NAPOVEDOVANJE VREMENA IN SONČNEGA OBSEVA

dr. Marija Zlata Božnar

dr. Primož Mlakar

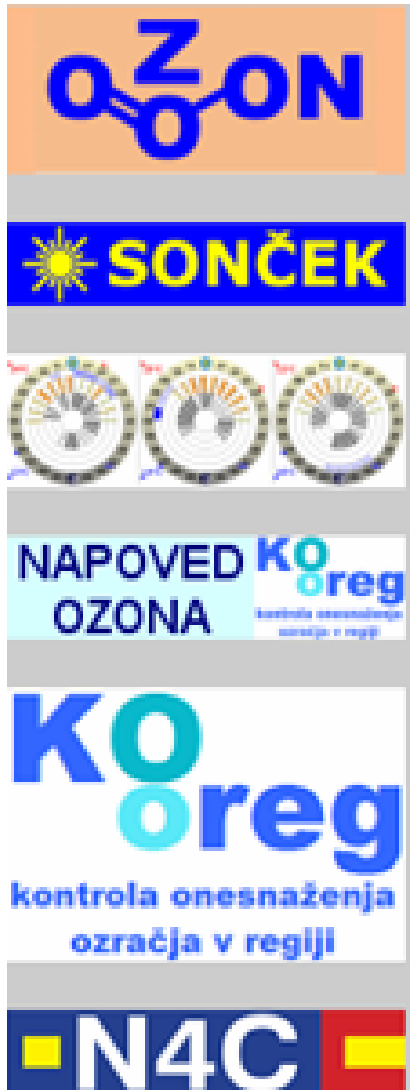
dr. Boštjan Grašič

Dragana Kokal

Darko Popović

MEIS d.o.o., www.meis.si september 2016





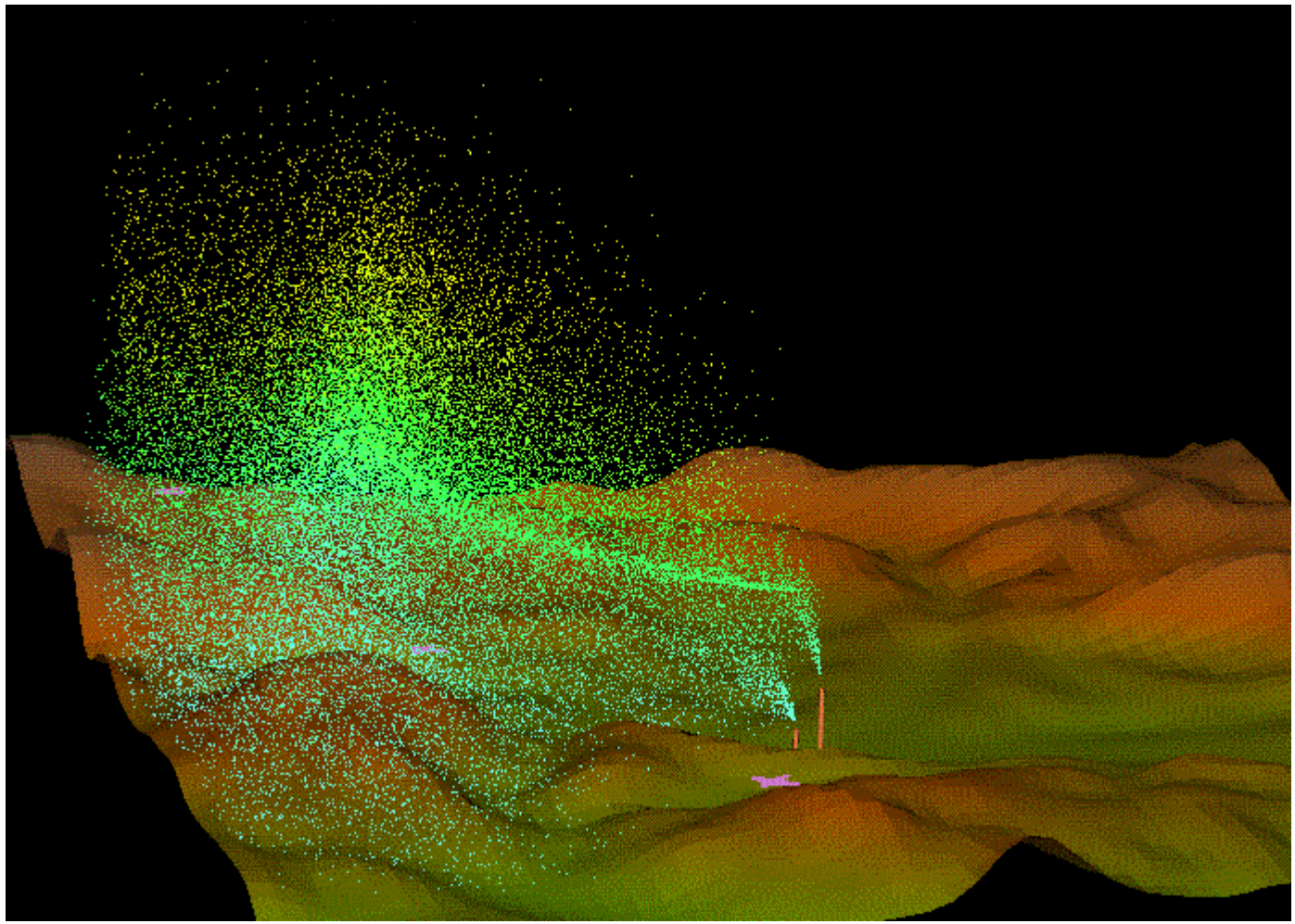
Modeliranje vremena v fini krajevni in časovni resoluciji ZAKAJ SPLOH???







POSNEMANJE NARAVE



Avtomatske meritve











www.kvalitetazraka.si KOoreg

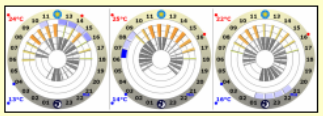
Portal | Sponzorji | Uporabniki | Zakaj Zasavje | O Modelih | O Natančnosti | Napoved | Zahteve | Financiranje | Komentarji | Izjava | Avtorske pravice | Ostalo

1) Predavanje 2) Članek 3) Knjiga

Sponzorji: LAFARGE Building better cities

Prognostični in diagnostični modelirni sistem za kontrolo onesnaženja ozračja v regiji

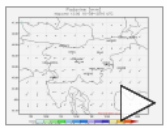
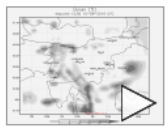
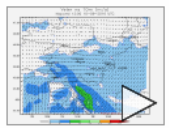
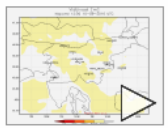
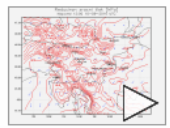
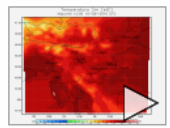
KOoreg kontrola onesnaženja ozračja v regiji



Napovedi za ostale kraje v Sloveniji

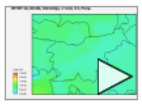
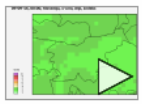
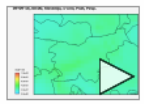
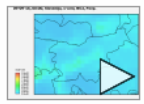
NAPOVED za 2 DNI | METEOGRAMI za 2 DNI | NAPOVED za 6 DNI | METEOGRAMI za 6 DNI

PODROBNA VREMENSKA NAPOVED ZA SLOVENIJO 12:00 10. 09. 2016
(za dva dni v polurnih korakih) izdelana z modelom WRF
za dvodnevne podrobnosti kliknite na sličico

PADAVINE	OBLAČNOST	VETER na 10m	VIDLJIVOST	ZRAČNI TLAK	TEMPERATURA
					

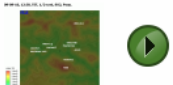
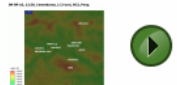
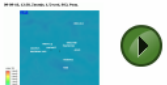
KVALITETA ZRAKA

NAPOVED KVALITETE ZRAKA ZA SLOVENIJO 09. 09. 2016
(v urnih korakih) izdelana z modelirnim sistemom QualeAria
za podrobnosti kliknite na sličico

O_3 [µg/m³]	AQI [indeks]	PM10 [µg/m³]	NO_2 [µg/m³]	SO_2 [µg/m³]	CO [mg/m³]	AQHI [indeks]
						

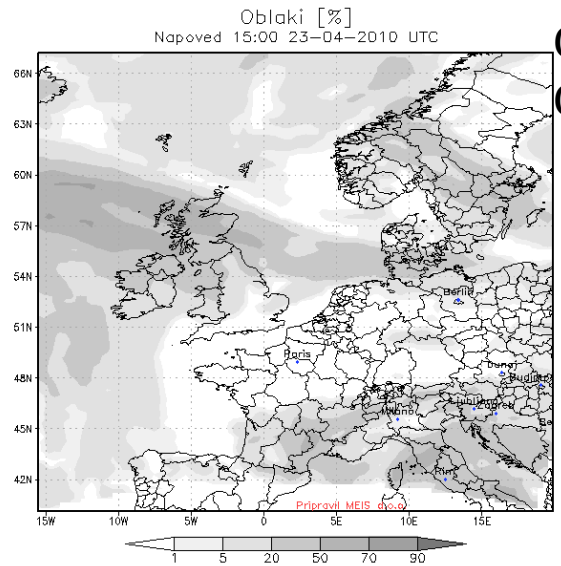
ONESNAŽENJE | NAPOVED KVALITETE ZRAKA | VALIDACIJA MODELIRANJA

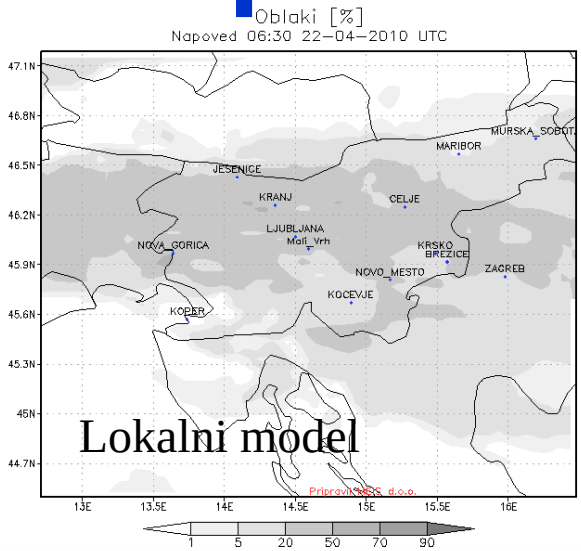
ZASAVJE: POLURNE POVPREČNE KONCENTRACIJE ONESNAŽEVAL za 12:30 09. 09. 2016 (zimski čas) (zaključek intervala)
za podrobnosti kliknite sličico

Vir upoštevane so nazivne emisije pri polnem obratovanju	Termoelektrarna Trbovlje	Lafarge Cement	Steklarna Hrastnik	IGM Zagorje	JPK Zagorje	Zasavje
ŽVEPLOV DIOKSID SO_2 [µg/m³]						

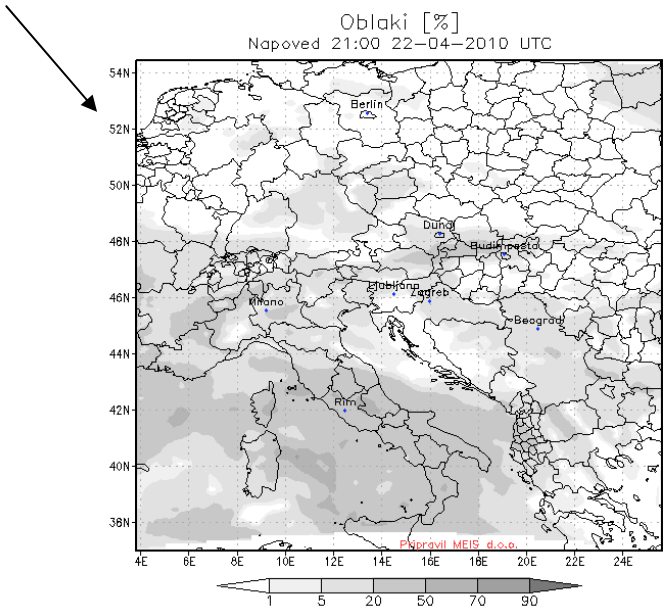
Prognostični podatki

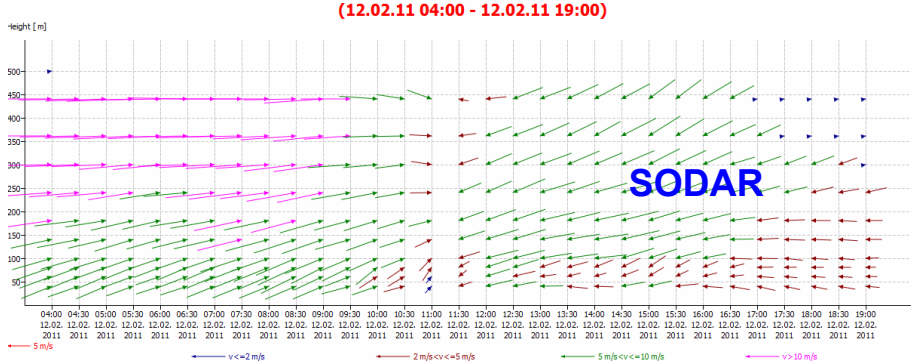
Globalne podatki
GFS modela

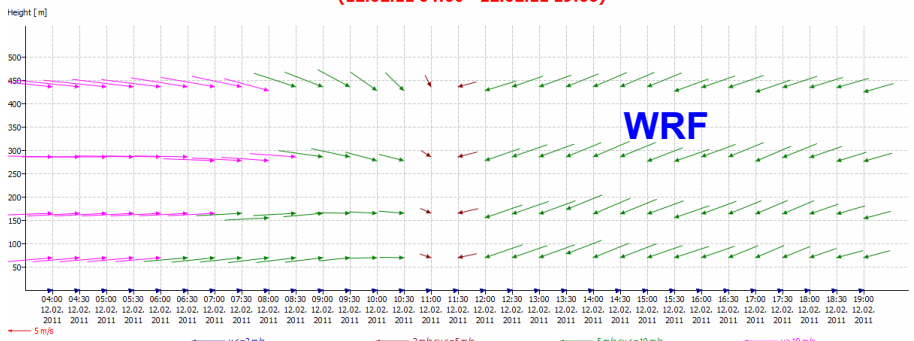




Lokalni model







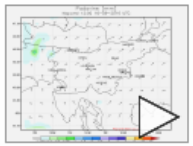
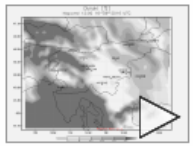
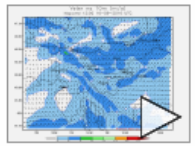
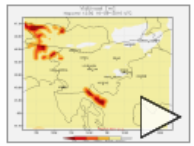
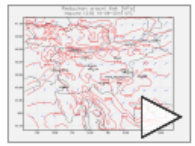
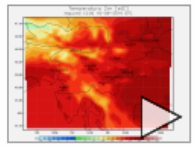
Modeliranje vremena v fini resoluciji

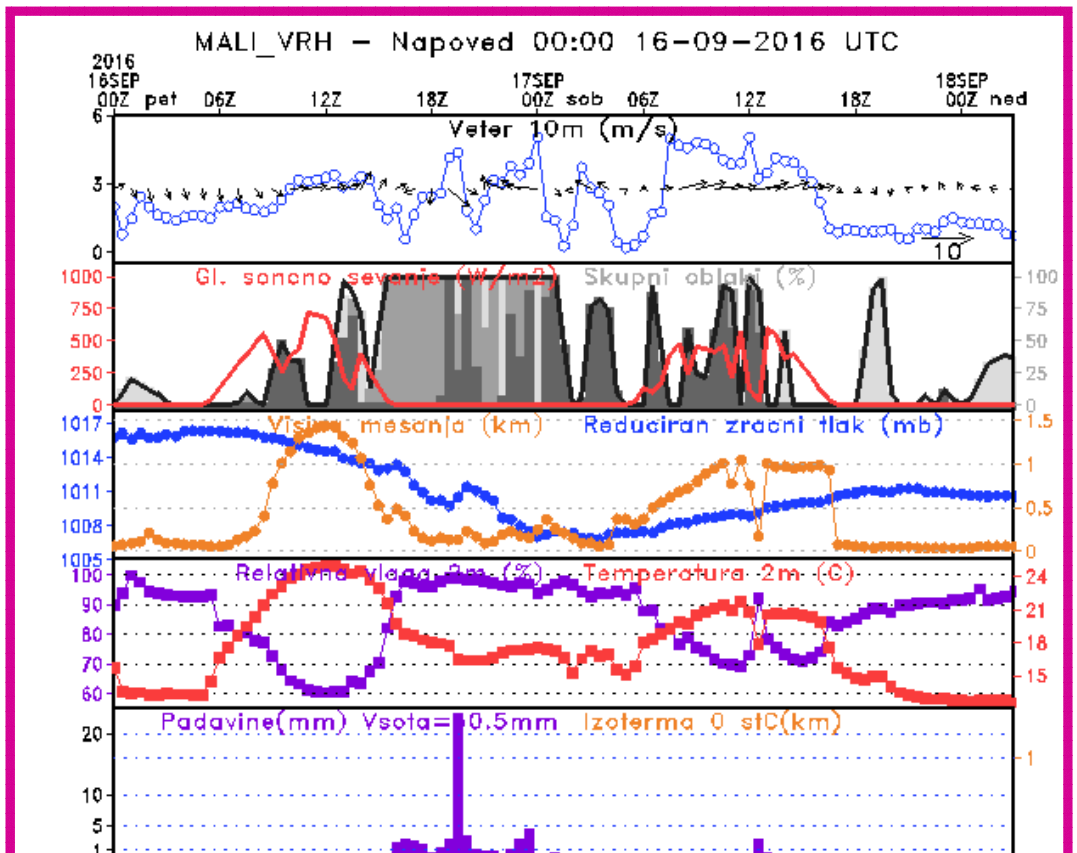
NAPOVED za 2 DNI | METEOGRAMI za 2 DNI | NAPOVED za 6 DNI | METEOGRAMI za 6 DNI

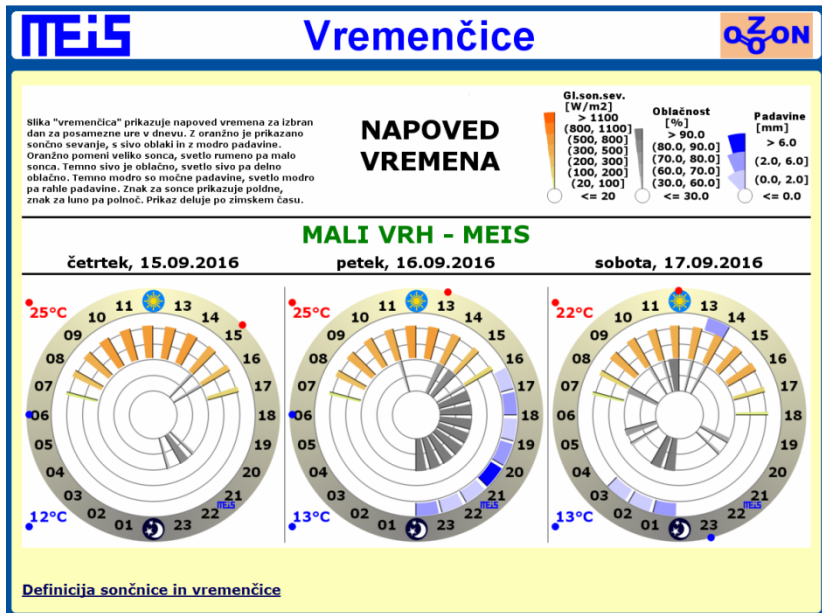
PODROBNA VREMENSKA NAPOVED ZA SLOVENIJO 12:00 16. 09. 2016

(za dva dni v polurnih korakih) izdelana z modelom WRF

za dvodnevne podrobnosti kliknite na sličico

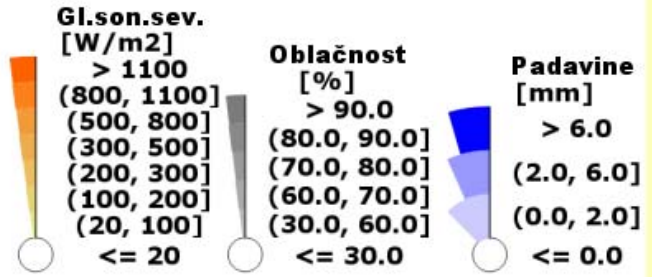
PADAVINE	OBLAČNOST	VETER na 10m	VIDLJIVOST	ZRAČNI TLAK	TEMPERATURA
					





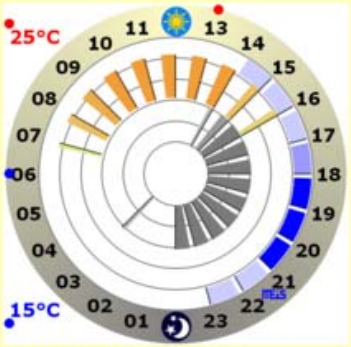
Slika "vremenčica" prikazuje napoved vremena za izbran dan za posamezne ure v dnevu. Z oranžno je prikazano sončno sevanje, s sivo oblaki in z modro padavine. Oranžno pomeni veliko sonca, svetlo rumeno pa malo sonca. Temno sivo je oblačno, svetlo sivo pa delno oblačno. Temno modro so močne padavine, svetlo modro pa rahle padavine. Znak za sonce prikazuje poldne, znak za luno pa polnoč. Prikaz deluje po zimskem času.

NAPOVED VREMENA

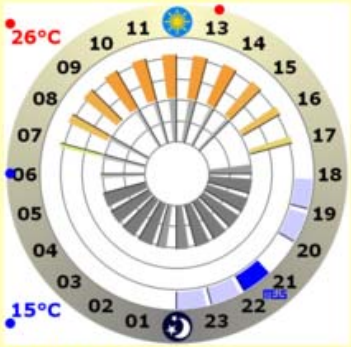


KLIKNITE NA VREMENČICO ZA VEČDNEVNO NAPOVED

petek, 16.09.2016



Ljubljana



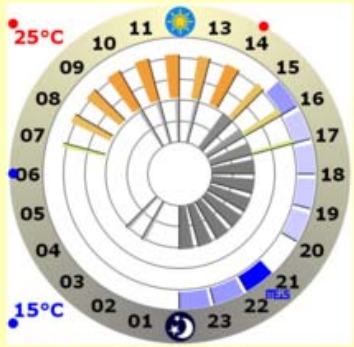
Maribor



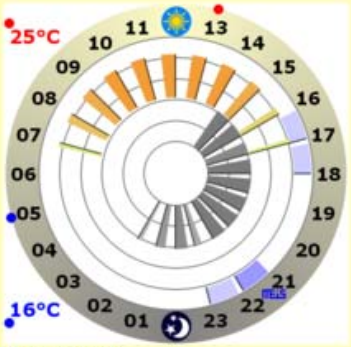
Veliki Ločnik



Mali Vrh - MEIS



Celje



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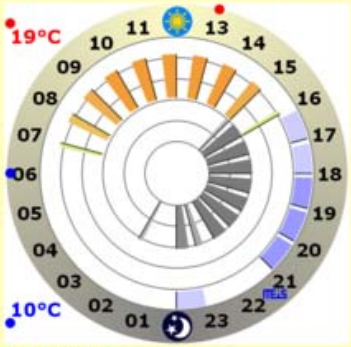
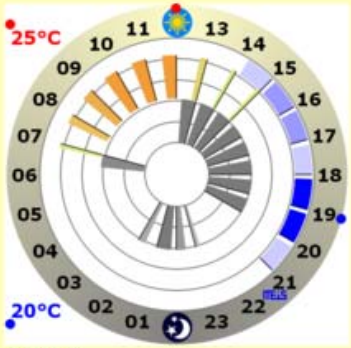
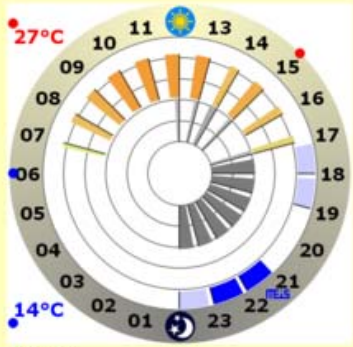


Jesenice



Koper



Krško



Murska Sobota











Solar radiation forecast



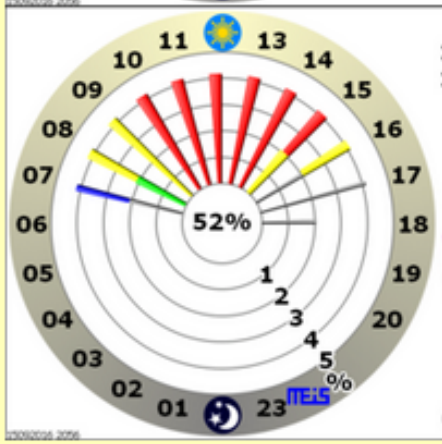
Stolp
15.09.16 00:30
16.09.16 00:00
all: 48
good: 48
unknown: 0%

Gl. sol. rad.
[W/m2]
> 1100
(800, 1100]
(500, 800]
(300, 500]
(200, 300]
(100, 200]
(5, 100]
<= 5



Stolp
16.09.16 00:30
17.09.16 00:00
all: 48
good: 48
unknown: 0%

Gl. sol. rad.
[W/m2]
> 1100
(800, 1100]
(500, 800]
(300, 500]
(200, 300]
(100, 200]
(5, 100]
<= 5



Stolp
17.09.16 00:30
18.09.16 00:00
all: 48
good: 48
unknown: 0%

Gl. sol. rad.
[W/m2]
> 1100
(800, 1100]
(500, 800]
(300, 500]
(200, 300]
(100, 200]
(5, 100]
<= 5

Weather forecast



Stolp
15.09.16 01:00
16.09.16 00:00
all: 24
good: 24
unknown: 0%

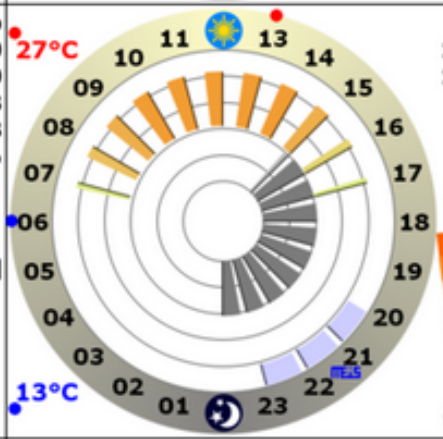
Stolp
15.09.16 01:00
16.09.16 00:00
all: 24
good: 24
unknown: 0%

Stolp
15.09.16 01:00
16.09.16 00:00
all: 24
good: 24
unknown: 0%

Gl. sol. rad.
[W/m2]
> 1100
(800, 1100]
(500, 800]
(300, 500]
(200, 300]
(100, 200]
(20, 100]
<= 20

Cloud cover
[%]
> 90.0
(80.0, 90.0]
(70.0, 80.0]
(60.0, 70.0]
(30.0, 60.0]
<= 30.0

Precip.
[mm]
> 6.0
(2.0, 6.0]
(0.0, 2.0]
<= 0.0



Stolp
16.09.16 01:00
17.09.16 00:00
all: 24
good: 24
unknown: 0%

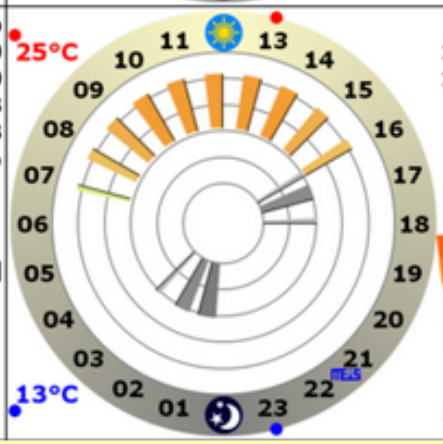
Stolp
16.09.16 01:00
17.09.16 00:00
all: 24
good: 24
unknown: 0%

Stolp
16.09.16 01:00
17.09.16 00:00
all: 24
good: 24
unknown: 0%

Gl. sol. rad.
[W/m2]
> 1100
(800, 1100]
(500, 800]
(300, 500]
(200, 300]
(100, 200]
(20, 100]
<= 20

Cloud cover
[%]
> 90.0
(80.0, 90.0]
(70.0, 80.0]
(60.0, 70.0]
(30.0, 60.0]
<= 30.0

Precip.
[mm]
> 6.0
(2.0, 6.0]
(0.0, 2.0]
<= 0.0



Stolp
17.09.16 01:00
18.09.16 00:00
all: 24
good: 24
unknown: 0%

Stolp
17.09.16 01:00
18.09.16 00:00
all: 24
good: 24
unknown: 0%

Stolp
17.09.16 01:00
18.09.16 00:00
all: 24
good: 24
unknown: 0%

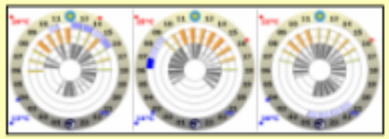
Gl. sol. rad.
[W/m2]
> 1100
(800, 1100]
(500, 800]
(300, 500]
(200, 300]
(100, 200]
(20, 100]
<= 20

Cloud cover
[%]
> 90.0
(80.0, 90.0]
(70.0, 80.0]
(60.0, 70.0]
(30.0, 60.0]
<= 30.0

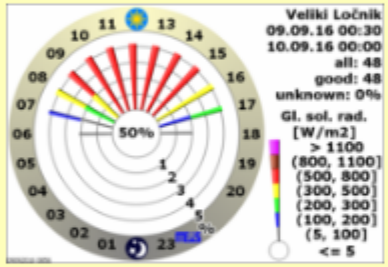
Precip.
[mm]
> 6.0
(2.0, 6.0]
(0.0, 2.0]
<= 0.0

www.meis.si/testbed

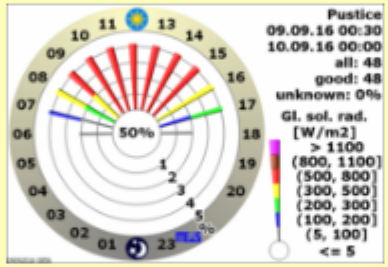
MEIS TestBed PORTAL SONČEK



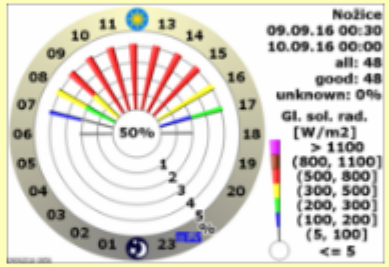
Other places in Slovenia - forecast



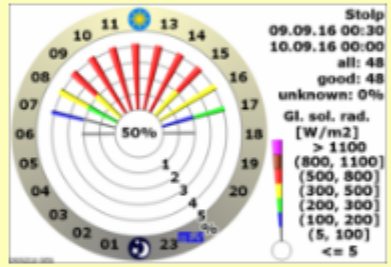
Forecast - Veliki Ločnik



Forecast - Pustice



Forecast - Nožice



Forecast - Stolp



Meteo - Veliki Ločnik



Meteo - Pustice

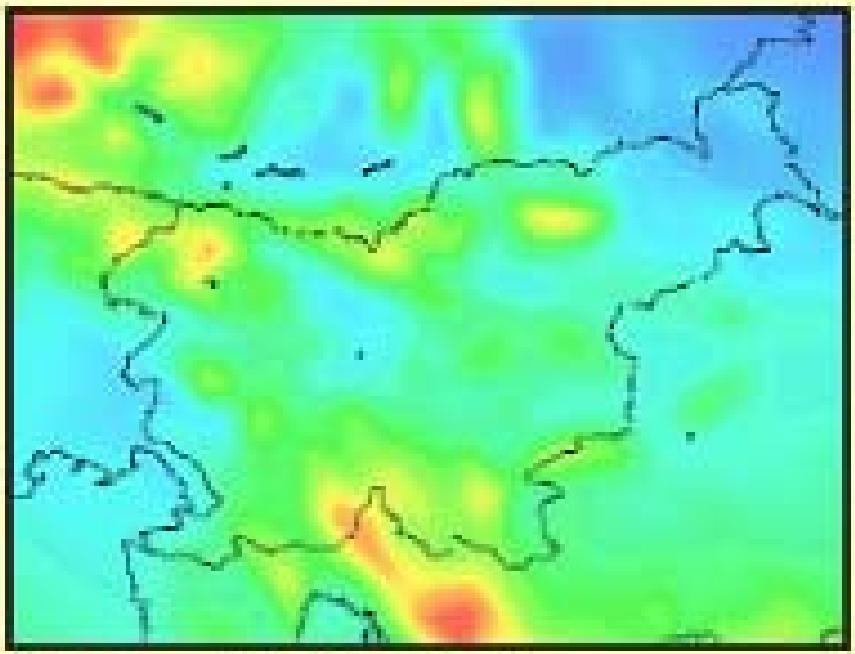


Meteo - Nožice

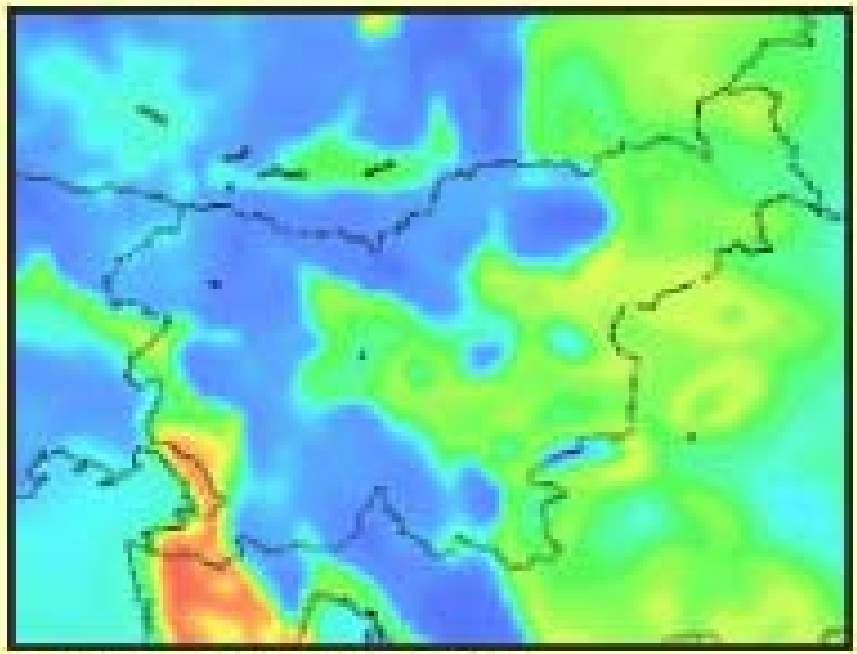


Meteo - Stolp

www.meis.si/testbed



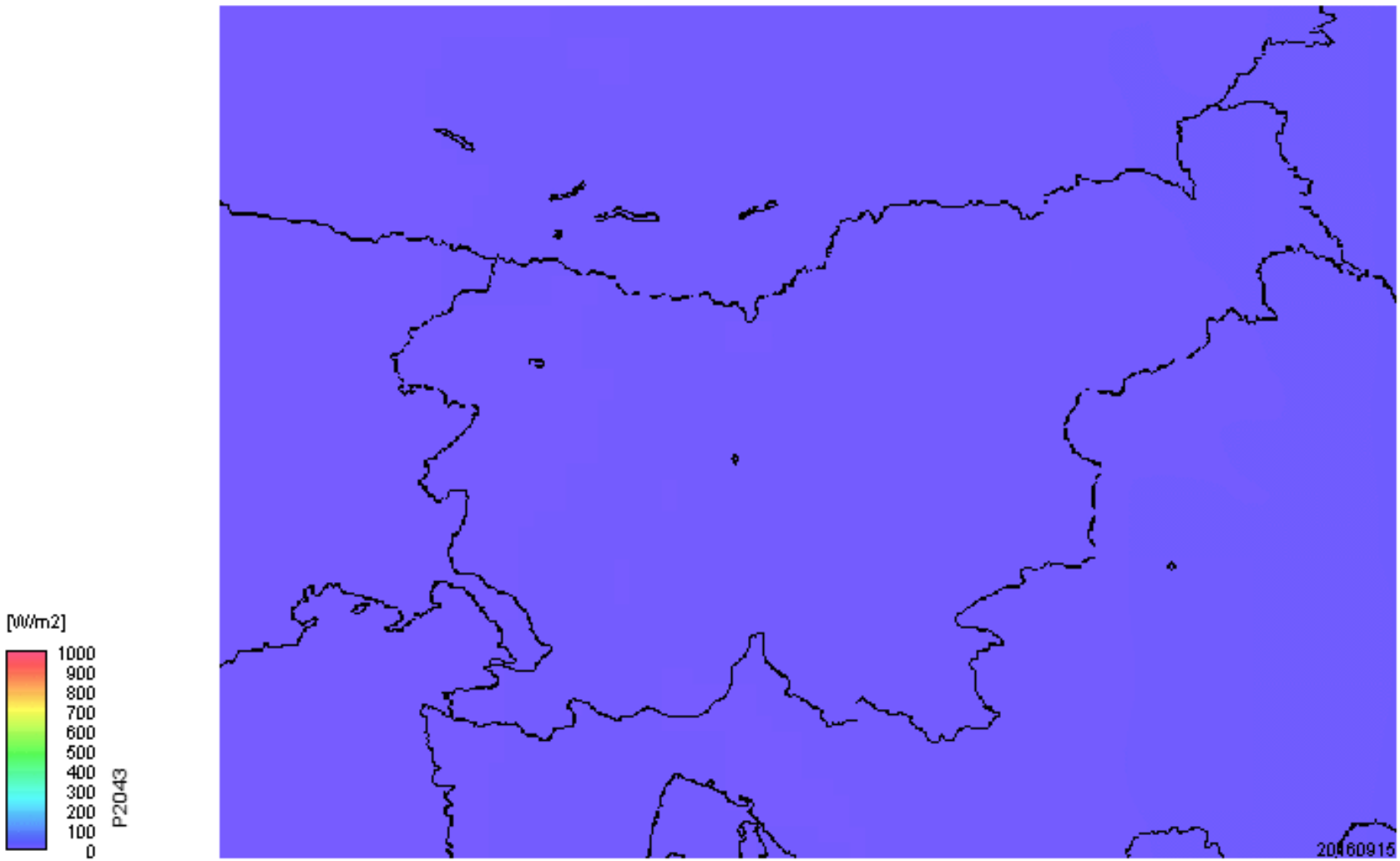
SLO - Global SR



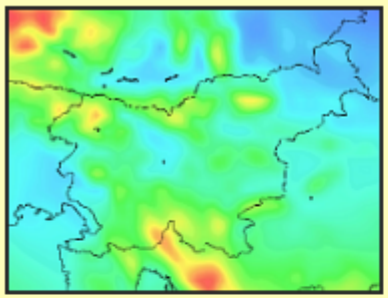
SLO - Diffuse SR

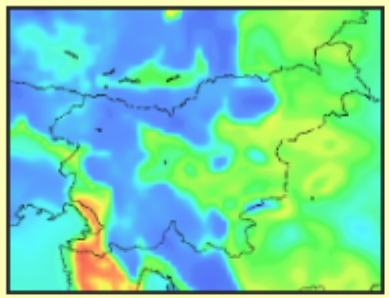
www.meis.si/testbed

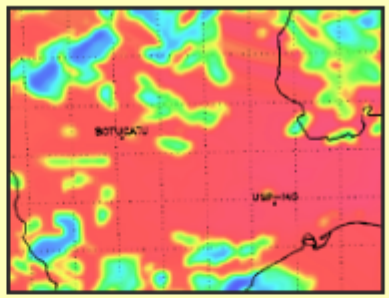
16-09-16, 06:00, Slovenija, half hour, Global SR, Avg.



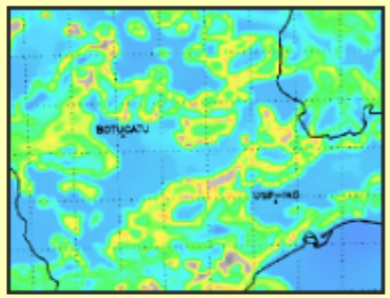
Modeliranje vremena v fini resoluciji


SLO - Global SR

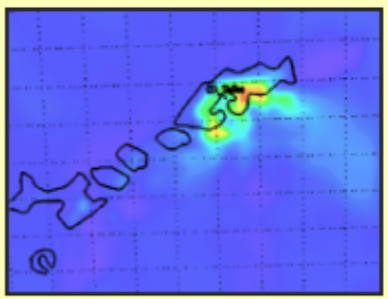

SLO - Diffuse SR

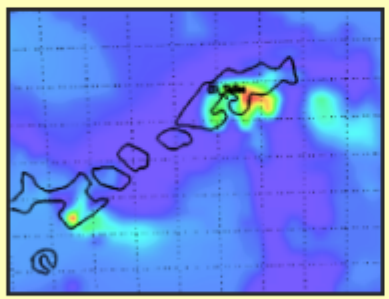


Sao Paulo - Global SR



Sao Paulo - Diffuse SR


Antarctica - Global SR


Antarctica - Diffuse SR

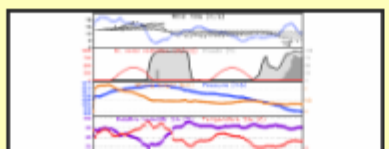


MCity

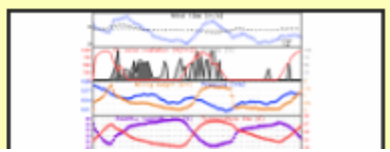


ETA Antarctica

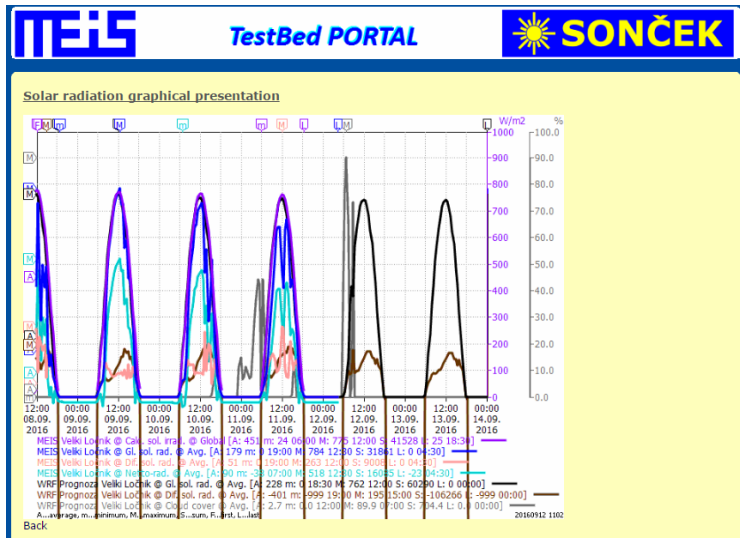


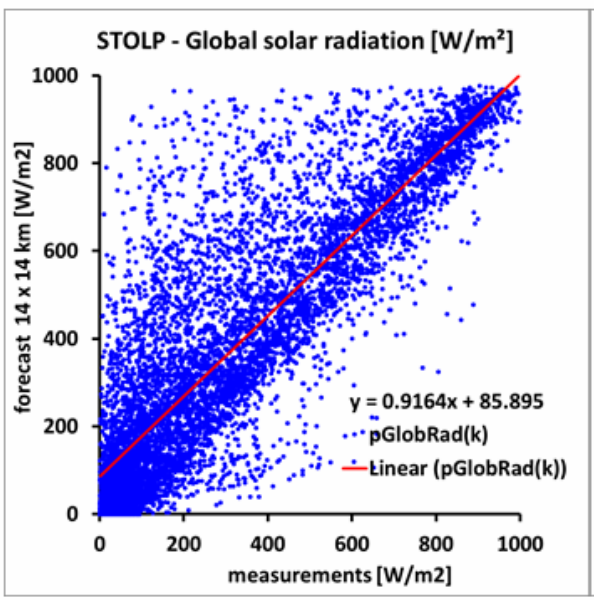


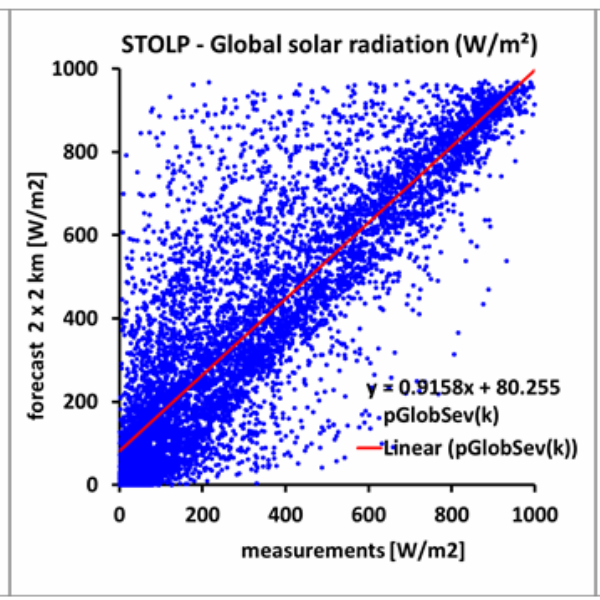


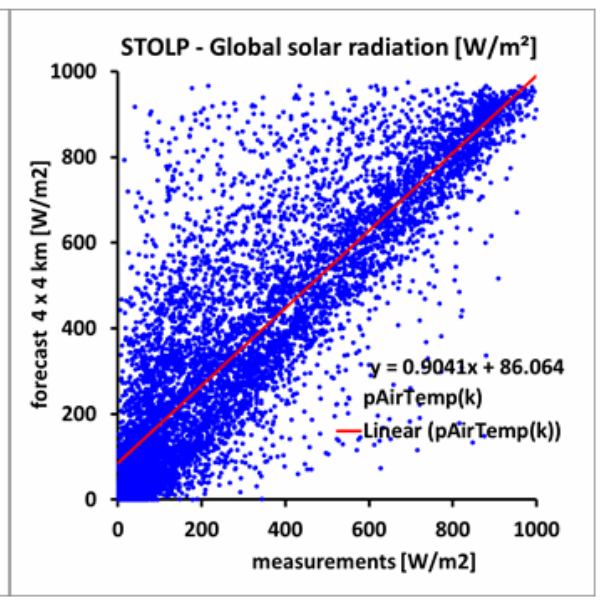


VALIDACIJA Z MERITVAMI









DIFUZNI SONČNI OBSEV



Merjenje difuznega sončnega obseva

pyranometer

Foto: Kipp&Zonen

EMPIRIČNO MODELIRANJE DIFUZNEGA SONČNEGA OBSEVA

razni parametrični modeli

vhodi – vrste oblakov

alternativa: umetne nevronske mreže

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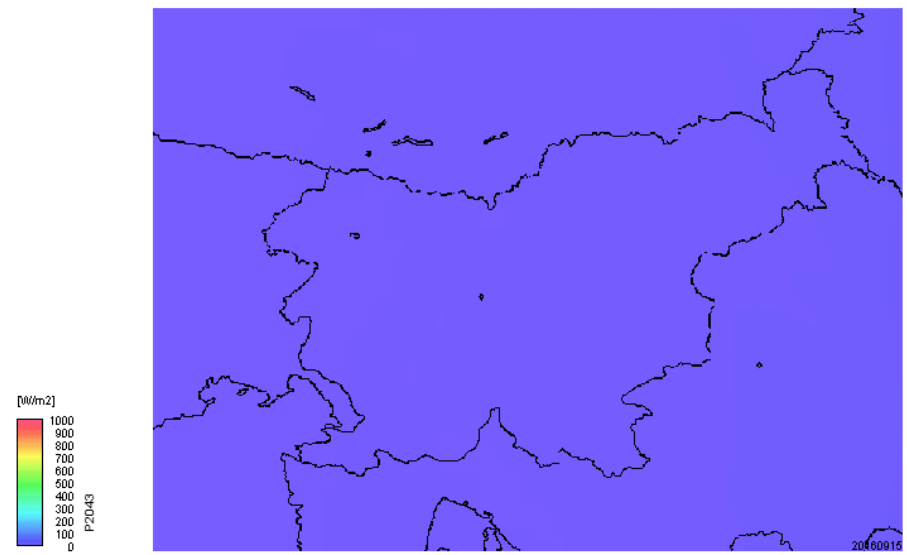
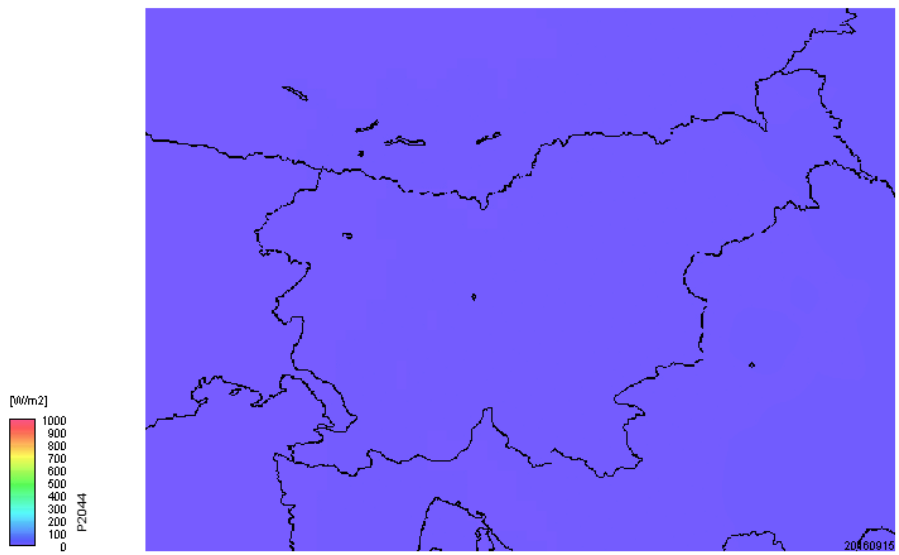
16-09-16, 06:00, Slovenija, half hour, Global SR, Avg.



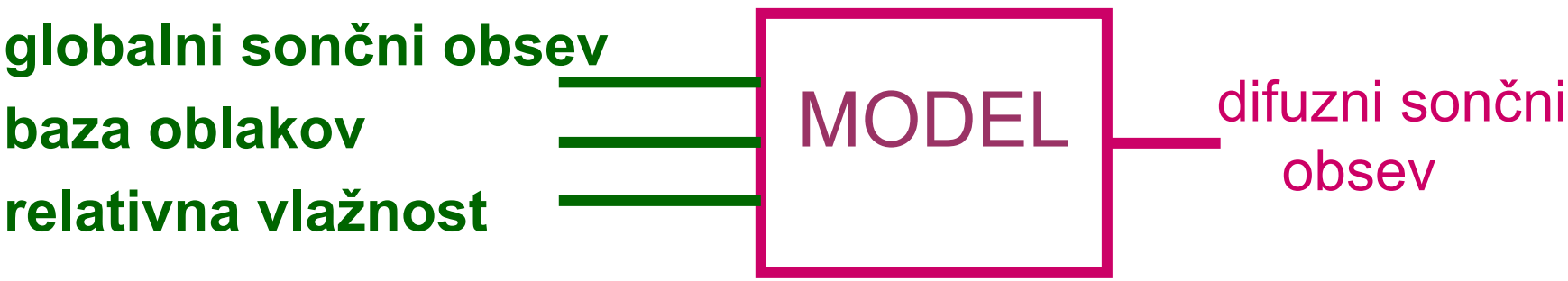
16-09-16, 06:00, Slovenija, half hour, Diffuse SR, Avg.



ZAKAJ perceptronske umetne nevronske mreže?

- aproksimacija naravnih pojavov, ki so merljivi
- odlične za nelinearne odvisnosti
- “izvleček” informacij iz raznovrstnih meritev
- uporabne na drugih področjih znanosti

Model na osnovi večnivojske perceptronske umetne nevronske mreže za polurni difuzni sončni obsev



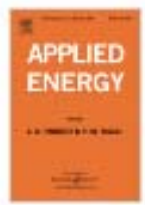
$$y = f(x_{in})$$

Model na osnovi večnivojske perceptronske umetne nevronske mreže za difuzni sončni obsev



Applied Energy

Volume 79, Issue 2, October 2004, Pages 201–214



Modeling hourly diffuse solar-radiation in the city of São Paulo using a neural-network technique

Jacyra Soares[a], Amauri P Oliveira[a], Marija Zlata Božnar[b], Primož Mlakar[b], João F Escobedo[c], Antonio J Machado[a]

Show more

Model na osnovi večnivojske perceptronske umetne nevronske mreže za difuzni sončni obsev

novo v projektu SONČEK:

izboljšani avtomatski podatki o oblačnosti

2D model

Letališče Portorož



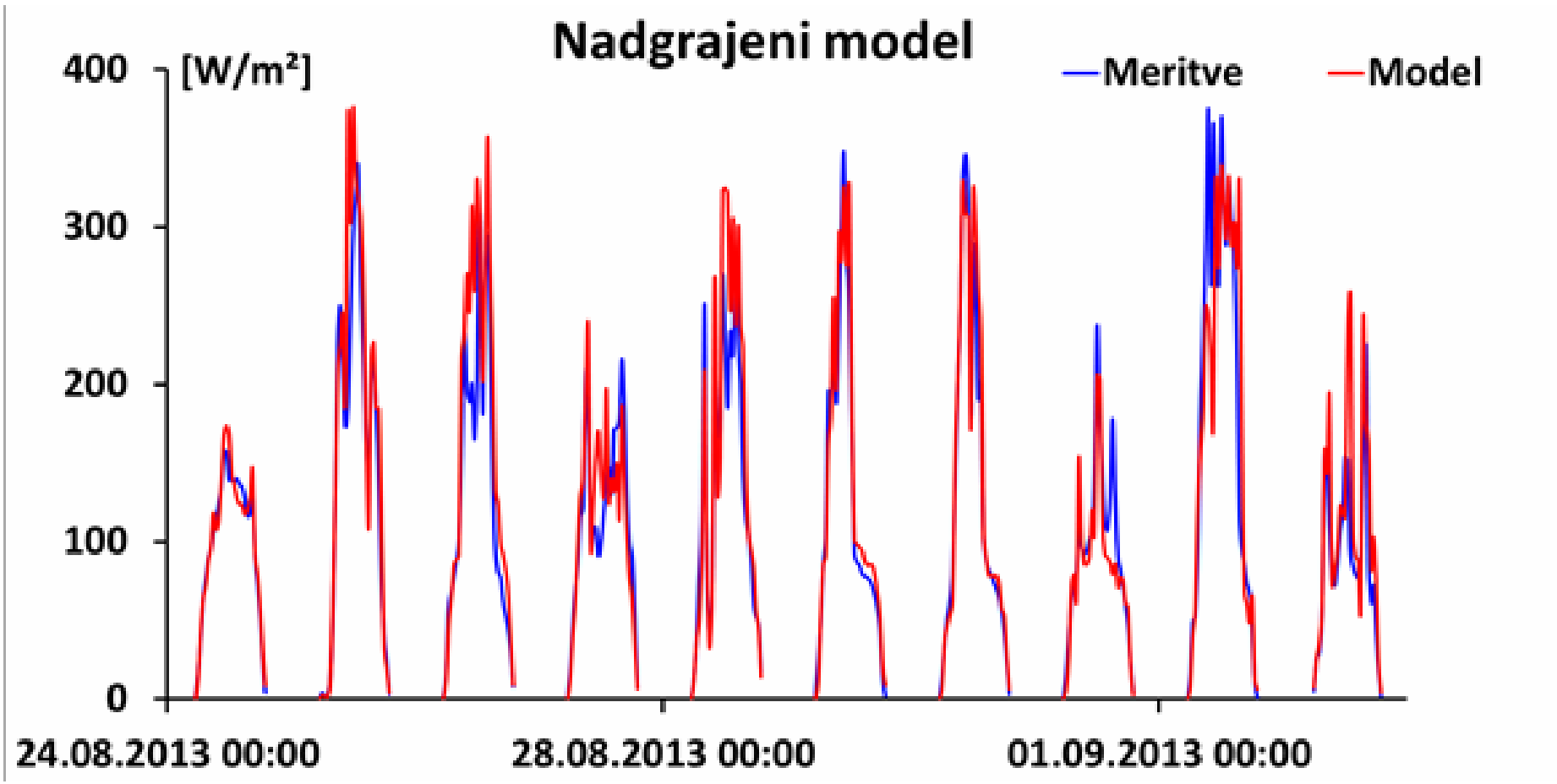
Temperatura zraka
Relativna vlažnost
Globalni sončni obsev
Difuzni sončni obsev
Zračni tlak
Hitrost vetra
Padavine
Sedanje vreme
RVR (hor. instrument. vidljivost)
MOR

Baza oblakov
Oblačnost – 1. nivo
Oblačnost – 2. nivo
Oblačnost – 3. nivo
Oblačnost – 4. nivo

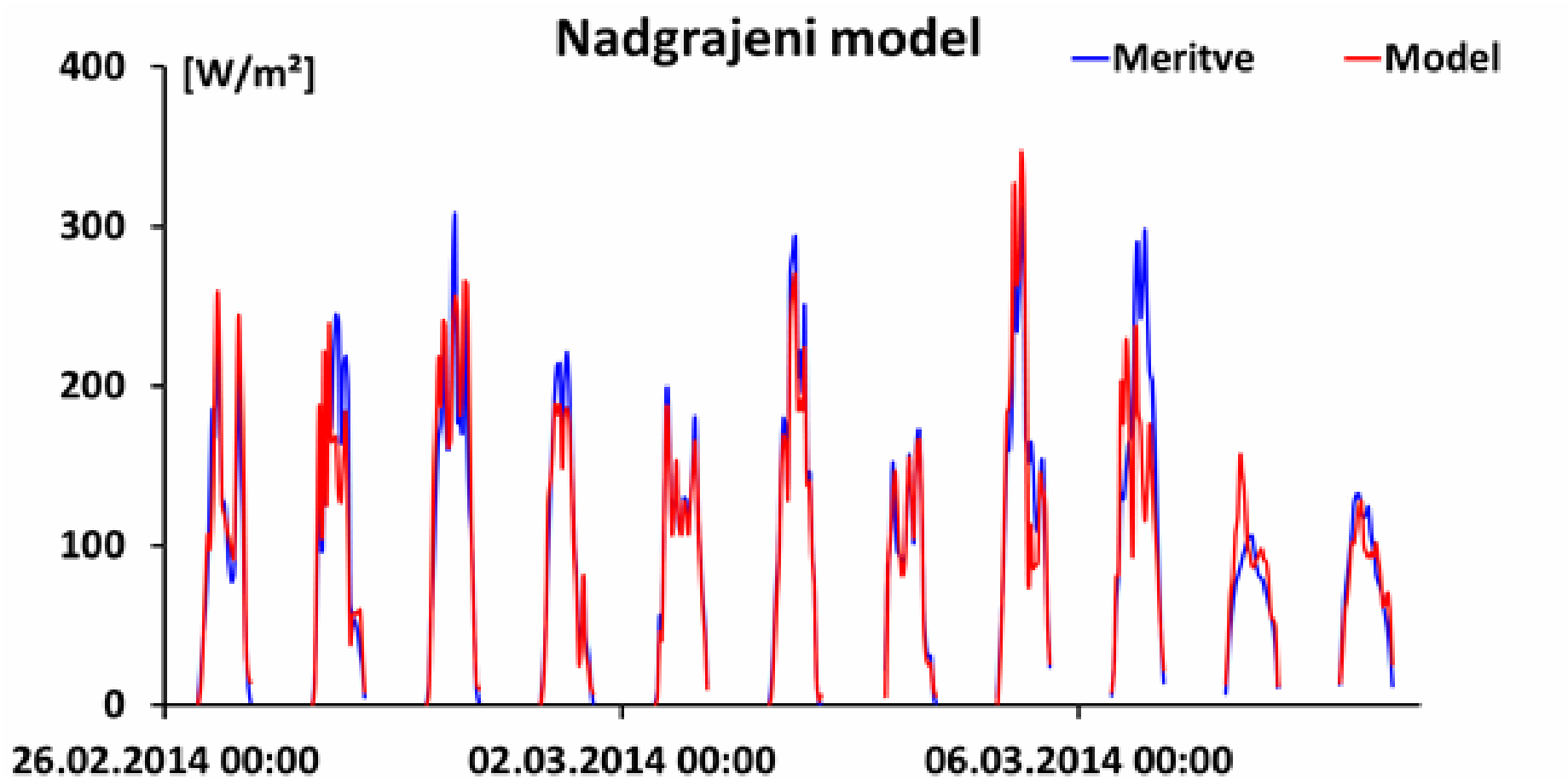
Dodatno:
- dan v letu
- ura v dnevu

Določitev vhodnih značilk NADGRAJENI MODEL

REZULTATI
modeliranja dif. son. obs.



REZULTATI
modeliranja dif. son. obs.



ZAHVALA: ARRS aplikativni raziskovalni projekti:

1	L1—4154	Izdelava modela za oceno razpoložljivosti sončne energije v Sloveniji na osnovi meteoroloških meritev	1.7.2011—30.6.2014
2	L2—5475	Razvoj in izvedba metode za sprotno modeliranje in napovedovanje onesnaženja zraka	1.8.2013—31.7.2016
3	L1—2082	Prognostični in diagnostični modelirni sistem za kontrolo onesnaženja ozračja v regiji	1.5.2009—30.4.2012

KOoreg
kontrola onesnaženja ozračja v regiji

SONČEK

OZON