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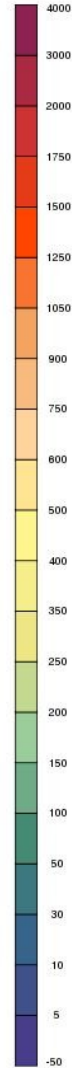
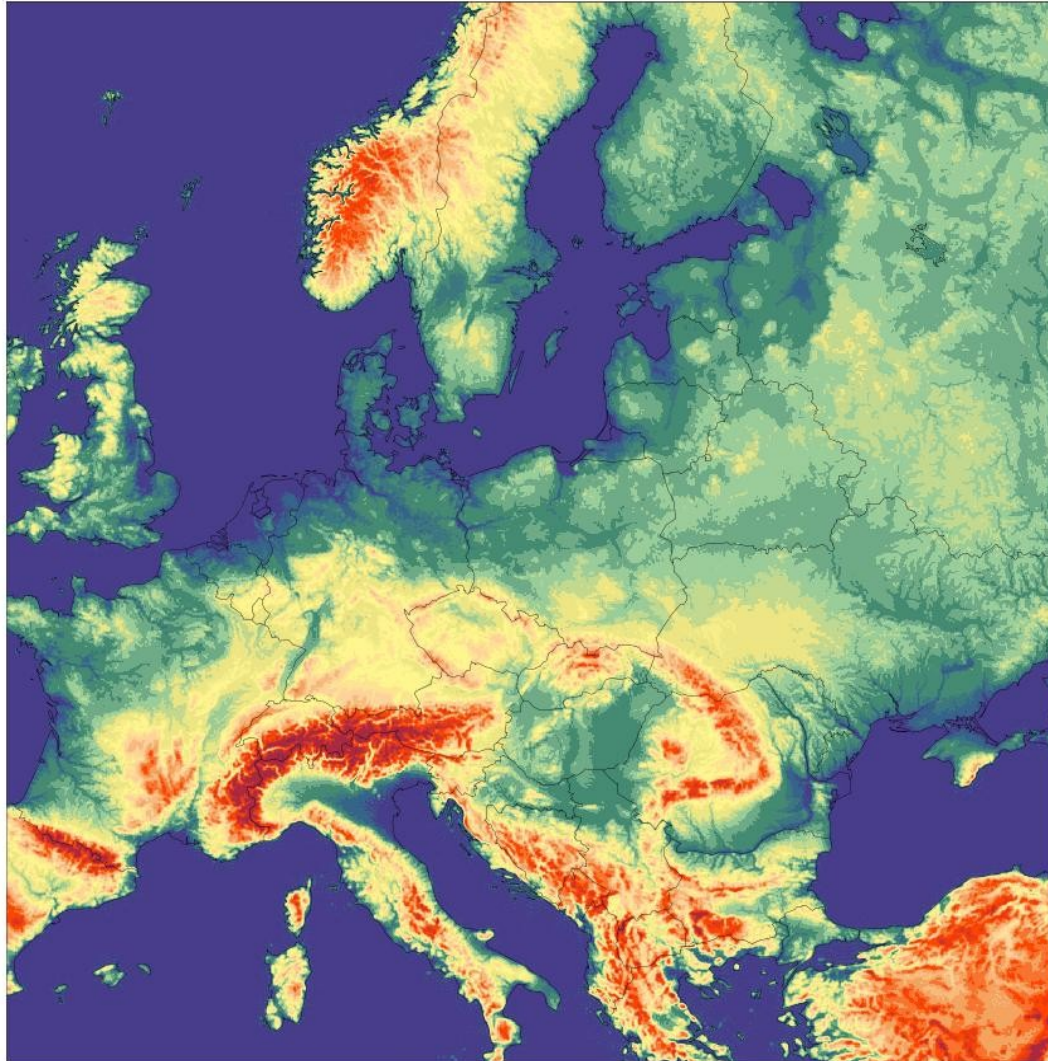
ALARO experience in Poland

Bogdan Bochenek
12.09.2016 Brussels



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SURFGEOPOTENTIEL
1/1/15 z0:0 Uninitialized



ALARO-1

789x789x60

4 km

~160 s

16 coupling zone

NFPBZONL=16,

NFPBZONG=16,

3h coupling with

ARPEGE

Cy40t1bf5 + ...

IO server

00/06/12/18 UTC

66/66/66/60 hours



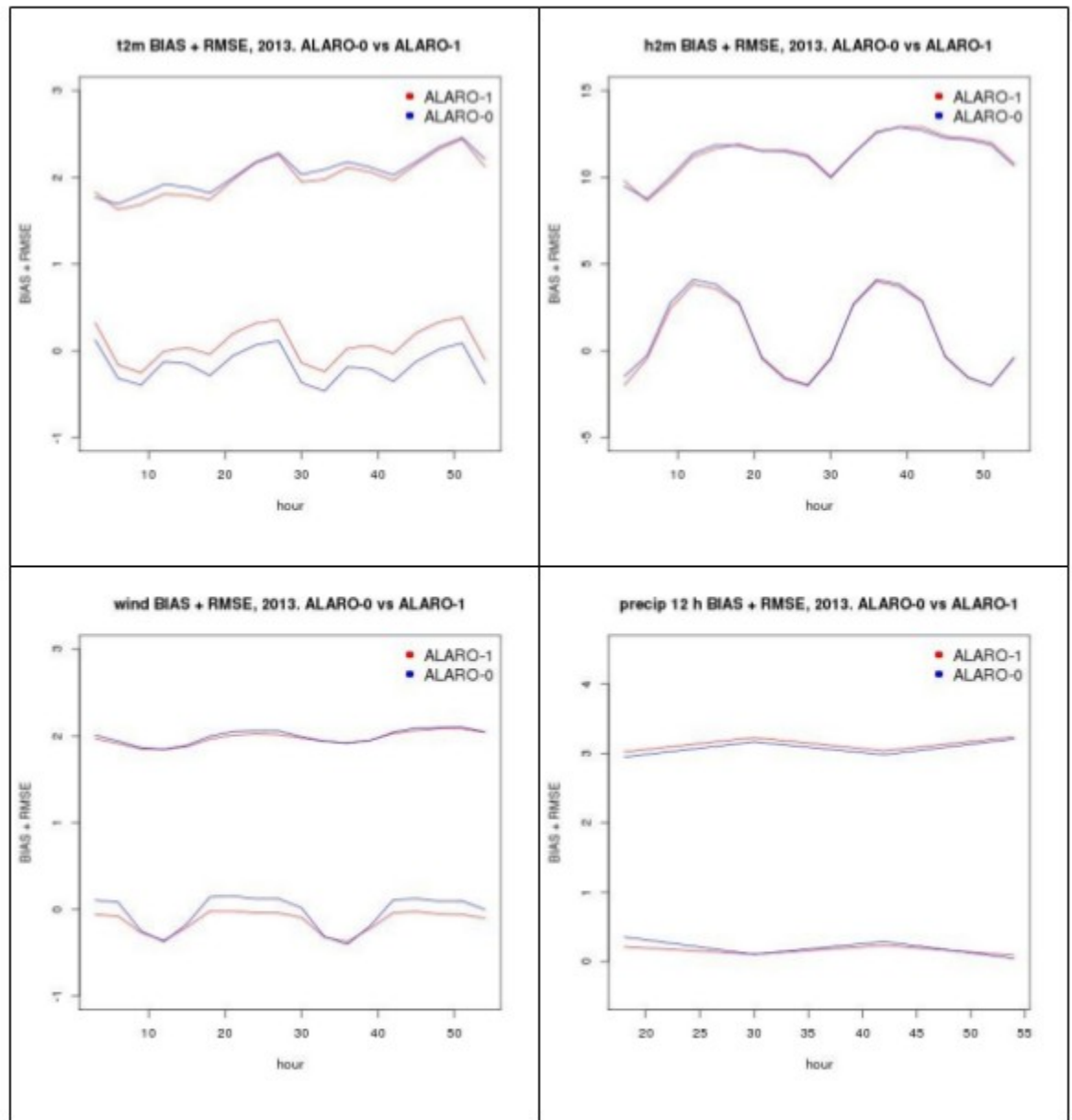
16/04/2014 ALARO-0 CY38T1 7.5 km

31/03/2015 ALARO-1 CY38T1 7.5 km

22/09/2015 ALARO-1 CY40T1 4 km



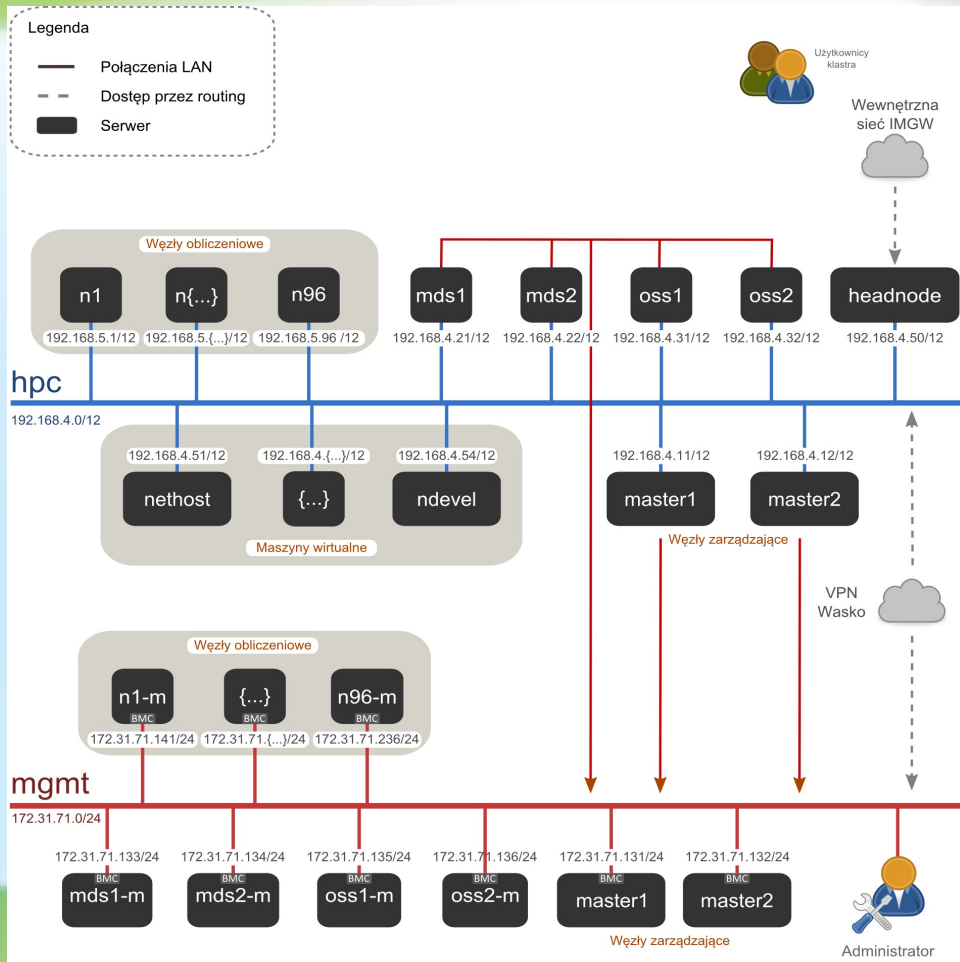
ALARO-0 vs ALARO-1 Verification for 2013 60 synop stations



BIAS and RMSE for cls temperature, cls humidity, cls wind speed and surface precipitation (12 h cumulations) for all synoptic stations, for whole 2013.



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EUROS cluster for ALADIN in Poland:

96 nodes

1 node = 2 Intel(R) Xeon(R) CPU E5-2690 132 G RAM

1552 cores

LINPACK test 31 Tflops

Lustre file system 65 T

Scientific Linux



CACHE memory problem
(clearcache/flushcache functions)

Coupling Zone

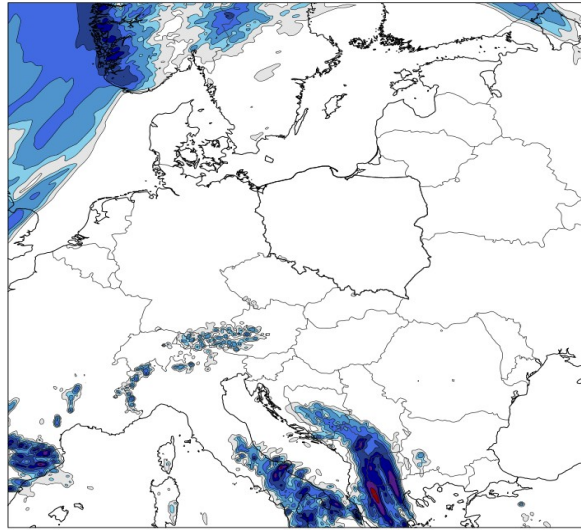
Optimization (R.E.Khatib 41 → 40)

Different compilers/OMP (intel 13/16 open-
mpi 1.6/1.8 intel-mpi)



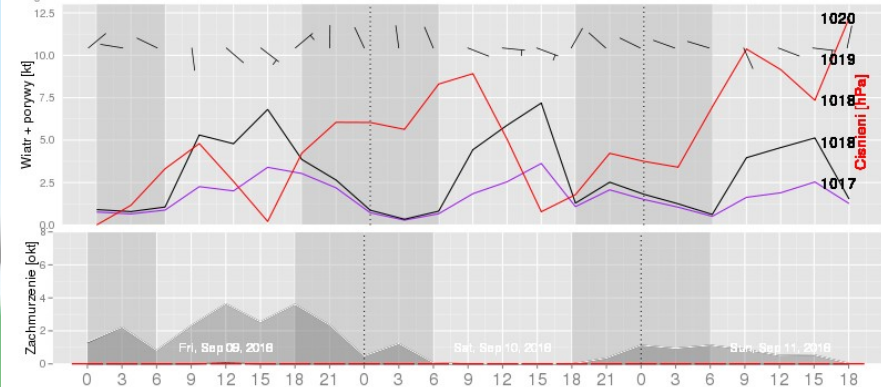
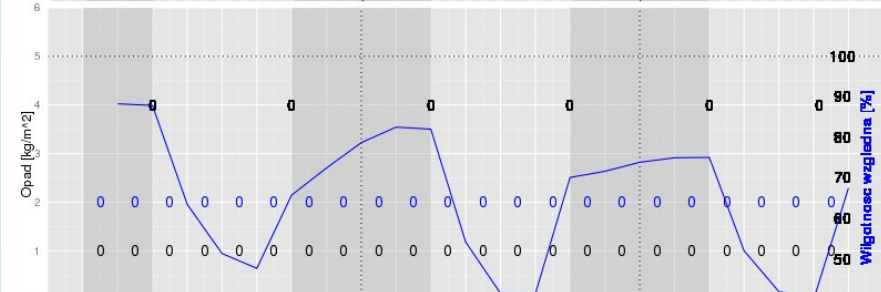
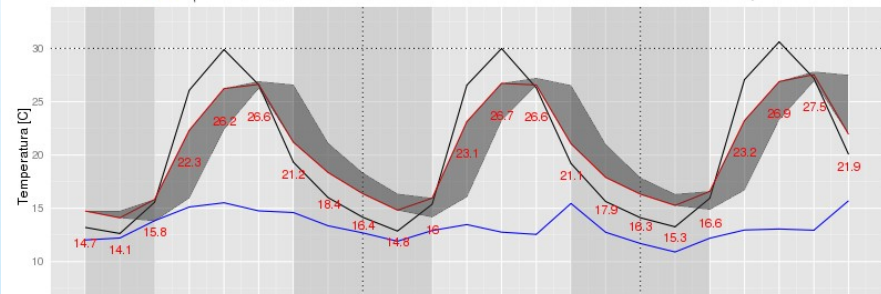
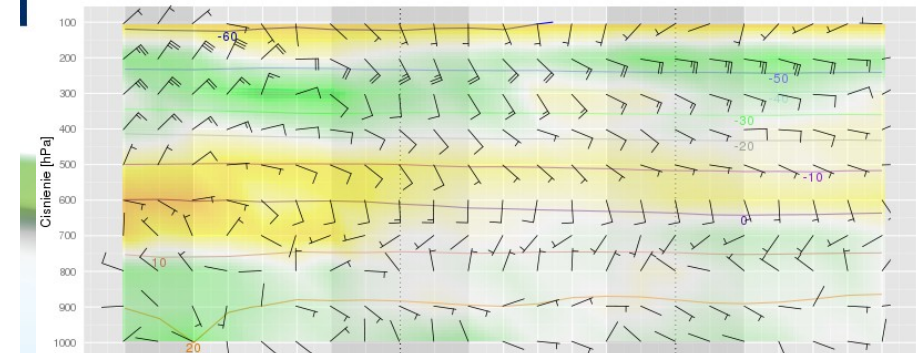
prognoza wazna na / forecast valid for
Saturday 10 September 2016 06:00 UTC

opad calkowity 24h [mm] /
total precipitation 24h [mm]



baza / base : 9 September 2016 00:00 UTC

Meteogram dla stacji : 12566 - Krakow. Baza Fri, Sep 09, 2016 00 UTC (00 - 66)
Wysokosc wezla nad poziomem morza: 242.6



Pole

- T2m
- H2m
- MSLP
- Pokaz izolnie na mapie

Przebieg

- 00
- 06
- 12
- 18

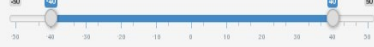
Model

- AROME
- ALARO

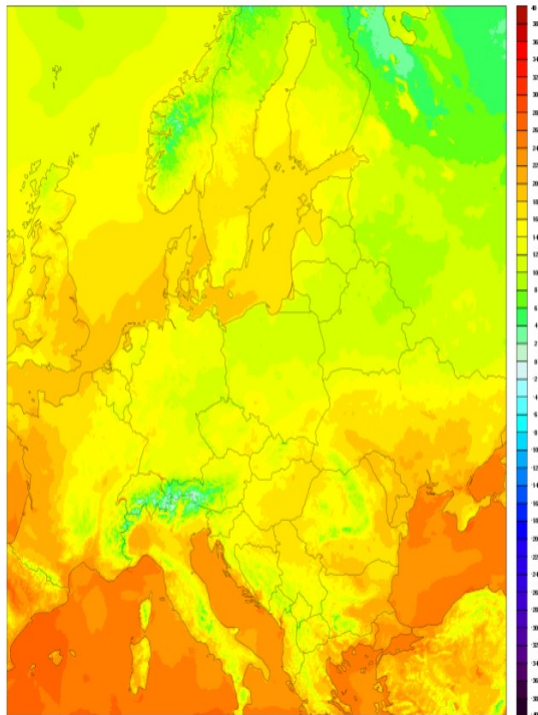
Godzina



Zakres wartosci:



CLSTEMPERATURE
2016/9/7 20:0 Initialized

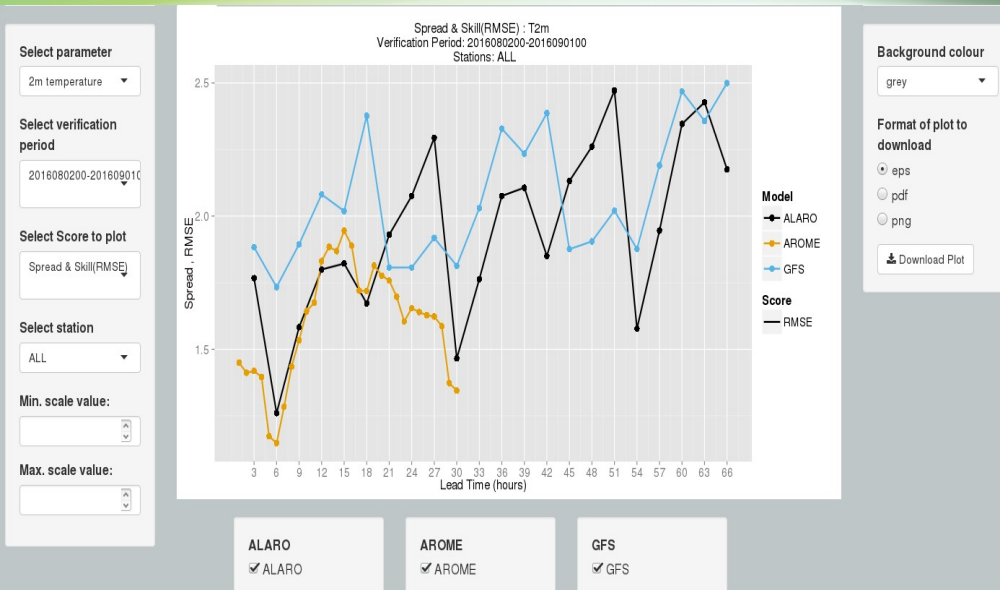




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Verification:



Sprawdzalność modeli numerycznych

2016 | sierpień | RAZEM | RAZEM | K2_TMAX | Pokaż | Info

OKRES	TYP	MIASTO	N	ALARO	AROME	COSM007	COSM014	COSM028	GFS	SYNOPTYK
2016-08	K2_TMAX	Białystok	30	90.0%	93.3%	46.7%	60.0%	73.3%	93.3%	100.0%
2016-08	K2_TMAX	Gdańsk	30	96.7%	93.3%	46.7%	66.7%	53.3%	60.0%	83.3%
2016-08	K2_TMAX	Kraków	30	93.3%	90.0%	53.3%	83.3%	46.7%	90.0%	90.0%
2016-08	K2_TMAX	Poznań	30	96.7%	93.3%	60.0%	66.7%	90.0%	90.0%	96.7%
2016-08	K2_TMAX	Szczecin	30	96.7%	76.7%	50.0%	53.3%	76.7%	83.3%	86.7%
2016-08	K2_TMAX	Warszawa	30	90.0%	86.7%	26.7%	76.7%	26.7%	96.7%	96.7%
2016-08	K2_TMAX	Wrocław	30	90.0%	93.3%	46.7%	33.3%	40.0%	56.7%	100.0%
2016-08	K2_TMAX	RAZEM	210	93.3%	89.5%	47.1%	62.9%	58.1%	81.4%	93.3%

Model ALADIN Polska

Weryfikacja prognozy 12-godzinnej sumy opadu (najbliższy węzeł)
Okres od 31 07 2016 do 30 08 2016 (godzina bazowa 00.00 UTC)
Wszystkie stacje

Akumulacja opadu pomiędzy 6 a 18 godzina prognozy

		Opad obserwowany (mm/12h)								razem
		brak	< 2	2-5	5-10	10-20	20-40	> 40		
Opad prognozowany (mm/12h)	brak	1003	76	24	7	2	3	1	1116	
	< 2	153	79	25	15	4	2	0	278	
	2-5	29	38	23	15	8	0	1	114	
	5-10	13	20	18	21	11	0	0	83	
	10-20	4	7	8	19	19	6	0	63	
20-40	1	0	2	4	5	3	1	16		
> 40	0	0	0	0	0	0	0	0		
razem		1203	220	100	81	49	14	3	1870	

Statystyki (wg klasy):
POD 0.83 0.36 0.23 0.26 0.39 0.21 0.00
FAR 0.10 0.72 0.80 0.75 0.70 0.81 -nan
bias 0.93 1.26 1.14 1.02 1.29 1.14 0.00

Ułamek poprawnych prognoz 0.687
Heidke skill score = 0.361
Hanssen & Kuipers score = 0.356

Akumulacja opadu pomiędzy 18 a 30 godzina prognozy

		Opad obserwowany (mm/12h)								razem
		brak	< 2	2-5	5-10	10-20	20-40	> 40		
Opad prognozowany (mm/12h)	brak	1131	112	15	10	1	0	0	1269	
	< 2	75	64	42	18	7	1	1	208	
	2-5	16	20	22	15	11	1	1	86	
	5-10	9	11	16	11	7	2	0	56	
	10-20	1	5	5	15	8	4	0	38	
20-40	0	0	1	5	4	3	0	13		
> 40	0	0	0	0	0	0	0	0		
razem		1232	212	101	74	38	11	2	1870	

Statystyki (wg klasy):
POD 0.92 0.30 0.22 0.15 0.21 0.27 0.00
FAR 0.11 0.69 0.74 0.60 0.79 0.77 -nan
bias 1.03 0.95 0.85 0.76 1.00 1.18 0.00

Ułamek poprawnych prognoz 0.742
Heidke skill score = 0.353
Hanssen & Kuipers score = 0.370

Akumulacja opadu pomiędzy 30 a 42 godzina prognozy

		Opad obserwowany (mm/12h)								razem
		brak	< 2	2-5	5-10	10-20	20-40	> 40		
Opad prognozowany (mm/12h)	brak	1059	71	23	11	3	4	2	1173	
	< 2	141	76	25	17	11	1	0	281	
	2-5	19	32	18	13	9	0	0	91	
	5-10	10	17	17	16	8	4	1	73	
	10-20	5	8	3	12	11	1	0	40	
20-40	0	1	1	5	4	2	0	13		
> 40	0	0	0	0	0	0	0	0		
razem		1234	205	97	74	48	12	3	1871	

Statystyki (wg klasy):
POD 0.86 0.37 0.19 0.22 0.24 0.17 0.00
FAR 0.10 0.73 0.80 0.76 0.72 0.85 -nan
bias 0.95 1.37 0.94 0.99 0.87 1.08 0.00

Ułamek poprawnych prognoz 0.707
Heidke skill score = 0.357
Hanssen & Kuipers score = 0.375

Akumulacja opadu pomiędzy 42 a 54 godzina prognozy

		Opad obserwowany (mm/12h)								razem
		brak	< 2	2-5	5-10	10-20	20-40	> 40		
Opad prognozowany (mm/12h)	brak	1164	123	34	11	5	1	0	1338	
	< 2	90	60	25	11	1	0	0	188	
	2-5	14	13	13	6	6	0	0	52	
	5-10	8	7	11	16	7	0	0	49	
	10-20	4	3	7	11	10	3	0	38	
20-40	0	0	1	2	1	2	0	6		
> 40	0	0	0	0	0	0	0	0		
razem		1280	205	97	57	36	6	0	1871	

Statystyki (wg klasy):
POD 0.91 0.29 0.14 0.28 0.33 0.33 -nan
FAR 0.13 0.65 0.75 0.67 0.74 0.67 -nan
bias 1.05 0.91 0.57 0.66 1.27 1.00 -nan

Ułamek poprawnych prognoz 0.757
Heidke skill score = 0.343
Hanssen & Kuipers score = 0.322



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INTERESTING CASES



“Halny” 23-25 XII 2013



Wind speed over 170 km/h

100 000 m³ fallen trees

70 people in hospitals
118 buildings damaged

economic damage over 1 million €

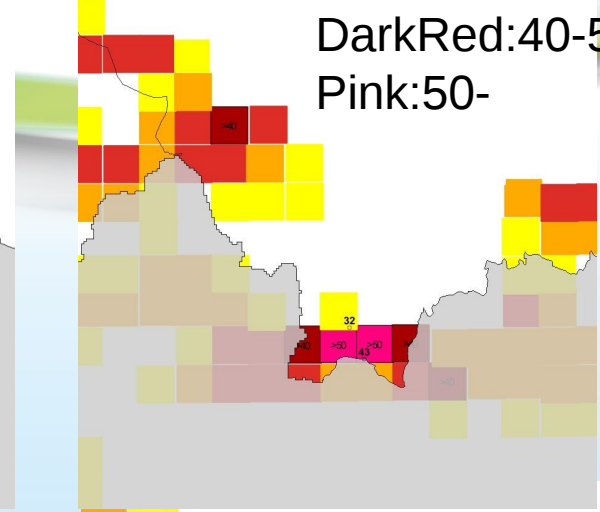
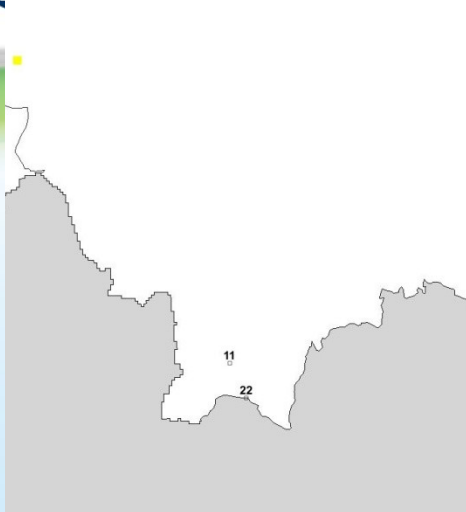
15 000 houses without electricity



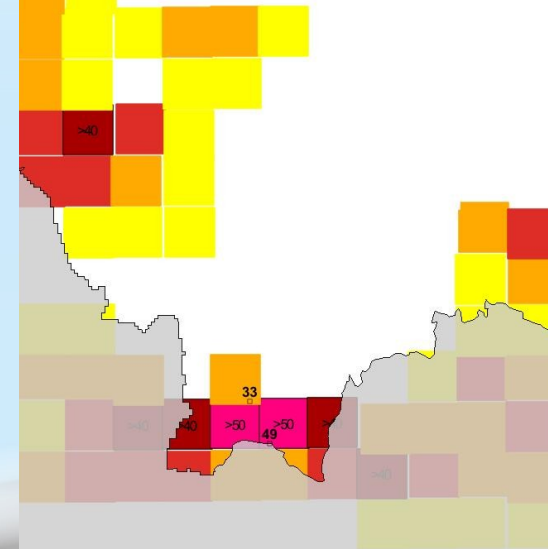
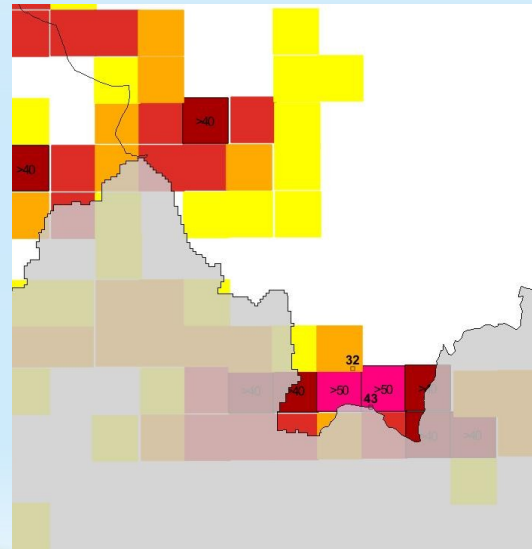
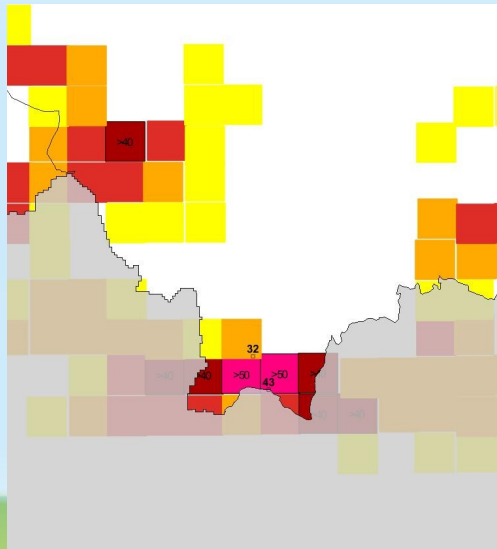
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Yellow: 20-25 [m/s]
Orange: 25-32
Red: 32-40
DarkRed: 40-50
Pink: 50-

2013-12-23



2013-12-24



06-18h

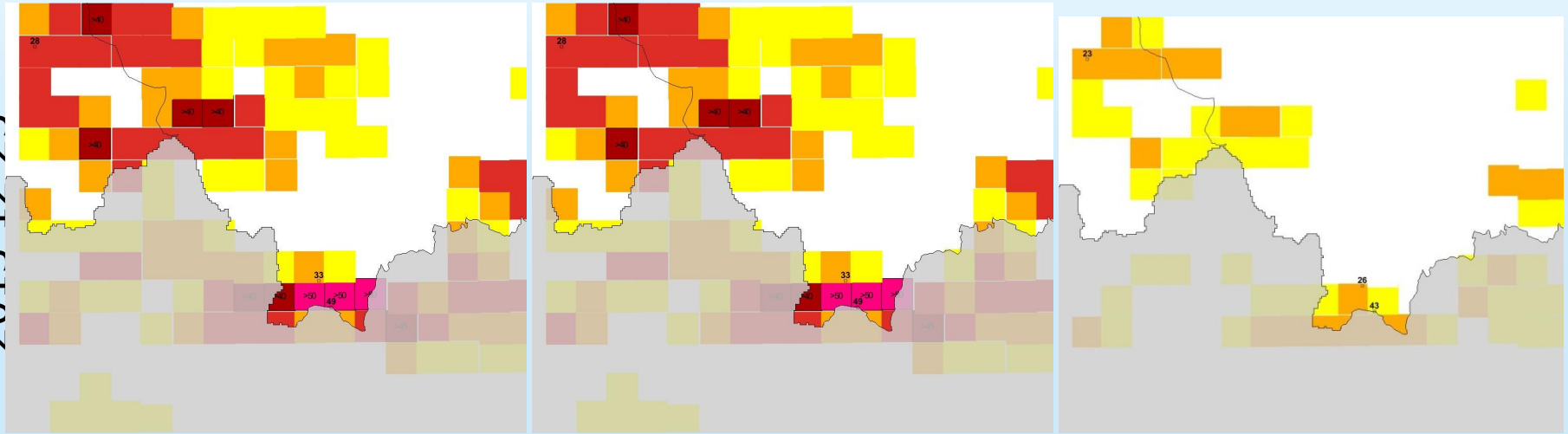
06-30h

30-54h



Yellow:20-25 [m/s]
Orange:25-32
Red:32-40
DarkRed:40-50
Pink:50-

2013-12-25



06-18h

06-30h

30-54h



SLAF EXPERIMENT ALARO-1

mbr111 – not perturbed member, initial and boundary condition from most recent run.

Formula for perturbation of mbr211 – 6 hours delay:

$$\text{Perturbed_field} = \text{mbr111_field} + 1 * (\text{mbr111_field} - \text{mbr211_field})$$

Formula for perturbation of mbr311 – 12 hours delay:

$$\text{Perturbed_field} = \text{mbr111_field} + 0.75 * (\text{mbr111_field} - \text{mbr311_field})$$

Formula for perturbation of mbr411 – 18 hours delay:

$$\text{Perturbed_field} = \text{mbr111_field} + 0.5 * (\text{mbr111_field} - \text{mbr411_field})$$

Formula for perturbation of mbr511 – 18 hours delay:

$$\text{Perturbed_field} = \text{mbr111_field} + 0.25 * (\text{mbr111_field} - \text{mbr511_field})$$

Formula for perturbation of mbr212 – 6 hours delay:

$$\text{Perturbed_field} = \text{mbr111_field} - 1 * (\text{mbr111_field} - \text{mbr212_field})$$

Formula for perturbation of mbr311 – 12 hours delay:

$$\text{Perturbed_field} = \text{mbr111_field} - 0.75 * (\text{mbr111_field} - \text{mbr312_field})$$

Formula for perturbation of mbr411 – 18 hours delay:

$$\text{Perturbed_field} = \text{mbr111_field} - 0.5 * (\text{mbr111_field} - \text{mbr412_field})$$

Formula for perturbation of mbr511 – 18 hours delay:

$$\text{Perturbed_field} = \text{mbr111_field} - 0.25 * (\text{mbr111_field} - \text{mbr512_field})$$



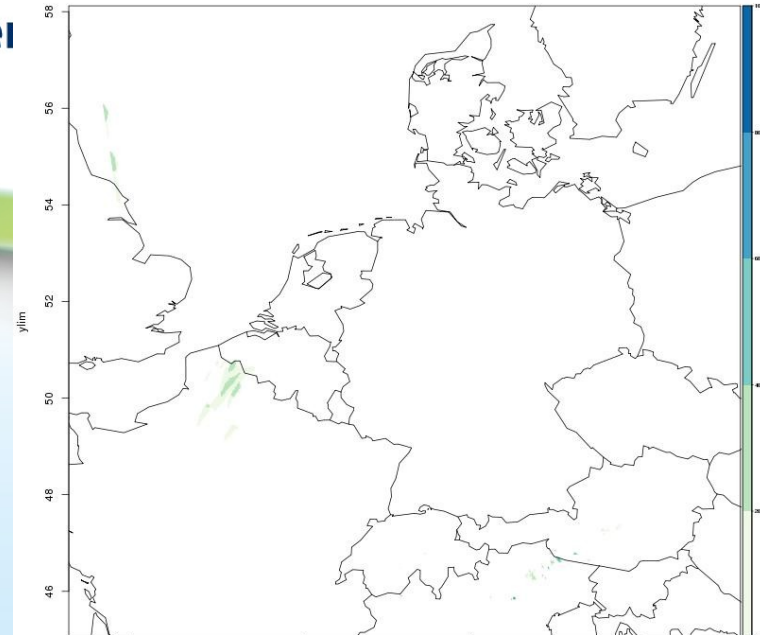
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RADAR 20140607
prec. 15h - 18h

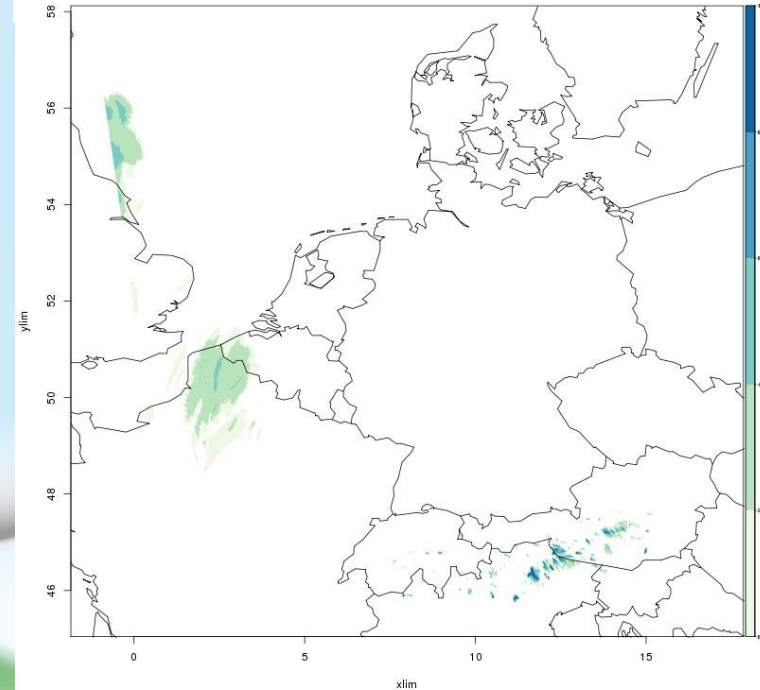


Pentecost storm

Prob 3h precipitation over 30 kg/m²
Start: 20140607 Valid: r12 + 06h



Prob 3h precipitation over 5 kg/m²
Start: 20140607 Valid: r12 + 06h





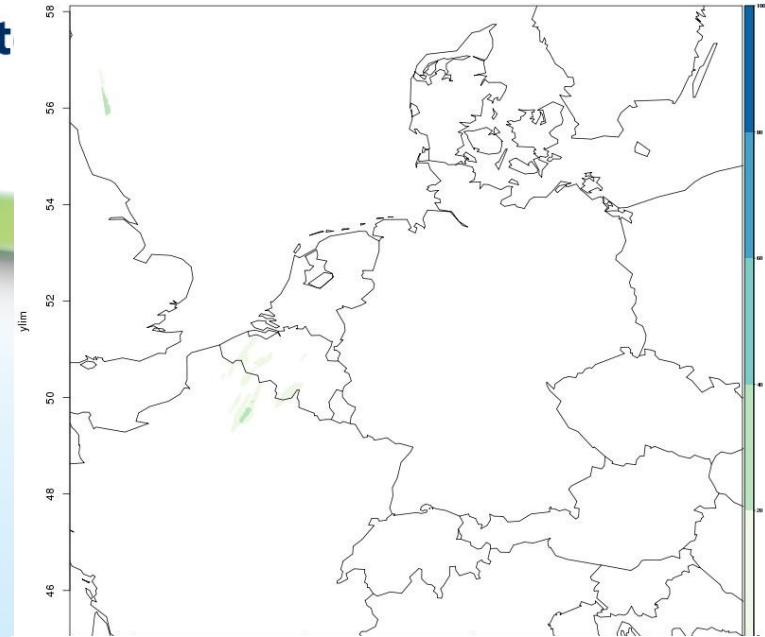
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RADAR 20140607
prec. 18h - 21h

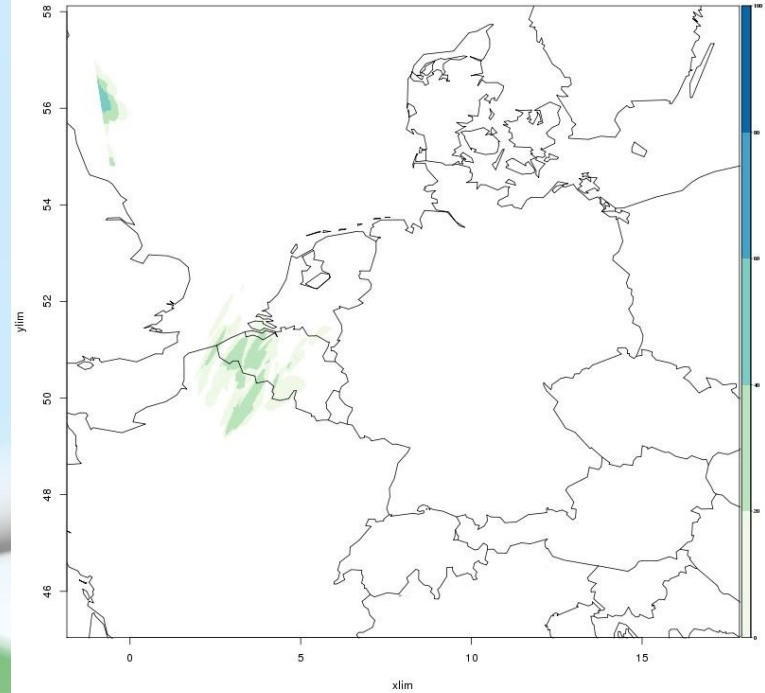


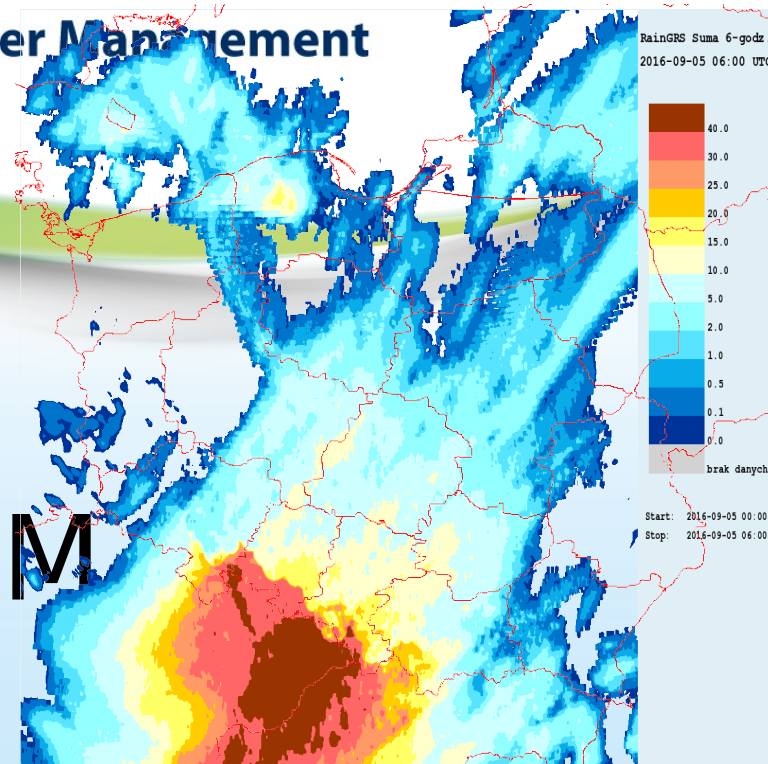
Pentecost storm

Prob 3h precipitation over 30 kg/m²
Start: 20140607 Valid: r12 + 09h



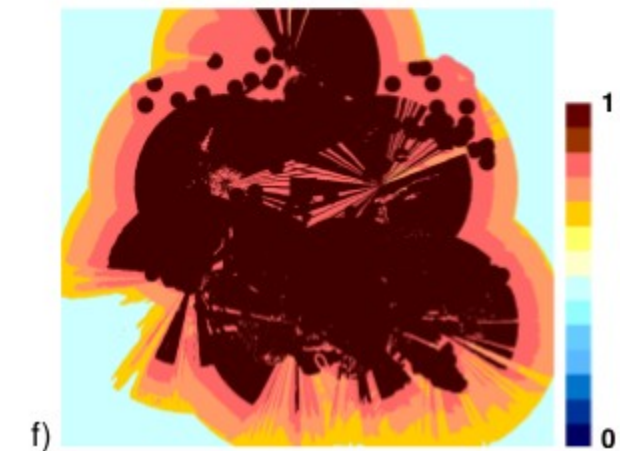
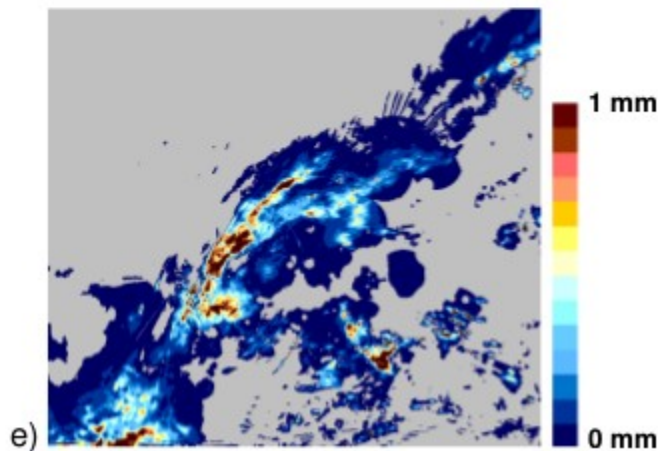
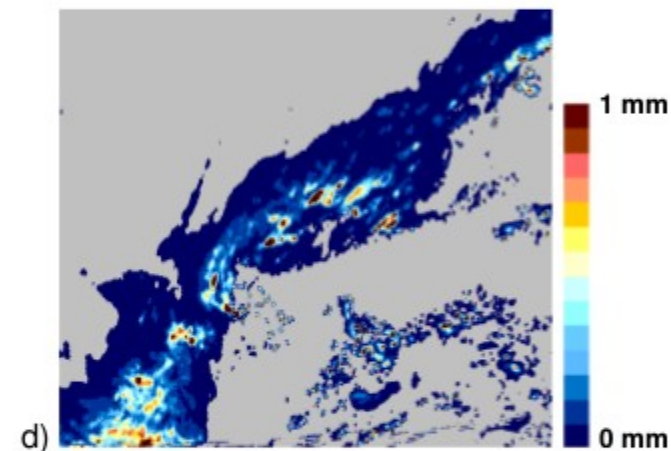
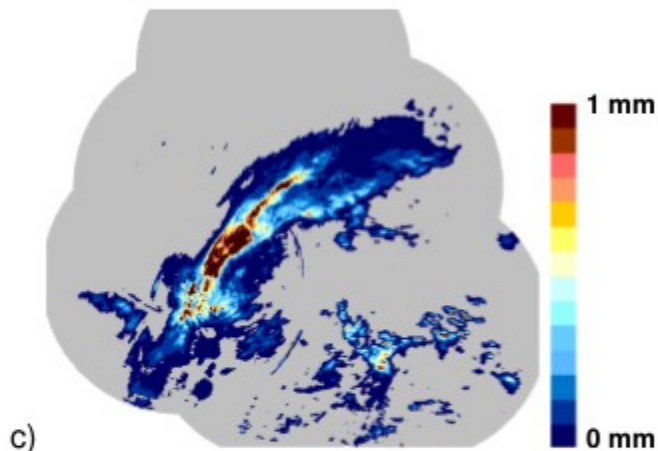
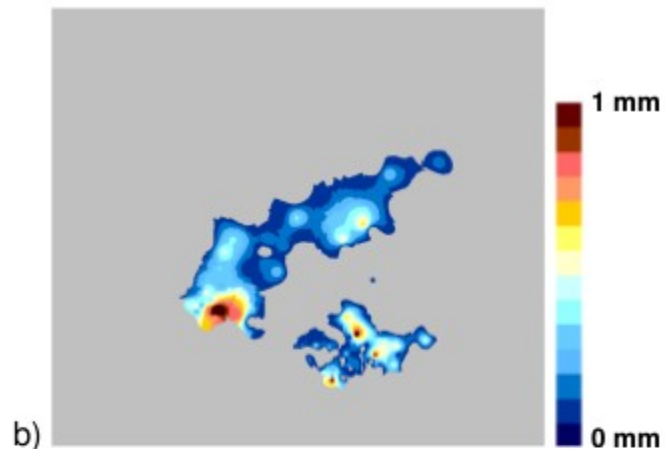
Prob 3h precipitation over 10 kg/m²
Start: 20140607 Valid: r12 + 09h





GRS RAIN SYSTEM

Collect data surface measurements, radar and satellite (NWC-SAF) data to produce estimate values of rain on surface.

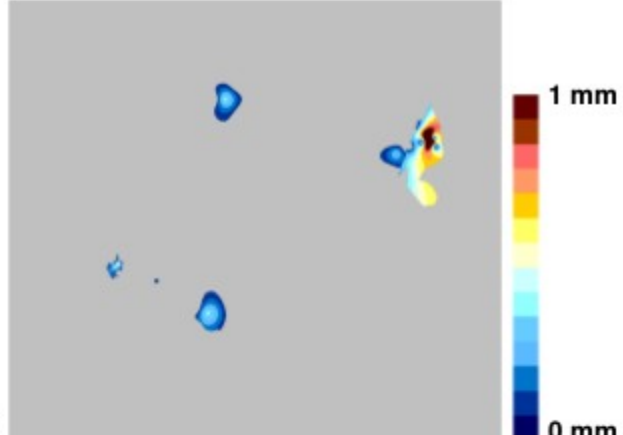




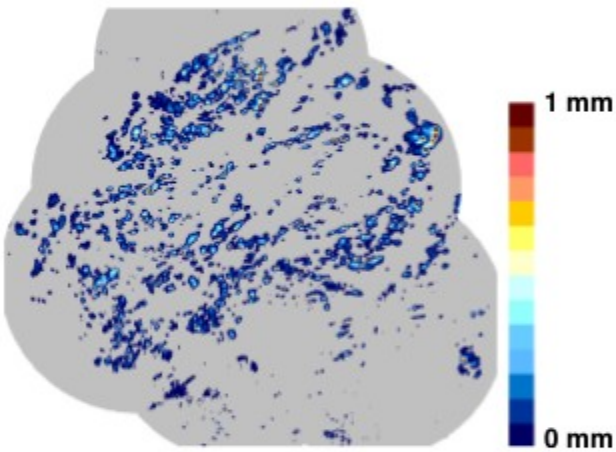
a)



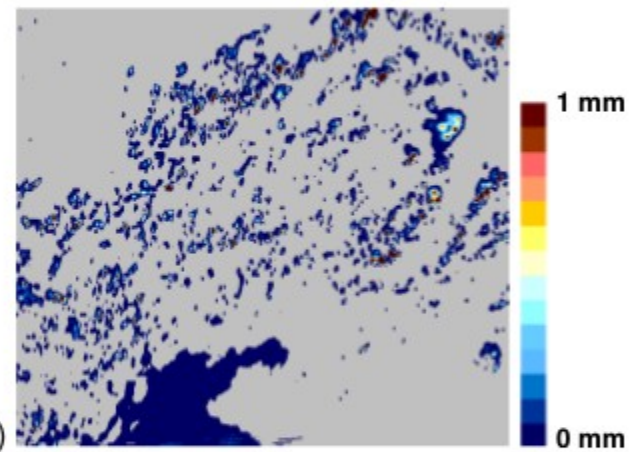
b)



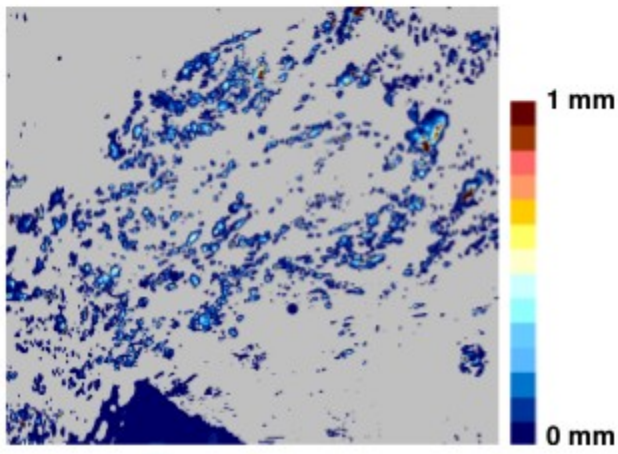
c)



d)



e)

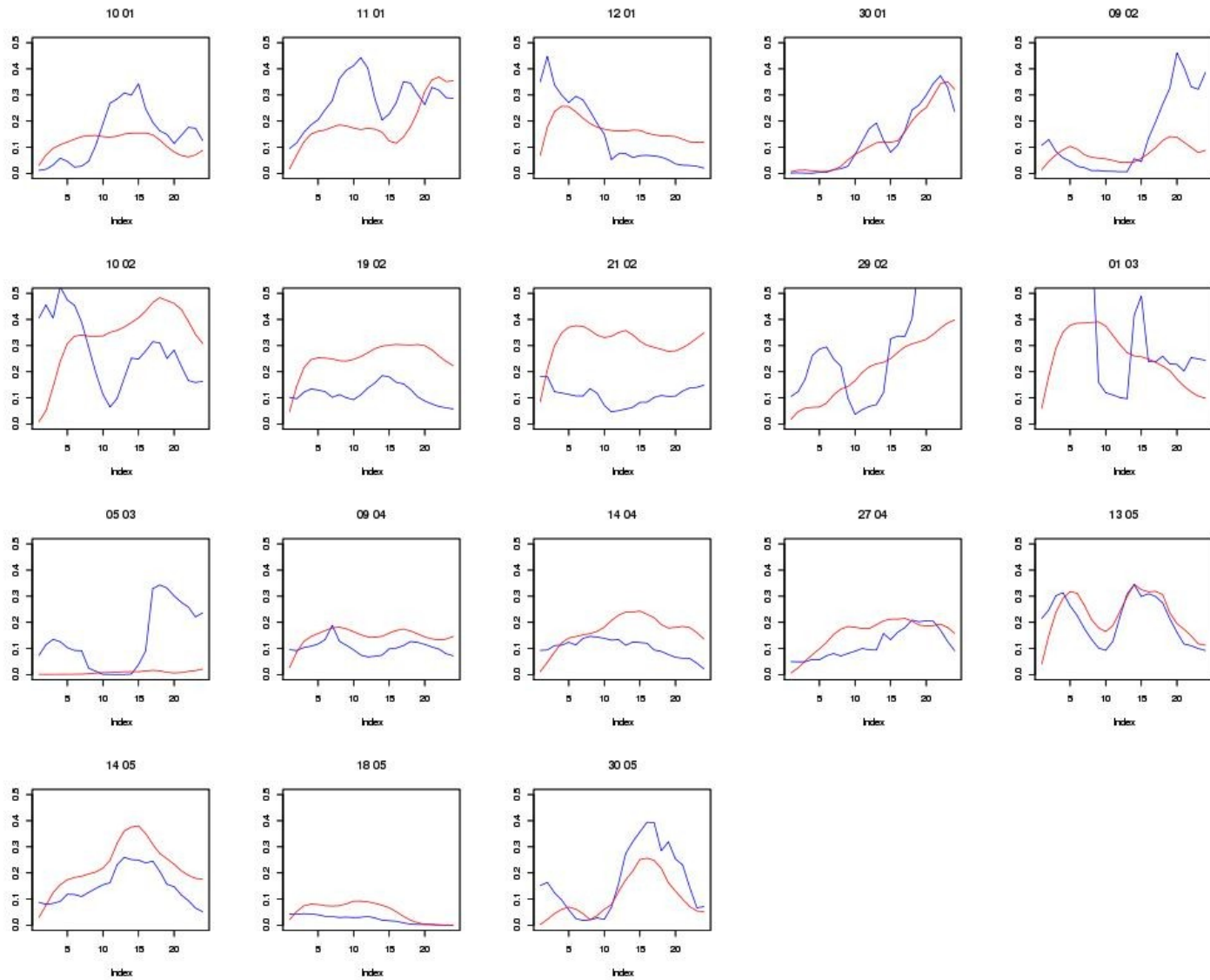


f)





Institu
Nator



ALARO (red) vs
GRSRain (blue)

hourly precipitation



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Simple verification system:

If $|T_{MOD} - T_{OBS}| < 2.5 \rightarrow \text{TRUE}$
 Else $\rightarrow \text{FALSE}$

MODEL	MIASTO	DATA	TNI_06	K1_TMIN	SPR
ALARO	Białystok	2016-05-01	3.5	5.8	+
ALARO	Białystok	2016-05-02	4.9	9.7	-
ALARO	Białystok	2016-05-03	8.6	10.6	+
ALARO	Białystok	2016-05-04	7.7	10.6	-
ALARO	Białystok	2016-05-05	5.8	9.9	-
ALARO	Białystok	2016-05-06	4.2	11.9	-
ALARO	Białystok	2016-05-07	6.3	13.0	-
ALARO	Białystok	2016-05-08	6.3	13.2	-
ALARO	Białystok	2016-05-09	5.6	10.7	-
ALARO	Białystok	2016-05-10	7.0	14.1	-
ALARO	Białystok	2016-05-11	8.2	13.0	-
ALARO	Białystok	2016-05-12	8.7	13.9	-
ALARO	Białystok	2016-05-13	11.2	13.2	+
ALARO	Białystok	2016-05-14	8.2	8.8	+
ALARO	Białystok	2016-05-15	3.5	5.9	+
ALARO	Białystok	2016-05-16	4.0	7.0	-
ALARO	Białystok	2016-05-17	0.2	5.7	-
ALARO	Białystok	2016-05-18	0.6	4.7	-
ALARO	Białystok	2016-05-19	2.8	9.0	-
ALARO	Białystok	2016-05-20	4.5	10.2	-
ALARO	Białystok	2016-05-21	7.3	11.9	-
ALARO	Białystok	2016-05-22	9.4	13.2	-
ALARO	Białystok	2016-05-23	7.5	14.6	-
ALARO	Białystok	2016-05-24	12.1	15.9	-
ALARO	Białystok	2016-05-25	10.3	13.0	-
ALARO	Białystok	2016-05-26	9.1	13.4	-
ALARO	Białystok	2016-05-27	9.7	15.4	-
ALARO	Białystok	2016-05-28	11.6	17.8	-
ALARO	Białystok	2016-05-29	14.5	18.5	-
ALARO	Białystok	2016-05-30	15.1	18.2	-
ALARO	Białystok	2016-05-31	16.2	17.2	+
ALARO	Białystok				19.4%

Man...

MODEL	MIASTO	DATA	TNI_06	K1_TMIN	SPR
ALARO	Warszawa	2016-05-01	6.3	8.1	+
ALARO	Warszawa	2016-05-02	8.2	10.6	+
ALARO	Warszawa	2016-05-03	9.0	10.4	+
ALARO	Warszawa	2016-05-04	7.6	10.3	-
ALARO	Warszawa	2016-05-05	9.1	9.3	+
ALARO	Warszawa	2016-05-06	9.2	10.6	+
ALARO	Warszawa	2016-05-07	10.3	11.6	+
ALARO	Warszawa	2016-05-08	8.3	11.3	-
ALARO	Warszawa	2016-05-09	10.1	11.2	+
ALARO	Warszawa	2016-05-10	11.1	10.6	+
ALARO	Warszawa	2016-05-11	10.3	11.8	+
ALARO	Warszawa	2016-05-12	12.2	14.1	+
ALARO	Warszawa	2016-05-13	12.4	13.0	+
ALARO	Warszawa	2016-05-14	9.7	8.9	+
ALARO	Warszawa	2016-05-15	4.8	6.6	+
ALARO	Warszawa	2016-05-16	4.7	7.5	-
ALARO	Warszawa	2016-05-17	6.5	5.8	+
ALARO	Warszawa	2016-05-18	3.9	4.3	+
ALARO	Warszawa	2016-05-19	6.2	7.4	+
ALARO	Warszawa	2016-05-20	12.1	12.7	+
ALARO	Warszawa	2016-05-21	10.3	12.1	+
ALARO	Warszawa	2016-05-22	14.3	15.2	+
ALARO	Warszawa	2016-05-23	14.2	17.7	-
ALARO	Warszawa	2016-05-24	13.6	15.4	+
ALARO	Warszawa	2016-05-25	11.7	12.7	+
ALARO	Warszawa	2016-05-26	12.6	14.6	+
ALARO	Warszawa	2016-05-27	14.4	15.6	+
ALARO	Warszawa	2016-05-28	15.1	18.5	-
ALARO	Warszawa	2016-05-29	17.2	19.1	+
ALARO	Warszawa	2016-05-30	16.6	17.9	+
ALARO	Warszawa	2016-05-31	17.1	16.4	+
ALARO	Warszawa				83.9%





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MODEL	MIASTO	DATA	TX1_18	K2_TMAX	SPR
ALARO	Białystok	2016-05-01	18.3	17.3	+
ALARO	Białystok	2016-05-02	20.4	16.8	-
ALARO	Białystok	2016-05-03	21.1	19.6	+
ALARO	Białystok	2016-05-04	21.5	19.8	+
ALARO	Białystok	2016-05-05	21.5	19.8	+
ALARO	Białystok	2016-05-06	22.0	21.3	+
ALARO	Białystok	2016-05-07	23.8	22.2	+
ALARO	Białystok	2016-05-08	22.8	22.2	+
ALARO	Białystok	2016-05-09	23.9	22.7	+
ALARO	Białystok	2016-05-10	23.7	23.2	+
ALARO	Białystok	2016-05-11	21.6	21.7	+
ALARO	Białystok	2016-05-12	22.2	18.9	-
ALARO	Białystok	2016-05-13	16.6	18.6	+
ALARO	Białystok	2016-05-14	13.5	13.6	+
ALARO	Białystok	2016-05-15	13.0	12.3	+
ALARO	Białystok	2016-05-16	12.4	11.7	+
ALARO	Białystok	2016-05-17	13.9	14.8	+
ALARO	Białystok	2016-05-18	18.1	17.2	+
ALARO	Białystok	2016-05-19	19.9	19.6	+
ALARO	Białystok	2016-05-20	20.0	21.0	+
ALARO	Białystok	2016-05-21	22.5	22.9	+
ALARO	Białystok	2016-05-22	24.3	24.9	+
ALARO	Białystok	2016-05-23	24.1	25.4	+
ALARO	Białystok	2016-05-24	21.8	23.1	+
ALARO	Białystok	2016-05-25	22.6	22.3	+
ALARO	Białystok	2016-05-26	24.2	24.2	+
ALARO	Białystok	2016-05-27	25.8	26.4	+
ALARO	Białystok	2016-05-28	27.2	27.6	+
ALARO	Białystok	2016-05-29	28.2	27.0	+
ALARO	Białystok	2016-05-30	26.1	26.5	+
ALARO	Białystok	2016-05-31	24.9	23.0	+
ALARO	Białystok				93.5%

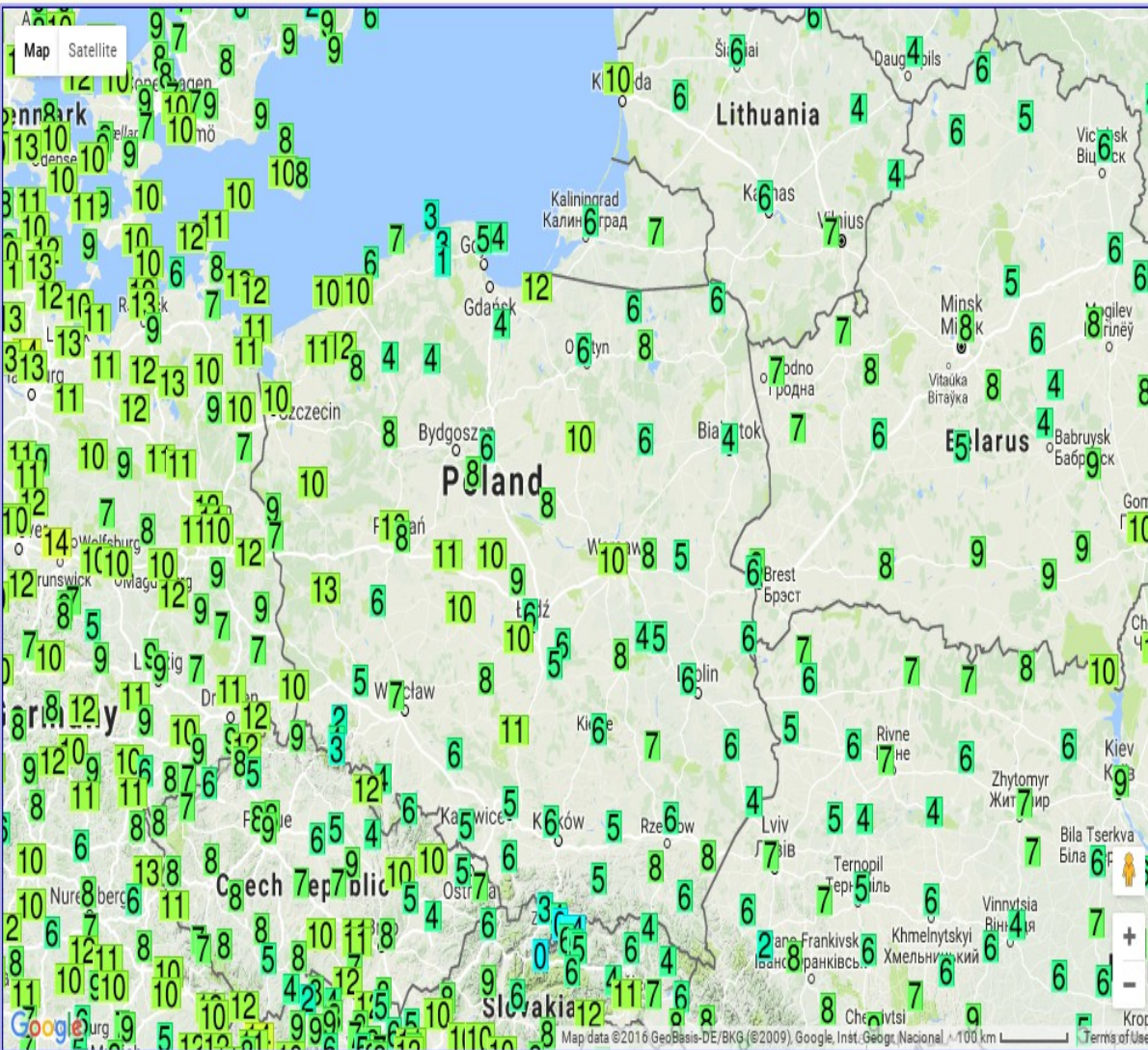
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MODEL	MIASTO	DATA	TX1_18	K2_TMAX	SPR
ALARO	Warszawa	2016-05-01	19.0	18.3	+
ALARO	Warszawa	2016-05-02	19.9	18.7	+
ALARO	Warszawa	2016-05-03	20.6	19.2	+
ALARO	Warszawa	2016-05-04	21.5	20.0	+
ALARO	Warszawa	2016-05-05	21.4	20.3	+
ALARO	Warszawa	2016-05-06	20.8	21.0	+
ALARO	Warszawa	2016-05-07	23.7	21.1	-
ALARO	Warszawa	2016-05-08	21.7	19.8	+
ALARO	Warszawa	2016-05-09	22.9	21.7	+
ALARO	Warszawa	2016-05-10	23.0	23.2	+
ALARO	Warszawa	2016-05-11	24.1	22.9	+
ALARO	Warszawa	2016-05-12	23.4	22.5	+
ALARO	Warszawa	2016-05-13	16.3	18.1	+
ALARO	Warszawa	2016-05-14	13.1	14.4	+
ALARO	Warszawa	2016-05-15	11.8	12.3	+
ALARO	Warszawa	2016-05-16	11.9	10.1	+
ALARO	Warszawa	2016-05-17	15.7	13.9	+
ALARO	Warszawa	2016-05-18	18.6	18.1	+
ALARO	Warszawa	2016-05-19	22.0	21.1	+
ALARO	Warszawa	2016-05-20	22.9	22.2	+
ALARO	Warszawa	2016-05-21	25.2	23.4	+
ALARO	Warszawa	2016-05-22	27.3	26.5	+
ALARO	Warszawa	2016-05-23	25.9	26.5	+
ALARO	Warszawa	2016-05-24	23.6	23.5	+
ALARO	Warszawa	2016-05-25	24.1	23.2	+
ALARO	Warszawa	2016-05-26	25.8	24.5	+
ALARO	Warszawa	2016-05-27	27.3	26.8	+
ALARO	Warszawa	2016-05-28	27.9	28.6	+
ALARO	Warszawa	2016-05-29	29.3	28.7	+
ALARO	Warszawa	2016-05-30	24.6	25.7	+
ALARO	Warszawa	2016-05-31	24.5	24.6	+
ALARO	Warszawa				96.8%

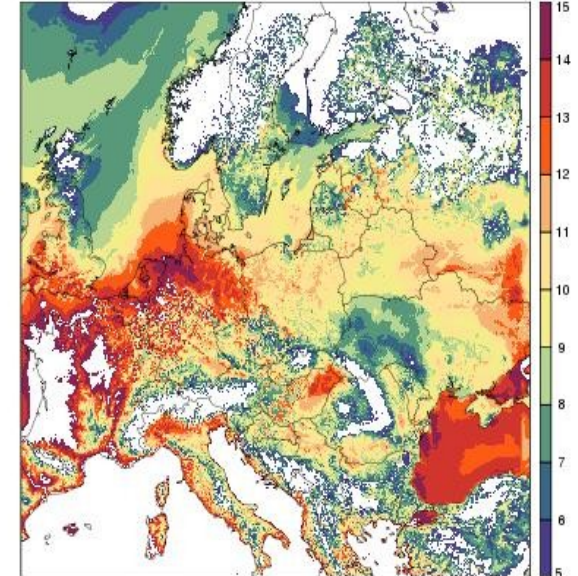


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MODEL	MIASTO	DATA	TNI_06	K1_TMIN	SPR	MODEL	MIASTO	DATA	TNI_06	K1_TMIN	SPR	MODEL	MIASTO	DATA	TNI_06	K1_TMIN	SPR	MODEL	MIASTO	DATA	TNI_06	K1_TMIN	SPR	
ALARO	Poznań	2016-04-01	3.7	2.9	+	ALARO	Poznań	2016-03-01	-1.3	-2.4	+	ALARO	Poznań	2016-02-01	6.5	6.4	+	ALARO	Szczecin	2016-02-01	8.4	6.6	+	
ALARO	Poznań	2016-04-02	6.4	7.6	+	ALARO	Poznań	2016-03-02	3.2	1.0	+	ALARO	Poznań	2016-02-02	5.0	2.7	+	ALARO	Szczecin	2016-02-02	4.8	4.3	+	
ALARO	Poznań	2016-04-03	6.7	8.9	+	ALARO	Poznań	2016-03-03	-2.3	-0.5	+	ALARO	Poznań	2016-02-03	2.5	0.7	+	ALARO	Szczecin	2016-02-03	2.3	1.1	+	
ALARO	Poznań	2016-04-04	9.7	10.6	+	ALARO	Poznań	2016-03-04	0.4	1.0	+	ALARO	Poznań	2016-02-04	-0.2	-0.9	+	ALARO	Szczecin	2016-02-04	-0.7	-0.5	+	
ALARO	Poznań	2016-04-05	7.3	8.5	+	ALARO	Poznań	2016-03-05	2.3	2.7	+	ALARO	Poznań	2016-02-05	2.6	0.9	+	ALARO	Szczecin	2016-02-05	3.7	2.7	+	
ALARO	Poznań	2016-04-06	6.9	7.0	+	ALARO	Poznań	2016-03-06	-0.3	-0.6	+	ALARO	Poznań	2016-02-06	3.1	1.9	+	ALARO	Szczecin	2016-02-06	3.6	5.2	+	
ALARO	Poznań	2016-04-07	5.0	6.4	+	ALARO	Poznań	2016-03-07	2.6	1.6	+	ALARO	Poznań	2016-02-07	4.4	2.9	+	ALARO	Szczecin	2016-02-07	5.2	4.2	+	
ALARO	Poznań	2016-04-08	6.2	7.1	+	ALARO	Poznań	2016-03-08	0.2	0.4	+	ALARO	Poznań	2016-02-08	5.9	5.3	+	ALARO	Szczecin	2016-02-08	6.4	5.2	+	
ALARO	Poznań	2016-04-09	6.9	7.3	+	ALARO	Poznań	2016-03-09	2.7	2.4	+	ALARO	Poznań	2016-02-09	5.4	4.0	+	ALARO	Szczecin	2016-02-09	4.1	2.9	+	
ALARO	Poznań	2016-04-10	7.8	8.9	+	ALARO	Poznań	2016-03-10	1.9	1.8	+	ALARO	Poznań	2016-02-10	1.1	-0.7	+	ALARO	Szczecin	2016-02-10	2.2	2.0	+	
ALARO	Poznań	2016-04-11	8.9	7.9	+	ALARO	Poznań	2016-03-11	0.6	0.3	+	ALARO	Poznań	2016-02-11	-0.3	0.2	+	ALARO	Szczecin	2016-02-11	1.4	1.0	+	
ALARO	Poznań	2016-04-12	7.6	6.3	+	ALARO	Poznań	2016-03-12	0.7	-0.6	+	ALARO	Poznań	2016-02-12	-2.9	-2.3	+	ALARO	Szczecin	2016-02-12	-3.6	-3.2	+	
ALARO	Poznań	2016-04-13	1.8	3.1	+	ALARO	Poznań	2016-03-13	-4.5	-2.8	+	ALARO	Poznań	2016-02-13	0.4	-0.5	+	ALARO	Szczecin	2016-02-13	0.4	-0.4	+	
ALARO	Poznań	2016-04-14	6.9	7.7	+	ALARO	Poznań	2016-03-14	1.0	0.0	+	ALARO	Poznań	2016-02-14	1.5	-0.8	+	ALARO	Szczecin	2016-02-14	3.2	0.8	+	
ALARO	Poznań	2016-04-15	7.0	8.4	+	ALARO	Poznań	2016-03-15	-1.7	-1.6	+	ALARO	Poznań	2016-02-15	2.3	-0.2	+	ALARO	Szczecin	2016-02-15	1.1	-0.6	+	
ALARO	Poznań	2016-04-16	3.9	3.8	+	ALARO	Poznań	2016-03-16	-3.0	-2.0	+	ALARO	Poznań	2016-02-16	-3.6	-3.7	+	ALARO	Szczecin	2016-02-16	-6.3	-4.6	+	
ALARO	Poznań	2016-04-17	7.7	6.4	+	ALARO	Poznań	2016-03-17	0.7	2.2	+	ALARO	Poznań	2016-02-17	1.0	0.5	+	ALARO	Szczecin	2016-02-17	-0.1	0.0	+	
ALARO	Poznań	2016-04-18	4.8	4.9	+	ALARO	Poznań	2016-03-18	1.4	0.6	+	ALARO	Poznań	2016-02-18	2.2	0.6	+	ALARO	Szczecin	2016-02-18	-3.2	-2.6	+	
ALARO	Poznań	2016-04-19	2.1	4.0	+	ALARO	Poznań	2016-03-19	2.4	3.2	+	ALARO	Poznań	2016-02-19	0.4	-0.3	+	ALARO	Szczecin	2016-02-19	-2.3	-0.8	+	
ALARO	Poznań	2016-04-20	4.0	5.7	+	ALARO	Poznań	2016-03-20	1.9	1.9	+	ALARO	Poznań	2016-02-20	3.2	3.1	+	ALARO	Szczecin	2016-02-20	4.7	4.2	+	
ALARO	Poznań	2016-04-21	2.2	3.7	+	ALARO	Poznań	2016-03-21	3.3	3.2	+	ALARO	Poznań	2016-02-21	6.1	5.3	+	ALARO	Szczecin	2016-02-21	6.5	5.7	+	
ALARO	Poznań	2016-04-22	1.0	2.0	+	ALARO	Poznań	2016-03-22	-2.8	-0.7	+	ALARO	Poznań	2016-02-22	2.4	2.1	+	ALARO	Szczecin	2016-02-22	3.7	2.0	+	
ALARO	Poznań	2016-04-23	-1.2	-0.6	+	ALARO	Poznań	2016-03-23	1.5	0.7	+	ALARO	Poznań	2016-02-23	1.8	1.2	+	ALARO	Szczecin	2016-02-23	1.8	1.4	+	
ALARO	Poznań	2016-04-24	1.1	-0.1	+	ALARO	Poznań	2016-03-24	1.3	2.0	+	ALARO	Poznań	2016-02-24	-1.9	-1.3	+	ALARO	Szczecin	2016-02-24	-1.1	-1.2	+	
ALARO	Poznań	2016-04-25	0.9	0.2	+	ALARO	Poznań	2016-03-25	5.6	4.4	+	ALARO	Poznań	2016-02-25	-1.3	-1.2	+	ALARO	Szczecin	2016-02-25	0.7	-1.3	+	
ALARO	Poznań	2016-04-26	3.0	2.1	+	ALARO	Poznań	2016-03-26	2.3	2.2	+	ALARO	Poznań	2016-02-26	-5.5	-4.7	+	ALARO	Szczecin	2016-02-26	-6.7	-4.5	+	
ALARO	Poznań	2016-04-27	-0.4	0.8	+	ALARO	Poznań	2016-03-27	4.6	6.1	+	ALARO	Poznań	2016-02-27	0.1	-2.0	+	ALARO	Szczecin	2016-02-27	-0.4	-0.7	+	
ALARO	Poznań	2016-04-28	4.9	5.4	+	ALARO	Poznań	2016-03-28	7.9	7.5	+	ALARO	Poznań	2016-02-28	-0.6	-1.8	+	ALARO	Szczecin	2016-02-28	-4.8	-3.1	+	
ALARO	Poznań	2016-04-29	4.0	6.1	+	ALARO	Poznań	2016-03-29	2.8	4.4	+	ALARO	Poznań	2016-02-29	-0.9	-0.8	+	ALARO	Szczecin	2016-02-29	-1.1	-1.7	+	
ALARO	Poznań	2016-04-30	4.6	6.3	+	ALARO	Poznań	2016-03-30	4.9	4.7	+	ALARO	Poznań						ALARO	Szczecin				
ALARO	Poznań				100.0%	ALARO	Poznań				100.0%	ALARO	Poznań				100.0%	ALARO	Szczecin				100.0%	



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OKRES	TYP	MIASTO	N	ALARO	AROME	COSH007	COSH014	COSH028	GFS	SYNOPTYK
2016-08	K2_TMAX	Białystok	31	90.3%	93.5%	48.4%	61.3%	74.2%	93.5%	100.0%
2016-08	K2_TMAX	Gdańsk	31	96.8%	93.5%	45.2%	64.5%	51.6%	58.1%	83.9%
2016-08	K2_TMAX	Kraków	31	93.5%	90.3%	54.8%	83.9%	48.4%	90.3%	90.3%
2016-08	K2_TMAX	Poznań	31	96.8%	93.5%	58.1%	64.5%	87.1%	90.3%	96.8%
2016-08	K2_TMAX	Szczecin	31	96.8%	74.2%	48.4%	54.8%	77.4%	83.9%	87.1%
2016-08	K2_TMAX	Warszawa	31	90.3%	87.1%	25.8%	77.4%	25.8%	96.8%	96.8%
2016-08	K2_TMAX	Wrocław	31	90.3%	93.5%	45.2%	32.3%	38.7%	54.8%	100.0%
2016-08	K2_TMAX	RAZEM	217	93.5%	89.4%	46.5%	62.7%	57.6%	81.1%	93.5%



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Appendix:



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```
cat clearcache.c
#include <sys/types.h>
#include <sys/stat.h>
#include <fcntl.h>
#include <stdio.h>
#include <unistd.h>

main(int argc, char **argv)
{
    int fd, result, argi;
    for (argi=1; argi < argc; argi++)
    {
        printf("Opening: %s\n", argv[argi]);
        fd = open(argv[argi], O_RDWR);
        printf("FD: %d\n", fd);
        /* result = posix_fadvise(fd, 0, 0, POSIX_FADV_DONTNEED); */
        result = posix_fadvise(fd, 0, 0, 4);
        printf("Result: %d\n", result);
        close(fd);
    }

    _exit(0);
}
```



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```
cat flushcache2.c
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <sys/types.h>

int main(void) {
    if (geteuid() != 0) {
        fprintf(stderr, "Super user (root) privileges required. Aborting.\n");
        exit(EXIT_FAILURE);
    }
    printf("Syncing filesystems... ");
    if (system("sync") != 0) {
        fprintf(stderr, "sync failed\n");
        exit(EXIT_FAILURE);
    }
    printf("done.\n");
    printf("Flushing dentries and inodes... ");
    FILE* f;
    f = fopen("/proc/sys/vm/drop_caches", "w");
    if (f == NULL) {
        fprintf(stderr, "Couldn't open /proc/sys/vm/drop_caches.\n");
        exit(EXIT_FAILURE);
    }
    if (fprintf(f, "2\n") != 2) {
        fprintf(stderr, "Couldn't write 2 to /proc/sys/vm/drop_caches.\n");
        exit(EXIT_FAILURE);
    }
    fclose(f);
    printf("done.\n");
    // printf("Done flushing.\n");
}
```



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