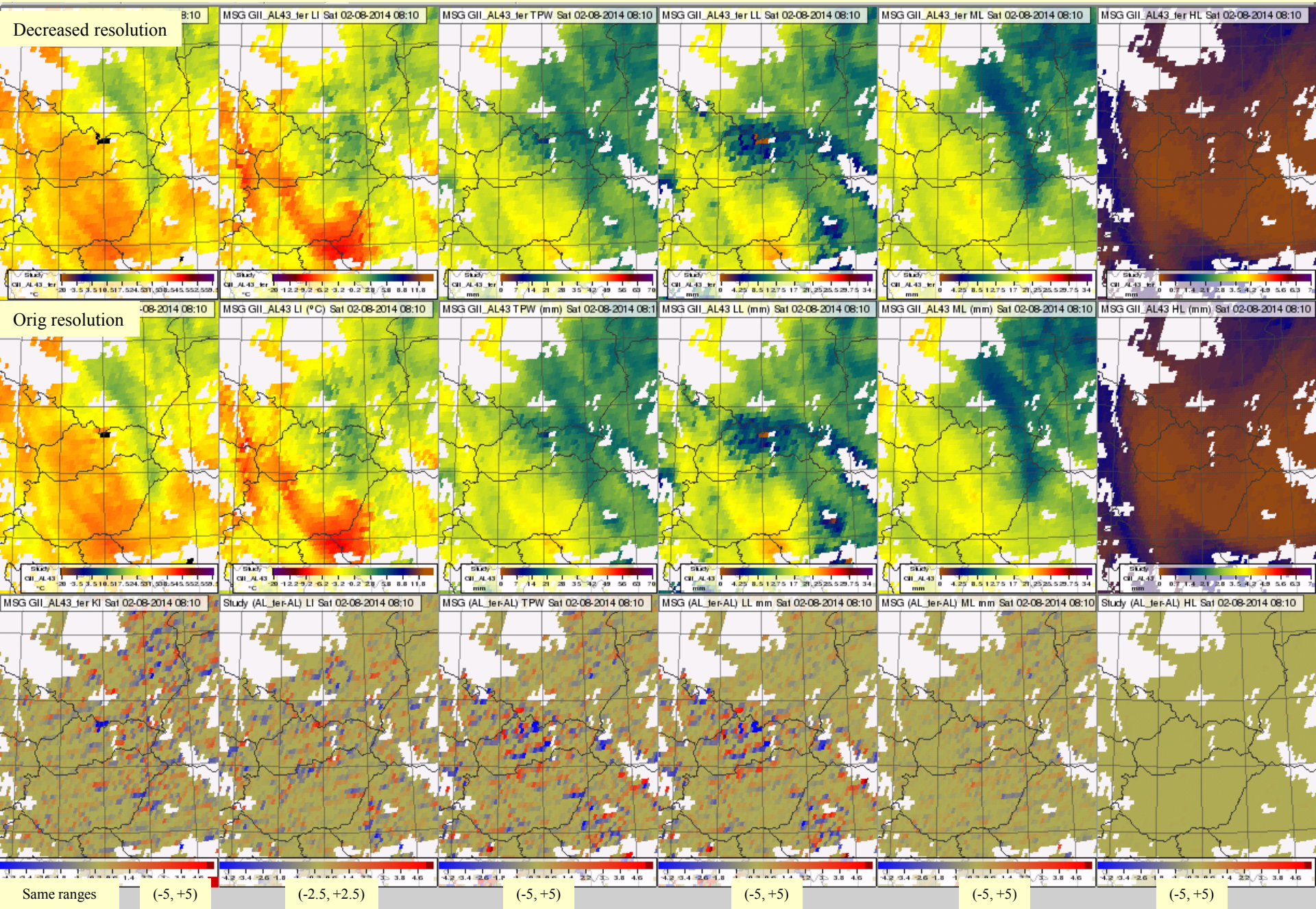
Difference of the GII corrections

(-10, +10)

(-10, +10)

(-10, +10)


8 UTC
forecasted TPW
GII corrected TPW
GII correction
Decreased resolution
(-2,+4)
(-10, +10)
Orig resolution
(-10, +10)
Difference of the GII corrections
(-2,+2)
(-8,+6)
(-10, +10)
(-10, +10)
(-10, +10)


K-index
Lifted index
Total PW
Low Layer PW
Mid Layer PW
High Layer PW
Decreased resolution
Orig resolution
MSG GII_AL43_ter KI Sat 02-08-2014 08:10
Study (AL_ter-AL) LI Sat 02-08-2014 08:10
MSG (AL_ter-AL) TPW Sat 02-08-2014 08:10
MSG (AL_ter-AL) LL mm Sat 02-08-2014 08:10
MSG (AL_ter-AL) ML mm Sat 02-08-2014 08:10
Study (AL_ter-AL) HL Sat 02-08-2014 08:10
Same ranges
(-5, +5)
(-2.5, +2.5)
(-5, +5)
(-5, +5)
(-5, +5)
(-5, +5)

Outlines

Aim of the study

Presenting the results through a case study - 02 August 2014

- Task2 – impact of the actual NWP forecast differences
- Task1 – impact of the vertical and horizontal resolution of the NWP data

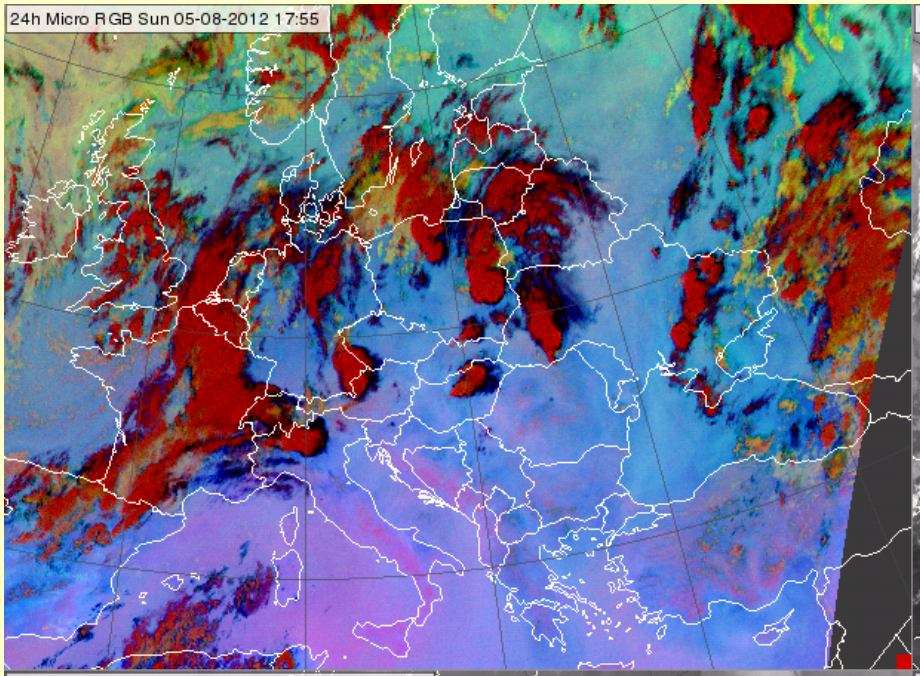
Additional material

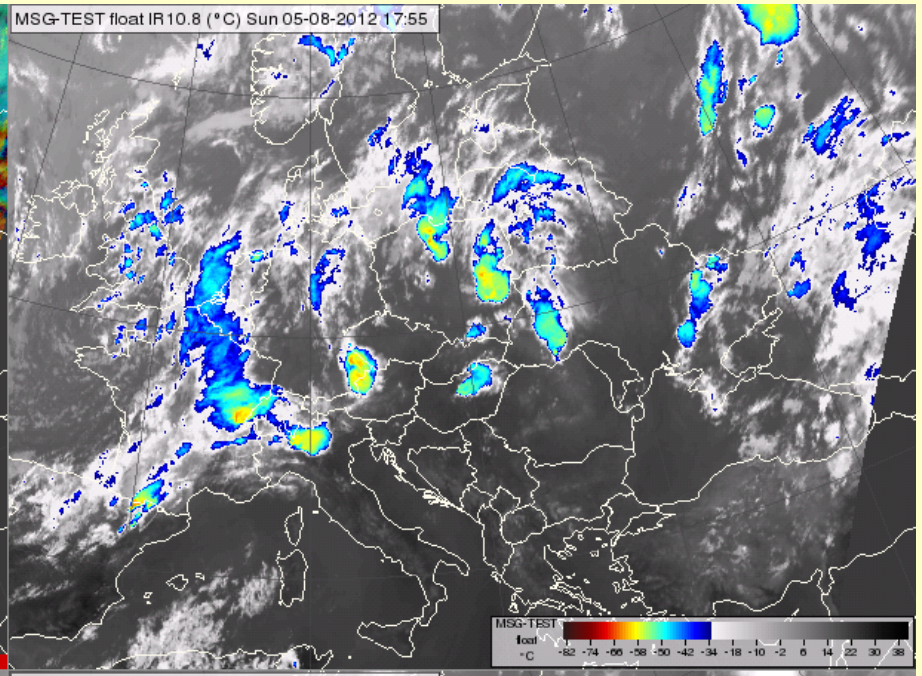
Comparison with radiosonde data

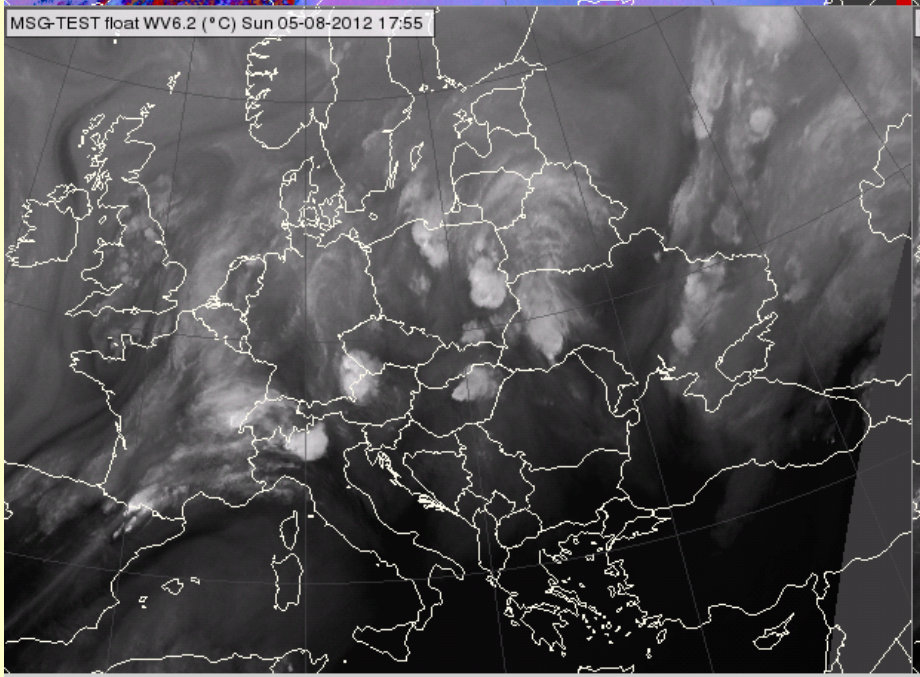
Summary, conclusions

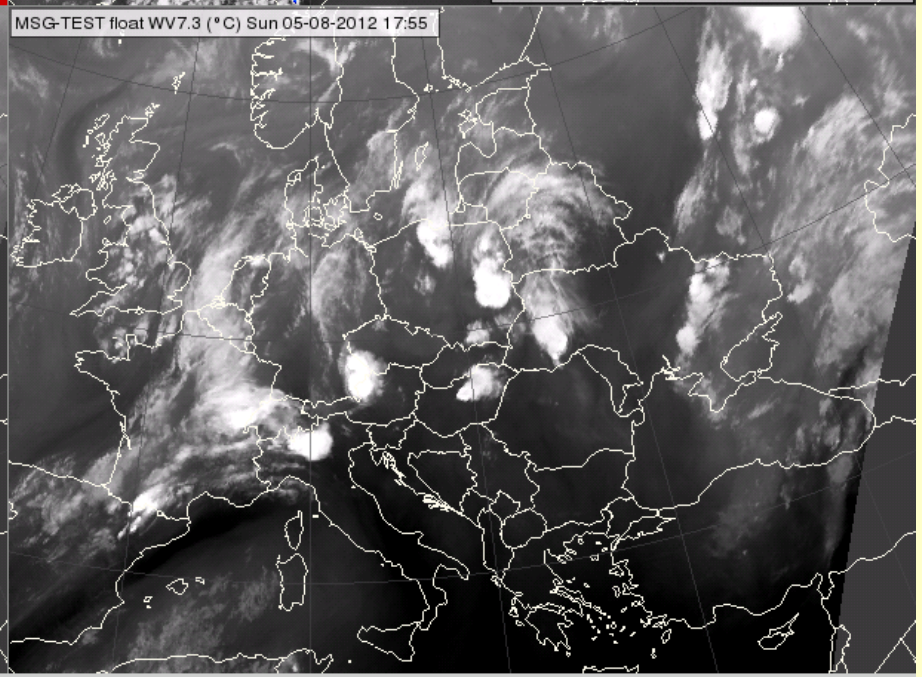
05 August 2012

weak pressure gradient forces



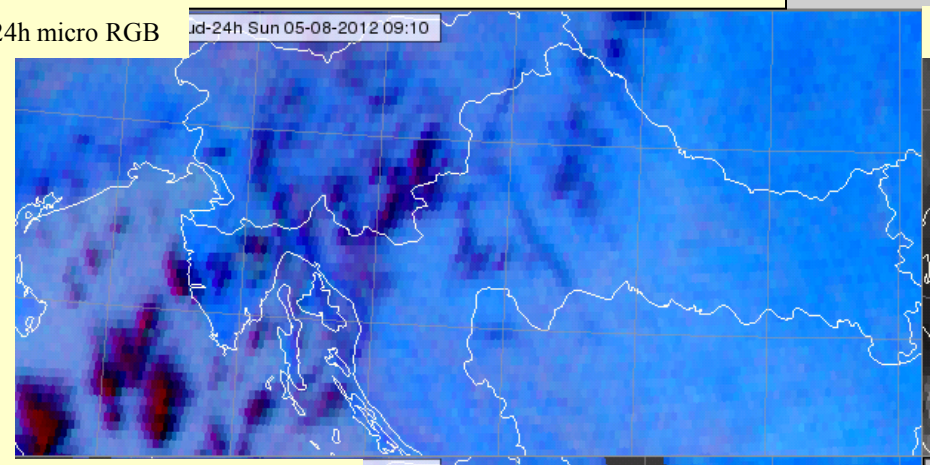


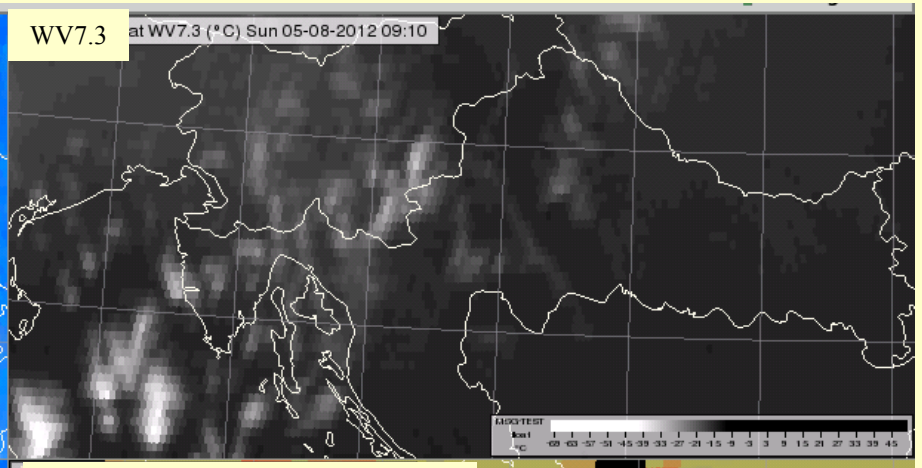


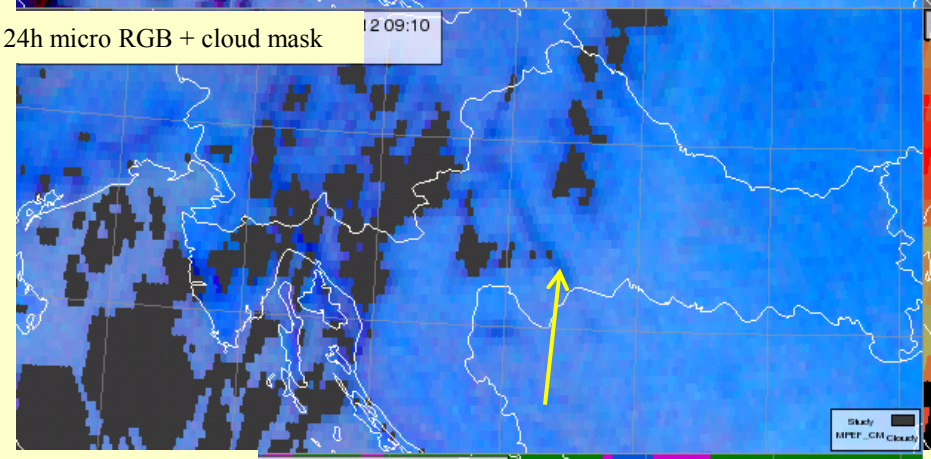


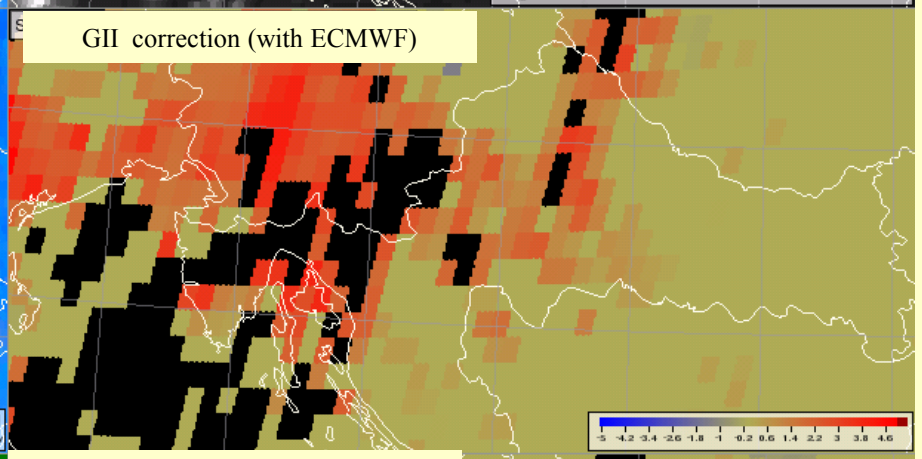
09:10 UTC undetected thin cirrus cloud

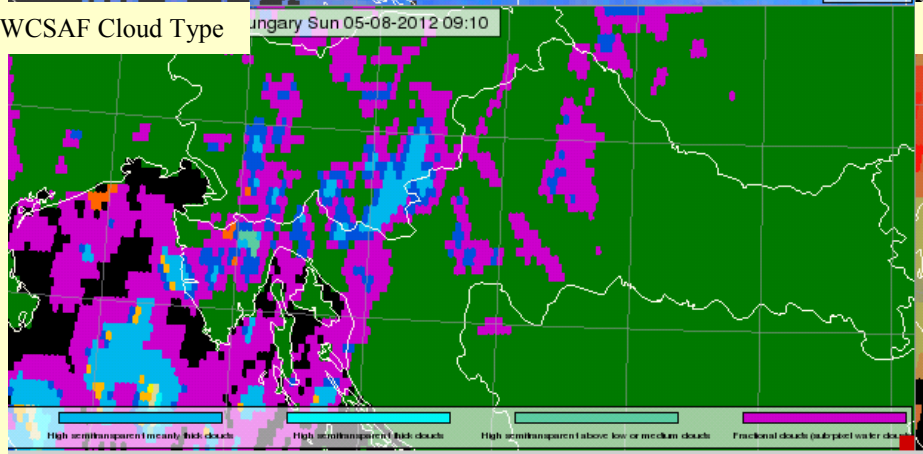
See an analyses for the pixel indicated by the arrow in the next slide.

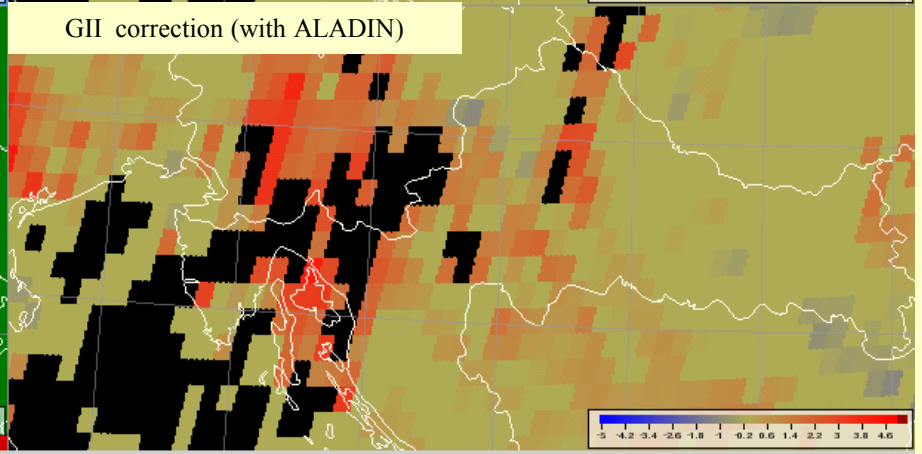






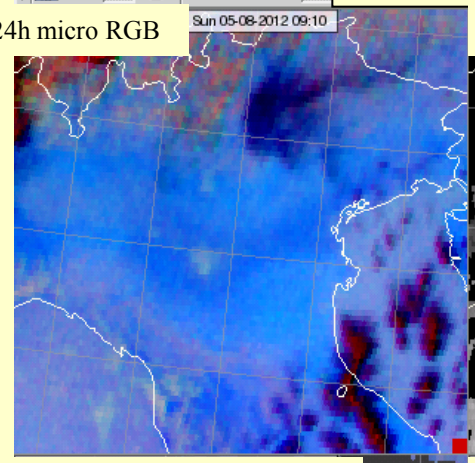




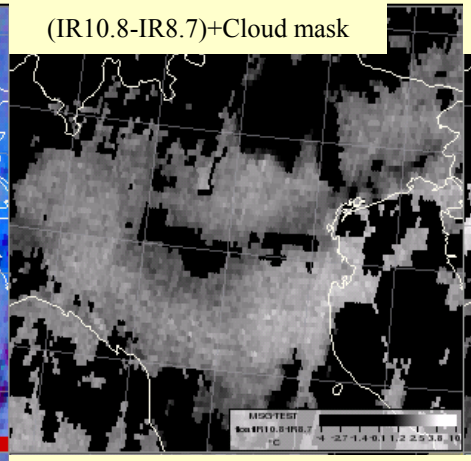


09:10 UTC increased low-level moisture band in the Po valley

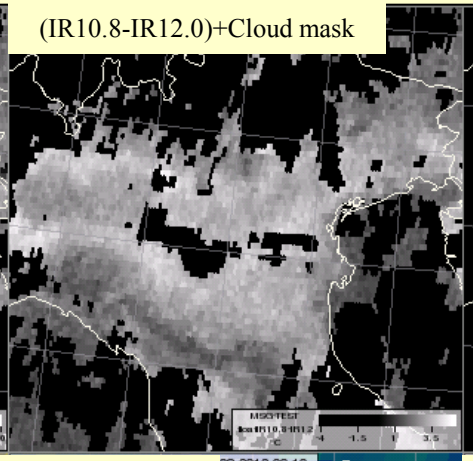
24h micro RGB



(IR10.8-IR8.7)+Cloud mask



(IR10.8-IR12.0)+Cloud mask



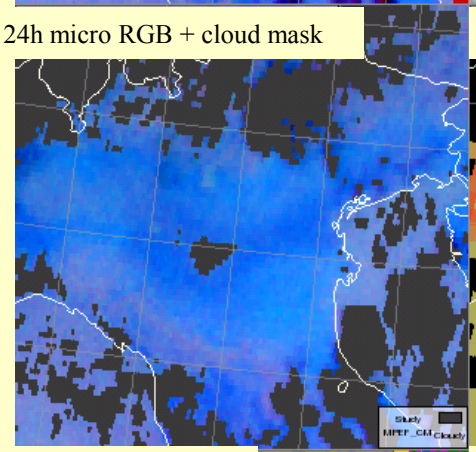
There is a more moist area in the middle of the Po valley

Not seen in the WV images but seen in the RGB -> low level moisture

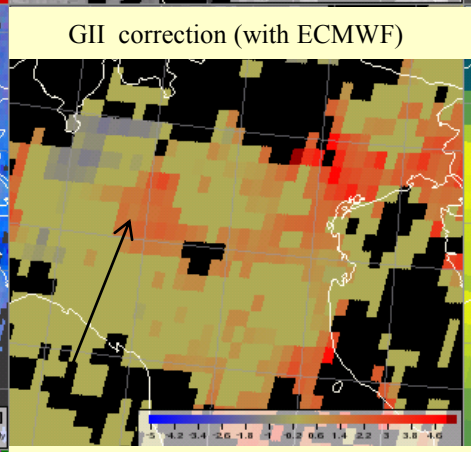
GII increased the forecasted TPW.

See an analyses for the pixel indicated by the arrow in the next slide

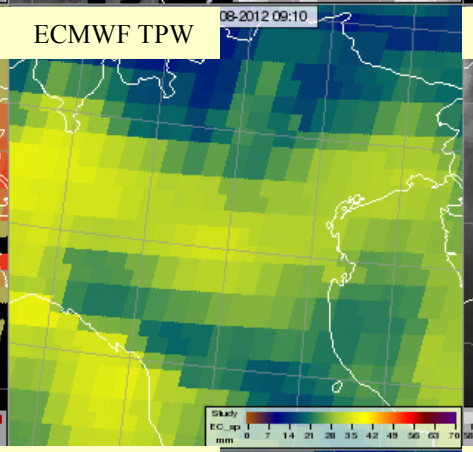
24h micro RGB + cloud mask



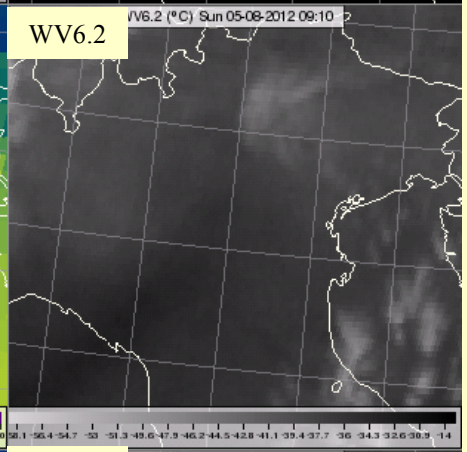
GII correction (with ECMWF)



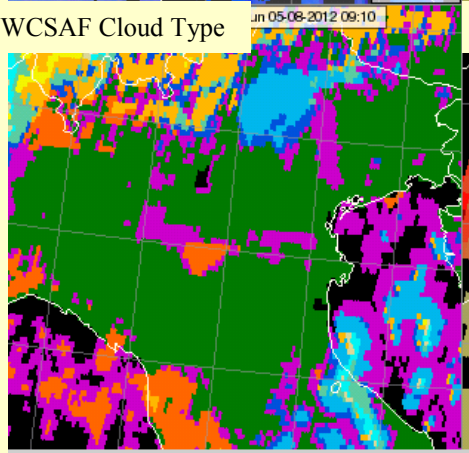
ECMWF TPW



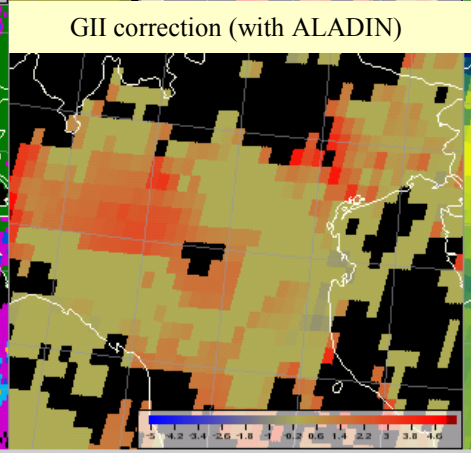
WV6.2



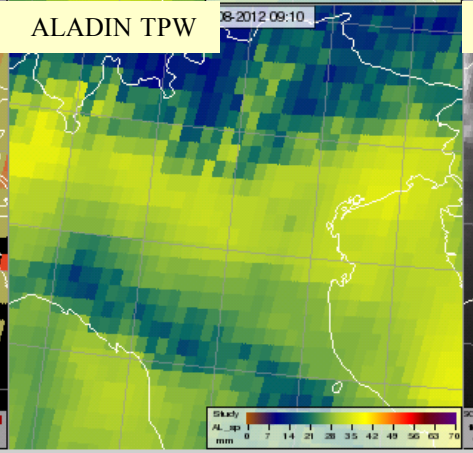
NWCSAF Cloud Type



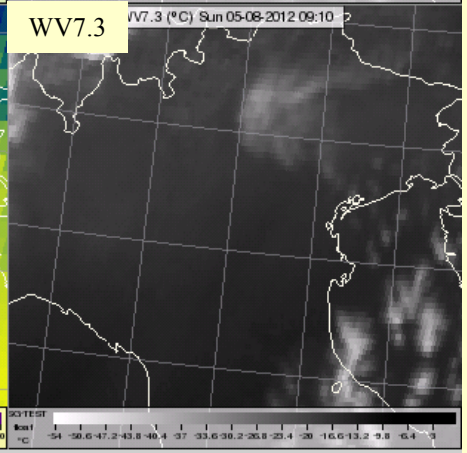
GII correction (with ALADIN)



ALADIN TPW



WV7.3



2012.08.05. 09:10 UTC

Data for the pixel in the Po valley indicated by an arrow in the previous slide. It is cloud-free according NWCSAF Cloud Type product

Pixel	WV6.2	WV7.3	IR8.7	IR10.8	IR12.0	IR13.4	RMS
Measured BT	235.7	256.0	295.5	297.3	294.1	267.3	
simulated BT with ECMWF profileS	237.9	257.0	298.6	300.8	296.4	268.6	2.4
Simulated BT with GII corrected ECMWF profiles	236.5	255.9	295.6	297.6	294.0	267.7	0.4
Simulated BT with ALADIN profiles	238.2	257.0	297.7	300.7	297.3	269.6	2.6
AL Simulated BT with GII corrected ALADIN profiles	236.5	255.5	295.2	297.7	294.7	268.3	0.7

The ECMWF and ALADIN forecasted TPW values were increased by the GII algorithm. They became closer to each other after the satellite correction.
The simulated and measured BTs were far from each other for several channels.
For the channels with weighting function maximum at low levels, but also for the WV6.2.

	TPW	diffTPW
ECMWF	31.3	1.87
ALADIN	29.7	2.71

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Additional material

Comparison with radiosonde data

Summary, conclusions

Summary of the comparison with radiosonde measurements

3 days 12 UTC radiosonde data were collected from cloud-free areas

TPW and K-index derived from **27** soundings were compared with GII corrected data using ECMWF and ALADIN as first guess

	Radiosonde derived minus			
TPW difference	ECMWF forecasted TPW	GII corrected TPW with ECMWF as first guess	ALADIN forecasted TPW	GII corrected TPW with ALADIN as first guess
< 1 mm	**6**	**12**	**4**	**6**
< 2 mm	13	15	11	12
< 3 mm	16	16	16	17

	Radiosonde derived minus			
K-index difference	ECMWF forecasted K-index	GII corrected K-index with ECMWF as first guess	ALADIN forecasted K-index	GII corrected K-index with ALADIN as first guess
1 °C	7	8	**6**	**9**
2 °C	14	14	9	10
3 °C	18	18	11	14

Summary of the comparison with radiosonde measurements

3 days 12 UTC radiosonde data were collected from clod-free areas

TPW and K-index derived from 27 soundings were compared with GII corrected data using ECMWF and ALADIN as first guess

GII correction of TPW	ECMWF as first guess	ALADIN as first guess
in good direction	**13**	**8**
In bad direction	**4**	**3**

GII correction of K-index	ECMWF as first guess	ALADIN as first guess
In good direction	7	7
In bad direction	10	3

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Conclusions

The satellite correction is usually small, but comparable to the forecasted value.
->
The NWP fields have big influence on the GII results. The GII corrected field has usually similar structure as the forecasted field, except the areas where the GII algorithm modifies it. These are not strong modifications, and the majority of the image is not corrected.

However, this little modification can be important. GII can improve the shape of some mesoscale features: like the exact location of a moisture boundary, and local moisture gradient.

Undetected thin cirrus clouds cause error in the retrieval. It increases the TPW value.

The GII corrections (the location and the shape of the patches) are similar in all three layers and also for the instability indices. The corrected profiles seem to be strongly constrained to the first guess humidity profile. (Due to the few measurements against the many unknowns.)

With IRS we hope better ability of correcting also the vertical shape of the moisture profile + good temporal resolution

Task1

Using the same NWP model with different **spatial resolution** as first guess the difference between the two forecasts has a noise like structure, which amplitude depends on the inhomogeneity of the original field.

The amplitude of the forecast difference is quit high (first of all for TPW and LL in the mountainous regions). **GII correction does not modify it considerably.**

Using the same NWP model with different **vertical resolution** as first guess the GII correction will be very **similar**, but **NOT identical.** Neither the extension nor the values will be exactly the same.

-> Higher differences between the GII corrected fields than between the forecasts. The difference could be doubled. - Altogether this is not a strong effect.

Task2

The GII algorithm **does not correct all differences** between the NWP models. (This can happen even with 4-5 mm TPW differences.)

The satellite correction are usually smaller, but comparable to the differences between ALADIN, ECMWF and AROME forecasted fields.

The moisture (instability) fields forecasted by different models often became **closer** to each other due to the GII correction.

Comparisons with radiosonde data showed that

- the GII algorithm corrected the TPW values in good direction in more than 70 % of the cases
- The GII corrected TPW and K-index was more often close (within 1/2/3 mm/°C to the radiosonde derived TPW than the forecasted ones.

Thank you for the attention!