THE IMPACT OF HIGH RESOLUTION WINDS IN THE ALADIN-HUNGARY MODEL

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IN THE ALADIN-HUNGARY MODEL

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Outlines

Motivations, Aims

Operational ALADIN LAM system

Details of the AMV Impact study

Impact on Analysis

Impact on Forecast

Conclusion and Questions

Motivation of this Impact Study

NWCSAF/MSG retrieval packages are installed at Hungarian Met Service(HMS) which provide wide ranges of products for different purposes (e.g. forecasting, nowcasting, NWP)

Among several useful products from these packages, there is a retrieval tool for computation of High Resolution Winds(HRW) Atmospheric Motion Vectors (AMV) data

Numerical weather prediction requires accurate initial conditions which can be estimated by Data Assimilation (DA)

To make DA more efficiently, more accurate observations are needed.

Motivation of this Impact Study

The AMV observations are beneficial on DA analysis and
have good potential e.g. to improve convective weather situations.
(Randriamampianina 2006)

The aim of this work was to evaluate the impact of HRW AMV in our
ALADIN Limited Area Model (LAM) through its DA system.

This work was supported by NWCSAF and AEMET expert team

Introduction of the ALADIN-Hungary system

Operational System Characteristics:

- Mesh Size: 8km
- Vertical Levels: 49
- 4 runs/day, +60h (max)
- 3 hourly coupling ECMWF LBC
- Data Assimilation Suite
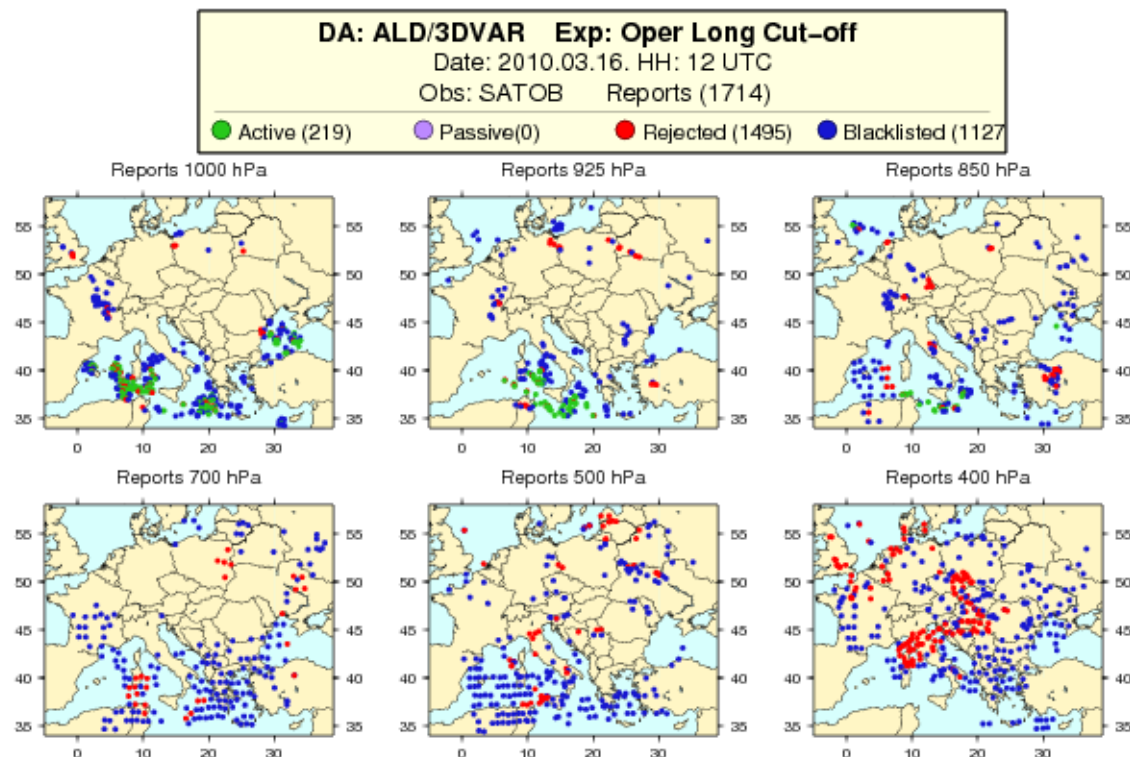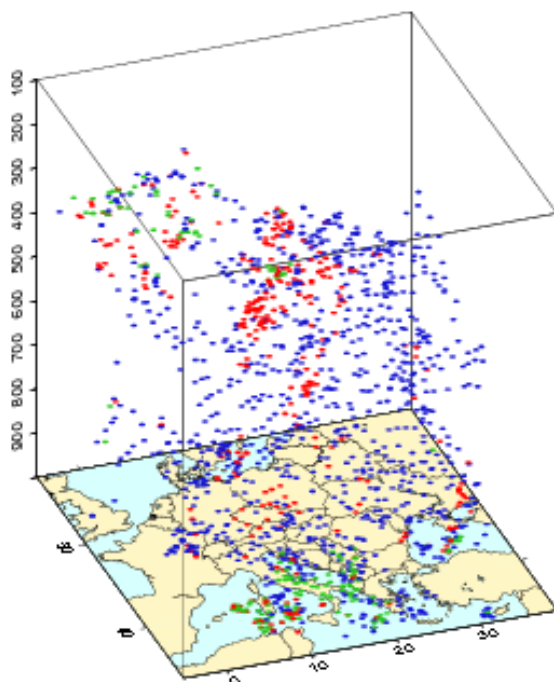
Data Assimilation(DA) inside ALADIN:

- 3DVAR(upper air), OI(surface)
- Conventional and Satellite Obs
- 6 hour cycling: 4 analyses/day
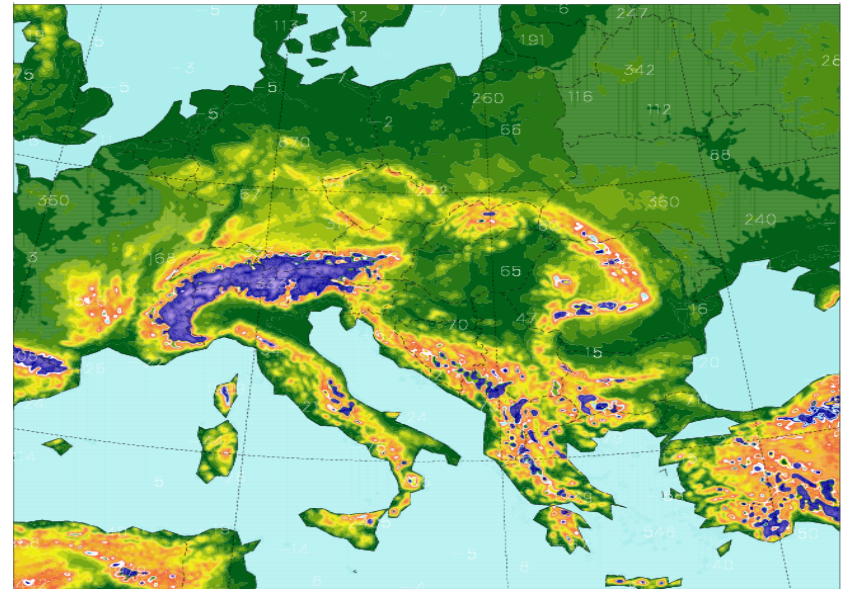
Type	Parameter (Channel)	Bias correction	Thinning
TEMP	U, V, T, Q, Z	Only T using ECMWF tables	No
SYNOP	Z	No	Temporal and spatial
PILOT (Europrof.)	U, V	No	Redundancy check against TEMP
DRIBU	Z	No	Temporal and spatial
AIREP	U, V, T	No	25 km horizontal
AMV	U, V	No-Use of quality flags	25 km horizontal
MSG/SEVIRI	2 wv channels	Variational	70 km horizontal
AMSU-A	5 to 10	Variational	80 km horizontal
AMSU-B, MHS	3, 4, 5	Variational	80 km horizontal

An operationally applied AMV in ALADIN DA

GEOWIND AMV
through EUMETCast

DA: ALD/3DVAR   Exp: Oper Long Cut–off
Date: 2010.03.16. HH: 12 UTC
Obs: SATOB   Reports (1714)

● Active (219)   ● Passive(0)   ● Rejected (1495)   ● Blacklisted (1127)

Reports 1000 hPa   Reports 925 hPa   Reports 850 hPa
Reports 700 hPa   Reports 500 hPa   Reports 400 hPa

Assimilation Time & Availability:
00UTC – IR3,WVCL1,WVCL2
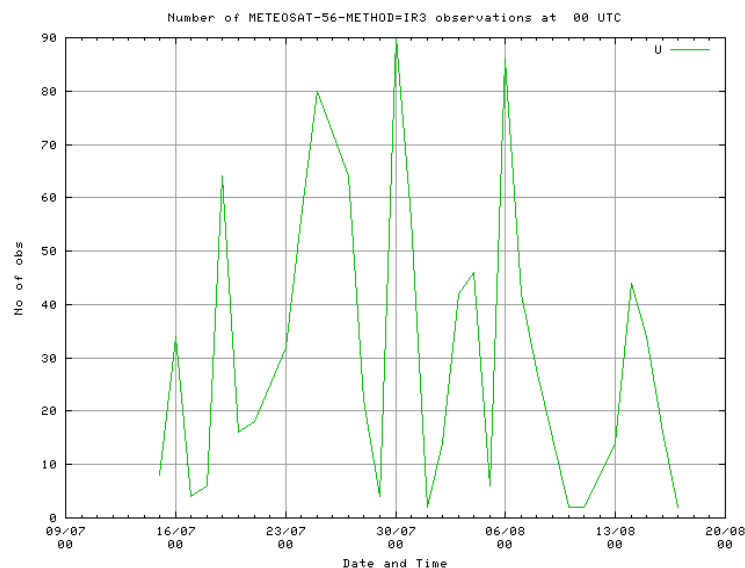06UTC – IR3,VIS2,VIS3,WVCL1,WVCL2
12UTC – IR3,VIS2,VIS3,WVCL1,WVCL2
18UTC – IR3,VIS3,WVCL1,WVCL2

Settings of the Impact Study

- A summer period was chosen with 'wet' and 'dry' period:
- 15.07.2011. – 20.08.2011. In Central and Eastern Europe the first
- two weeks were relatively convective and the rest of the period was
- more stable synoptically

- Forecasts for 00 and 12 UTC up to 48h
- (06;18 runs only for assimilation cycling)

- Experiments:
  - AMV1 – Run with HRW
  - AMVE – Oper config (GEOWIND)
  - AMVA – Run with both AMV
  - AMVN – Run without AMV (only other oper obs)

Number of Active AMV and Availability

- Active AMV if QI more than 85%

- No. GEOWIND AMV ~ No. HRW AMV (for one channel)

Number of METEOSAT-56-METHOD=IR3 observations at 00 UTC

HRW data sample at 00UTC(IR3)

Availability

GEOWIND AMV – retrieved from 5 ch.
00UTC – IR3,WVCL1,WVCL2
06UTC – IR3,VIS2,VIS3,WVCL1,WVCL2
12UTC – IR3,VIS2,VIS3,WVCL1,WVCL2
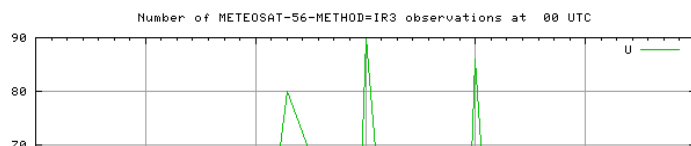18UTC – IR3,VIS3,WVCL1,WVCL2

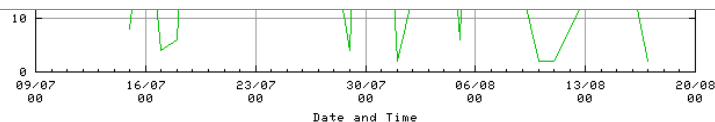HRW AMV – retrieved from 2 ch.
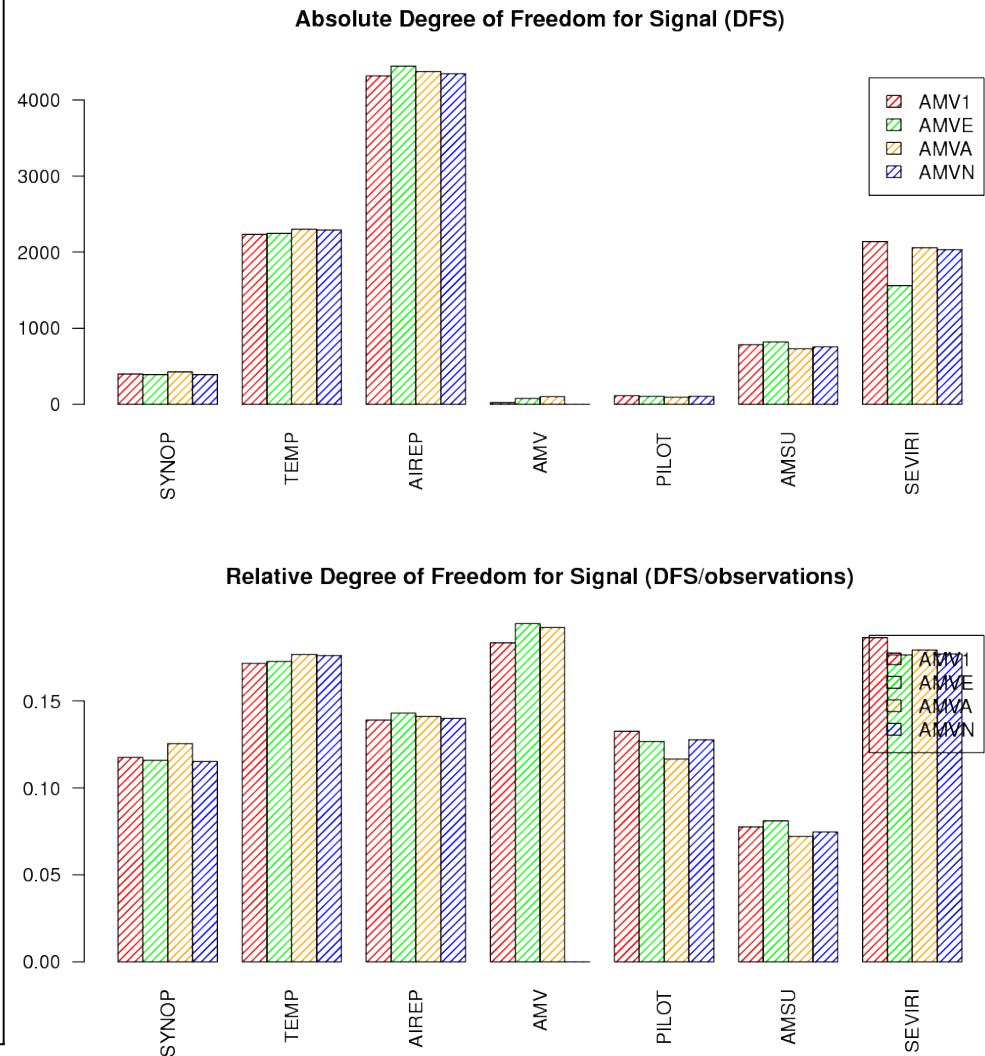00UTC – IR3
06UTC – VIS3
12UTC – VIS3
18UTC – VIS3

Number of Active AMV and Availability

- Active AMV if QI more than 85%

- No. GEOWIND AMV ~ No. HRW AMV (for one channel)

Number of METEOSAT-56-METHOD=IR3 observations at 00 UTC

The new version of HRW AMV contains much more amount of observations

HRW data sample at 00UTC(IR3)

Availability

GEOWIND AMV – retrieved from 5 ch.
00UTC – IR3,WVCL1,WVCL2
06UTC – IR3,VIS2,VIS3,WVCL1,WVCL2
12UTC – IR3,VIS2,VIS3,WVCL1,WVCL2
18UTC – IR3,VIS3,WVCL1,WVCL2

HRW AMV – retrieved from 2 ch.
00UTC – IR3
06UTC – VIS3
12UTC – VIS3
18UTC – VIS3

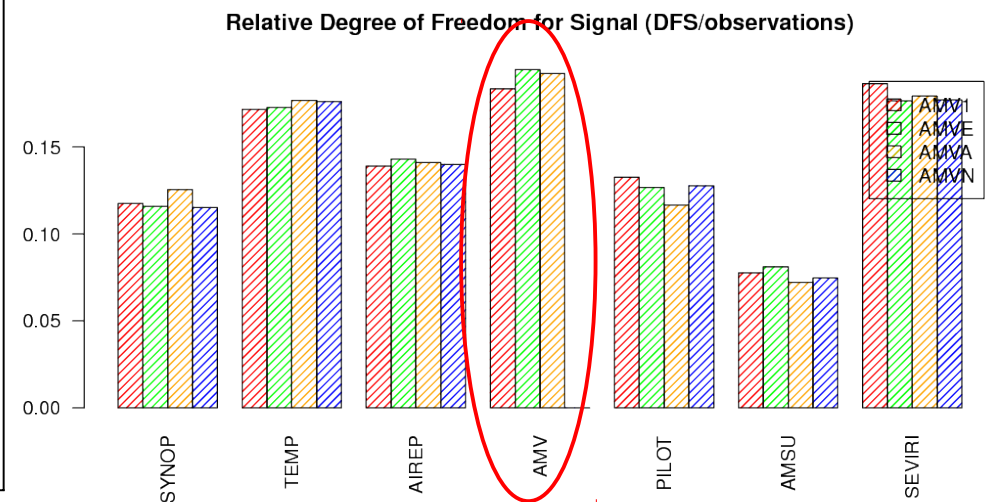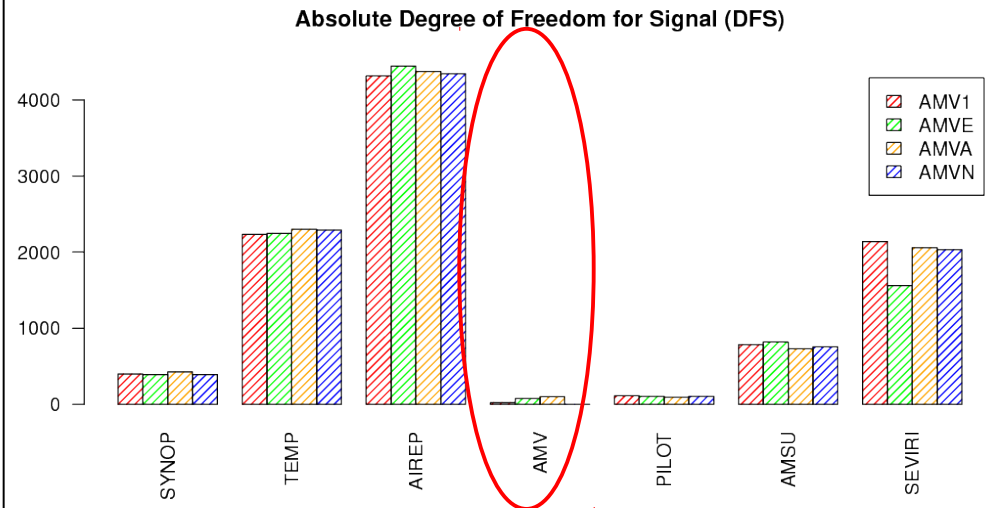**The Impact (on analysis and forecast)...**

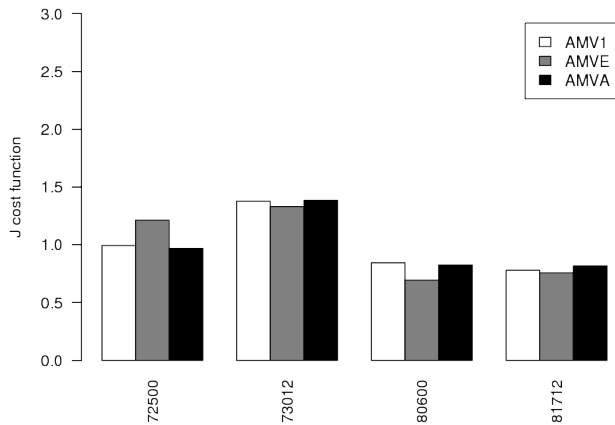# Analysis Impact

Degrees of Freedom for Signal (DFS)

- Absolute DFS of AMV data – small

- Relative DFS of AMV data – large

25.07.2011 (00UTC)
30.07.2011 (06 UTC)
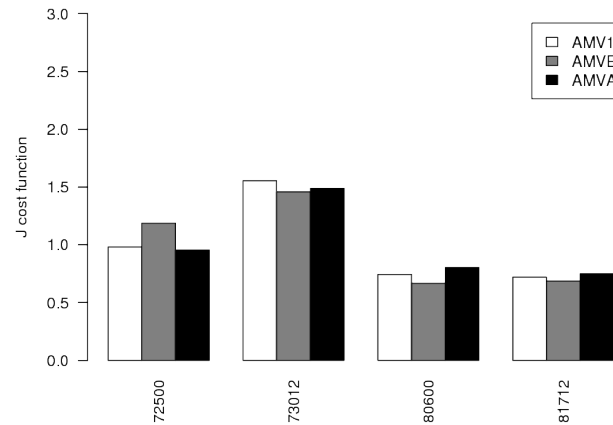08.08.2011 (12UTC)
16.08.2011 (18UTC)

Absolute Degree of Freedom for Signal (DFS)

Relative Degree of Freedom for Signal (DFS/observations)

Analysis Impact

Degrees of Freedom for Signal (DFS)

- Absolute DFS of AMV data – small

- Relative DFS of AMV data – large

25.07.2011 (00UTC)
30.07.2011 (06 UTC)
08.08.2011 (12UTC)
16.08.2011 (18UTC)

Absolute Degree of Freedom for Signal (DFS)

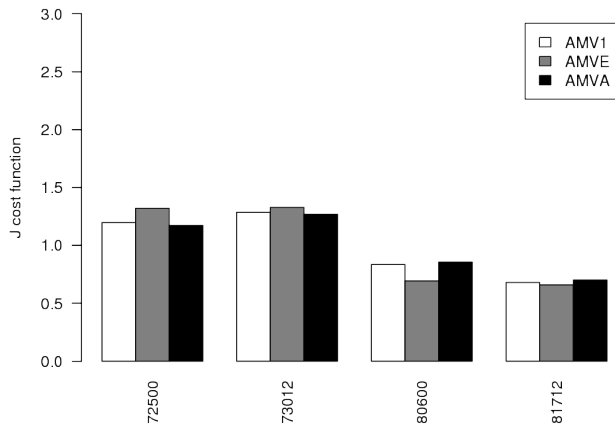Relative Degree of Freedom for Signal (DFS/observations)

Forecast Impact

Normalized variability of the cost function over different dates
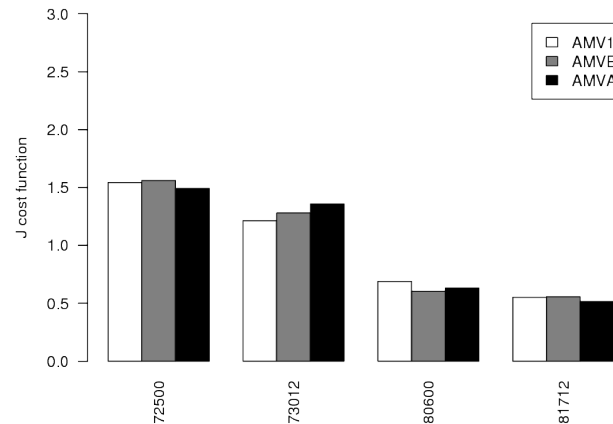**Forecast: 6 hours, Total Norm**

Normalized variability of the cost function over different dates
Forecast: 12 hours, Total Norm

Normalized variability of the cost function over different dates
Forecast: 24 hours, Total Norm

Normalised variability of the cost function over different dates
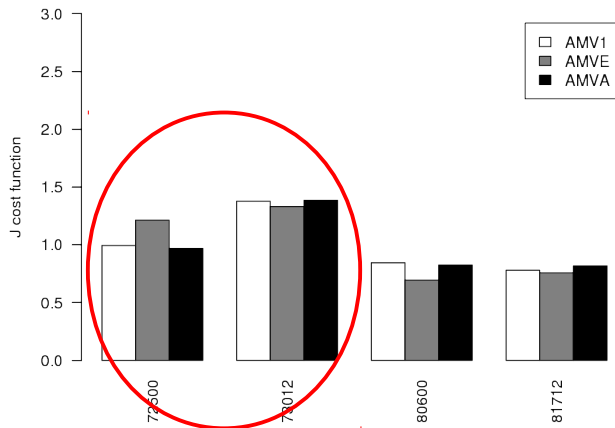**Forecast: 48 hours, Total Norm**

Moist Total Energy Norm (MTEN)
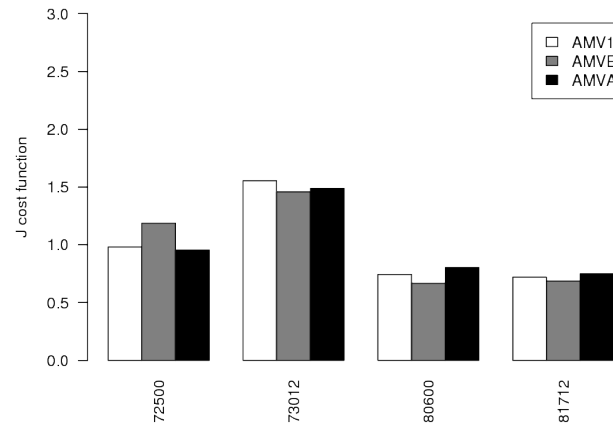
The runs used for the computation were:

25.07.2011 (00UTC) (72500);
30.07.2011 (12UTC) (73012);
06.08.2011 (00UTC) (80600);
17.08.2011 (12UTC) (81712)
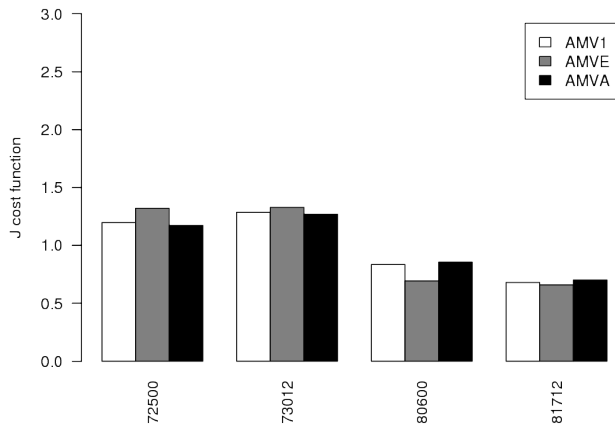
Forecast Impact

Normalized variability of the cost function over different dates
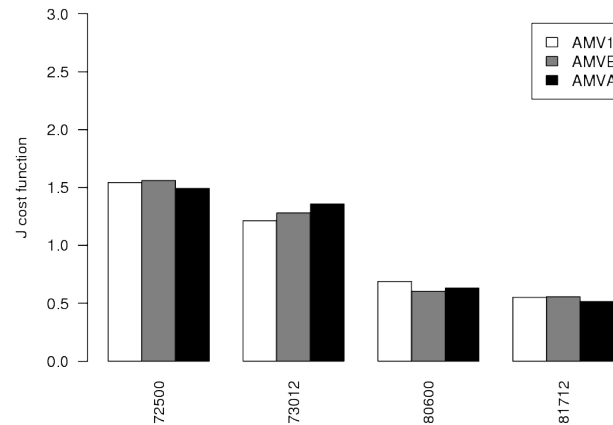Forecast: 6 hours, Total Norm

Normalized variability of the cost function over different dates
Forecast: 12 hours, Total Norm

Normalized variability of the cost function over different dates
Forecast: 24 hours, Total Norm

Normalised variability of the cost function over different dates
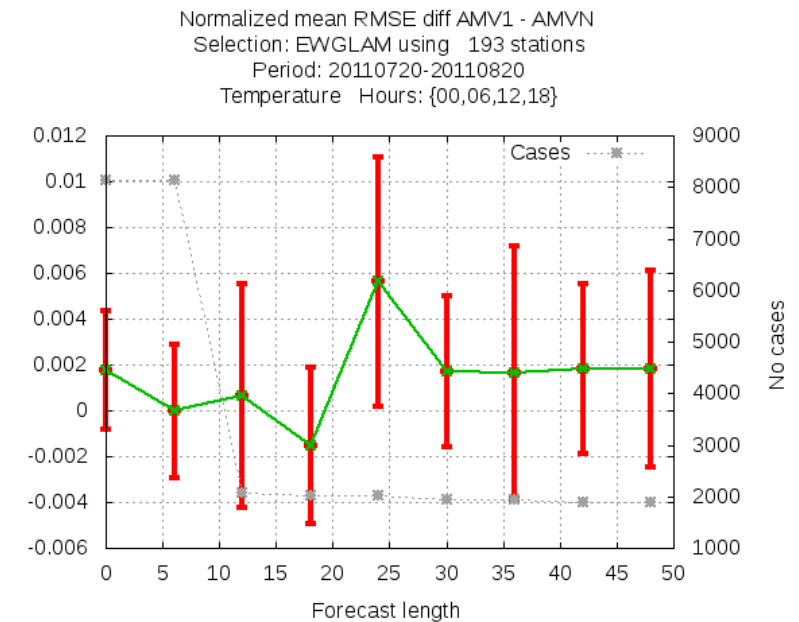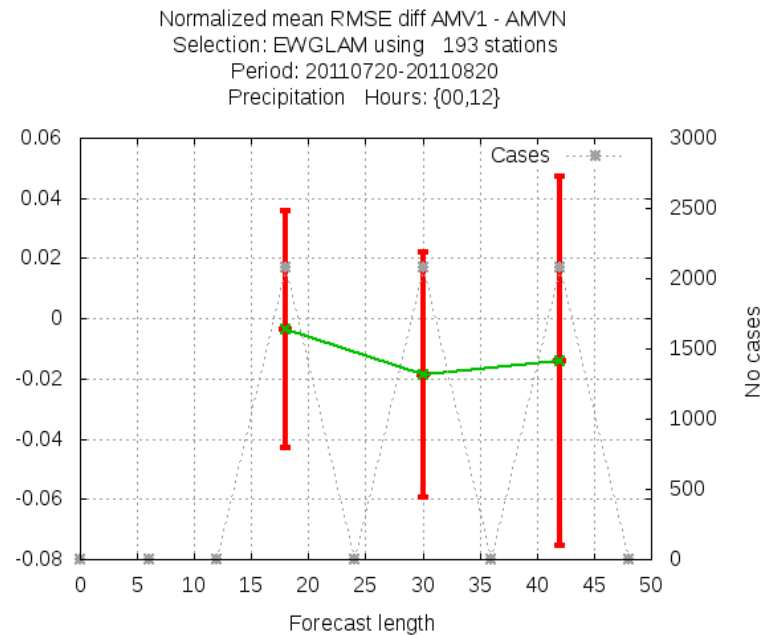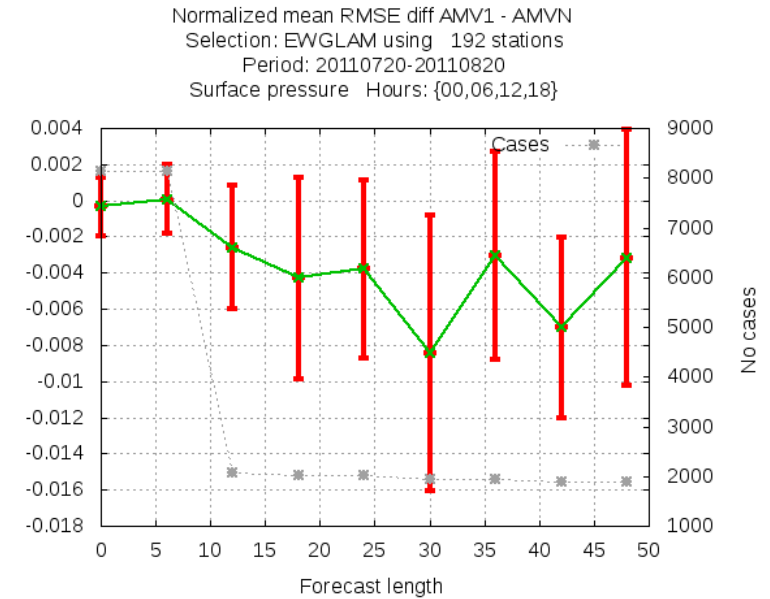Forecast: 48 hours, Total Norm

Moist Total Energy Norm (MTEN)

The runs used for the computation were:

25.07.2011 (00UTC) (72500);
30.07.2011 (12UTC) (73012);
06.08.2011 (00UTC) (80600);
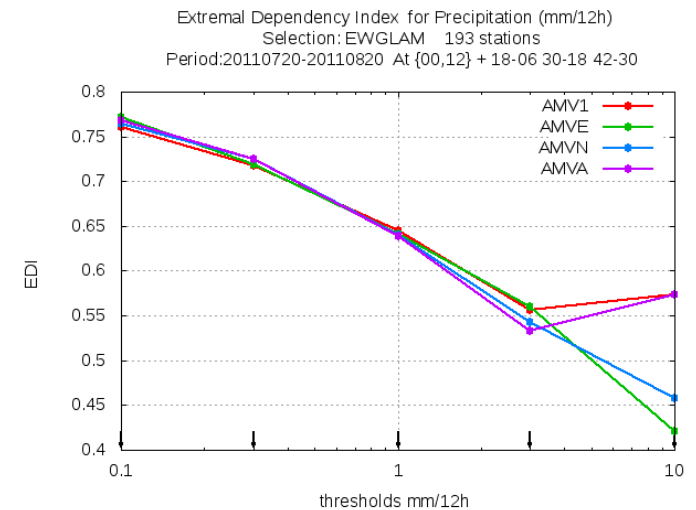17.08.2011 (12UTC) (81712)

Forecast Impact

- Objective Verification Scores:

  Normalized RMSE differences for AMV1-AMVN

Normalized mean RMSE diff AMV1 - AMVN
Selection: EWGLAM using 192 stations
Period: 20110720-20110820
Surface pressure Hours: {00,06,12,18}

Normalized mean RMSE diff AMV1 - AMVN
Selection: EWGLAM using 193 stations
Period: 20110720-20110820
Precipitation Hours: {00,12}

Normalized mean RMSE diff AMV1 - AMVN
Selection: EWGLAM using 193 stations
Period: 20110720-20110820
Temperature Hours: {00,06,12,18}

Forecast Impact

- Objective Verification Scores:

- Precipitation

    RMSE-BIAS, STDV
    SEDS, EDI

Symmetric Extreme Dependency Score for Precipitation (mm/12h)
Selection: EWGLAM 193 stations
Period:20110720-20110820 At {00,12} + 18-06 30-18 42-30

Selection: EWGLAM using 193 stations
Period: 20110720-20110820
Precipitation Hours: {00,12}

Selection: EWGLAM using 193 stations
Period: 20110720-20110820
Precipitation Hours: {00,12}

Extremal Dependency Index for Precipitation (mm/12h)
Selection: EWGLAM 193 stations
Period:20110720-20110820 At {00,12} + 18-06 30-18 42-30

Forecast Impact

AMVE	AMV1	AMVN	Interpol. OBS

Forecast Impact

AMVE	AMV1	AMVN	Interpol. OBS

Conclusion

Due to a strong data quality check, only few AMV data were kept in the analysis system. Also, NWCSAF products comprise 2 inversion technique versus 5 available in GEOWIND data.

Relative contribution of the HRW is considerable in DFS.

The Objective verification scores showed that the impact is small over the whole domain but notable over convective regions.

Thanks & Questions

For Hungarian Satellite Group
For AEMet Expert Team
For Your Attention....