

Atmosfersko modeliranje u zaštiti okoliša za potrebe istraživanja i krajnjeg korisnika

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Gekom - Geofizikalno i ekološko modeliranje d.o.o., Zagreb
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Agenda



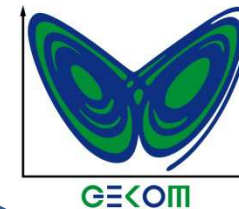
- Gekom d.o.o.
- Numerički meteorološki model WRF
- Modeli kvalitete zraka, primjena
- Numeričko modeliranje razina buke

Gekom – tko smo?



- Osnovani 2007.
- Poduzeće čije se usluge baziraju na specijalističkim znanjima iz geofizike, ekologije, matematike i informatike
- Interdisciplinarni tim od 10 ljudi:
 - geofizičari (meteorolozi, oceanografi)
 - matematičari (geomatika, promet)
 - informatičari
 - ekolozi
- Razvoj i primjena numeričkih (simulacijskih, predikcijskih) modela
 - potrebe primijenjene ekologije
 - organizacije prostora (zaštite prirode i okoliša, prostorno planiranje)
 - upravljanja prirodnim resursima i infrastrukturama

Gekom – čime se bavimo?



Usluge geofizikalnog,
ekološkog i numeričkog
modeliranja:

Atmosferski procesi

Hidrodinamički procesi

Hidrološki procesi

Procjena potencijala
obnovljivih izvora energije

Disperzija polutanata

Procjena razina buke

Modeliranje prometa

Biološko/ekološki procesi

Procjena okolišnog rizika

Prometni tokovi

..

Područja
primjene

Zaštita okoliša i
prirode

Obnovljivi
izvori energije

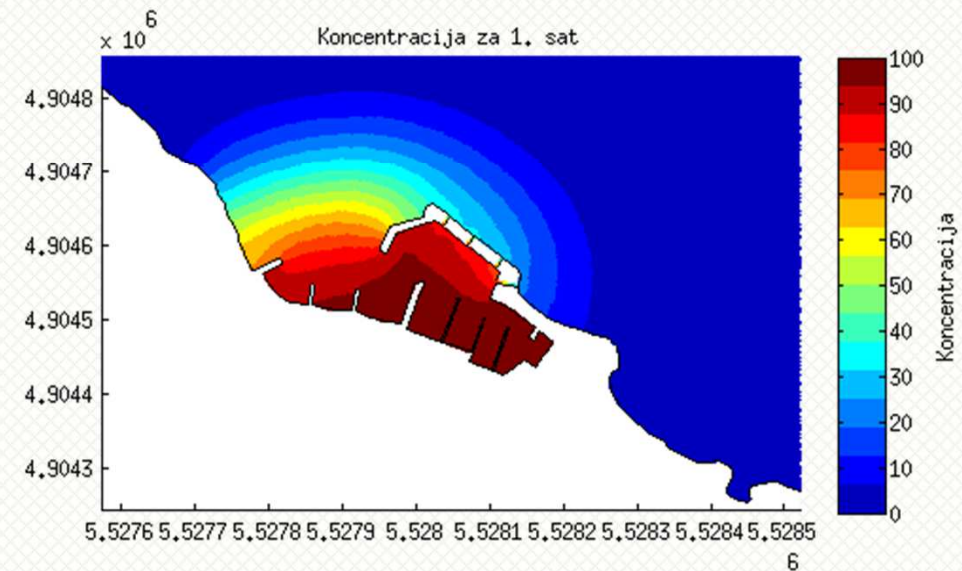
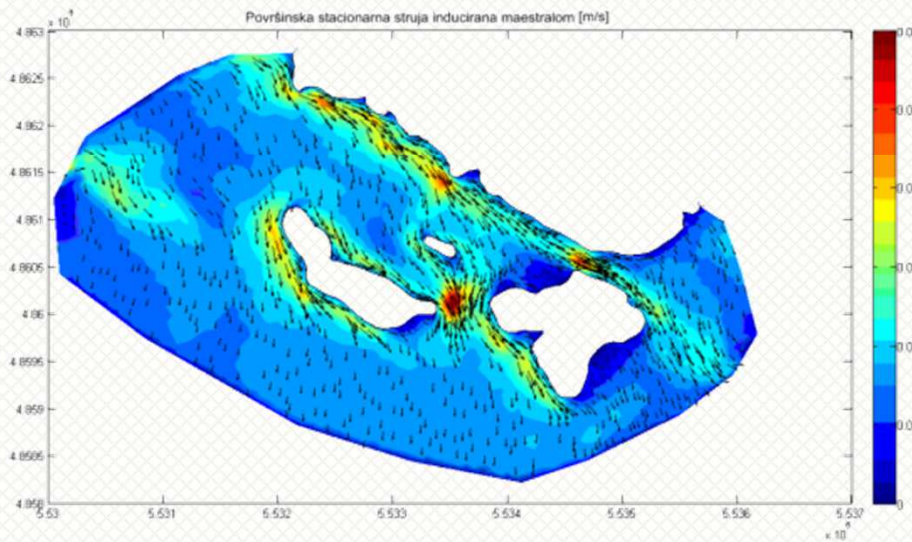
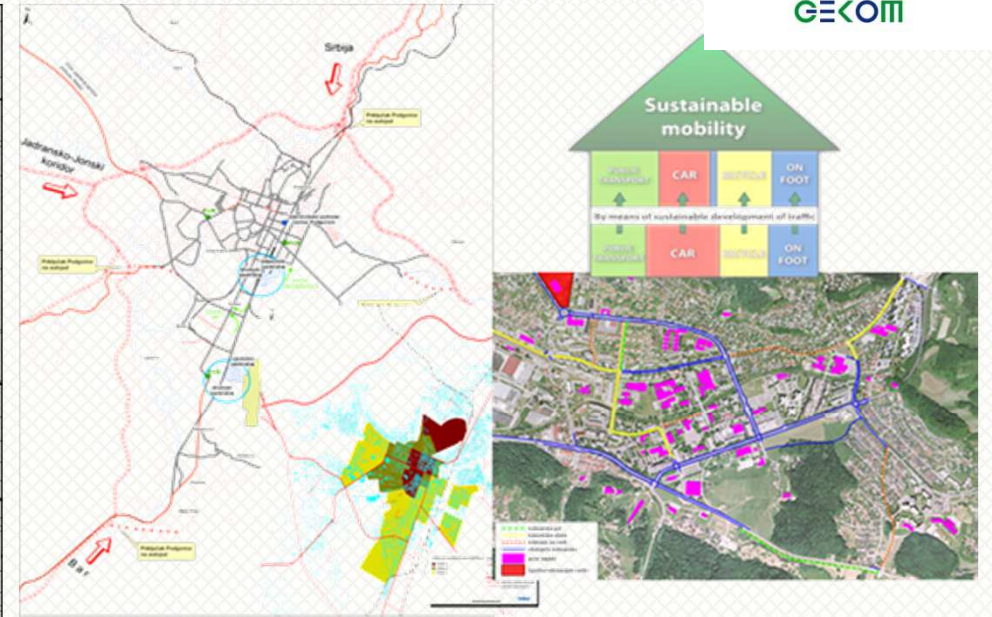
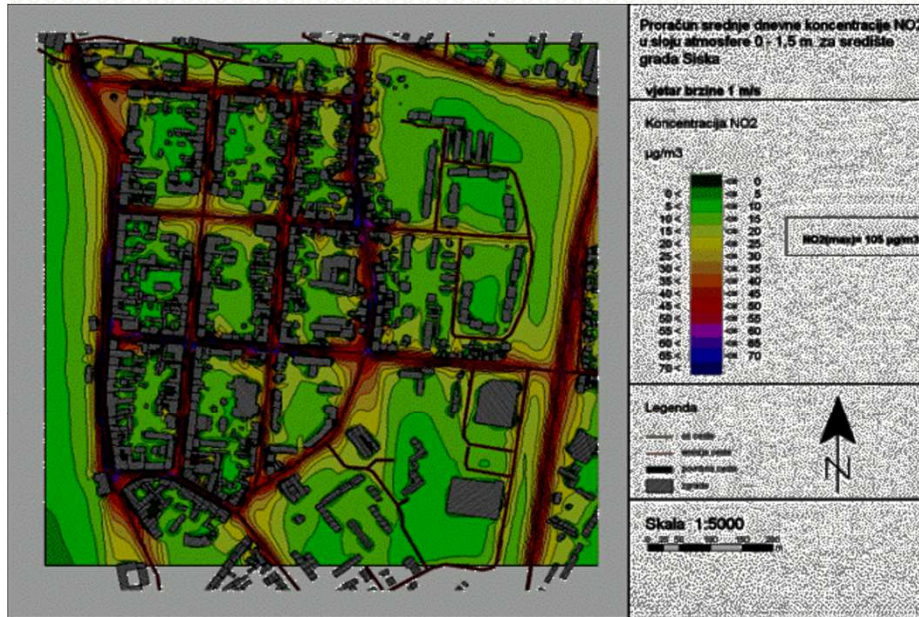
Upravljanje
prirodnim
resursima

Optimiranje
građevinskih i
infrastrukturnih
objekata

Promet i
prostor

Istraživanje i razvoj

Gekom – čime se bavimo?



Numerički meteorološki model



WRF (*Weather Research and Forecasting*)

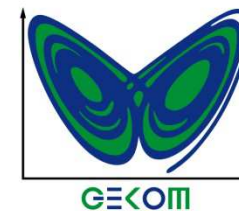
- Mezoskalni meteorološki model
 - Regionalno
 - Lokalno
- Znanstveno – stručna primjena
- Združivanje sa drugim modelima (modeli kvalitete zraka)



NAUTIČKA PROGNOZA ZA JADRAN

Računalna prognoza vremena, valova, struja i ostalih parametara mora za nautičare i sve one koje zanima prognoza za Jadran - **rezultati vlastito pokretanih modela!**

saznaj ➔ više



Prognoza vremena za JADRAN

Prognoštiki model WRF-ARW visoke prostorne razlučivosti za cijeli Jadran i pojedinačne regije - meteo karte.



- > Vjetar
- > Temperatura zraka
- > Refleksivnost
- > Naoblaka niska
- > Naoblaka srednja
- > Naoblaka visoka
- > Oborina
- > Relativna vlaga
- > MCAPE

Karte mora

Karte oceanografskih parametara na visokoj prostornoj razlučivosti za Jadran i pojedinačne regije



- > Značajna visina vala
- > Period vala
- > Duljina vala
- > Površinske struje
- > Struje na 20m dubine
- > Anomalija razine
- > Temperatura mora
- > Salinitet

Prognoza za odabranu lokaciju

Šestodnevne (svaka 3 sata) ili trodnevne (satne) prognoze meteoroloških i oceanografskih parametara za odabranu lokaciju.



- > Brzina i smjer vjetra
- > Valni parametri
- > Temperatura zraka
- > Tlak zraka
- > Naoblaka i oborina
- > Morske struje
- > Temperatura mora
- > Razina mora

Obavijesti o nadogradnjama

Ukoliko želite primati obavijesti o nadogradnjama sustava prijavite se na našu kontakt listu.

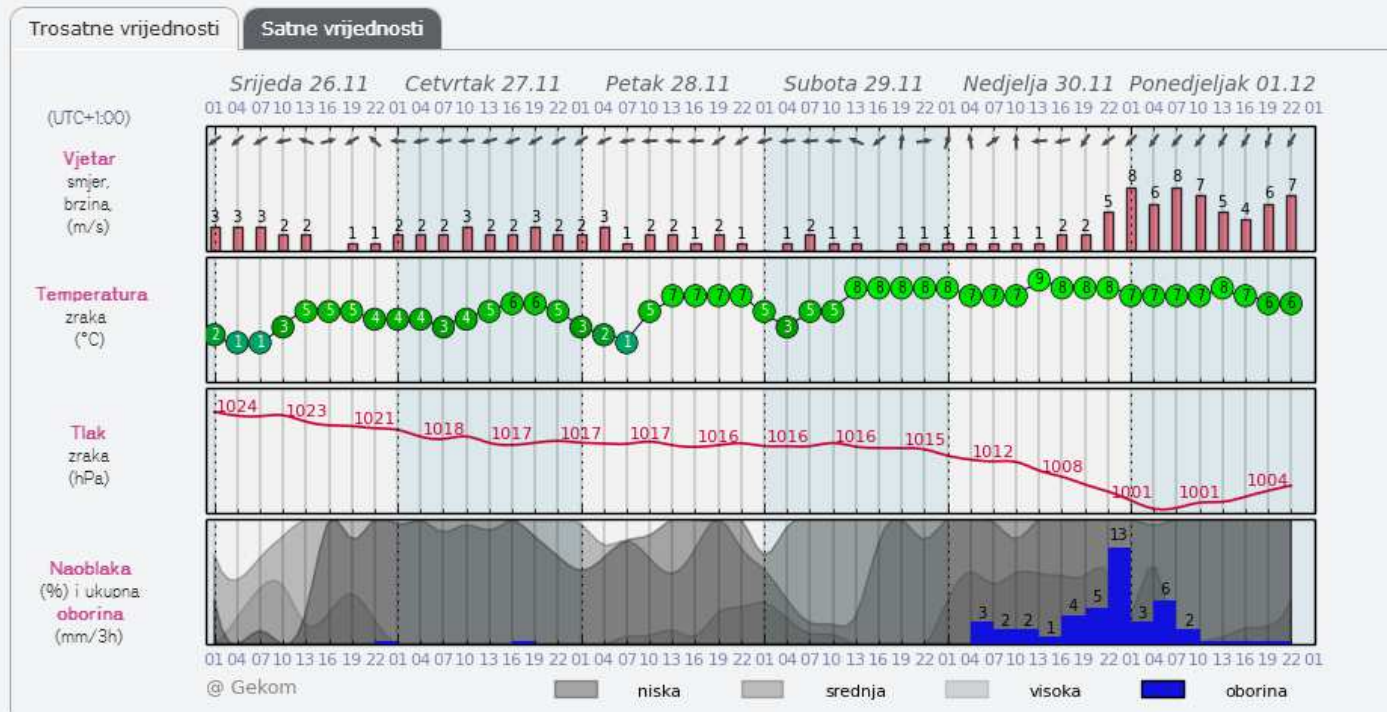
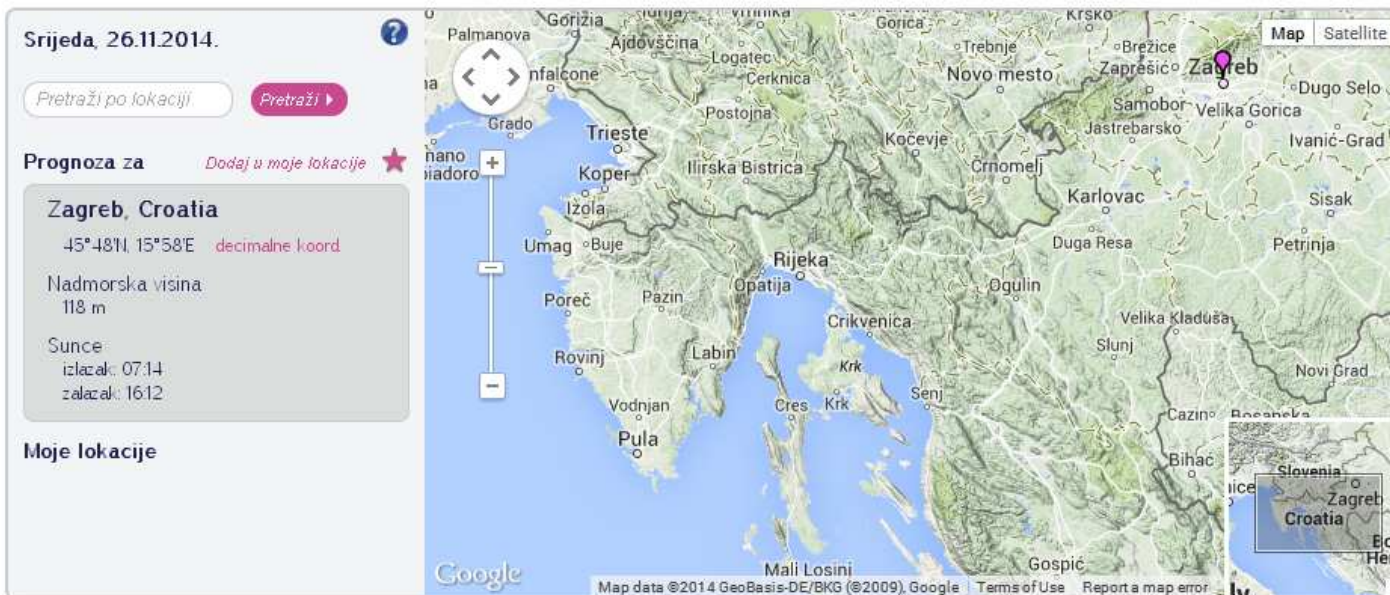
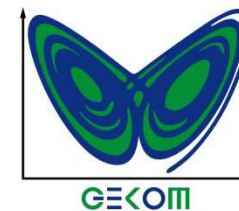
Unesite Vašu email adresu...

Pošalji

Za podatke ili detaljne meteo karte i karte mora za specifična područja od interesa, u svrhu planiranja regata ili plovidbenog puta, **kontaktirajte nas!**

Preporučite nas ukoliko su Vam naše informacije bile korisne!

Google+ 3 Facebook Share 16 Tweet 1 Email 4



REGIJE

Jadran

DATUM

26.11.2014

SAT (UTC+1:00)

01 04 07 10 13 16 19 22

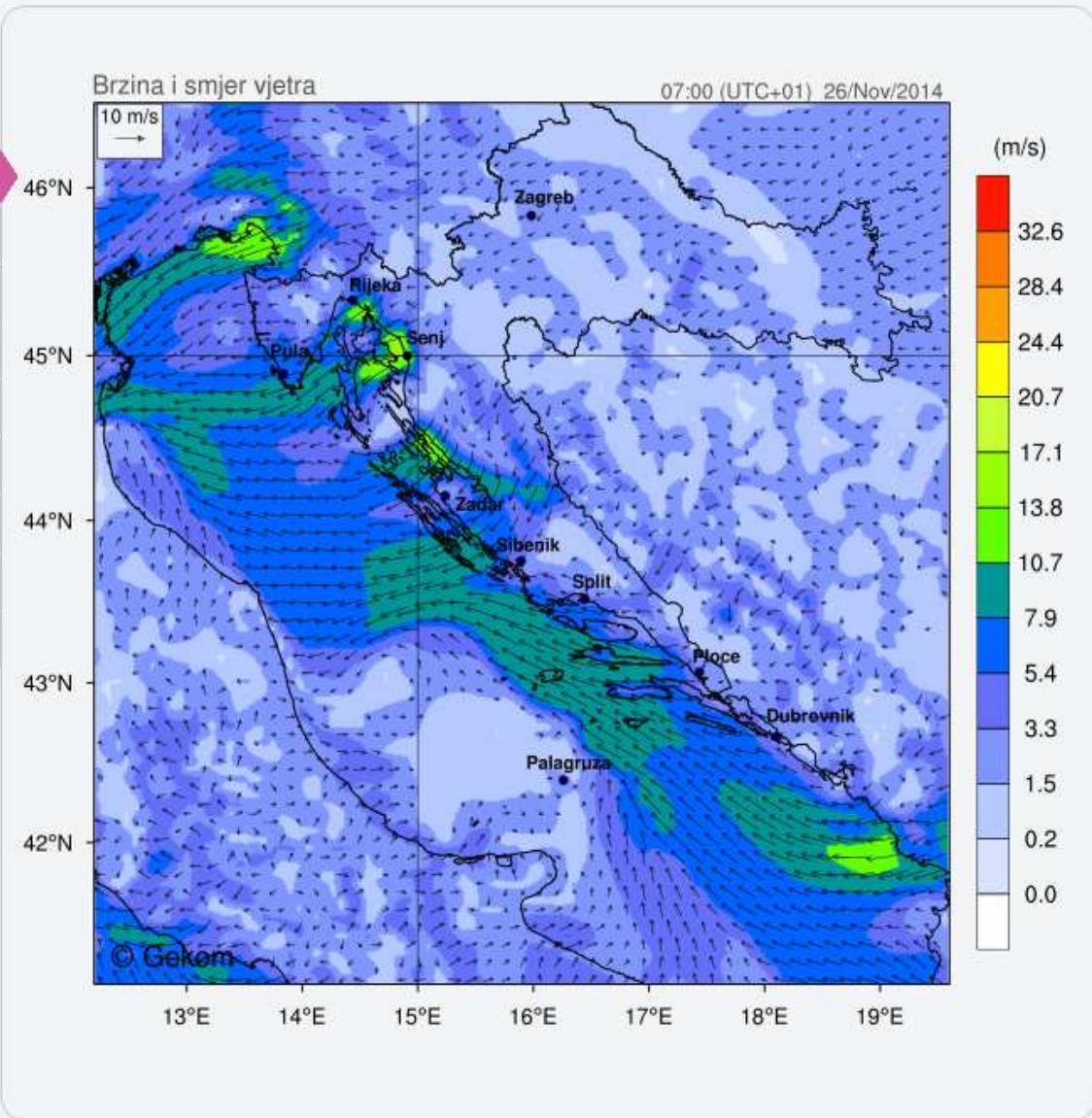
animacija

Lokacija



Rezultati prognostičkog modela WRF-ARW

- Vjetar
- Temperatura zraka
- Refleksivnost
- Naoblaka niska
- Naoblaka srednja
- Naoblaka visoka
- Oborina
- Relativna vlaga
- MCAPE



Modeli kvalitete zraka



Rješavanje jednažbi:

- Gauss
- Lagrangian
- Euler
 - CFD

Model gustoće plina

Box model

...

Način rješavanja procesa:

- Disperzijski modeli
- Fotokemijski modeli
- Receptorski modeli

Izlazna polja

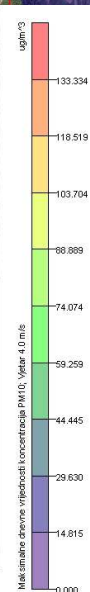
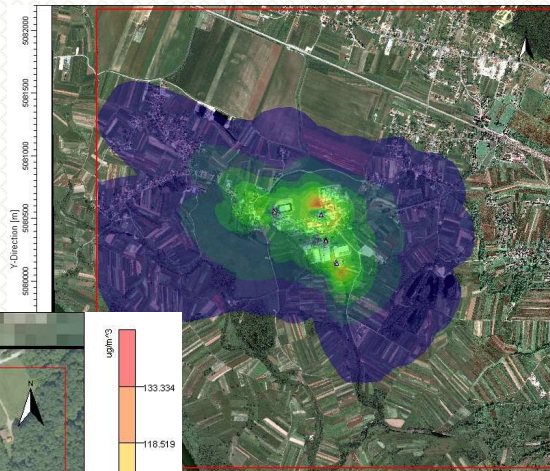
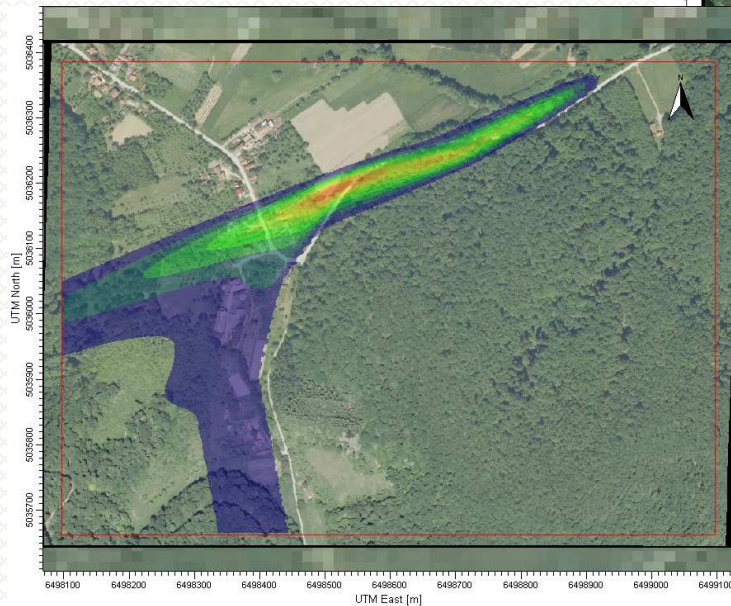
- Procjena vrijednosti koncentracija (maks. koncentracije)
- Izračun vrijednosti koncentracija

Modeli kvalitete zraka

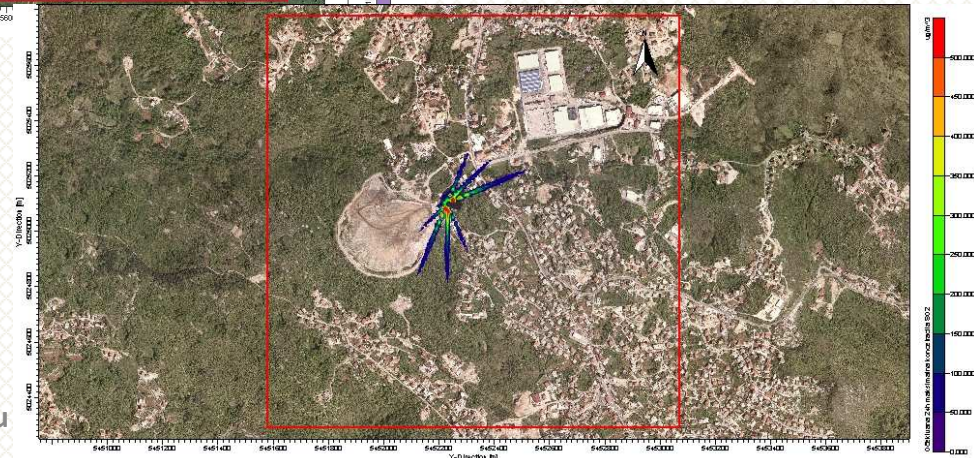
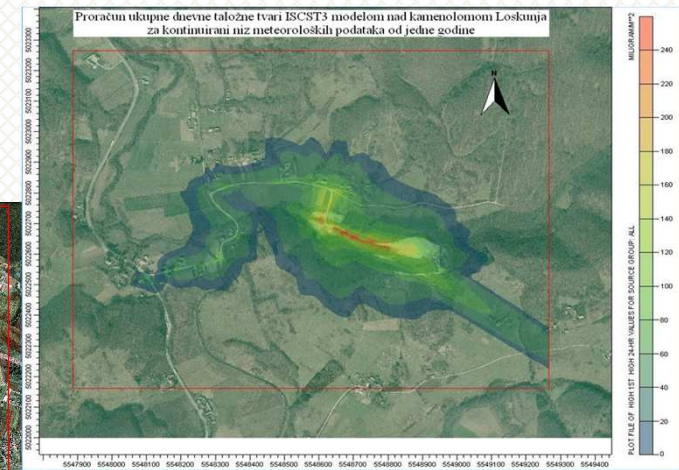


Primjena

- Studije utjecaj na okoliš (procjene utjecaja na okoliš)
AERMOD, ISCST3, MLuS, ...



odela u

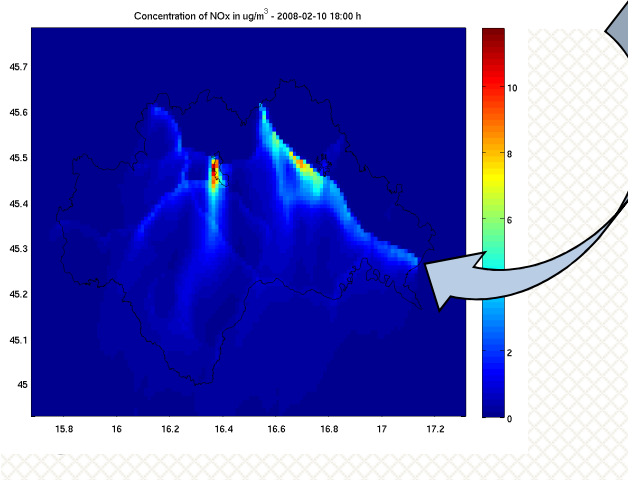
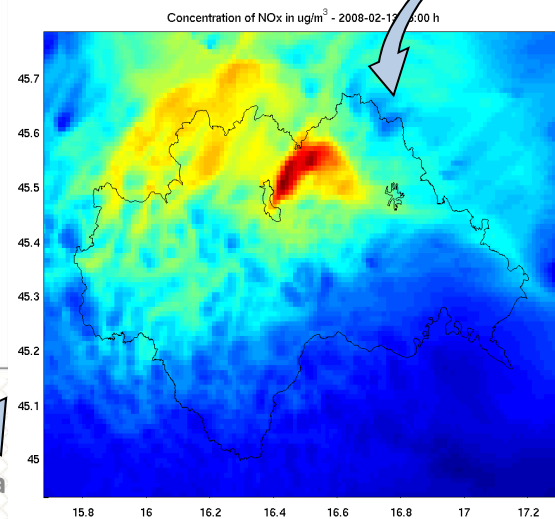
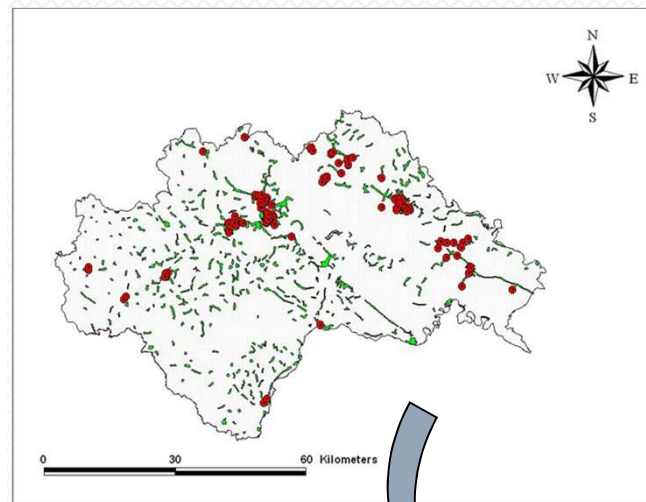
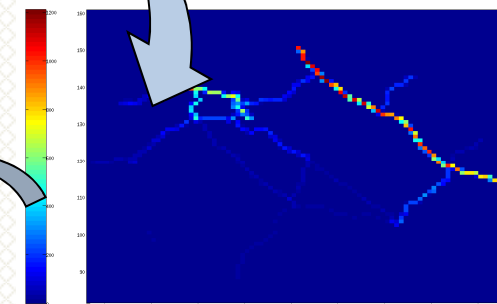
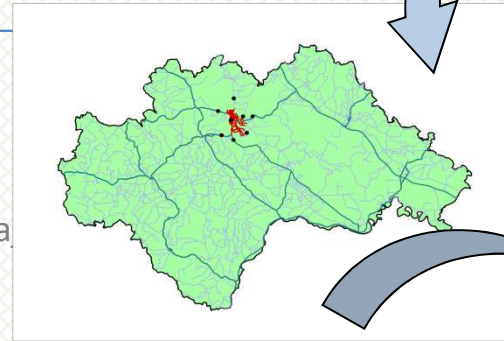


Modeli kvalitete zraka



Primjena

- Studije utjecaj na okoliš (procjene utjecaja na okoliš)
AERMOD, ISCST3, MLuS
- **Stručne studije (Slučaj grada Siska i Sisačko-moslavačke županije)**
WRF – CAMx model



Modeli kvalitete zraka



Primjena

- Studije utjecaj na okoliš (procjene utjecaja na okoliš)
AERMOD, ISCST3, MLuS
- Stručne studije (Slučaj grada Siska i Sisačko-moslavačke županije)
WRF – CAMx model
- **Znanstveno - stručni projekti (EUREKA 3266!, EUREKA 5460!)**
Online informacijski sustav za upravljanje kvalitetom zraka i izvješćivanje javnosti (*Web Based Air Quality Assessment and Management Information System - for regional and local urban and industrial air quality management*)
WRF, MM5, CAMx, AERMOD (CAMQ, WRF Chem, ...)

ENVIRONMENTAL SOFTWARE AND SERVICES



AIRWARE: URBAN AIR QUALITY ASSESSMENT AND MANAGEMENT

User: kurt

- close
- logout
- help

AirWare: SISAK

Release 5.6 September 2009



- Hourly Nowcast
- Daily Forecast
- Scenario Analysis
- Databases
- Administrative Tools



Weather at 2011-08-23 08:00 CEST
Average over Sisak City A domain

Temperature: 17.9°C 21.5°C
 Min/Max: 20.4°C / 23.4°C
 Wind: 0.5 m/s 1.4 m/s
 167° 120°
 Pressure: 1002 mb 1004 mb
 Precipitation: 0.0 mm/h 0.0 mm/h
 Humidity: 81 % 67 %

last 3 hours



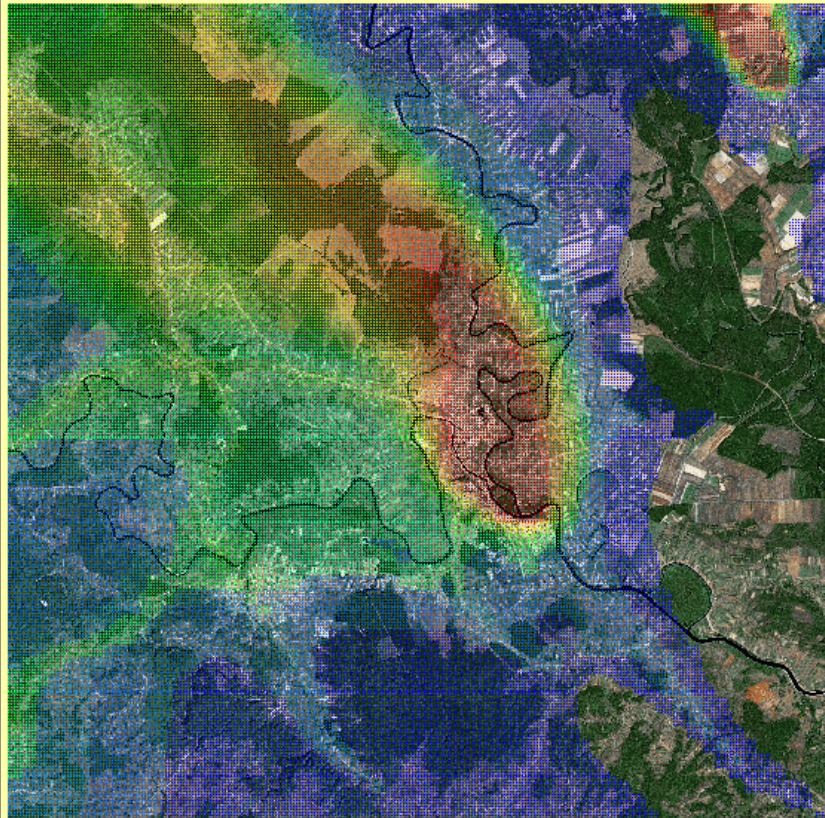
Pollutant **NO2**

Tuesday, 23rd of August 2011

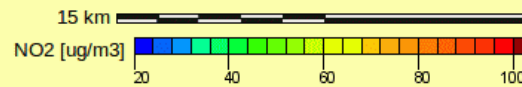


Current time 2011-08-23 08:39:29 CEST

07:00 - 08:00 CEST



Scenario
 Animate



Emission Inventory

Sisak 2

Owner
franz

Created 2008-11-11 14:46
Modified 2011-08-22 17:43

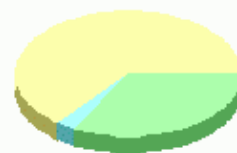
Number of Sources

| | |
|-------------------|-----|
| Industrial Plants | 0 |
| Boilers | 28 |
| Small Stacks | 84 |
| Area Sources | 1 |
| Line Sources | 390 |

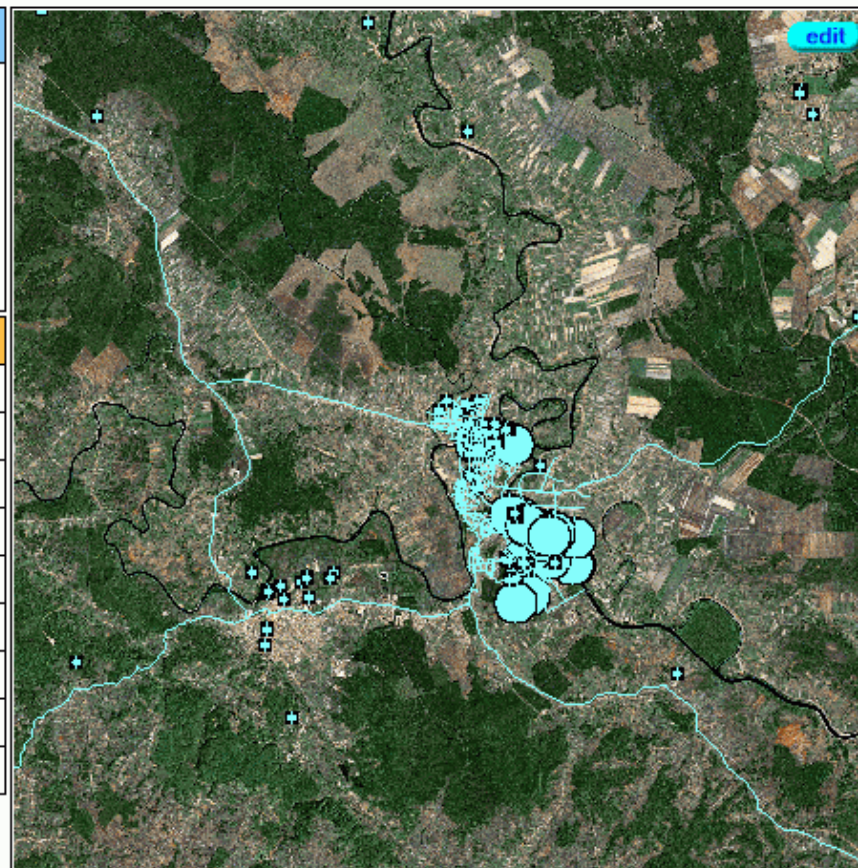
Emission by Sector

NOX

| | |
|--------------|--------|
| Area Sources | 0 % |
| Boilers | 64.3 % |
| Traffic | 3 % |
| Small Stacks | 32.8 % |



| Emissions | Total | Avg | Max | Missing |
|-----------|---------|----------|---------|---------|
| NOX | 729 g/s | 1.47 g/s | 170 g/s | 5.8 % |
| NO2 | 69 g/s | 0.67 g/s | 17 g/s | 83.3 % |
| NO | 623 g/s | 1.27 g/s | 153 g/s | 5.8 % |
| SO2 | 164 g/s | 1.50 g/s | 85 g/s | 83.3 % |
| TSP | 0 g/s | 0.00 g/s | 0 g/s | 100.0 % |
| PM10 | 1 g/s | 0.00 g/s | 0 g/s | 5.8 % |
| PM2.5 | g/s | g/s | g/s | 100 % |
| VOC | 9 g/s | 0.02 g/s | 1 g/s | 22.5 % |
| CO | 87 g/s | 0.17 g/s | 33 g/s | 5.8 % |



User: **close**

kurt **help**

delete **save**

Description **Overview**



Model scenario: MM5

Croatia e3 FC2

Thursday, 25th of August 2011

00:00 - 24:00

Owner: christina
Created: 2011-08-18 18:19
Modified: 2011-08-18 18:19

2011-08-25

10:00-11:00
Layer: 1

details

Wind speed [m/s]

Animate

GENERAL PROPERTIES

| | |
|-----------------|------------|
| Domain | Croatia e3 |
| Duration | 24 h |
| Grid resolution | 6000 m |
| Output layers | 8 |

Averages of layer 1 at 10:00

| | |
|----------------|---------|
| Temperature | 25.8 °C |
| Wind speed | 0.4 m/s |
| Wind direction | 237 ° |



RESULT SUMMARY

Temperature (first layer)

| | |
|---------|------------------|
| Average | 24.8 °C |
| Min/Max | 8.2 °C / 35.5 °C |

Wind speed (first layer)

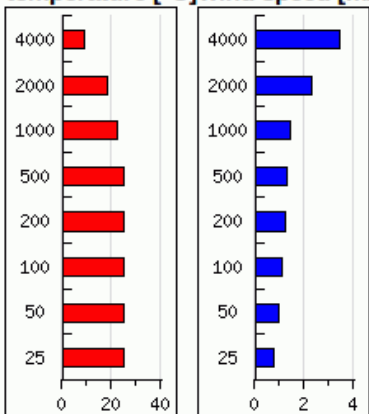
| | |
|---------|-------------------|
| Average | 0.8 m/s |
| Min/Max | 0.0 m/s / 8.0 m/s |

Water content (first layer)

| | |
|---------------------|------------|
| Humidity | 18912 ppm |
| Cloud water | 0.11 g/m3 |
| Max Precipitation | 0.33 mm/h |
| Total Precipitation | 1.6 mm/day |
| Pressure | 970 mb |

VERTICAL PROFILES

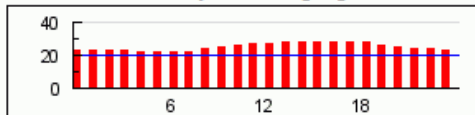
temperature [°C] wind speed [m/s]



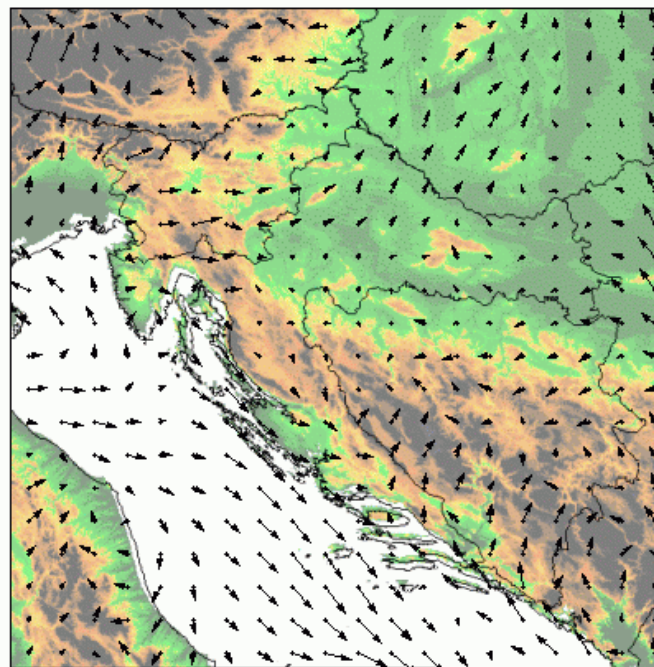
wind speed [m/s]



temperature [°C]



relative humidity [%]



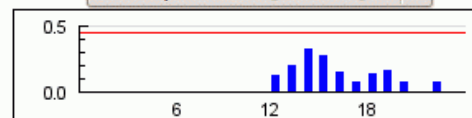
Comparison

300 km

Wind speed [m/s]

0.8

Precipitation [mm/h]





TIMESERIES: Comparison

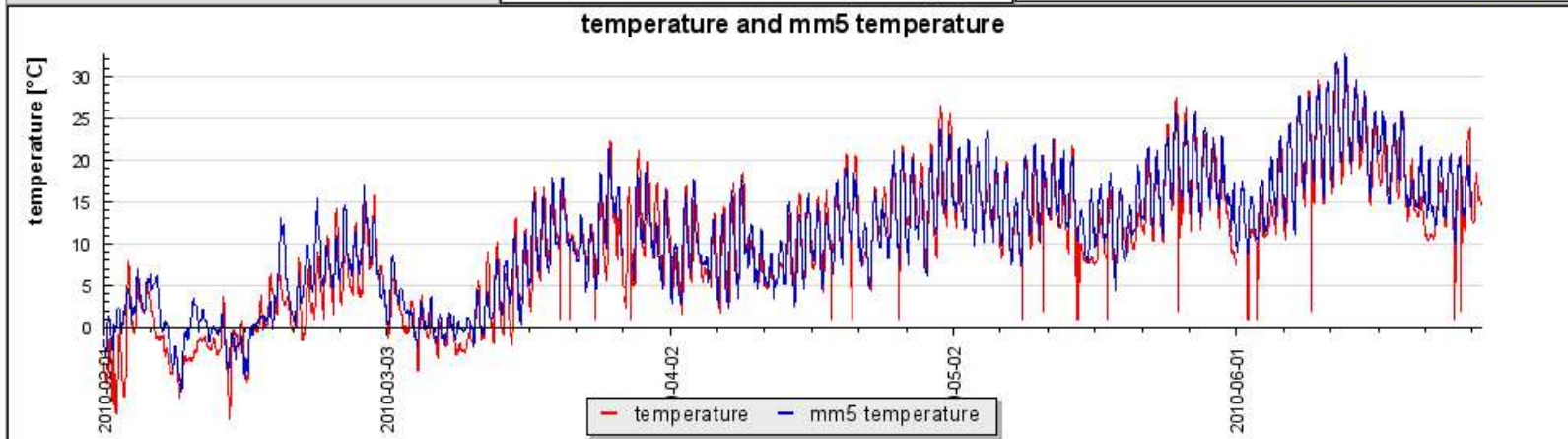
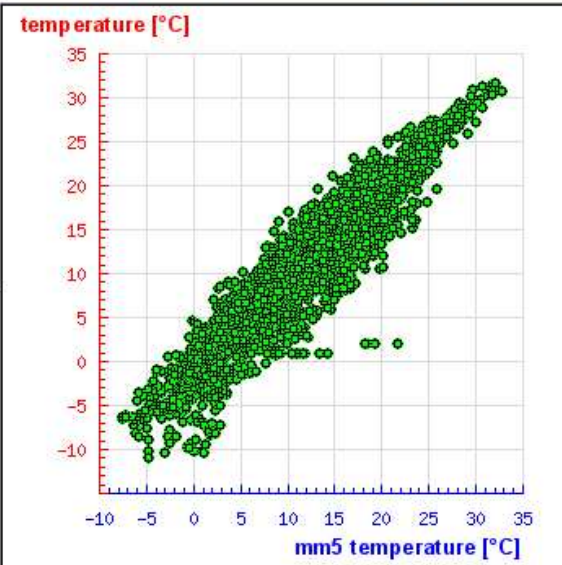
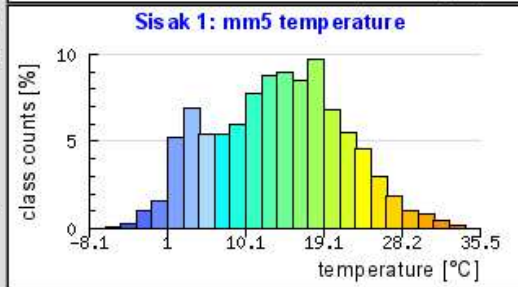
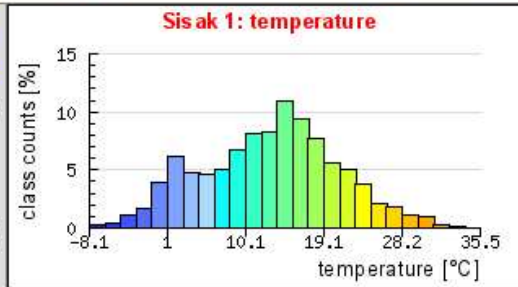
| Parameter | Dataset | Station type | Station | Name | Step |
|-------------|----------|--------------|---------|-----------------|--------|
| temperature | observed | Combined | Sisak 1 | temperature | 60 min |
| temperature | MM5 | Combined | Sisak 1 | mm5 temperature | 60 min |

| Name | Values | Valid | Min | Max | Avg | Unit | stdev | Skewness | Kurtosis |
|-----------------|--------|--------|---------|--------|--------|------|-------|----------|----------|
| temperature | 3464 | 98.9 % | -10.900 | 31.600 | 9.972 | degC | 7.909 | -0.037 | -0.452 |
| mm5 temperature | 3458 | 98.7 % | -7.620 | 32.670 | 10.908 | degC | 7.524 | 0.049 | -0.575 |

Startdate: 2010-02-01
 Enddate: 2010-06-26
 Matching data pairs: 3420
 Bias Error: 0.99
 Mean square error: 2.78

Pearson: coeff 0.94, prob0 0.00e+00
 Spearman: 0.94, 0.00e+00
 Kendall: 0.80, 0.00e+00
 coeff ... (correlation) coefficient
 prob0 ... probability of zero correlation

Min. Scale:



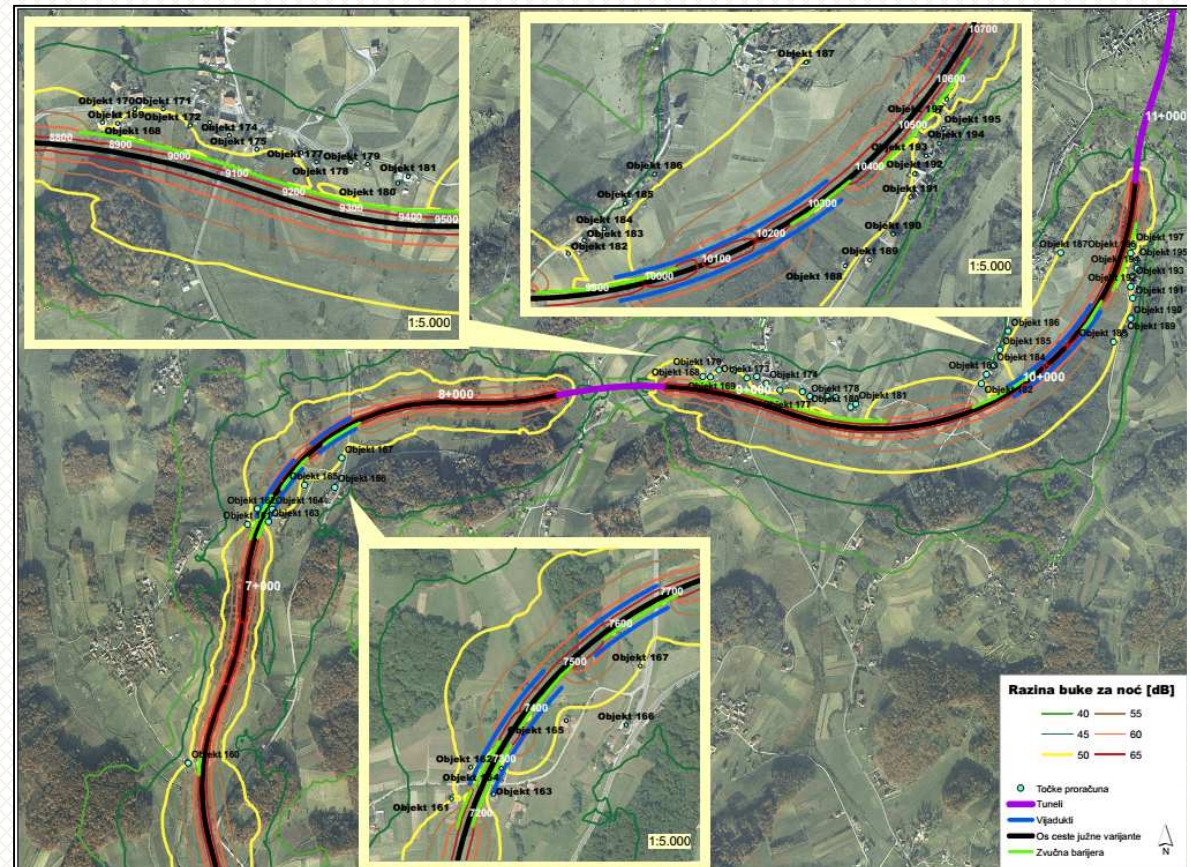
Numeričko modeliranje buke



Iznimno važan dio Studije utjecaja na okoliš prilikom planiranja i projektiranja novih ili rekonstrukcije postojećih zahvata u okolišu

Soundplan 7.1.

- Prometna infrastruktura
ceste, željezničke pruge, ...
- Industrijski izvori
*vjetroelektrane, plinovodi,
kamenolomi...*



Primjena atmosferskih modela u zaštiti okoliša i ljudi, 27.11.2014.

Numeričko modeliranje buke



Iznimno važan dio Studije utjecaja na okoliš prilikom planiranja i projektiranja novih ili rekonstrukcije postojećih zahvata u okolišu

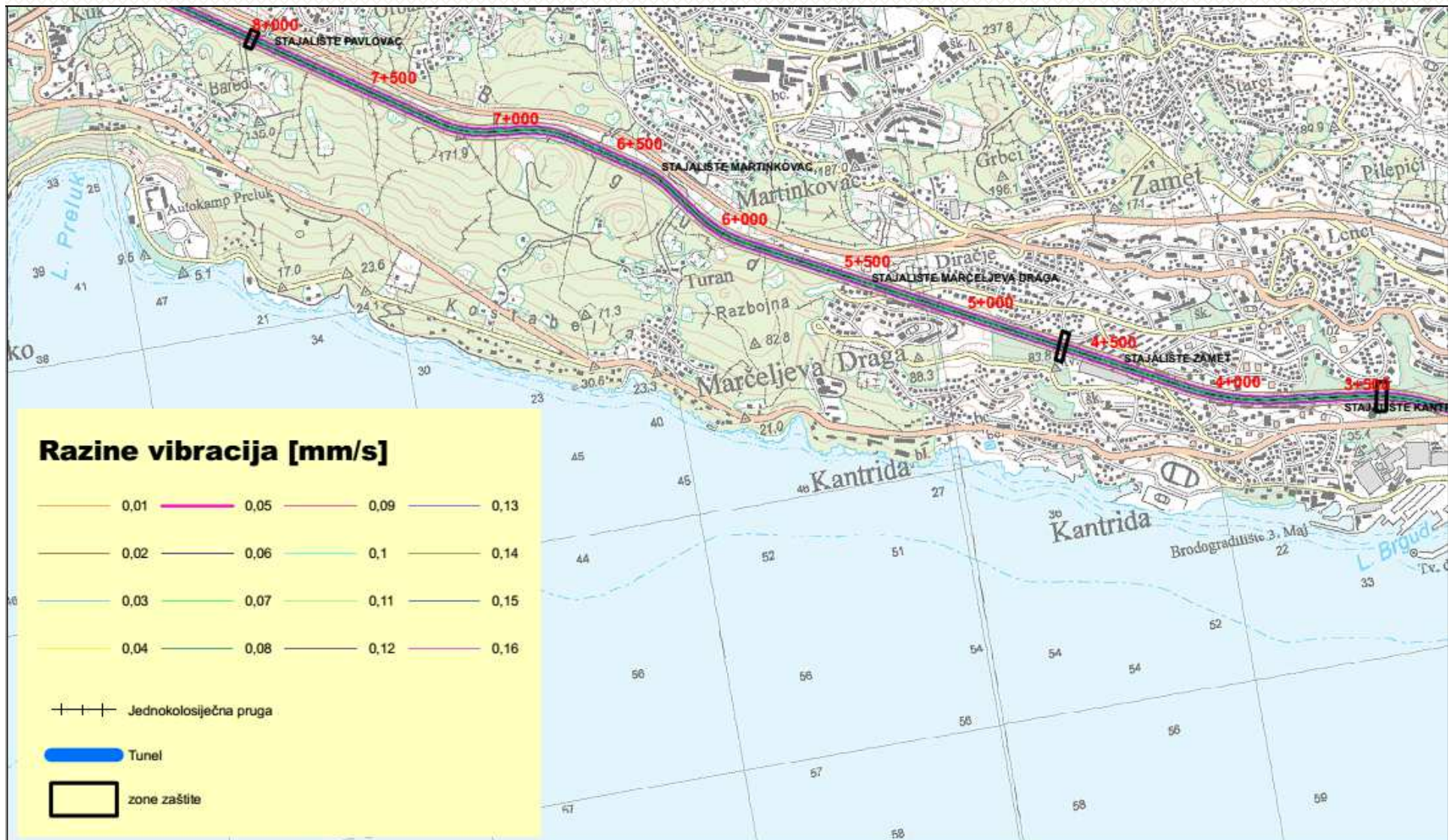
Soundplan 7.1.

- **Prometna infrastruktura**
ceste, željezničke pruge, ...
- **Industrijski izvori**
*vjetroelektrane, plinovodi,
kamenolomi...*

Vibra 1. & 2.

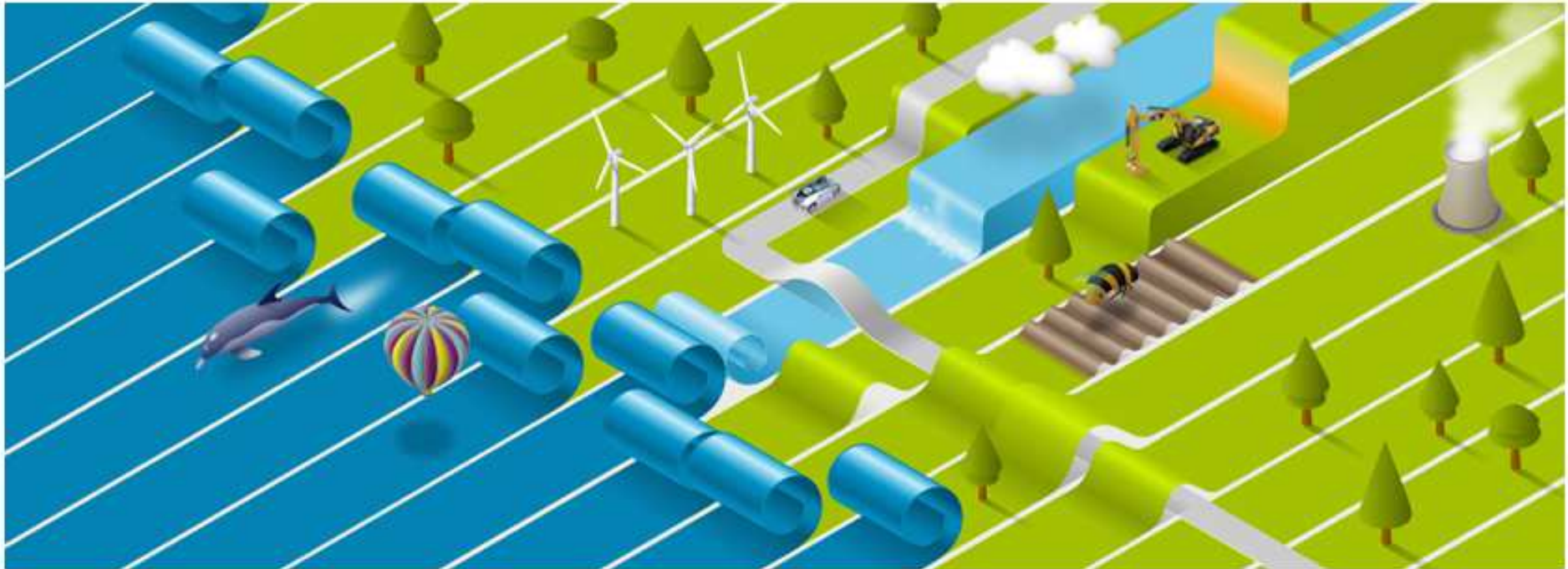
- Vibracije i niskofrekventna buka

Numeričko modeliranje buke



Sažetak

- Numeričko modeliranje
 - WRF
 - AERMOD, ISCST3, MluS, *screening modeli*
 - Soundplan, Vibra 1. & 2.
- Modelski sustav:
 - WRF – CAMx
 - WRF – CMAQ
 - WRF Chem
- Primjena – stručne i znanstvene studije



Hvala na pažnji!

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