ALARO-0 experience in Hungary

- *Hungarian Meteorological Service*
  Presented by: Dávid Lancz

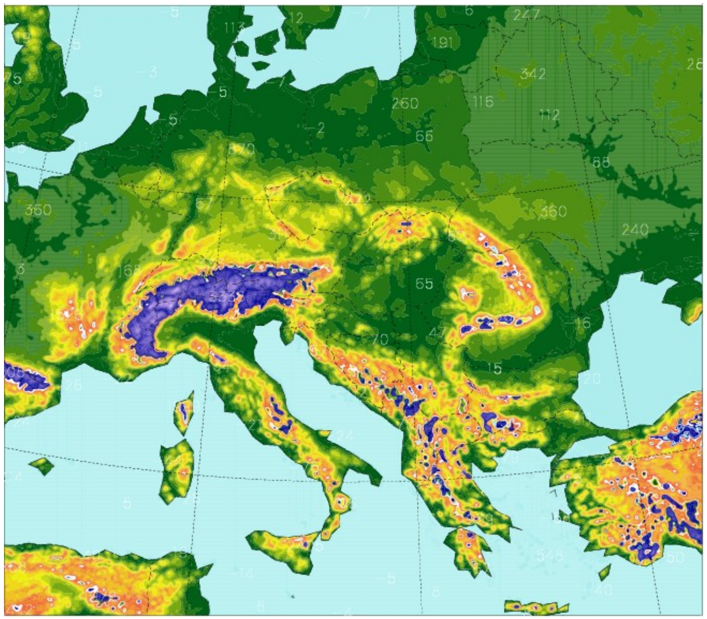
- *ALARO-1 Working Days, 12-14 May 2014, Vienna, Austria*

Contests

- Our operational model configuration
- 'Versions' of ALARO we have used:
  - General overview about the updates of cycles and ALARO versions
  - Verification results
- Local settings and problematic parts:
  - Negative BIAS in 2meter temperature
  - Positive BIAS in wind and wind gust
  - Missing orographic effect in wind fields

Operational model configurtion

- ‘Deterministic’ system:
  - With data assimilation
  - Coupled to IFS
  - ALARO (hydrostatic) is operational from March of 2012
  - Later represented scores are from the verification of this system
- Ensemble system:
  - Dynamical adaptation of the first 11 members from PEARP
  - ALARO (hydrostatic) is operational
    from November of 2011
- Resolution:
  - 8km horizontal
  - 49 vertical levels
  - 300s time steps



Updates in our system

Cy33 with old settings of ALADIN

Update was in March of 2012

Cy35 with an ALARO modset and namelist from Prague

Update was in September of 2013

Cy36 with ALARO-0-baseline version

On-going update and verification

Cy38 with ALARO-0-baseline version and an additional modset from Prague

Update to ALARO

Cy33 with old settings of ALADIN

Update was in March of 2012

Cy35 with an ALARO modset and namelist from Prague

- **Results have been represented in Ljubljana two years ago**
  - ALARO produced better scores in verification and
  - Precipitation pattern became more realistic especially in convective cases
  - Some problems have been reported (see also later)

Update to ALARO-0-baseline version

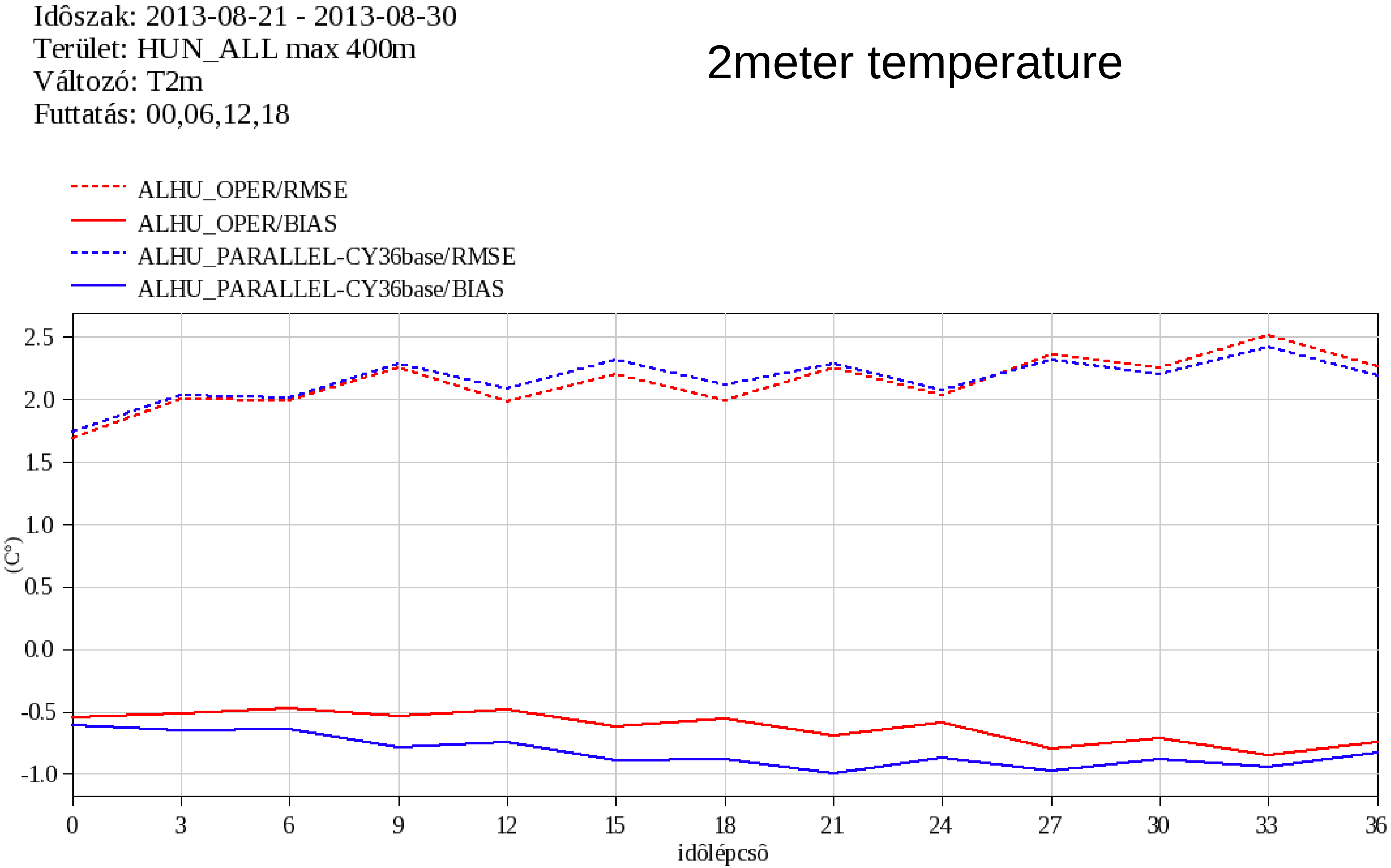
Cy35 with an ALARO modset and namelist from Prague

Update was in September of 2013

Cy36 with ALARO-0-baseline version

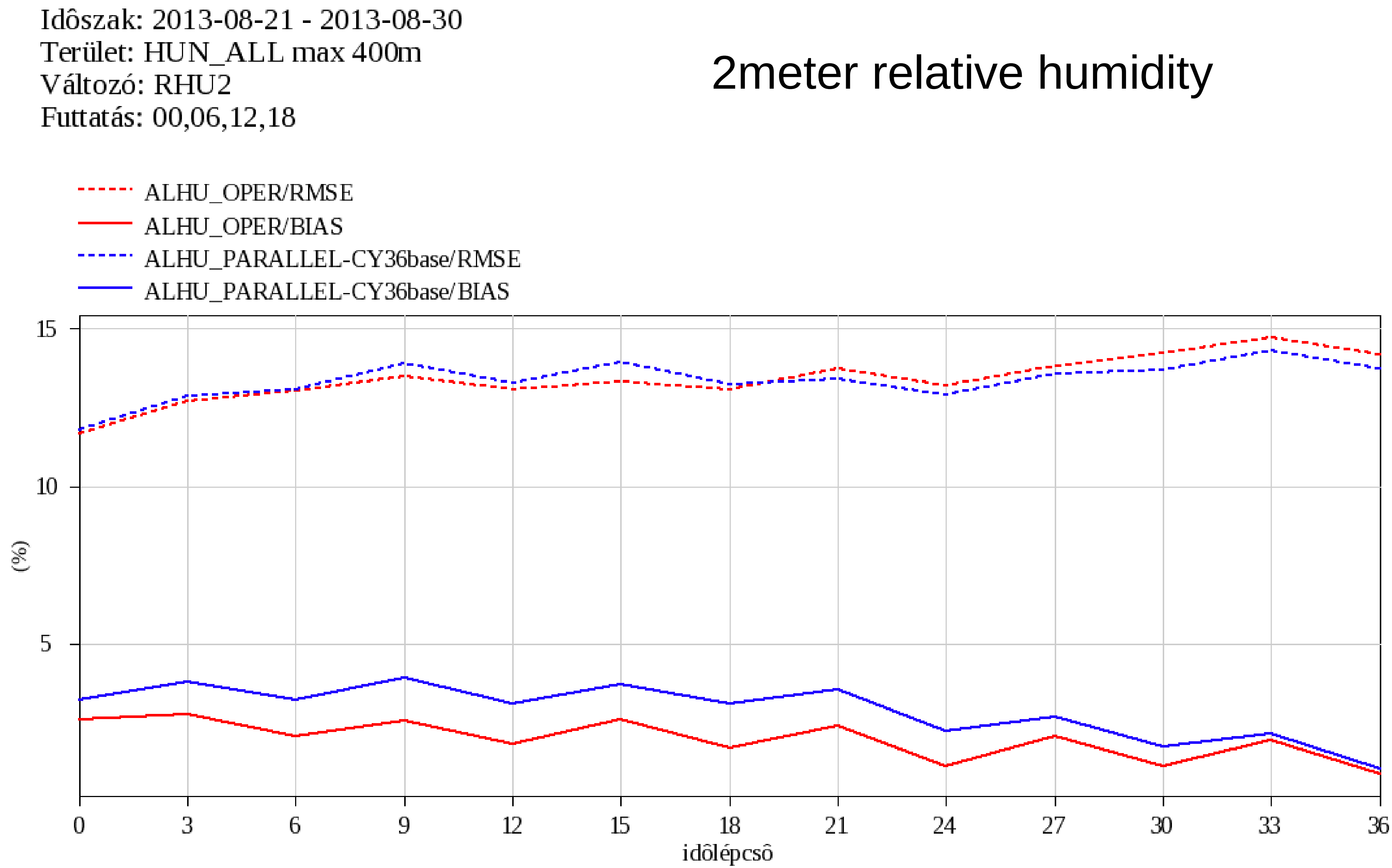
Update to ALARO-0-baseline version
Verification results

2meter temperature



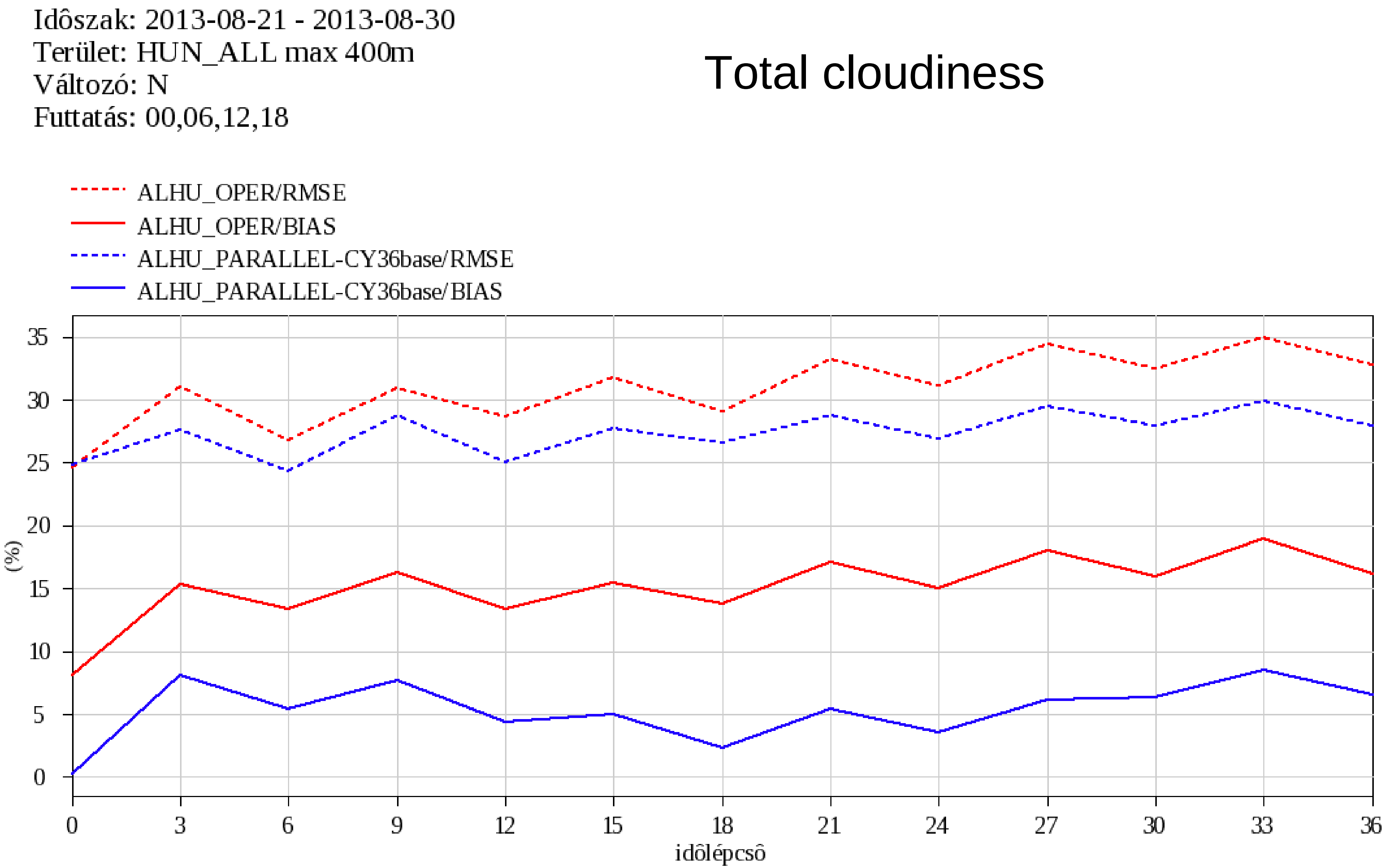
Update to ALARO-0-baseline version
Verification results

2meter relative humidity



Update to ALARO-0-baseline version
Verification results

Total cloudiness



Update to ALARO-0-baseline version Precipitation

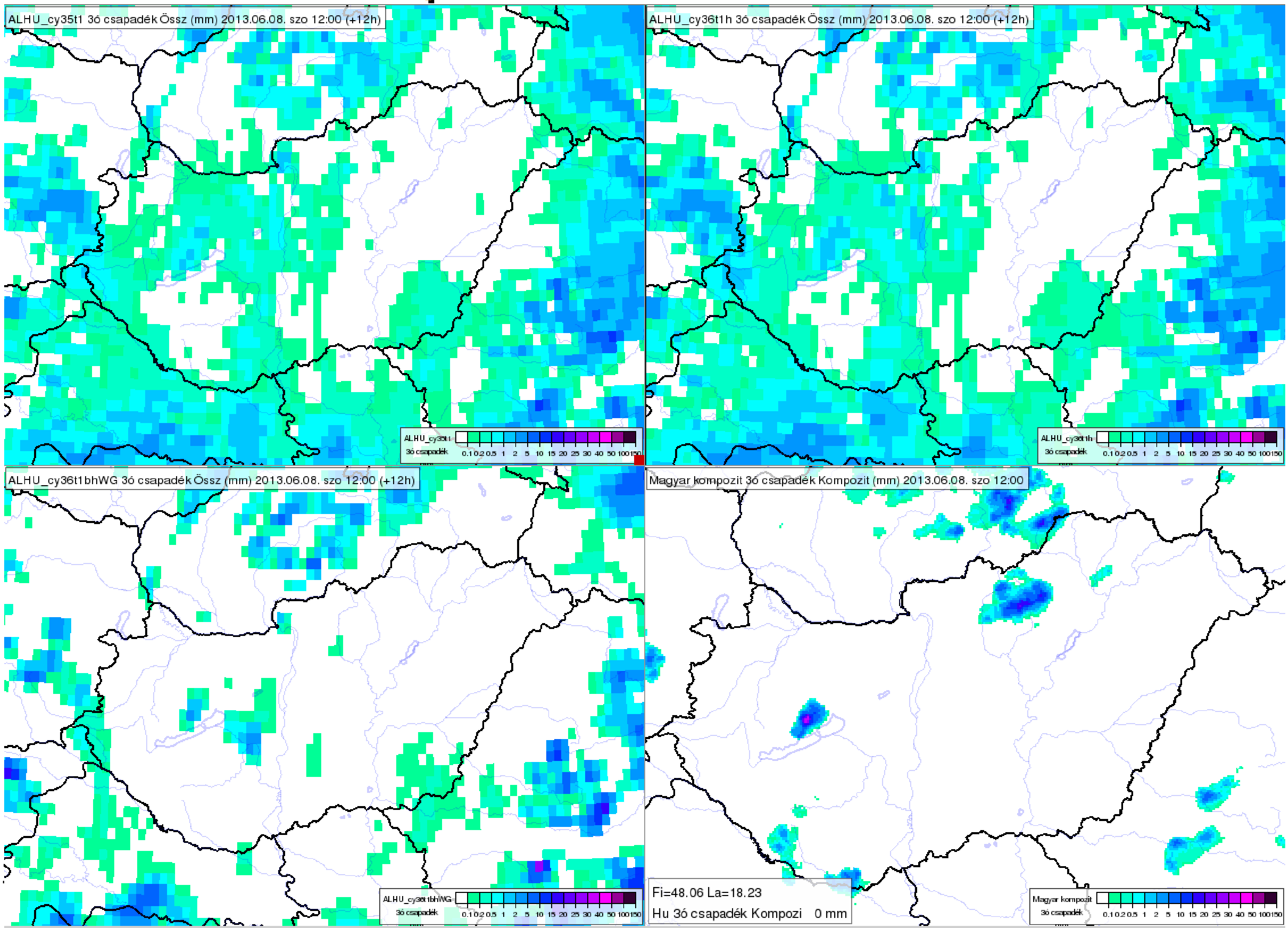
In many cases precipitation fields are qualitatively different and more realistic, especially in convective cases:

- Smaller structures
- More intense peaks

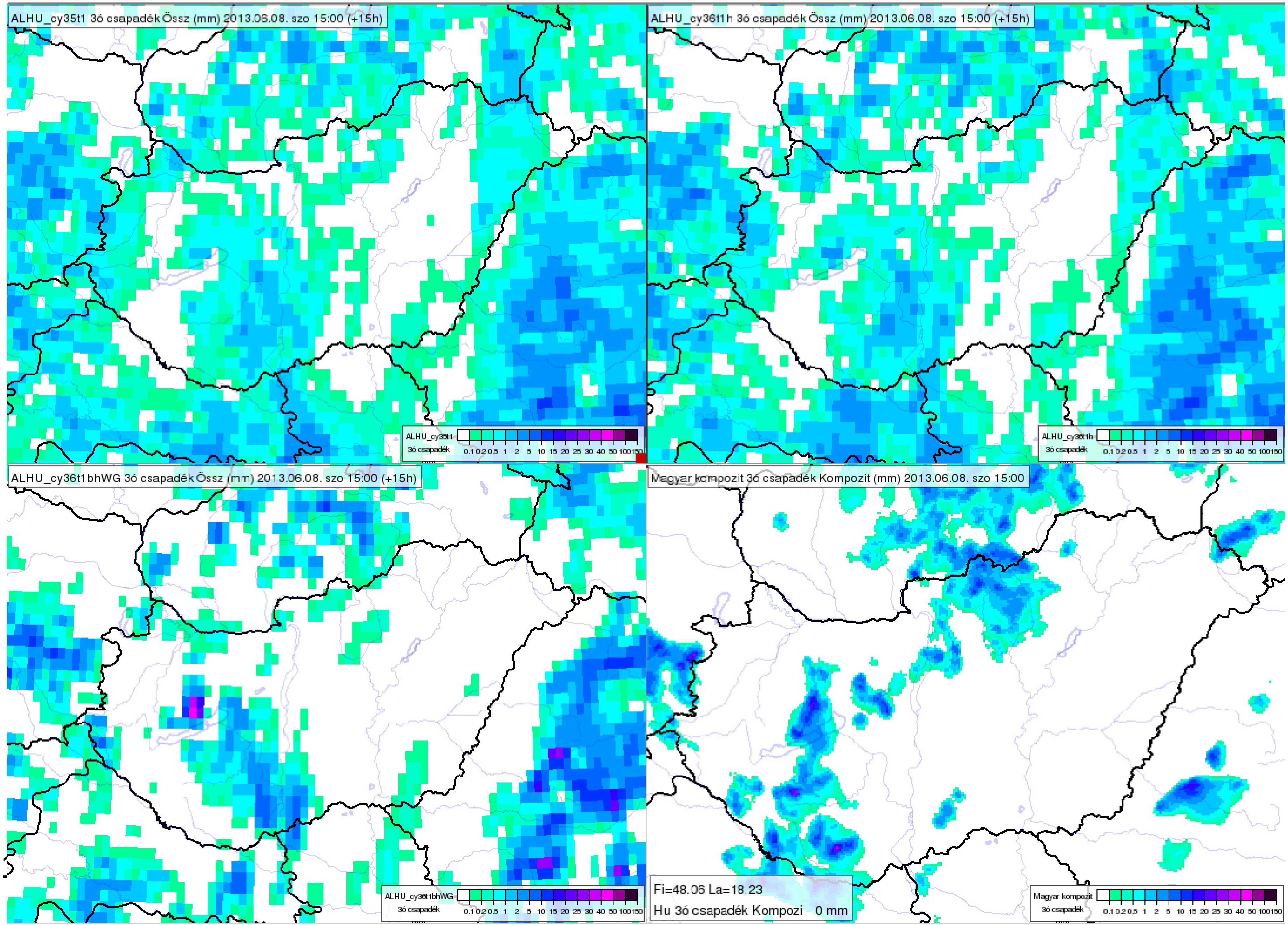
On the following slides there is an example from the previous summer: 08.06.2013

Model precip CY35	Model precip CY36
Model precip CY36 ALARO-0-baseline	Precip Calculated from RADAR reflectivity

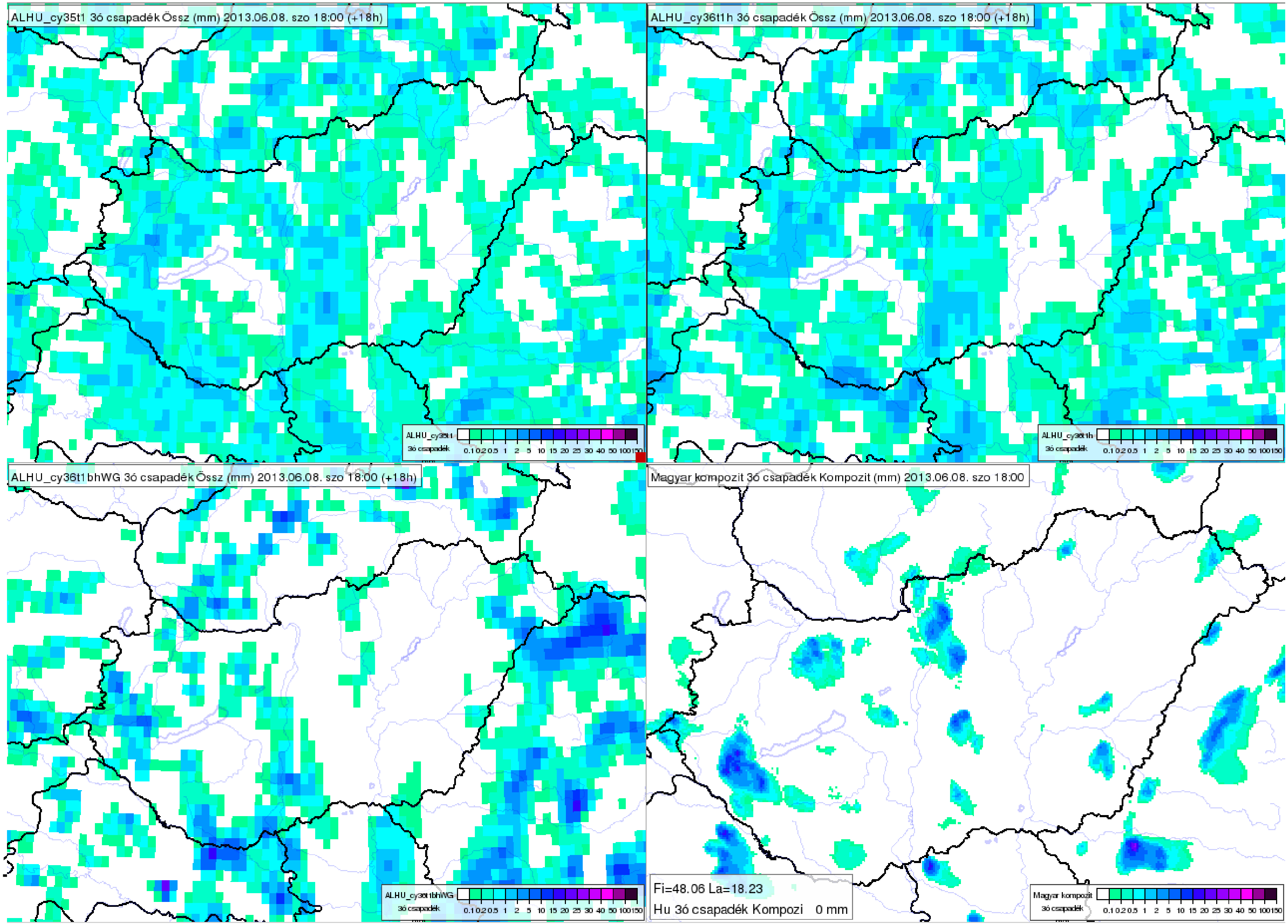
Update to ALARO-0-baseline version
Precipitation – 08.06.2013.



Update to ALARO-0-baseline version Precipitation – 08.06.2013.



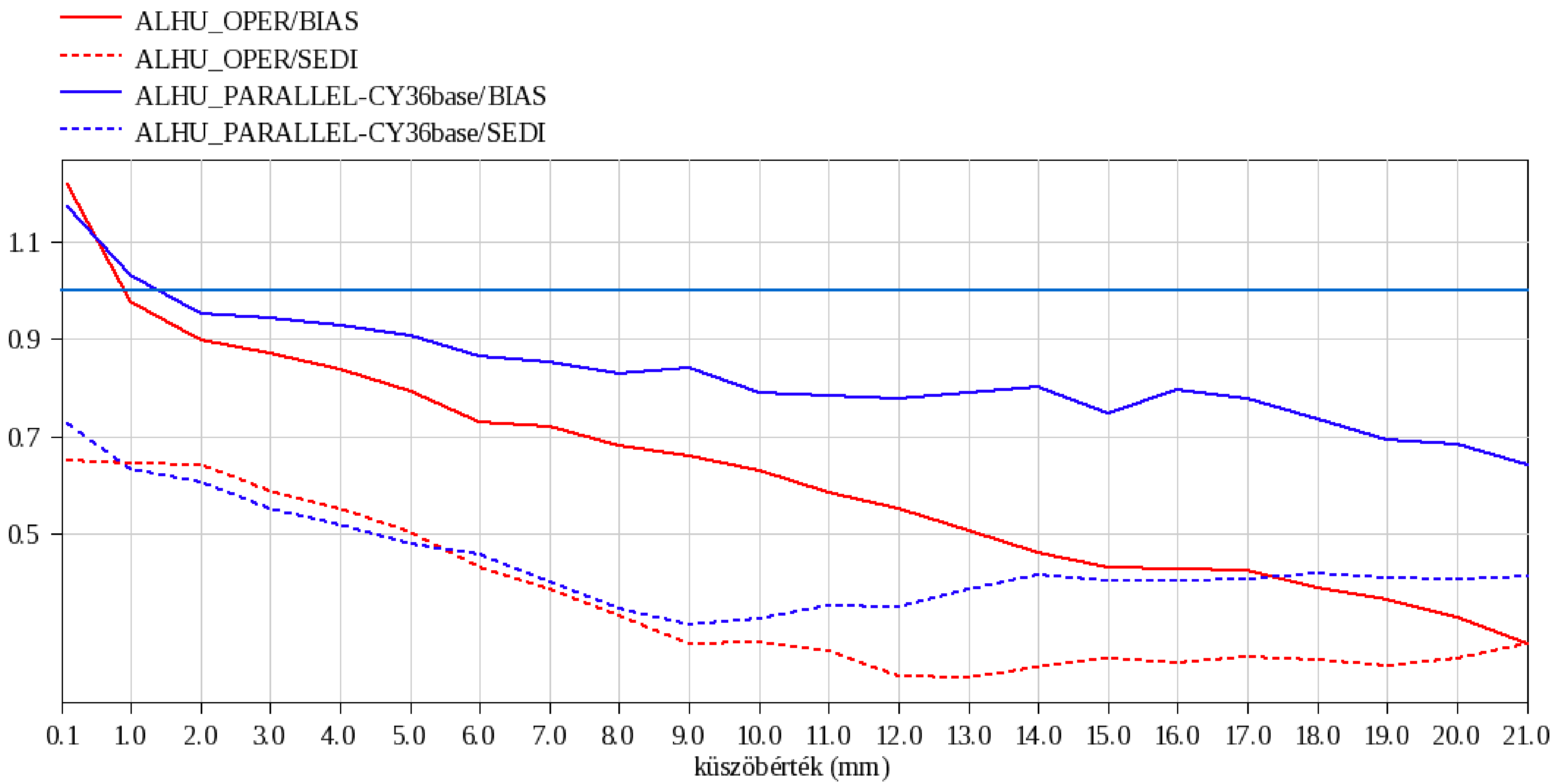
Update to ALARO-0-baseline version
Precipitation – 08.06.2013.



Update to ALARO-0-baseline version
Verification results

Idôszak: 2013-08-21 - 2013-08-30
Terület: HUN_ALL max 400m
Változó: Precip24h
Idôlépcsô: 030
Futtatás: 00,06,12,18

24h cumulated precipitation



Recent update

Cy36 with ALARO-0-baseline version

On-going update and verification

Cy38 with ALARO-0-baseline version and an additional modset from Prague

Recent update

Cy36 with ALARO-0-baseline version

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Cy38 with ALARO-0-baseline version and an additional modset fom Prague

In the new version we also tested the “multi-scale setup” of RMULACVG:

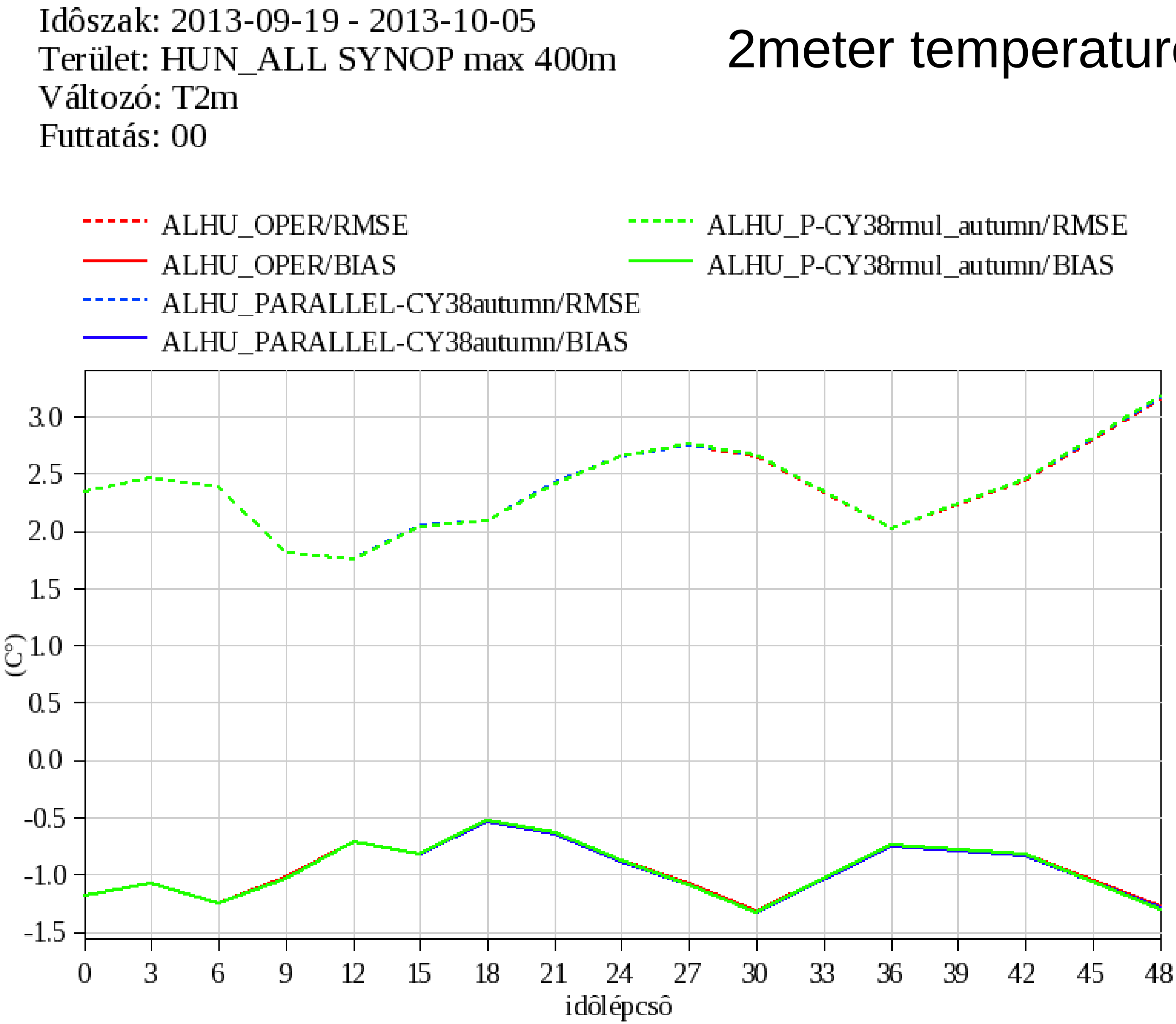
- Originally: RMULACVG=15.
- In new version: RMULACVG=-25.

Even with this modification the effect of cycle change is very small:

- Unfortunately we can not run test period for summer because ALARO-baseline had not been operational last summer
- On case studies differences were very small in convectional cases, too (not shown here)

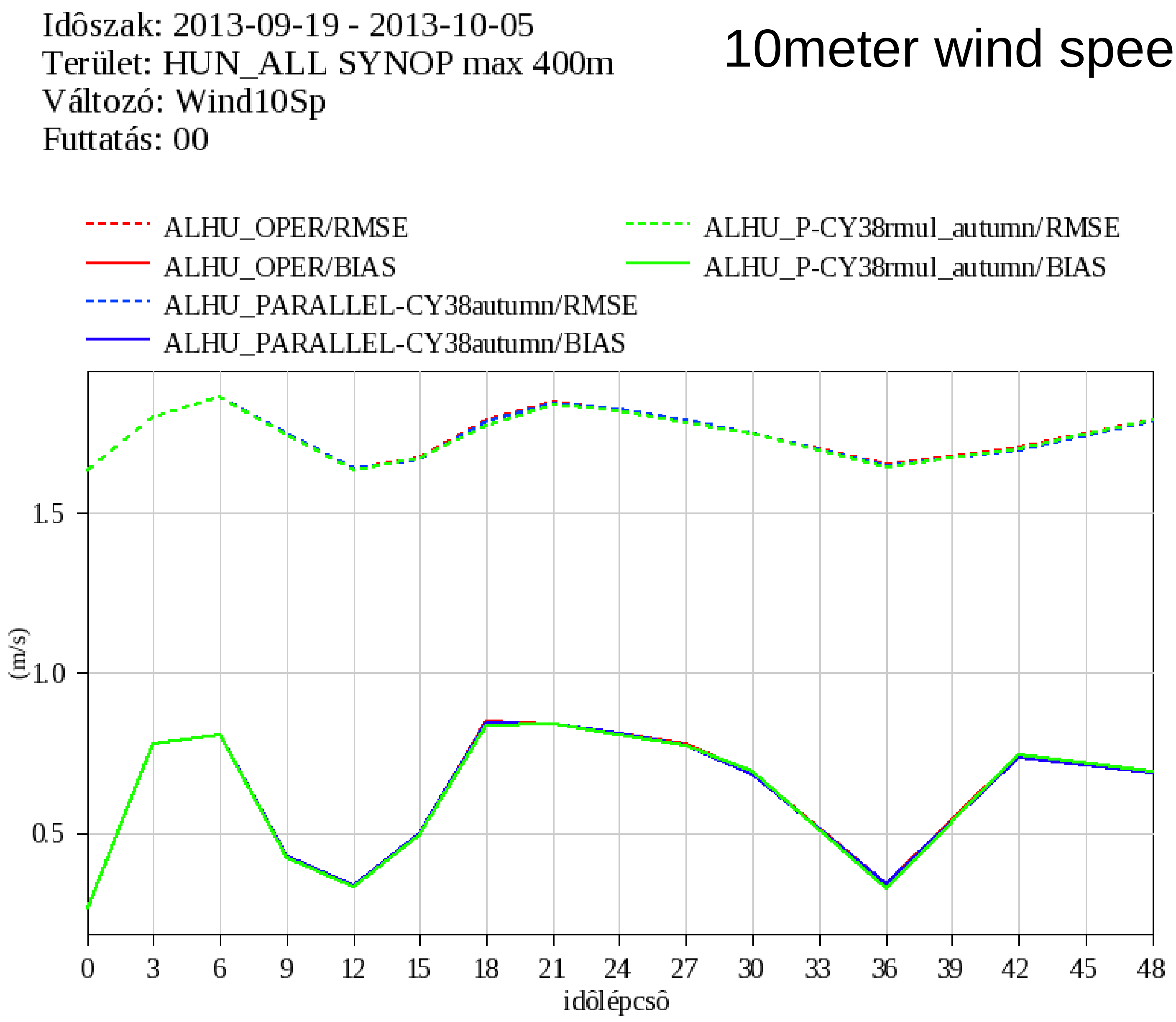
Recent update
Verification results

2meter temperature



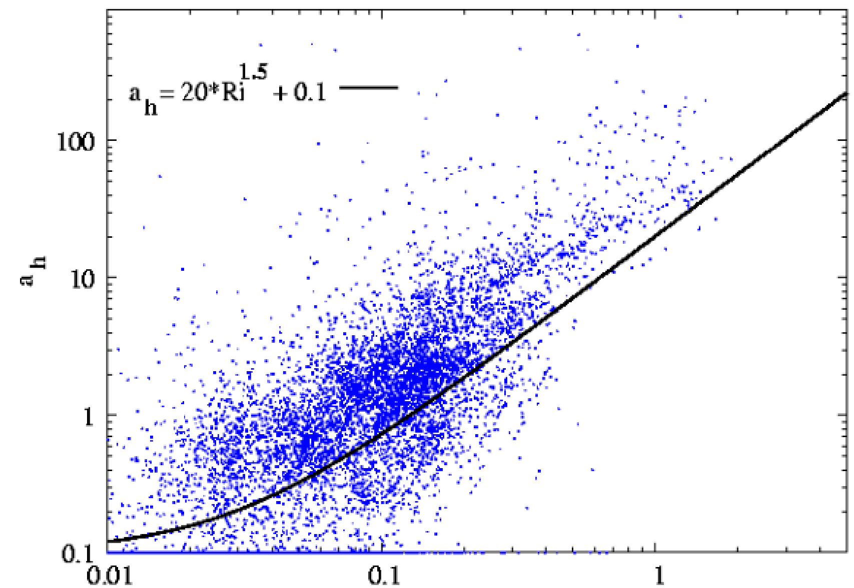
Recent update
Verification results

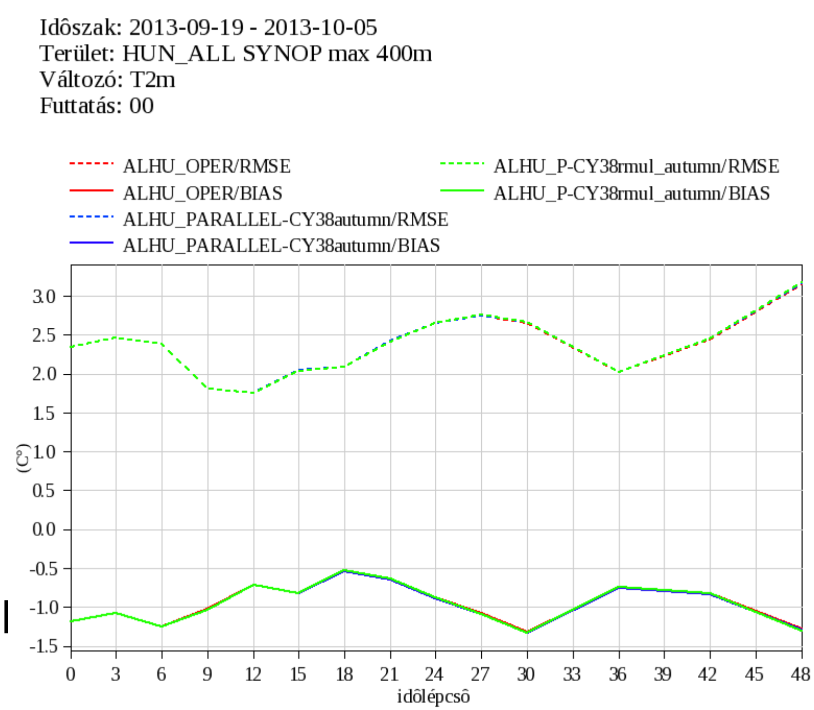
10meter wind speed



Local settings and problems
2meter diagnostics

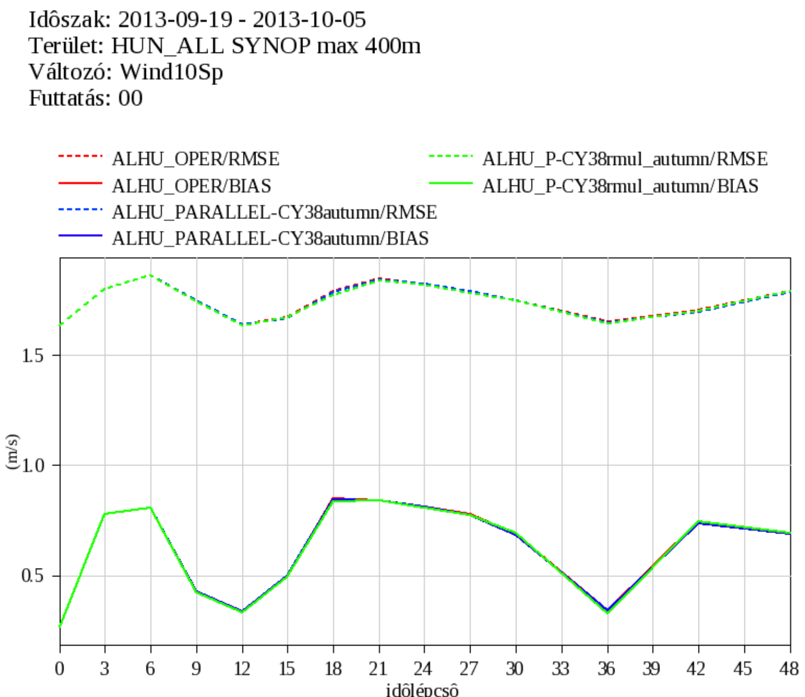
- With our ALARO version in cy35 there were serious 2meter temperature overestimations in stable cases, so we made some modification (shown 2 years ago):
  - a_h calculation in ACNTCLS is Richardson number dependent
  - Surface heat capacity was increased
- Tests verified this modification previously but now in ALARO-0-baseline we have massive negative BIAS.
- Its fluent phasing is problematic and a bit contradictory with other ALARO changes:
  - eg. in cy38 ACNTCLS can be also called from ACTKEHMT
  - We originally wanted to modify results only if it is called from ACNTCLS

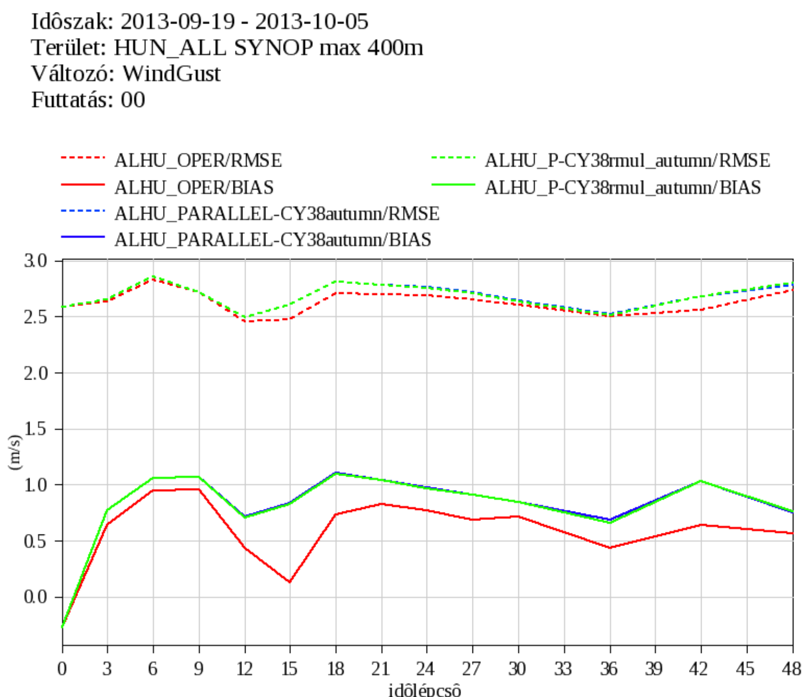




Local settings and problems
Wind gust overestimation

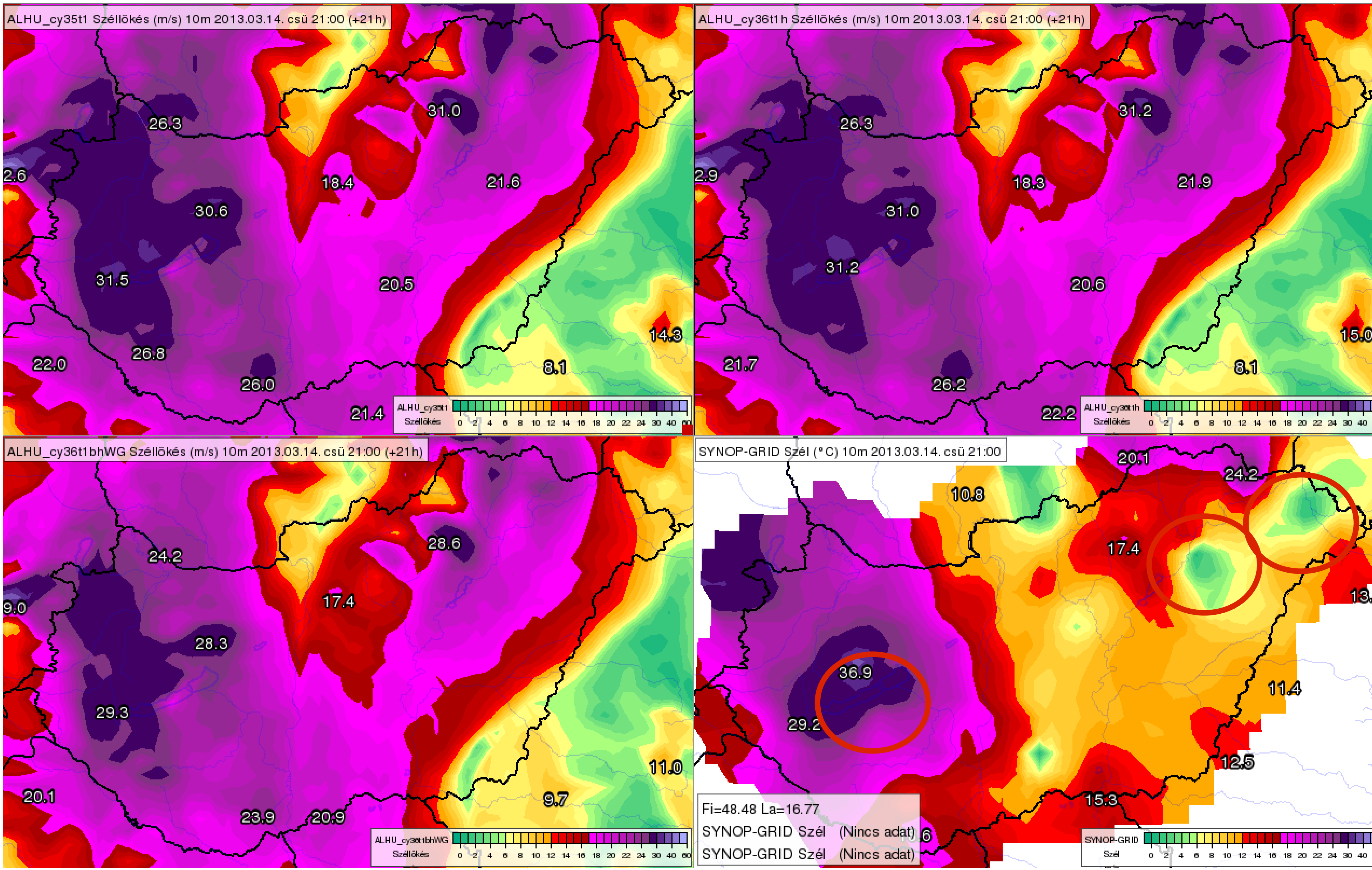
- Two years ago it was shown that we set α=FACRAF=10.
  For cy38 we set LXXGST=TRUE:
  - Wind gust output is a real maxima of a given period, what increases values.
  - If we decreased systematic error with further FACRAF tuning, we would lose extreme values in special cases (eg. very windy periods behind cold fronts), which are well estimated in the model. That does not look a good way.
  - However wind gust BIAS looks now consistent with wind BIAS. They should be improved together.





Local settings and problems
Orographical wind and wind gust problems

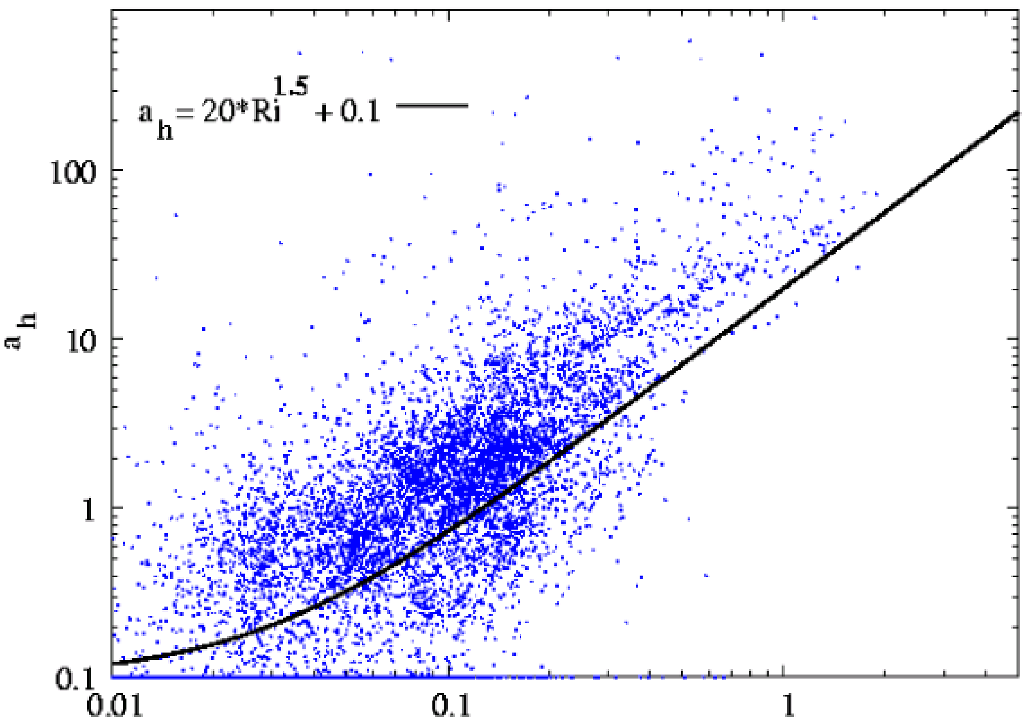
- In Hungary there are no big mountains at all, but behind hills there could be some shadow in real wind field. It is not well represented in ALARO.



Thank you for your attention!

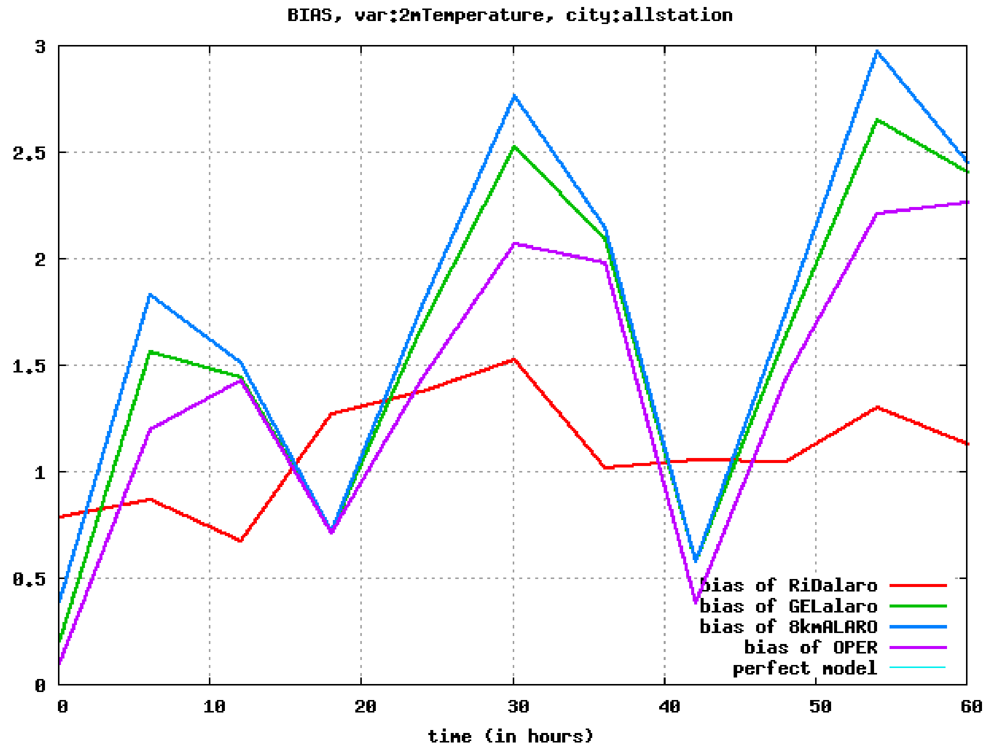
Screen level diagnostics – new formula

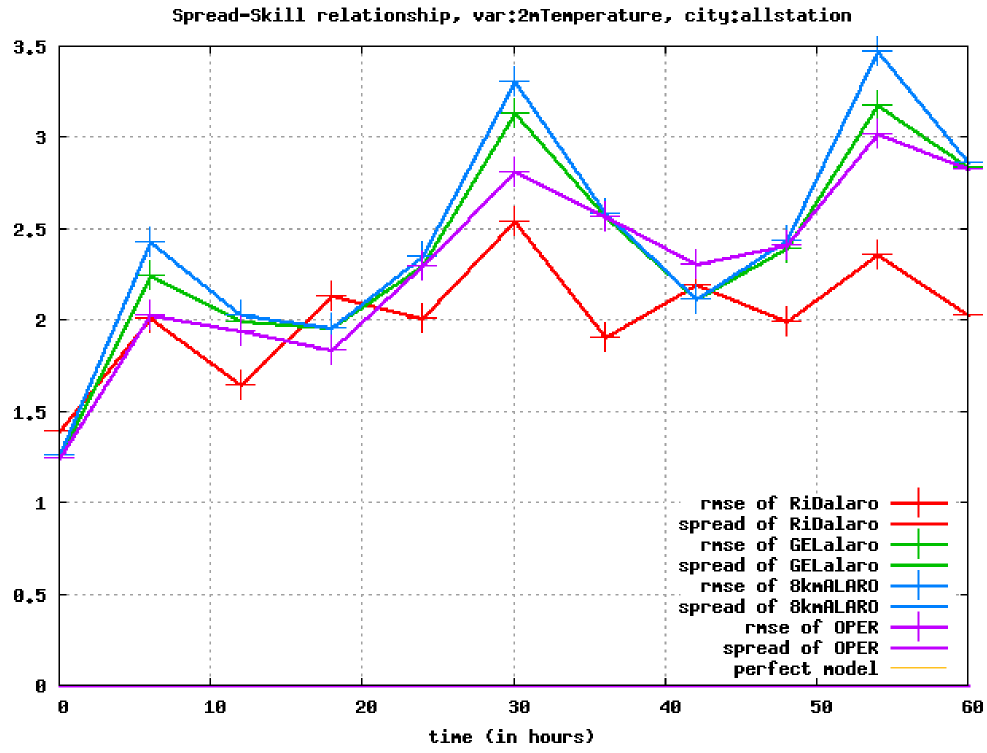
- 2 meter temperature and relative humidity is calculated by ACNTCLS
- In neutral cases we have a logarithmic profile between the surface and the lowest model level
- This profile is modified on a stability dependent way
- In this modification $\boldsymbol{a_h}$ is a parameter which:
  - Was a constant original ALARO version
  - We introduced a new Richardson number dependent formulation
- Surface heat capacity was also modified:
  - Original: RCGMAX= RCTVEG(:)= $\boldsymbol{8*10^{-6}}$
  - New value: RCGMAX=RCTVEG(:)= $\boldsymbol{2*10^{-5}}$



Screen level diagnostics – results

- A two-weeks periods which was full with stable situations (EPS showed bigger improvement – figures here)
- 2meter temperature was mostly even better than in ALADIN reference





Too strong wind gusts - formulation

- The formulation of wind gust calculation was not modified in ALARO
- PCD (surface exchange coefficint) calculation has changed in this formula

$$
\begin{aligned}
\mathrm{ZSCRAF} &= 1+\alpha\sqrt{\frac{C_D\,(U_N^2+V_N^2)}{(U_{10m}^2+V_{10m}^2)+(Z_{10m}\ \mathrm{GCISMIN})^2}}\sqrt{\frac{1}{1+\left[\frac{\ln(1+Z_{10m}/Z_{0,lim})}{\ln(1+Z_{10m}/Z_0)}\right]^2}} \\
U_{raf} &= \mathrm{ZSCRAF}\ U_{10m} \\
V_{raf} &= \mathrm{ZSCRAF}\ V_{10m}
\end{aligned}
$$

$\mathrm{GCISMIN} = 0.000067$: minimum value of shear
$\mathrm{GZ0RAF} = gZ_{0,lim} = 10$
$\mathrm{FACRAF} = \alpha = 15$