

Modelling support for near-surface ozone pollution assessment for 2012 and 2013 - Poland

Application of Delta Tool for GEM-AQ model evaluation

Contract from the Chief Inspectorate for Environmental Protection (Poland)

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Main contractor: Warsaw University of Technology

Sub-contractor: EcoForecast Foundation



Outline

- GEM-AQ model
 - Domains
 - Emissions used in assessment
 - Evaluation with DELTA tool
 - 2012-2013 assessment results
 - Other works
-

GEM-AQ description

Global Environmental Multiscale – Air Quality model
built as part of a Canadian consortium
MAQNet (2001-2008)

- Meteorological model GEM
 - Model developed by RPN
 - Canadian operational weather forecast
 - Grid configuration allows for calculations in variable resolutions
 - Built-in option of limited area domains– LAM (cascade consistent calculation)
 - An extensive library of parameterization of physical processes
 - Data assimilation cycle
-

GEM-AQ description

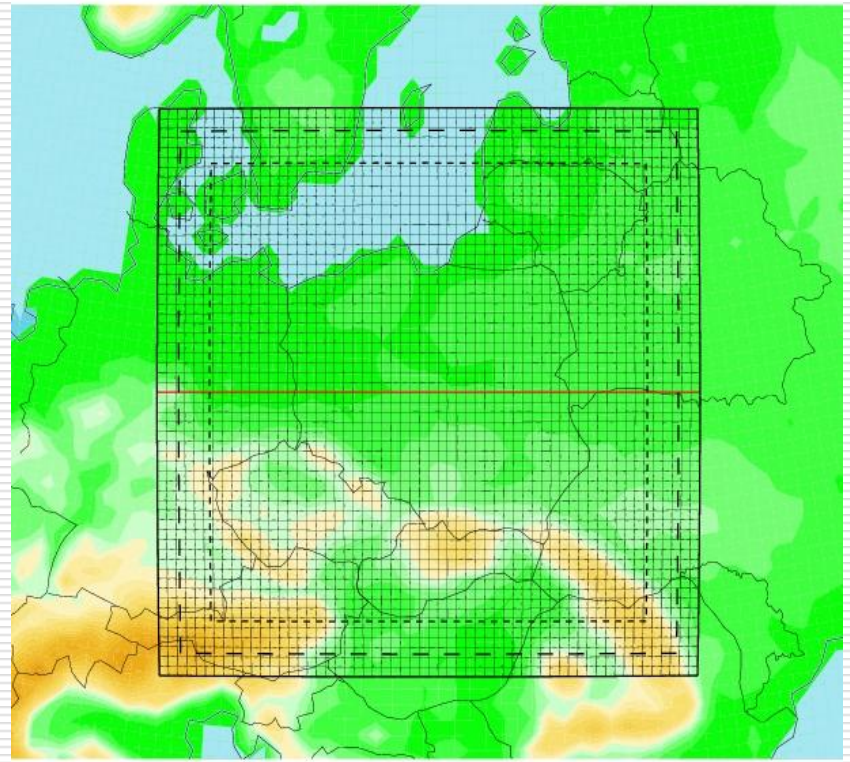
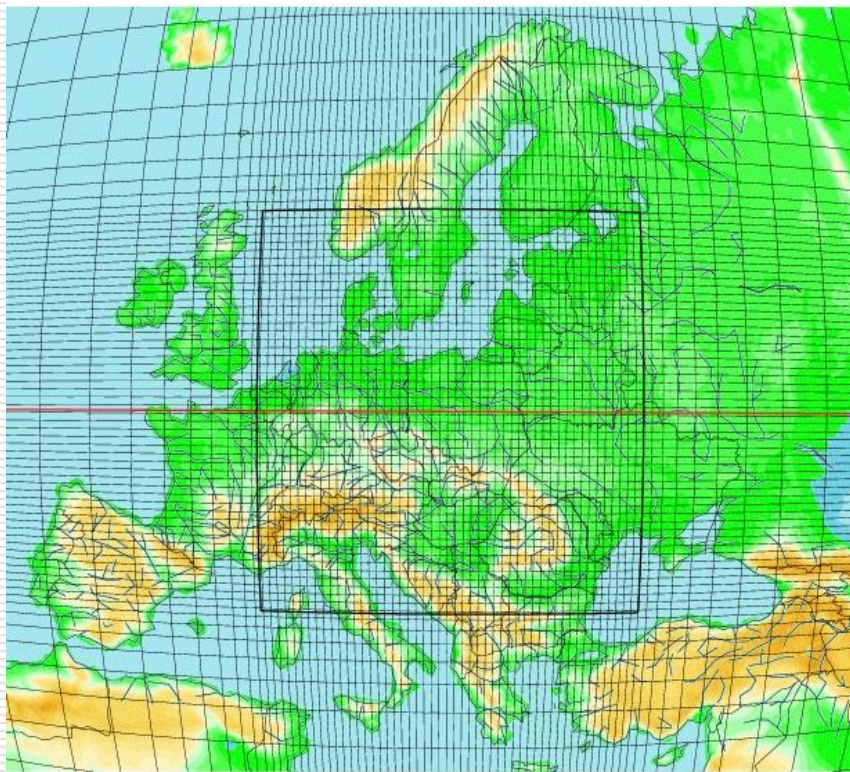
- Chemical module
 - On-line type
 - Tropospheric chemistry(extended ADOM II mechanism)
 - gas-phase chemistry – 50 species
 - Hydrocarbons aggregation(lumped molecular approach)
 - 116 chemical reactions, including 19 photochemical reactions – reaction constants dependent on temperature and pressure
 - chemical transformations typical of the troposphere
 - Dry deposition and washout
-

GEM-AQ description

- Chemical module cd...
 - Aerosols chemistry and physics – based on CAM (Gong, 2003)
 - 12 size intervals: 0.005 - 20.48 μm
 - Heterogeneous chemical reactions
 - Horizontal advection and diffusion

 - Biogenic and anthropogenic emissions
 - Possibility of area emission insertion for several gaseous pollutants
 - Different height of emission sources
 - Biogenic emissions
 - Aerosol precursors
 - Sea salt aerosol emissions generated on-line based on wind speed
-

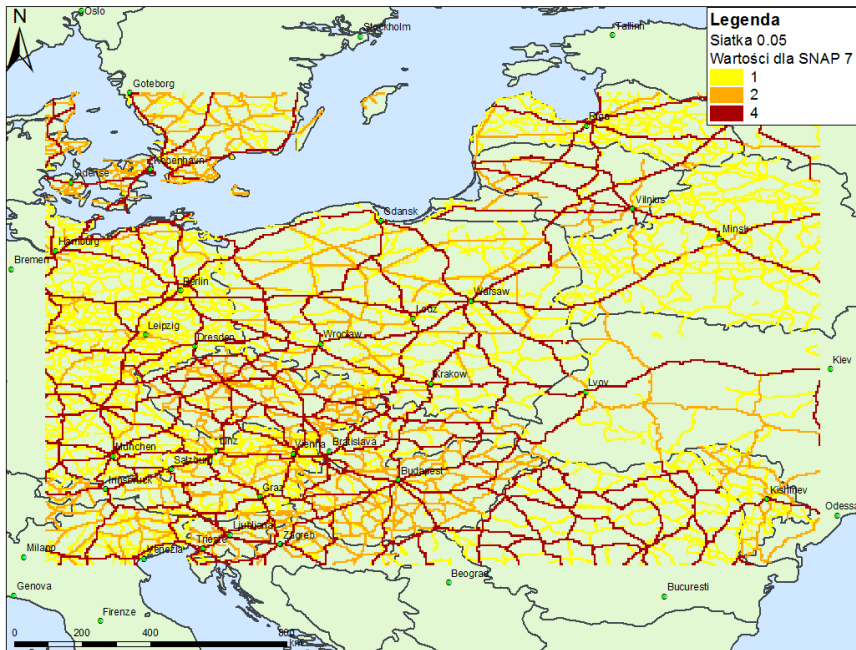
Modelling domain



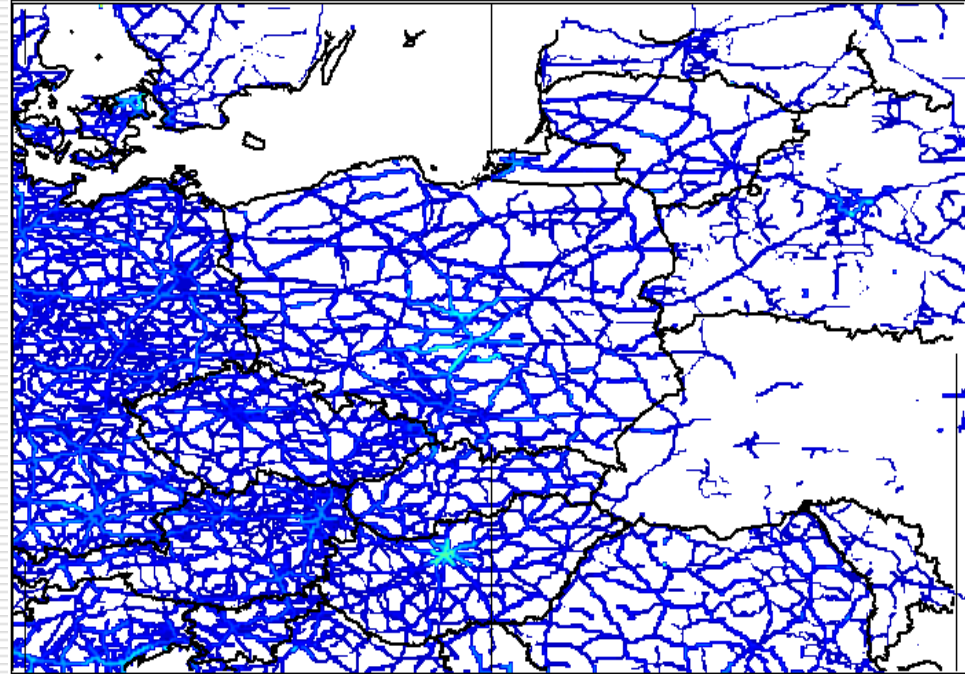
Emission data

- ❑ EMEP inventory (valid 2010/2011)
 - ❑ Emission 0.5x0.5 Mercator relocated to 0.125x0.125 and 0.05x0.05 based on GIS information
 - ❑ Relocation masks separate for each SNAP category
 - ❑ Temporal variability and vertical distribution for each SNAP category
-

EMEP inventory - relocation



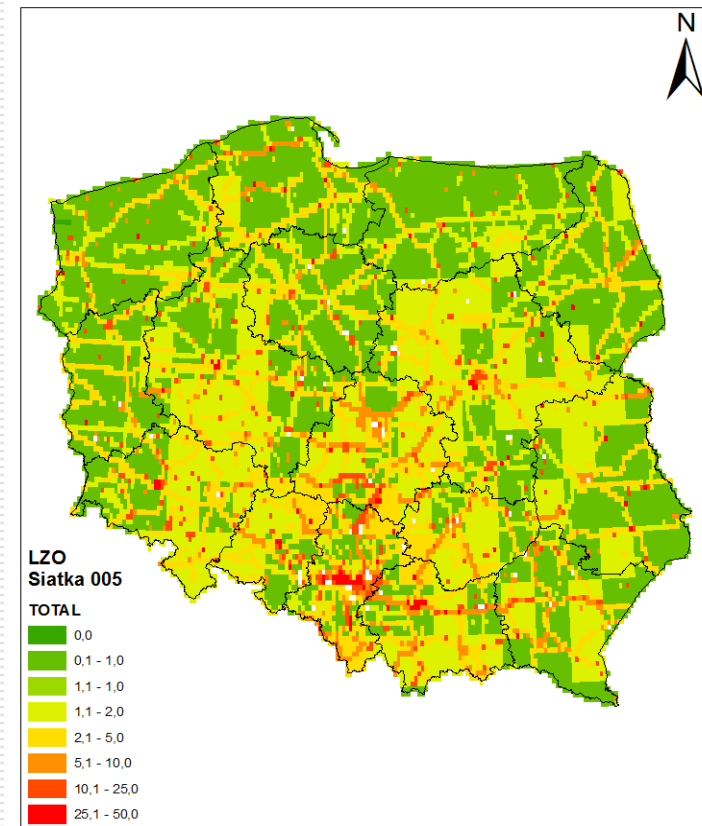
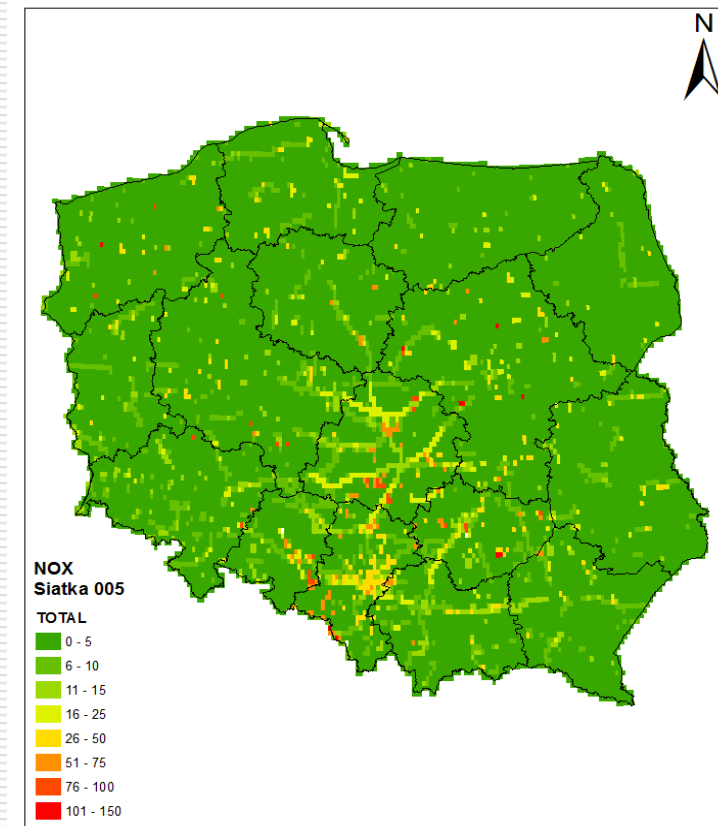
Relocation mask



Final emission flux

NO_x SNAP07

Total NOx and VOC

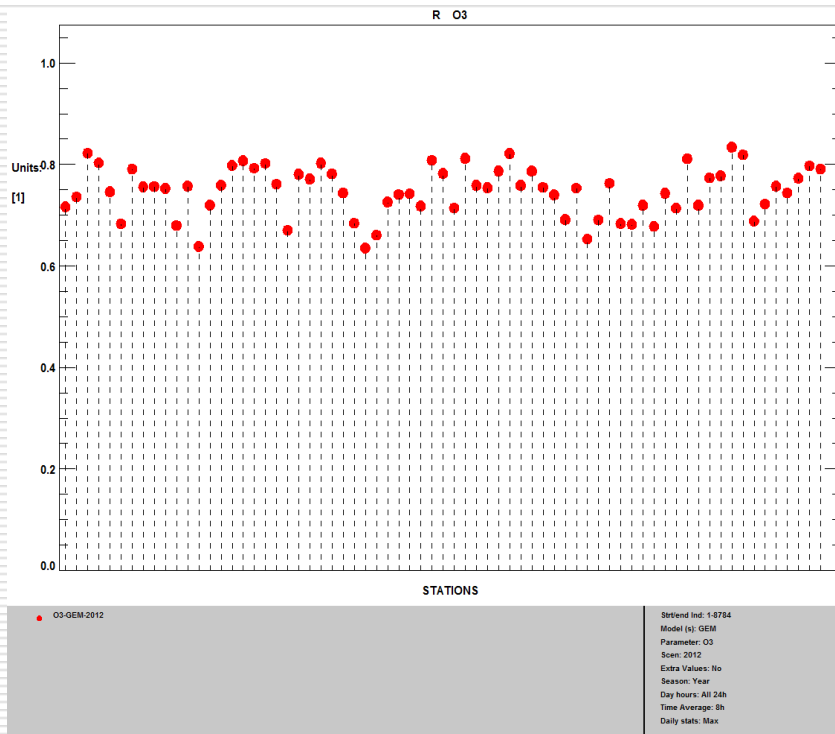


Delta tool application for Poland

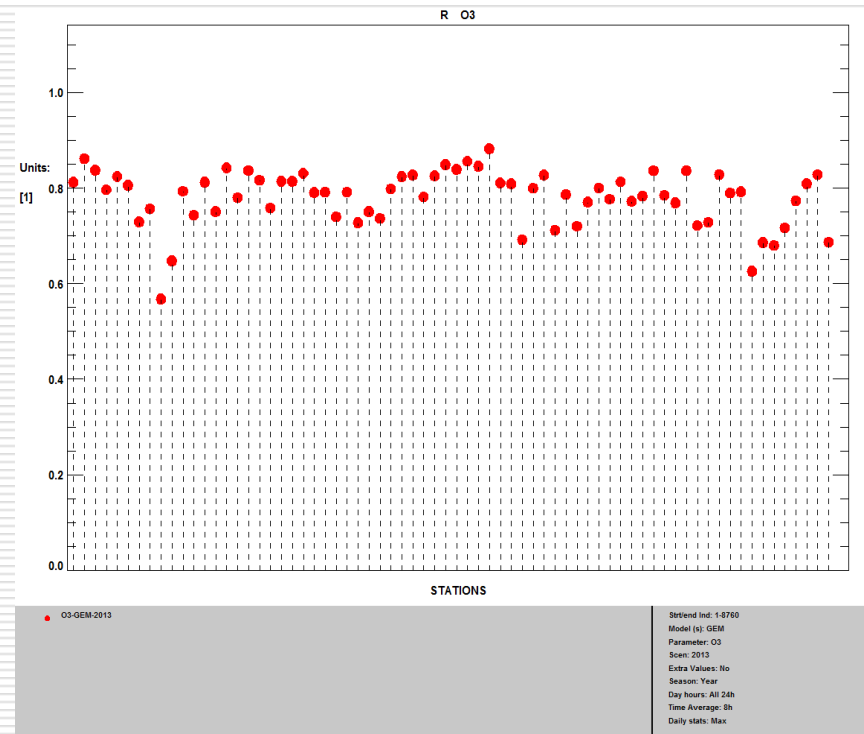


Correlation coefficient - barplot

2012

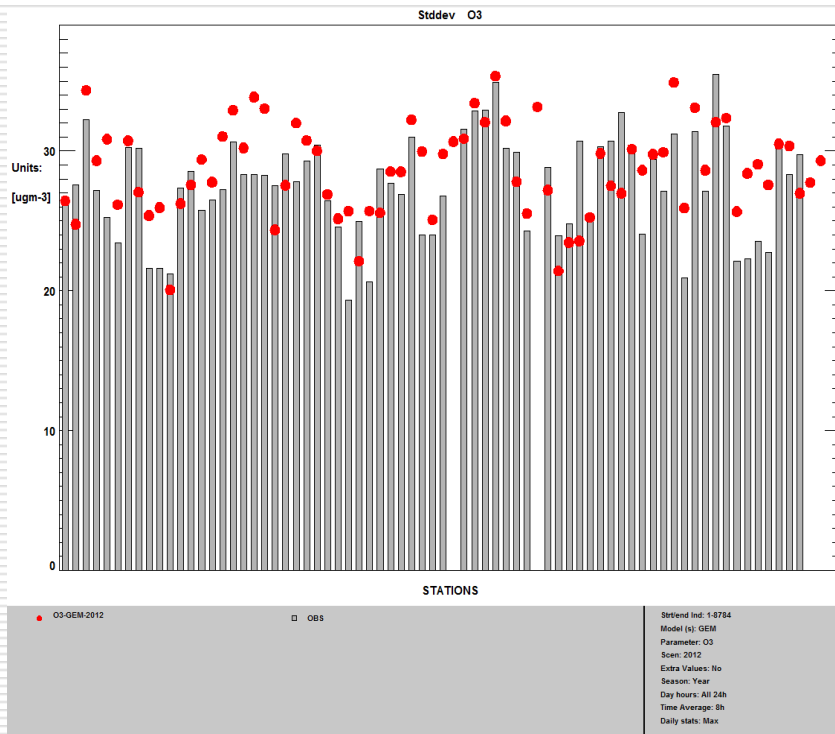


2013

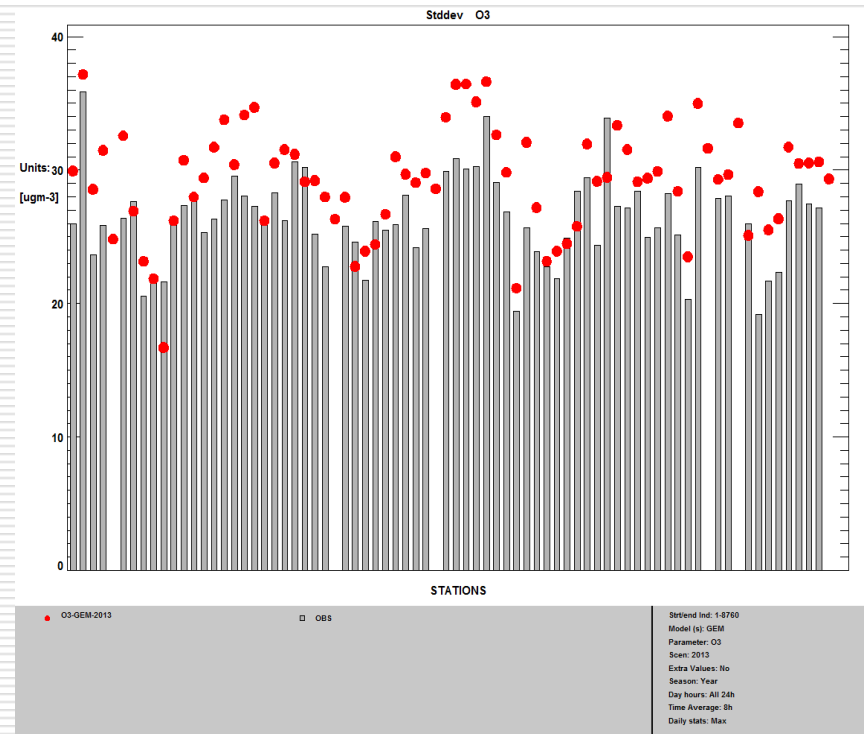


Normalized mean standard deviation- barplot

2012

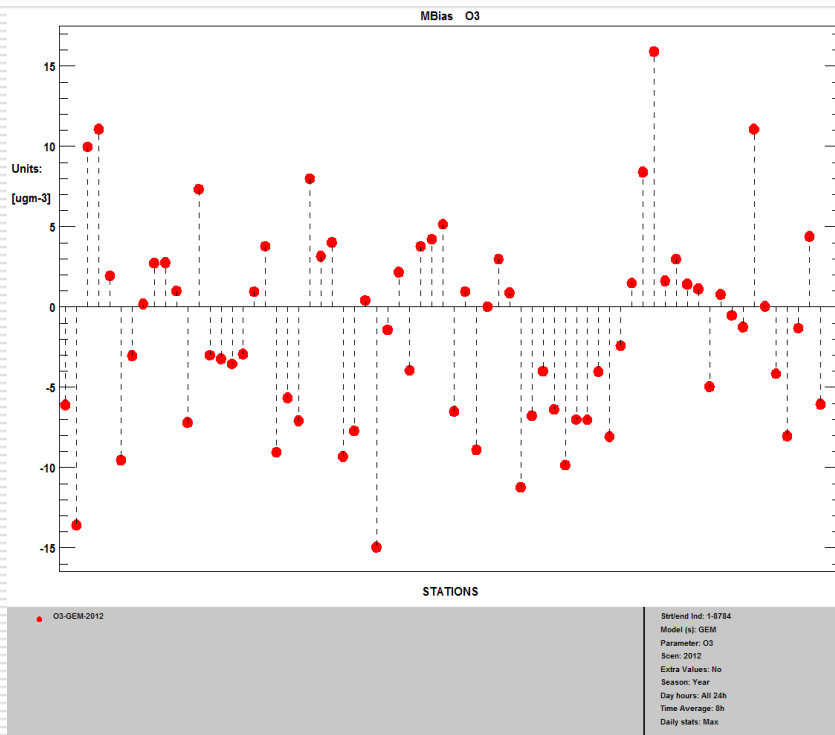


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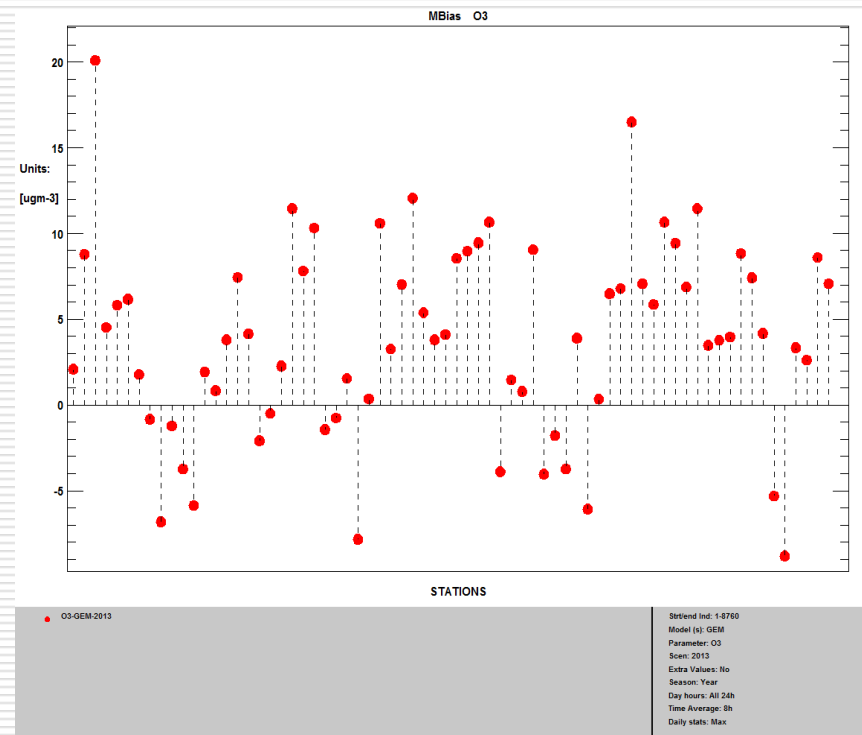


Normalized mean bias- barplot

2012



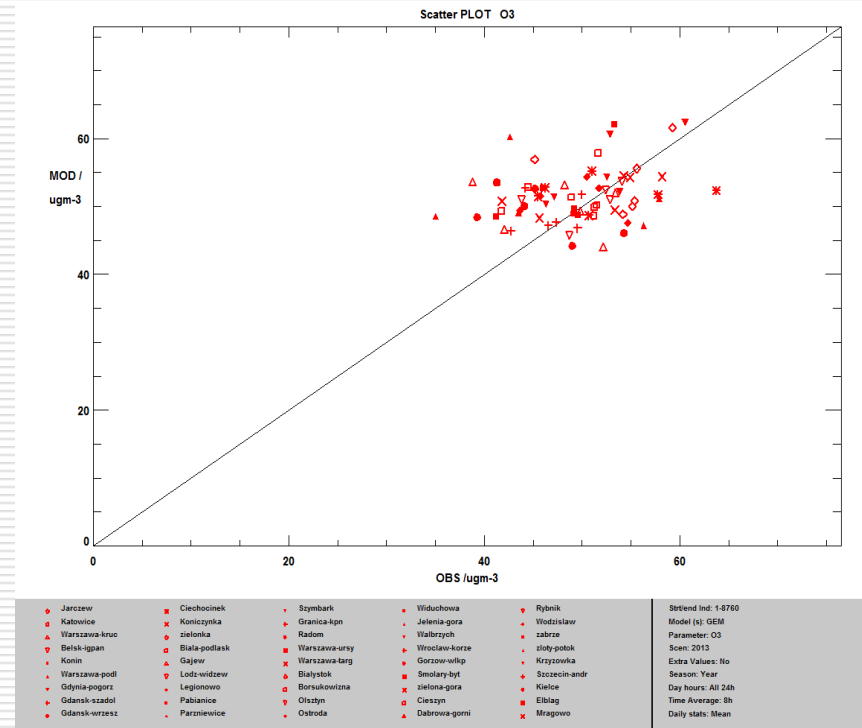
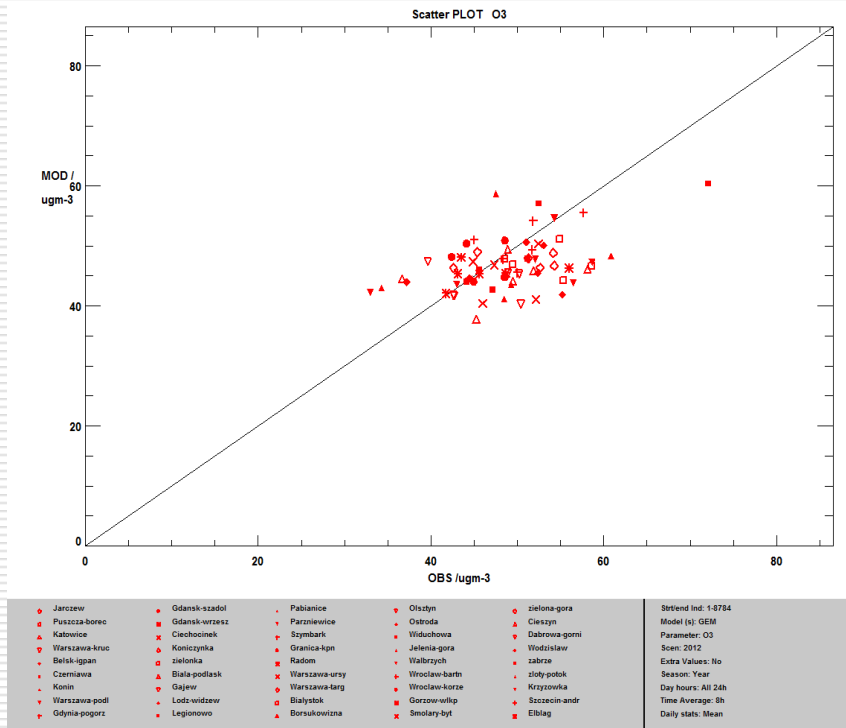
2013



Scatter plot – 8h mean

2012

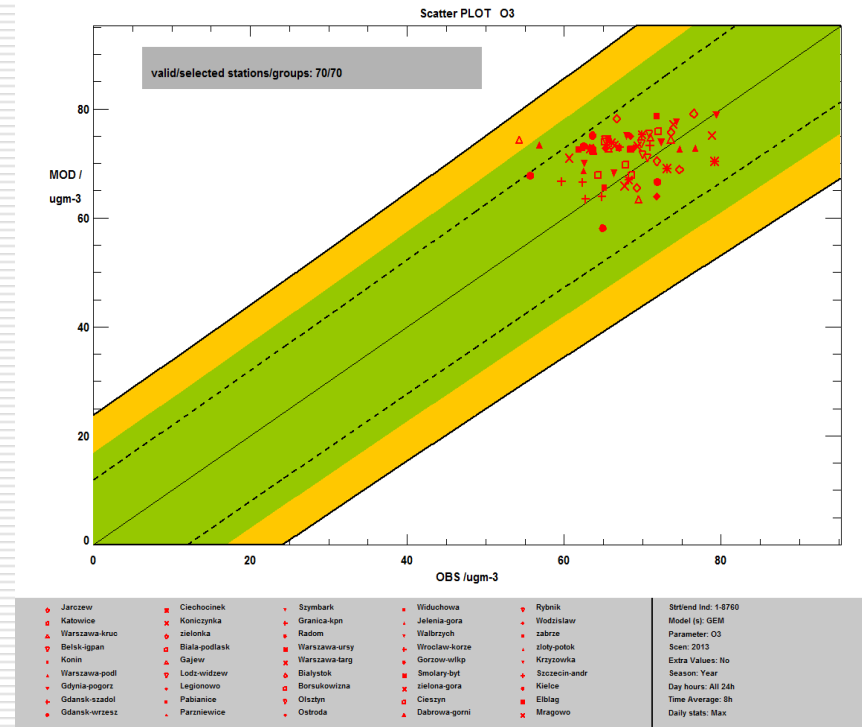
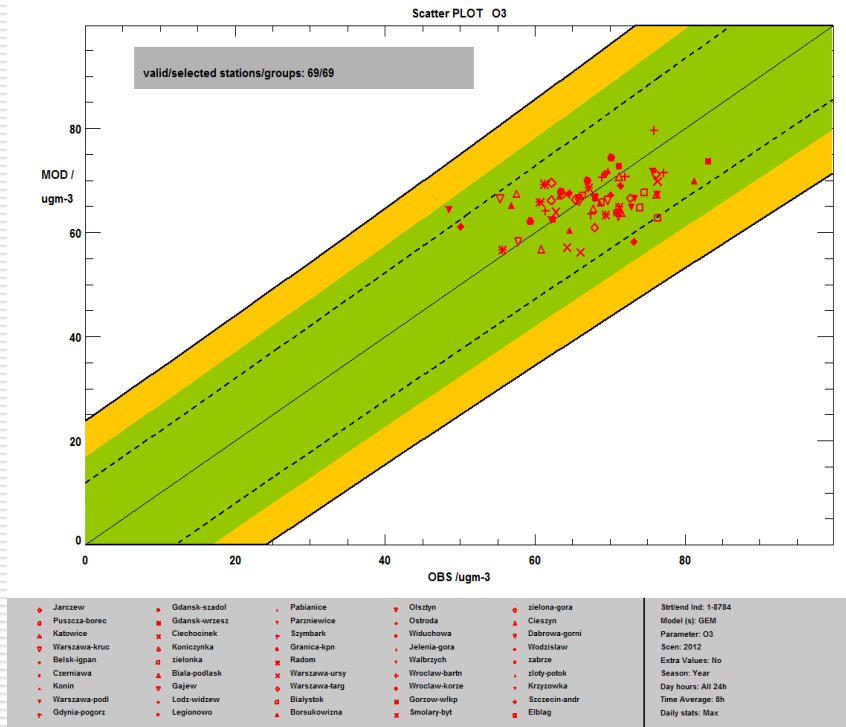
2013



Scatter plot – max value

2012

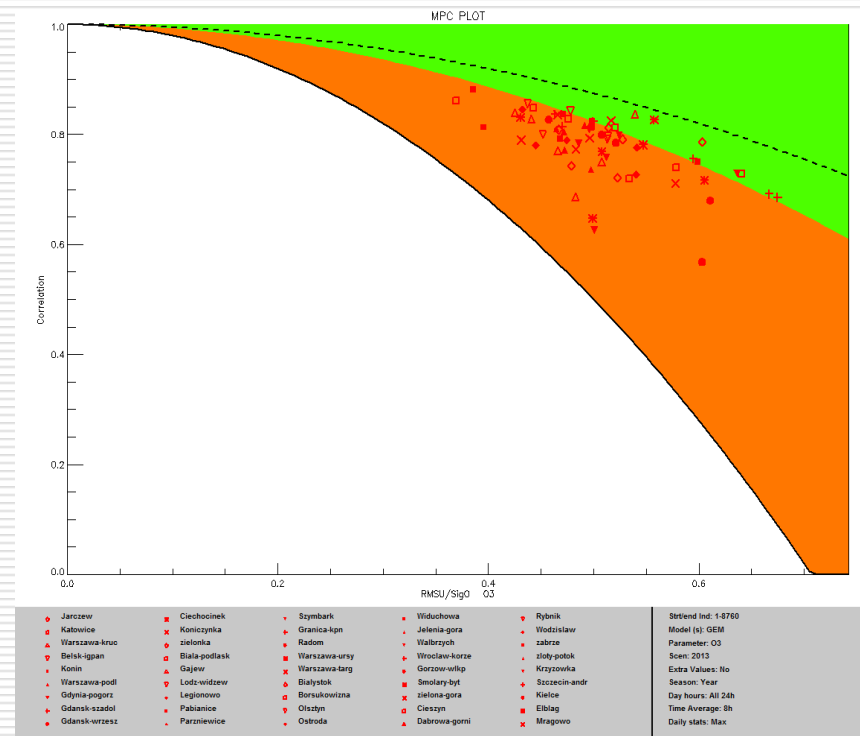
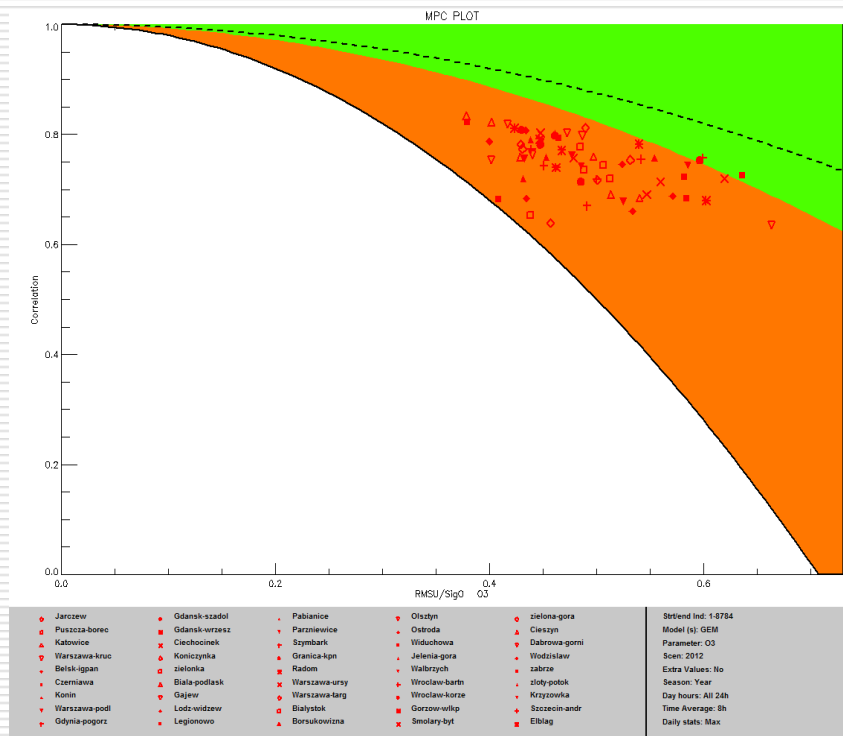
2013



MPC – correlation

2012

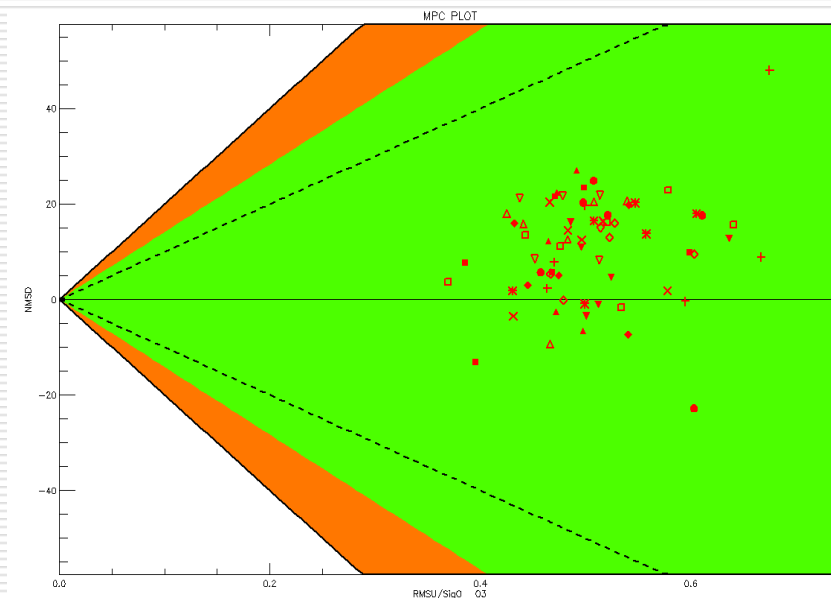
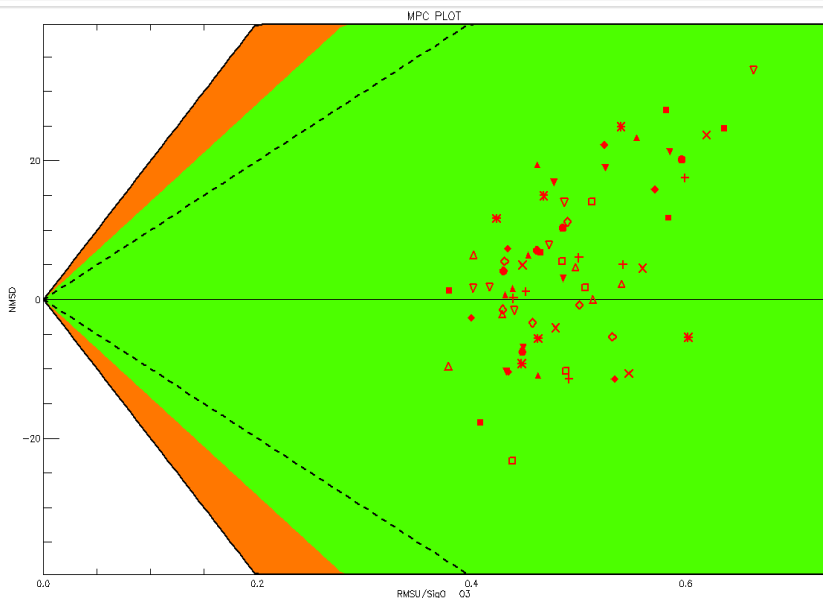
2013



MPC – standard deviation

2012

2013



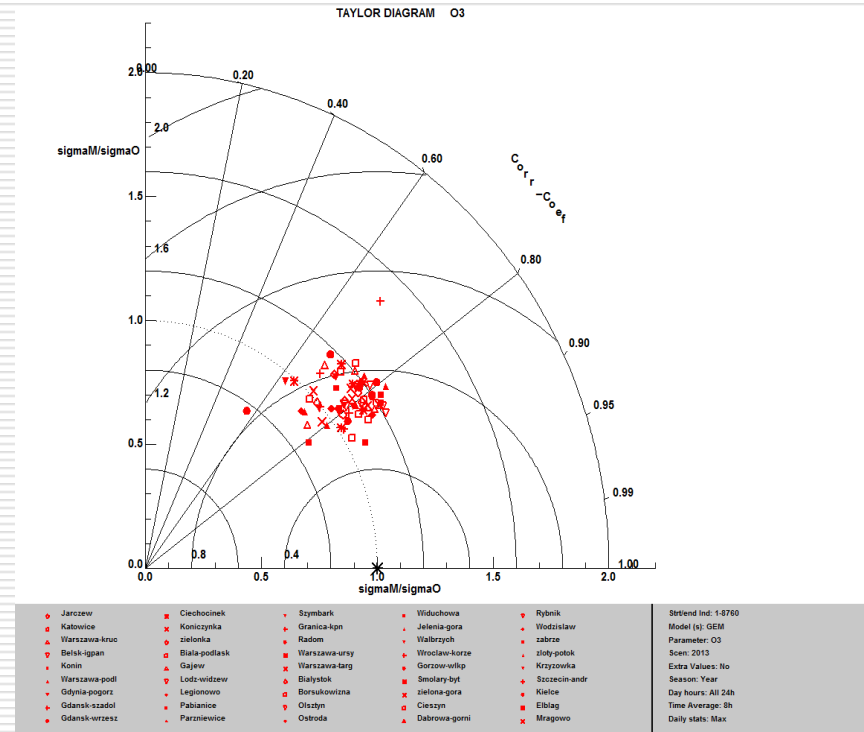
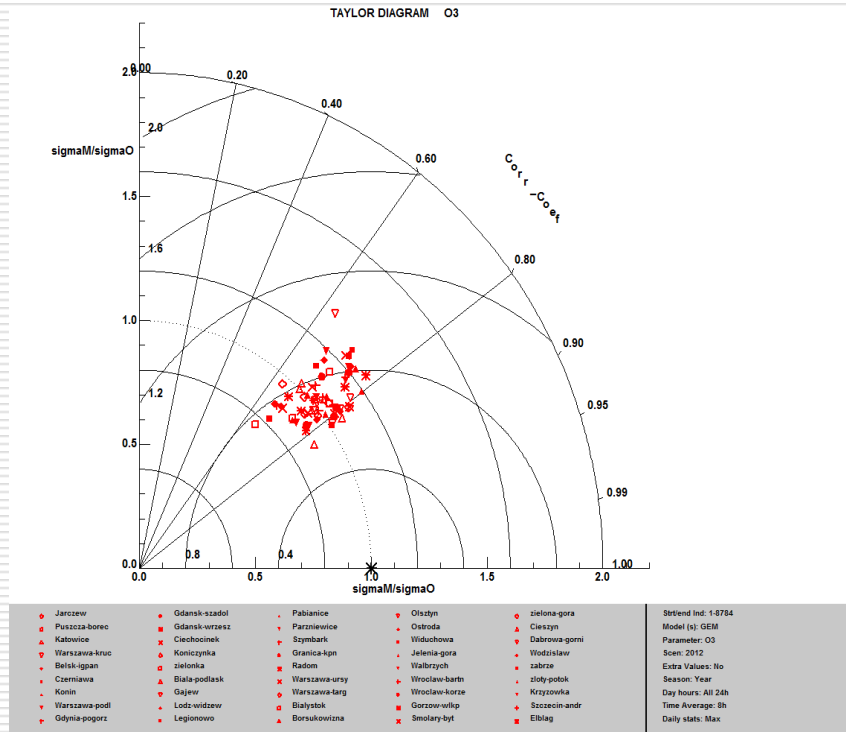
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• Pucza-borec	• Gdansk-wrzesz	• Parzewice	• Ostroda	• Cietyn	
• Katowice	• Ciecuchinek	• Szymbark	• Widuchowa	• Dabrowa-gorni	
• Warszawa-kruc	• Konieczynka	• Granica-agn	• Jelenia-gora	• Wodzislaw	
• Belsk-igian	• Zielonka	• Radom	• Walbrzych	• zabrze	
• Czerniawa	• Biaa-podlask	• Warszawa-ursy	• Wroclaw-bartn	• szolty-potok	
• Konin	• Gajew	• Warszawa-targ	• Wroclaw-korze	• Krzywka	
• Warszawa-podl	• Lodz-widzew	• Bialystok	• Gorzow-wlkp	• Szczecin-andr	
• Gdynia-pogorz	• Legionowo	• Borsukowizna	• Borsukowizna	• Kalcice	
		• Gdansk-szadol	• Ostryn	• Cietyn	
		• Legionowo	• Parzewice	• Eblag	
		• Borsukowizna	• Smolary-byt	• Eblag	

• Jarczew	• Ciecuchinek	• Szymbark	• Widuchowa	• Rybnik	Scenarij Ind: 18789 Model (s): GEM Parameter: O3 Scen: 2013 Extra Values: No Season: Year Day hours: All 24h Time Average: 8h Daily stats: Max
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• Belsk-igian	• Biaa-podlask	• Warszawa-ursy	• Wroclaw-korze	• szolty-potok	
• Konin	• Gajew	• Warszawa-targ	• Gorzow-wlkp	• Krzywka	
• Warszawa-podl	• Lodz-widzew	• Bialystok	• Smolary-byt	• Szczecin-andr	
• Gdynia-pogorz	• Legionowo	• Borsukowizna	• Jelenia-gora	• Kalcice	
• Gdansk-szadol	• Pabianice	• Ostryn	• Palenice	• Eblag	
• Gdansk-wrzesz	• Parzewice	• Ostroda	• Dabrowa-gorni	• Mragowo	

Taylor diagram

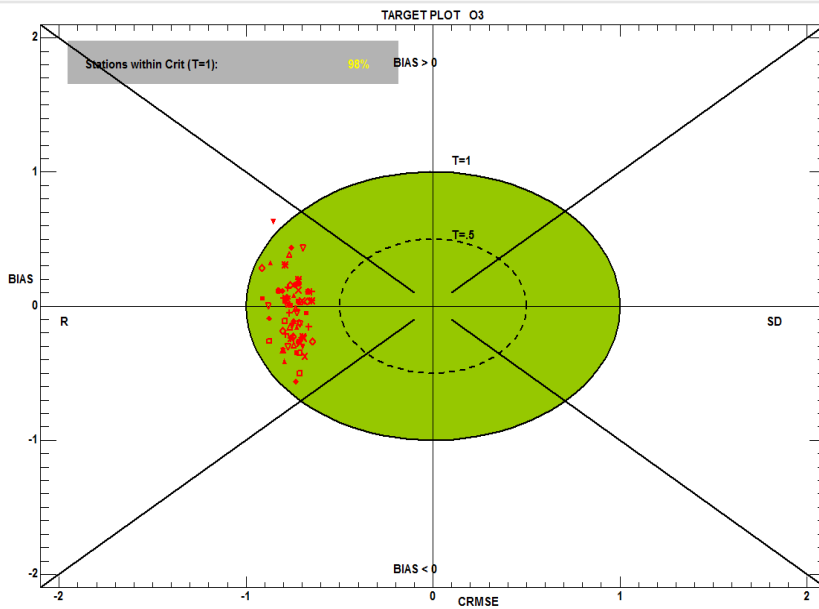
2012

2013



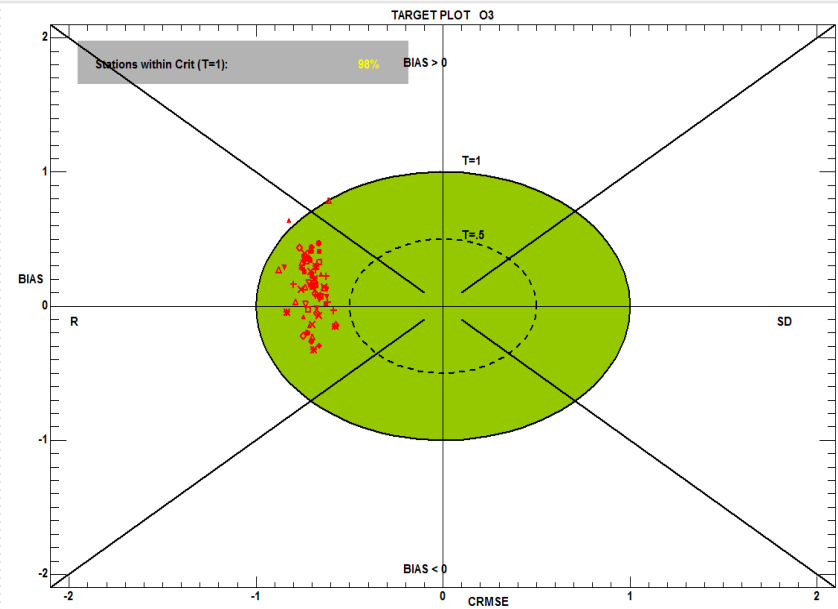
Target plot

2012



♦ Jarczew	♦ Gdansk-szadol	♦ Fabianice	♦ Olstyn	♦ Zielona-gora	Stitiend Ind: 1-9754
♦ Puszcza-borec	♦ Gdansk-wrzasz	♦ Parzniewice	♦ Ostroda	♦ Cieszyn	Model (s): GEM
♦ Kalowice	♦ Ciechocinek	♦ Szymbark	♦ Widuchowa	♦ Dabrowa-gorni	Parameter: O3
♦ Warszawa-kruc	♦ Konieczynka	♦ Granica-kpn	♦ Jelenia-gora	♦ Wodzislaw	Scen: 2012
♦ Belsk-iggan	♦ Zielonka	♦ Radom	♦ Walbrzych	♦ zabrze	Extra Values: No
♦ Czarniawa	♦ Biala-podlask	♦ Warszawa-ursy	♦ Wroclaw-barth	♦ sloty-potok	Season: Year
♦ Konin	♦ Gajew	♦ Warszawa-targ	♦ Wroclaw-korze	♦ Krzyzowka	Day Hours: All 24h
♦ Warszawa-podl	♦ Lodz-widzew	♦ Bialystok	♦ Gorzow-wlkp	♦ Szczecin-andr	Time Average: 8h
♦ Gdynia-pogorz	♦ Legionowo	♦ Borsukowizna	♦ Bialystok	♦ Eblag	Daily stats: Max
		♦ Borsukowizna	♦ Parzniewice	♦ Ostroda	

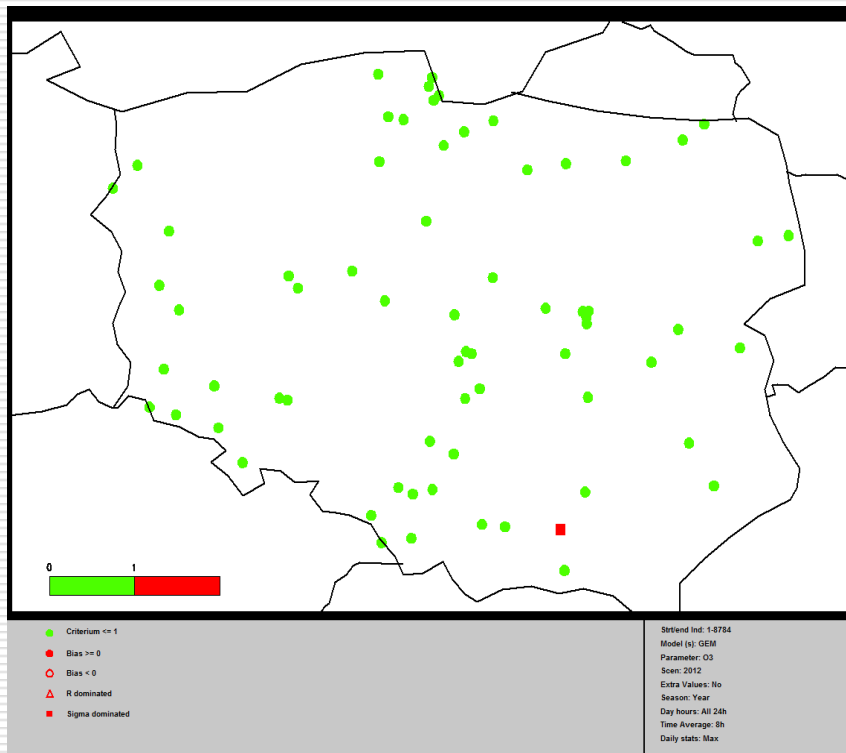
2013



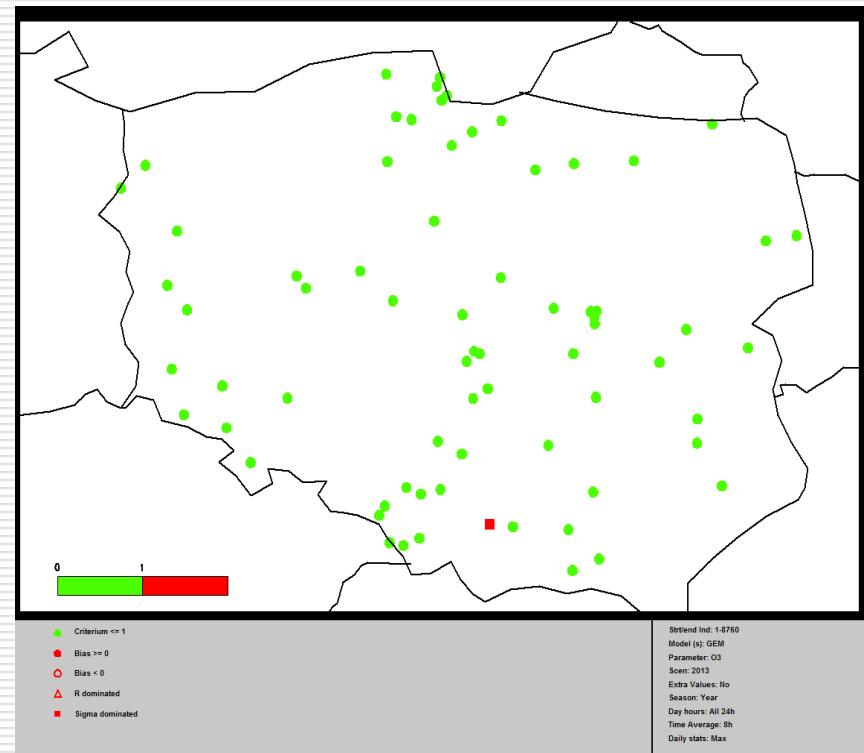
♦ Jarczew	♦ Ciechocinek	♦ Szymbark	♦ Widuchowa	♦ Rybnik	Stitiend Ind: 1-9750
♦ Kalowice	♦ Konieczynka	♦ Granica-kpn	♦ Jelenia-gora	♦ Wodzislaw	Model (s): GEM
♦ Warszawa-kruc	♦ Zielonka	♦ Radom	♦ Walbrzych	♦ zabrze	Parameter: O3
♦ Belsk-iggan	♦ Biala-podlask	♦ Warszawa-ursy	♦ Wroclaw-korze	♦ sloty-potok	Scen: 2013
♦ Konin	♦ Gajew	♦ Warszawa-targ	♦ Gorzow-wlkp	♦ Krzyzowka	Extra Values: No
♦ Warszawa-podl	♦ Lodz-widzew	♦ Bialystok	♦ Simolary-byt	♦ Szczecin-andr	Season: Year
♦ Gdynia-pogorz	♦ Legionowo	♦ Borsukowizna	♦ Zielona-gora	♦ Kalice	Day Hours: All 24h
♦ Gdansk-szadol	♦ Fabianice	♦ Olstyn	♦ Cieszyn	♦ Eblag	Time Average: 8h
♦ Gdansk-wrzasz	♦ Parzniewice	♦ Ostroda	♦ Dabrowa-gorni	♦ Mragowo	Daily stats: Max

Map of stations

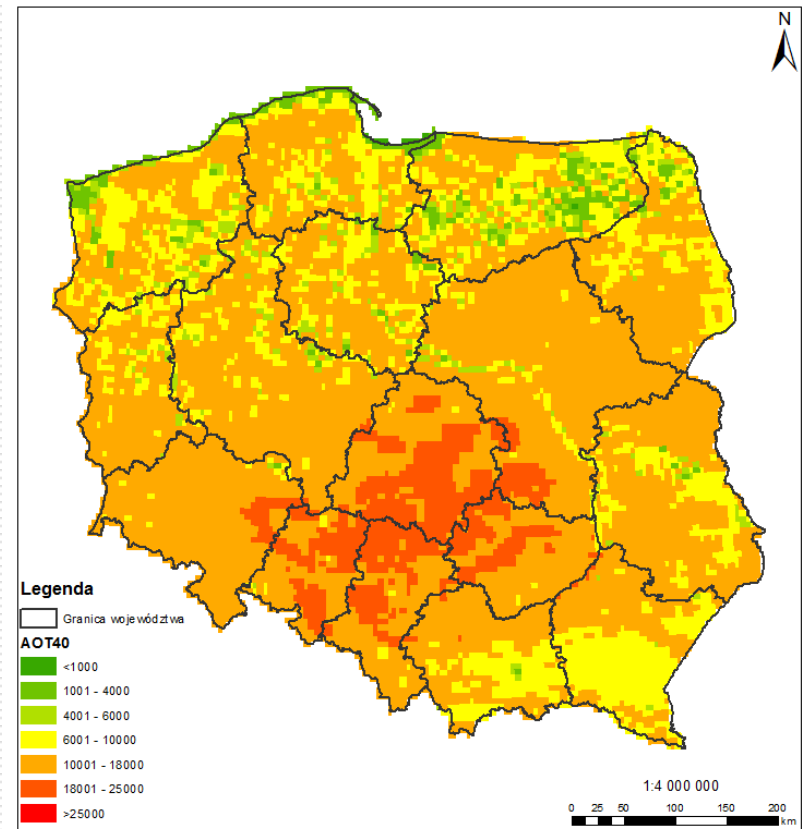
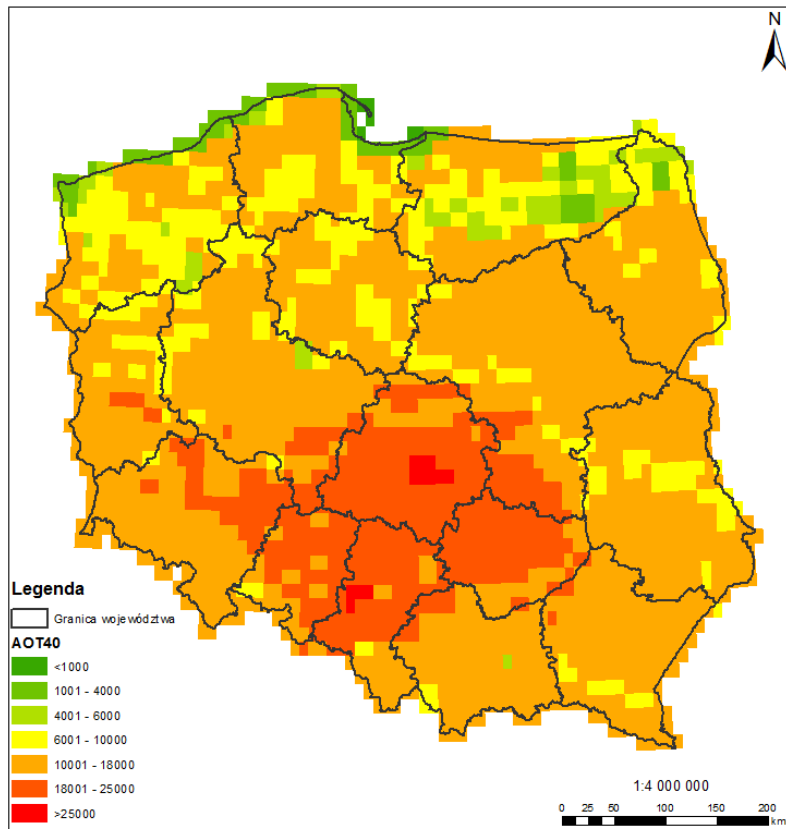
2012



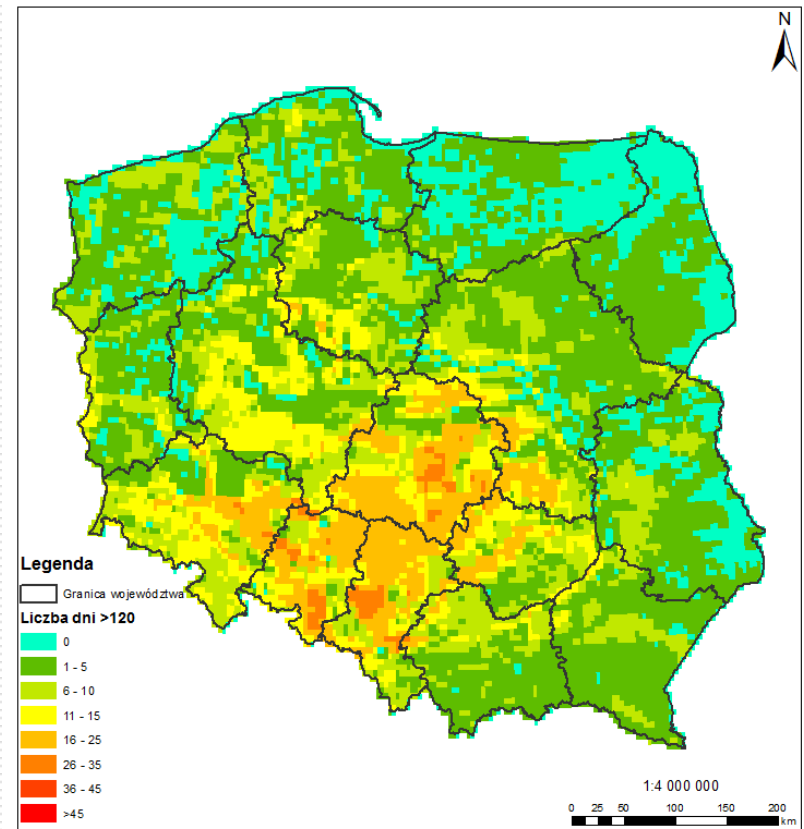
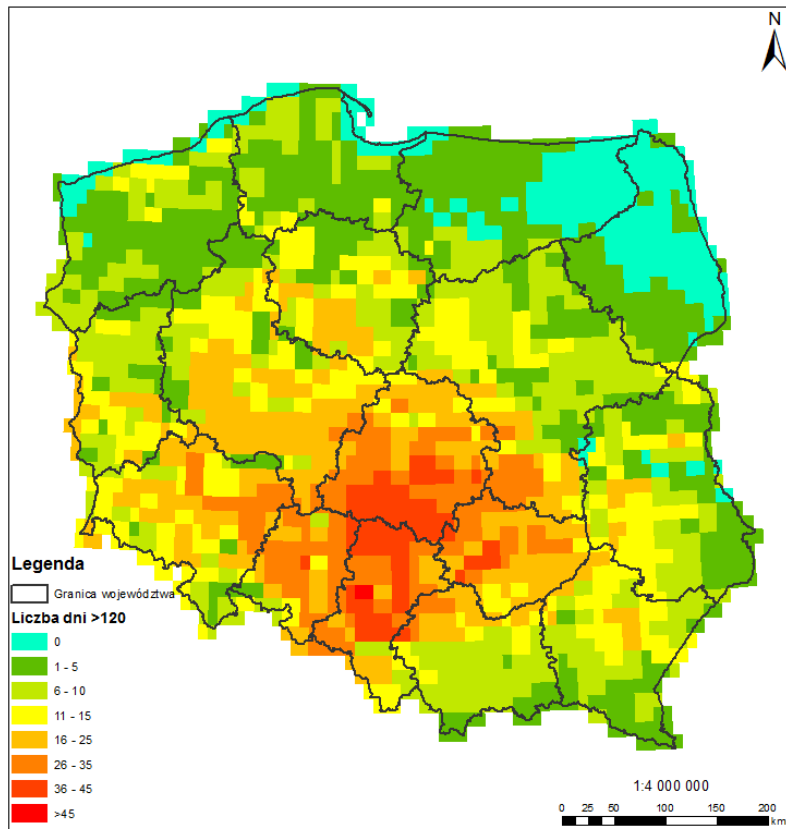
2013



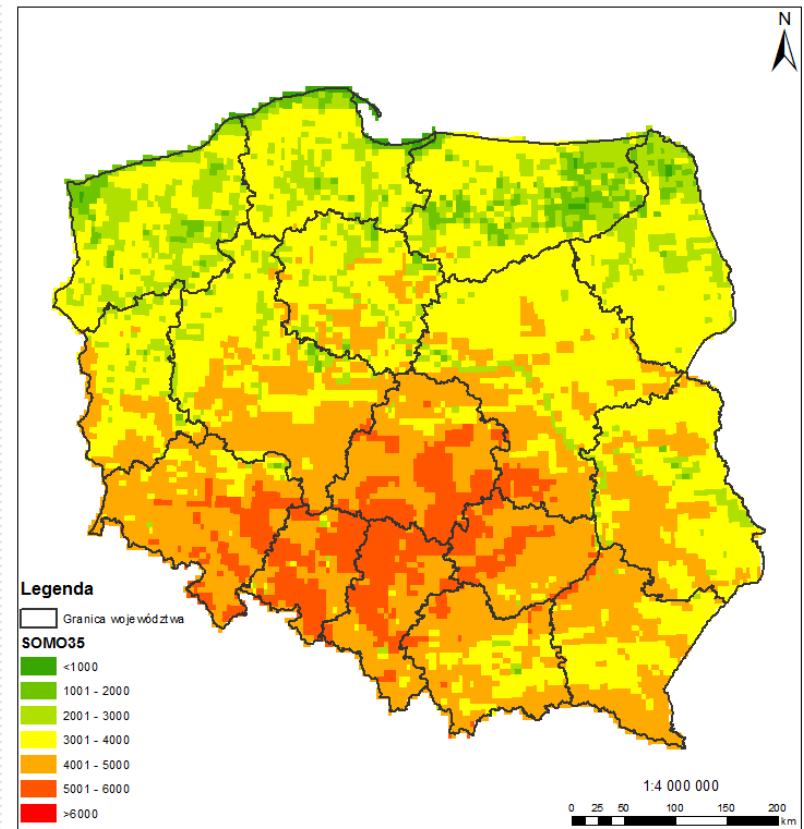
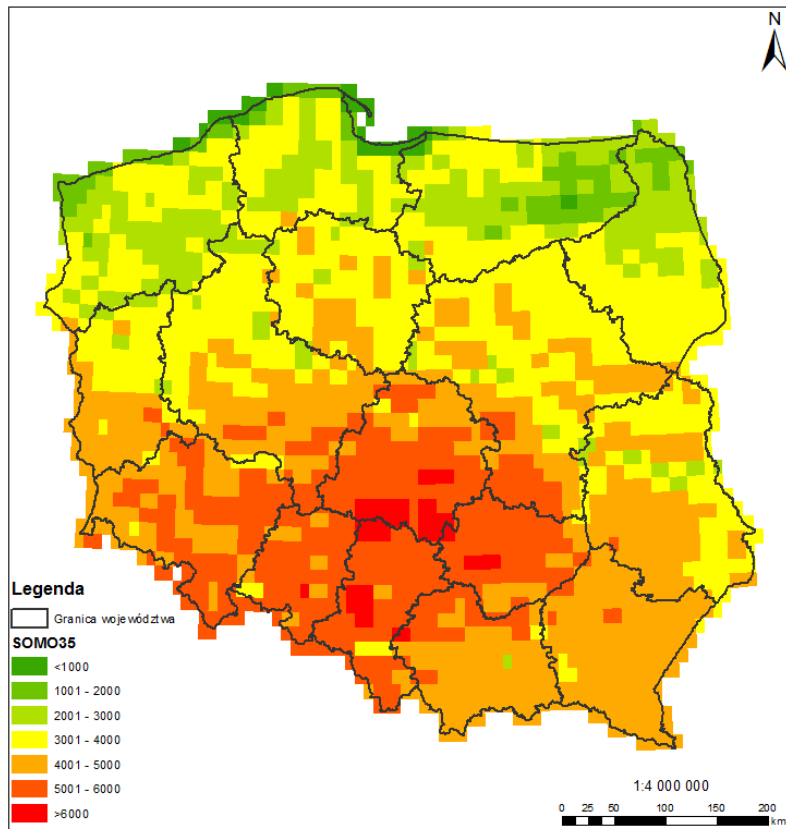
2012 assessment results – AOT40



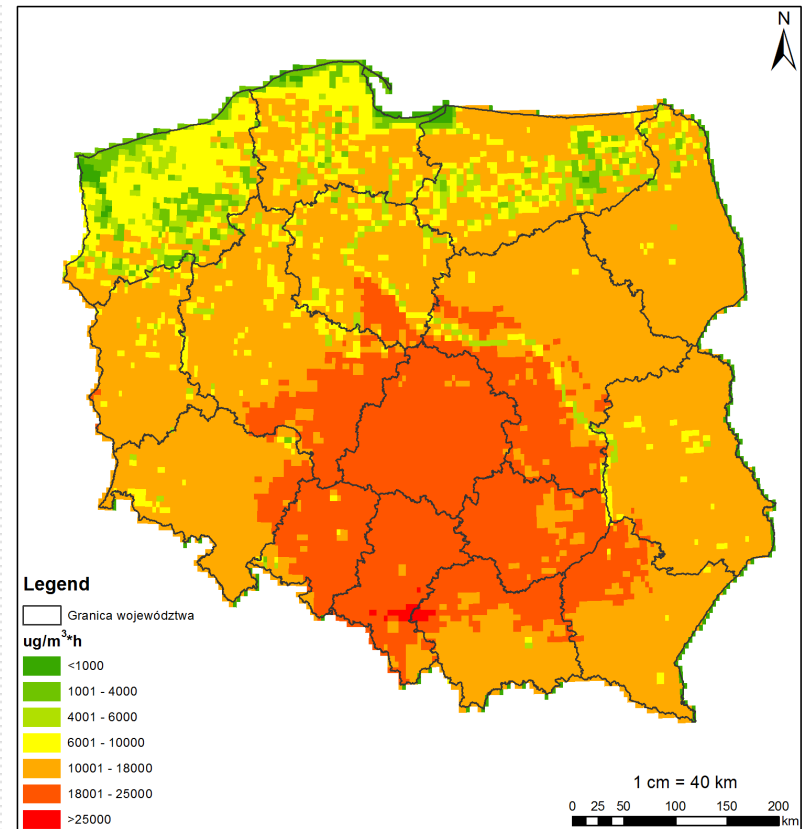
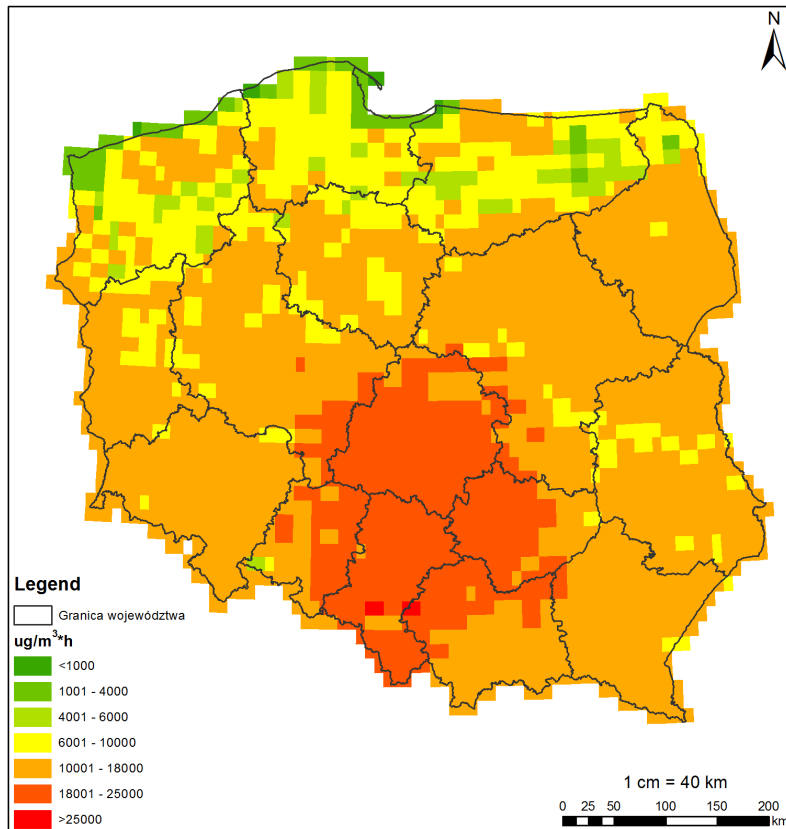
2012 assessment results - >120



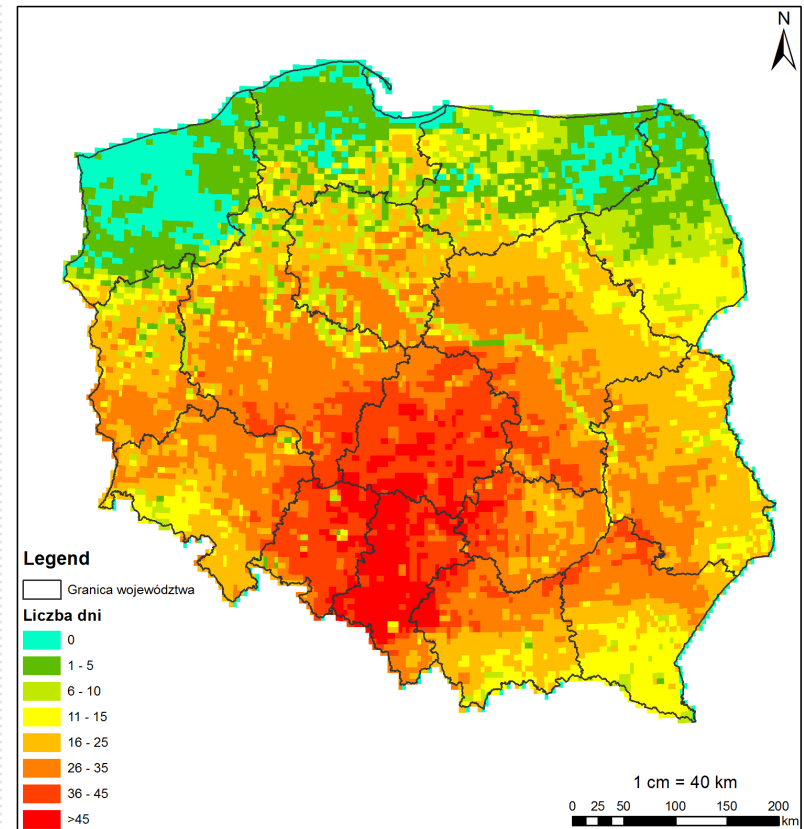
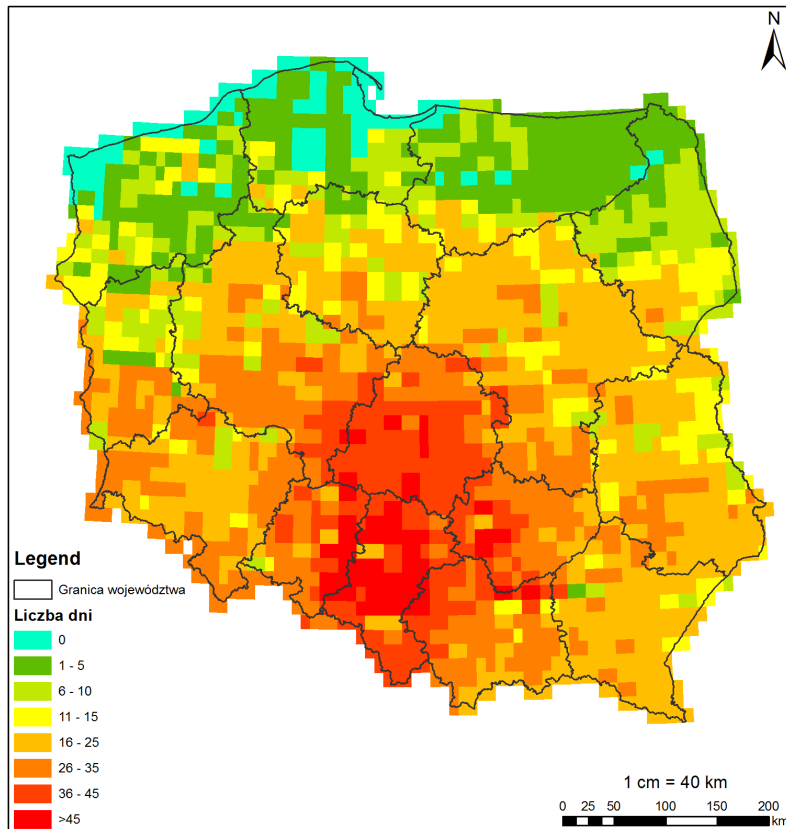
2012 assessment results – SOMO35



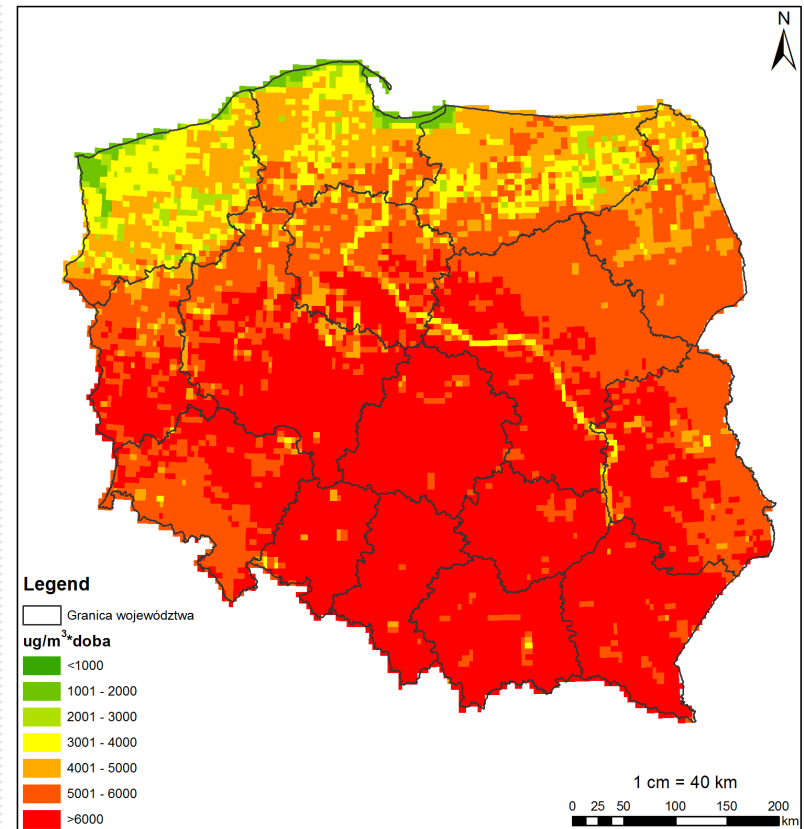
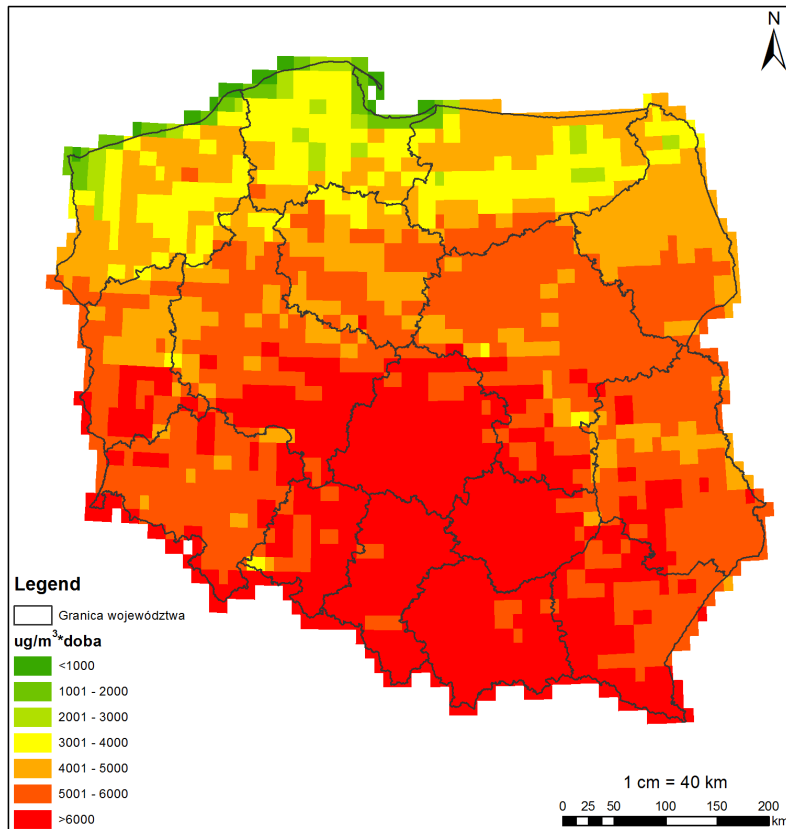
2013 assessment results – AOT40



2013 assessment results - >120



2013 assessment results – SOMO35



National near-surface ozone forecast 2013 - 2015

The screenshot displays the website 'Krajowe prognozy krótkoterminowe zanieczyszczenia powietrza ozonem' (National short-term ozone pollution forecasts). The page features a green navigation menu on the left with categories such as 'Prawodawstwo', 'Normy jakości powietrza', and 'Prognozy jakości powietrza'. A central section titled 'Krajowe prognozy krótkoterminowe zanieczyszczenia powietrza ozonem' includes tabs for 'Informacje ogólne', 'Prognozy krajowe dla ozonu', and others. Below these, there are three main forecast sections: 'Prognoza zanieczyszczenia powietrza ozonem na dziś - animacja', 'Trzydniowa prognoza zanieczyszczenia powietrza ozonem - mapy' (subdivided into 'dzisiaj', 'jutro', and 'pojutrze'), and 'stężenia średnie dobowe'. Each forecast section contains a map of Poland with a color-coded scale indicating ozone concentration levels. A red warning sign with the word 'OSTRZEŻENIA' is prominently displayed in the lower-left area. The bottom of the image shows the Windows taskbar with several open applications and the system clock at 21:52.

EcoForecast Foundation air pollution forecasts 2009 – 20??

The screenshot displays the EcoForecast website interface. At the top, there is a Facebook icon and the 'ekoprogniza' logo. A navigation bar contains links for 'weather', 'air quality index', and 'air pollution concentrations'. Below this, a dropdown menu shows 'Europe | Poland | *** select region ***'. On the left, a vertical menu lists various pollutants: Home page, Ozone, Nitrogen dioxide, Sulphur dioxide, Carbon monoxide, PM10, and PM2.5. The main content area is titled 'PM10 Poland' and features a grid of six maps. The top row shows 'stężenie średniodobowe' (daily average) for 27.04.2014, 28.04.2014, and 29.04.2014. The bottom row shows 'stężenie maksymalne dobowe' (daily maximum) for the same dates. Each map includes a color scale from 10 to 400 µg/m³ and is labeled 'DEM AQ forecast valid on Apr 27 2014', 'Apr 28 2014', or 'Apr 29 2014'. A link to the 'archive' is located below the maps. The footer contains the copyright notice '© 2009-2011 ekoprogniza.pl'.

<http://ecoforecast.eu/index.php>

THANK YOU!
