Wrocław University of Science and Technology

IOŚ-PIB

The air monitoring system in Poland

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November 6 - 8, 2016 – Kiev, Ukraine

Agenda

1. Air quality monitoring in Poland – Polish and UE legislation
2. Air quality management in Poland
3. Air quality standards in Poland
4. Measurement and assesment of air quality
5. Forecasting of air quality
6. Exposure to PM2.5
7. Regional background monitoring
8. Chemistry of precipitation
9. Air Quality National Reference Laboratory

Polish legislation – The most important legal acts

Environmental Law

- Act of 27 April 2001 r. – Prawo ochrony środowiska (Dz. U. z 2016 poz. 672 z późn. zm.)

Regulations of the Polish Minister of the Environment

- Rozporządzenie Ministra Środowiska z dnia 2 sierpnia 2012 r. w sprawie stref, w których dokonuje się oceny jakości powietrza (Dz.U. 2012 nr 0 poz. 914)

- Rozporządzenie Ministra Środowiska z dnia 18 września 2012 r. w sprawie poziomów niektórych substancji w powietrzu (Dz. U. z 2012 r., poz. 1031)

- Rozporządzenie Ministra Środowiska z dnia 18 września 2012 r. w sprawie dokonywania oceny poziomów substancji w powietrzu (Dz. U. z 2012 r., poz. 1032)

- Rozporządzenie Ministra Środowiska z dnia 13 września 2012 r. w sprawie sposobu obliczania wskaźników średniego narażenia oraz sposobu oceny dotrzymania pułapu stężenia ekspozycji (Dz. U. z 2012 r., poz. 1029)

- Rozporządzenie Ministra Środowiska z dnia 14 sierpnia 2012 r. w sprawie krajowego celu redukcji narażenia (Dz. U. z 2012 r., poz. 1030)

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National Air Protection Program until 2020

since 01.10.2015

The main objective:

improving the quality of life of Polish citizens by achieving acceptable level of particulate matter and other harmful substances in the air in the shortest possible time

European Union legislation – The most important legal acts

- DIRECTIVE 2008/50/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 May 2008 on ambient air quality and cleaner air for Europe (Dz. Urz. UE L 152 z 11.06.2008)

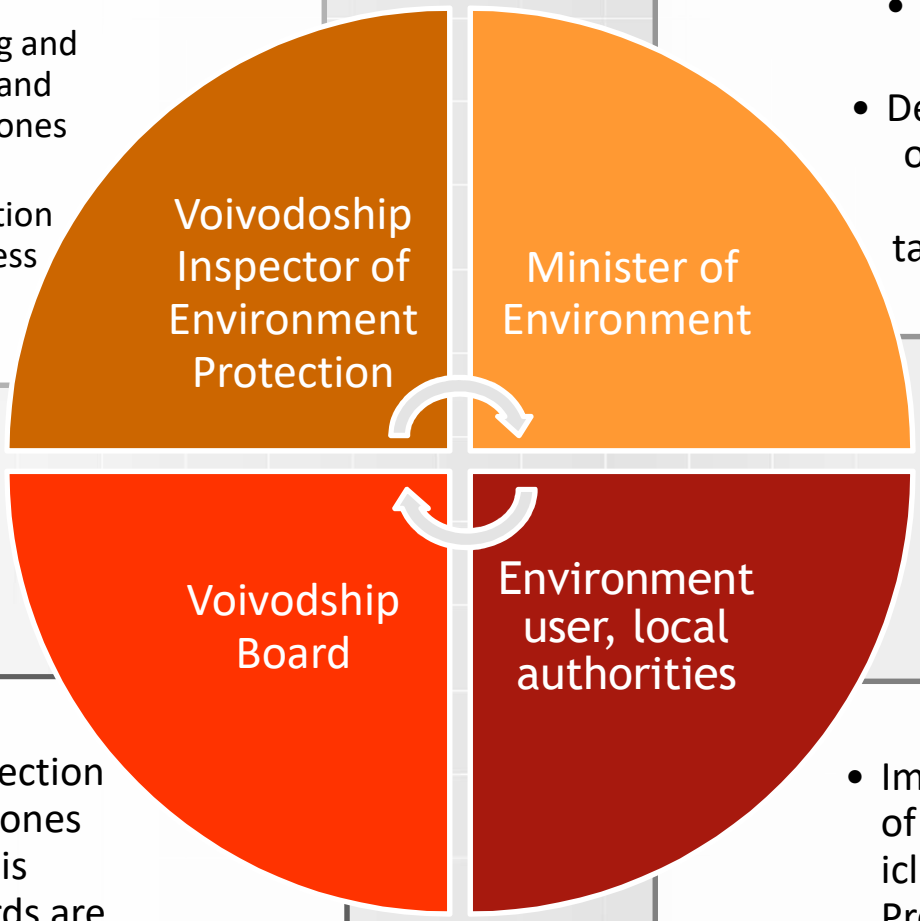
- DIRECTIVE 2004/107/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (Dz. Urz. UE L 23 z 26.01.2005)

- *COMMISSION IMPLEMENTING DECISION 2011/850/EU of 12 December 2011 laying down rules for Directives 2004/107/EC and 2008/50/EC of the European Parliament and of the Council as regards the reciprocal exchange of information and reporting on ambient air quality (Dz. Urz. UE L 335 z 17.12.2011)*

- **COMMISSION DIRECTIVE (EU) 2015/1480 of 28 August 2015** amending several annexes to Directives 2004/107/EC and 2008/50/EC of the European Parliament and of the Council laying down **the rules concerning reference methods, data validation and location of sampling points for the assessment of ambient air quality** (Dz. Urz. UE L 226/4 z 29.08.2015)

Air quality management in Poland

- Makes five-year air quality assessments (art. 88)
- Air quality monitoring and assessment in zones and classification of the zones (art. 89)
- Assess the air protection program's effectiveness (art. 89)



- Defines zones (art. 87)
- Defines standards of air pollutants (limit levels, target levels etc.) (art. 86)

- Creates a air protection program for the zones where air quality is poor (the standards are exceeded)(art.91)

- Implementation of arrangements icluded in The Air Protection Programs

Air quality management in Poland

Chief Inspector of Environmental Protecion

- coordination and execution of assessments in the country

Voivodship Inspectors (16) of Environmental Protection

- organization and maintenance of the air monitoring system
- the air quality assessments
- service of the measurement network

NATIONAL AND VOIVODSHIP
ENVIRONMENTAL MONITORING PROGRAMMES :

Specify **detailed structure of measurement network and measurement (sampling) range**

Air quality standards

Limit values – for SO_2, NO_2, CO, C_6H_6, particulate matter PM10, particulate matter PM2,5 and Pb in PM10

Limit levels are determined for human health and vegetation protection

Target values - for O_3, particulate matter PM2,5, heavy metals: As, Ni, Cd and B(a)P

Target levels are determined for human health and vegetation protection

Long term objectives for O_3

Long term objectives are determined for human health and vegetation protection

Limit values

Pollutant	Hourly limit value (average 1 h)	Daily limit value (average 24 h)	Annual limit value for human health protection (average 1 year)	Annual limit value for vegetation protection (average 1 year)
SO_2	350 µg/m^3 (24 hours/year)	125 µg/m^3 (3 days/year)	-	20 µg/m^3
NO_2	200 µg/m^3 (18 hours/year)	-	40 µg/m^3	-
NO_X	-	-	-	30 µg/m^3
PM_{10}	-	50 µg/m^3 (35 days/year)	40 µg/m^3	-
$PM_{2.5}$	-	-	25 µg/m^3 (20 µg/m^3 since 2020)	-
Lead	-	-	0.5 µg/m^3	-
Benzene	-	-	5 µg/m^3	-
CO*	-	10 mg/m^3	-	-

*Limit value – maximum 8 hours running averages

Target values

Pollutant	Hourly limit value (average 1 h)	Daily limit value (average 24 h)	Annual target value for human health protection (average 1 year)	Target value for vegetation protection AOT40 (01.V. – 31.VII)
O_3	-	120 µg/m^3 * (25 days/year)	-	18 000 (µg/m^3)*h (averaged over 5 years)
$PM_{2.5}$	-	-	25 µg/m^3	-
Arsenic	-	-	6 ng/m^3	-
Nickel	-	-	20 ng/m^3	-
Cadmium	-	-	5 ng/m^3	-
Benzo(a)pyrene	-	-	1 ng/m^3	-

*Daily maximum of 8 hours running averages. Number of days with exceedances averaged over 3 years

Long-term objectives

Pollutant	Hourly limit value (average 1 h)	Daily long-term objective value (maximum of 8 hours running averages)	Annually limit value for human health protection (average 1 year)	long-term objective value for vegetation protection AOT40 (01.V. – 31.VII)
O_3	-	120 µg/m^3	-	6 000 (µg/m^3)*h

The **deadline** for achieving of the long-term objectives: **2020**

Po lewej roślina z uszkodzeniami spowodowanymi działaniem ozonu, po prawej normalna.
http://www.biotechnolog.pl

Nicotiana tabaccum

Alert thresholds

Information thresholds

Pollutant	Average level	Infomation levels pollutant in the air [µg/m^3]
O_3	1 hour	180
PM_{10}	24 hours	200

Alarm thresholds

Pollutant	Average level	Alarm levels pollutant in the air [µg/m^3]
O_3	1 hour	240 (measured over 3 consecutive hours)
PM_{10}	24 hours	300
NO_2	1 hour	400 (measured over 3 consecutive hours)
SO_2	1 hour	500 (measured over 3 consecutive hours)

Annual air quality assessment

Air quality assessment

FOR HUMAN HEALTH PROTECTION

- ✓ Nitrogen dioxide NO_2,
- ✓ Sulphur dioxide SO_2,
- ✓ benzene C_6H_6,Lead Pb, rsenic As, Nickel Ni, Cadmium Cd, benzo(a)pyrene B(a)P,
- ✓ Particulate matter PM10,
- ✓ Particulate matter PM2,5,
- ✓ ozone O_3,
- ✓ Carbon oxide CO.

FOR VEGETATION PROTECTION

- ✓ Sulphur dioxide SO_2,
- ✓ Nitrogen oxides NO_x,
- ✓ ozone O_3.

Annual assessmnet of air quality

- **Who makeS???** → Voivodship Inspectorate of Environmental Protection (VIEP)
- **When???** → *30 April for every year*
- **For which period???** → for the previous year
- **for which area???** → for zones
- **What pollutants???** → for those whose limit levels, target levels and long-term objectives are specified in Polish and EU law
- **What about results???** → announced on the VIEP website and convey to Chief Inspectorate of Environmental Protection and to the Regional Management Board
- **For what purpose to Regional Managements Board???** → Regional Management Board in case of emergency developes and implements Air Quality Programme for the zones in that air quality is bad
- **For what purpose to Chief Inspectorate of Environmental Protection???** → Chief Inspectorate of Environmental Protection based on Annual Air Quality Assessments performes Cumulative national air quality assessment and reports information to the European Commission

Annual assessmnet of air quality

Zone is:

- **agglomeration with a population greater than 250,000;**
- **city with a population over 100,000;**
- **the remaining area of the province, that is not included in the cities over 100,000 inhabitants and agglomeration.**

Zones in Poland

http://powietrze.gios.gov.pl/pjp/maps/zones

Annual air quality assessment

The results of annual air quality assessment are based on:

- ✓ limit values of substances in the air,
- ✓ limit values of substances in the air plus the margin of tolerance,
- ✓ target values ,
- ✓ long-term objectives.

Classification of the zones in the annual air quality assessment is done separately for the two sets of criteria:

- ✓ for human health protection,
- ✓ for vegetation protection.

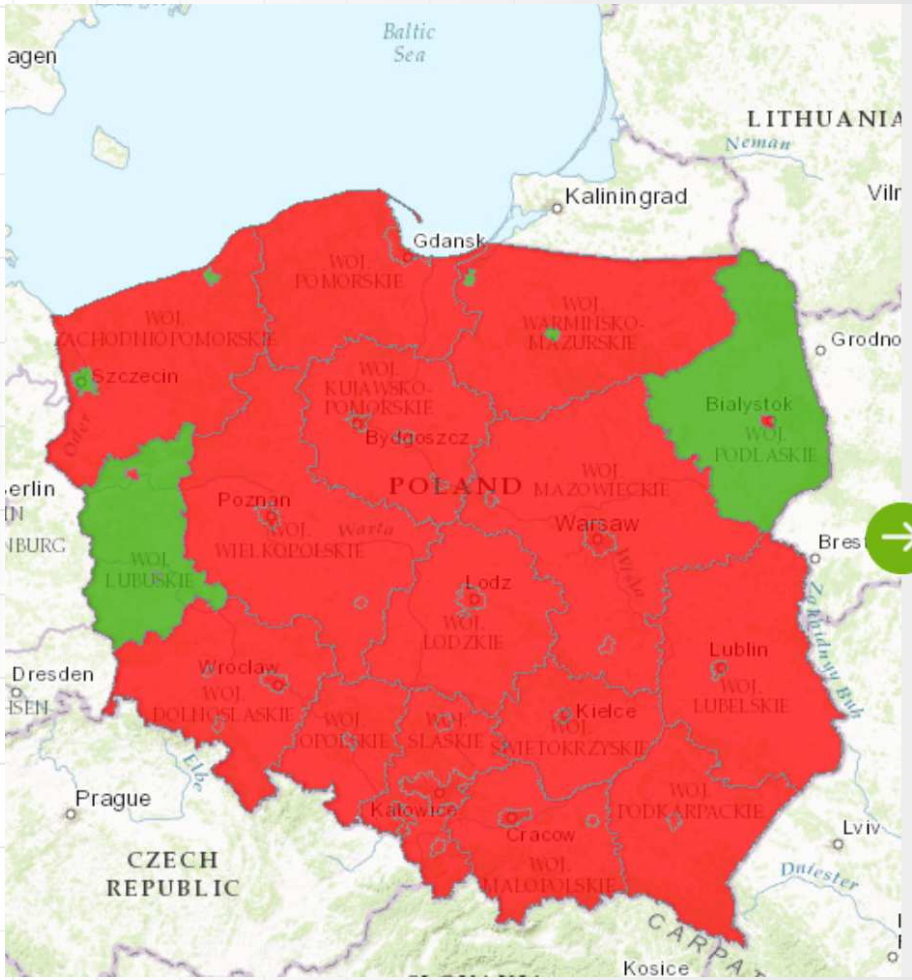
Each zone assigned to one class for each pollutant called the resulting class, separately for the human health and vegetation protection.

The result is one of three classes: A, B or C.

Since 2015 – only A and C (no more Margin of Tollerance for PM2,5)

Annual air quality assessment –

2015, PM10



Rok

2015

Typ wskaźnika

◉ Ochrona zdrowia ○ Ochrona roślin

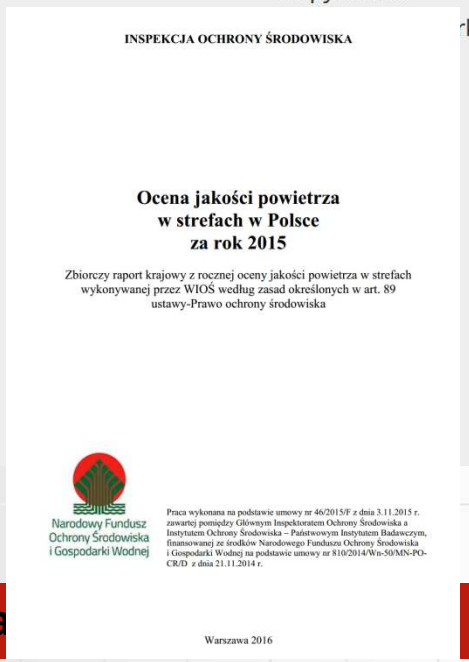
Wskaźniki

○ arsen (As)	○ B(a)P
○ benzen (C6H6)	○ kadm (Cd)
○ tlenek węgla (CO)	○ nikiel (Ni)
○ dwutlenek azotu (NO2)	○ ozon (O3)
○ ołów (Pb)	◉ pył PM10
○ pył PM2,5	

Legenda

A

C



INSPEKCJA OCHRONY ŚRODOWISKA

Ocena jakości powietrza w strefach w Polsce za rok 2015

Zbiorczy raport krajowy z rocznej oceny jakości powietrza w strefach wykonywanej przez WIOŚ według zasad określonych w art. 89 ustawy-Prawo ochrony środowiska

Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej

Praca wykonana na podstawie umowy nr 46/2015/F z dnia 3.11.2015 r. zawartej pomiędzy Głównym Inspektoratem Ochrony Środowiska a Instytutem Ochrony Środowiska – Państwowym Instytutem Badawczym, finansowanej ze środków Narodowego Funduszu Ochrony Środowiska i Gospodarki Wodnej na podstawie umowy nr 810/2014/Wn-50/MN-PO-CR/D z dnia 21.11.2014 r.

Warszawa 2016

http://powietrze.gios.gov.pl/pjp/maps/air/quality/type/R

Measurements

Automatic measurement

automatic collection of the sample and automatic analysis

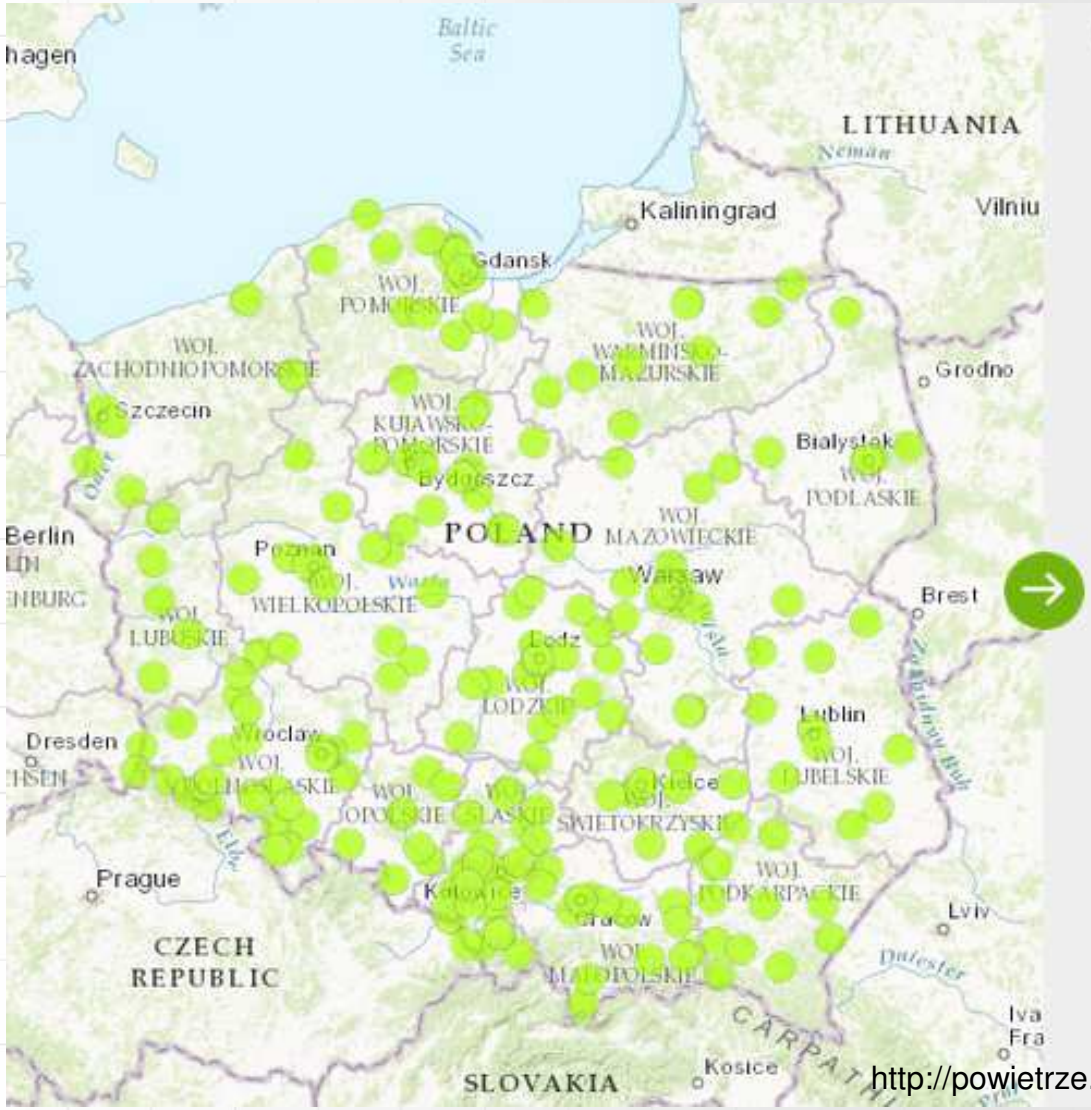
Automatic sampling
Manual measurement

the sample is taken on filter
and later analyzed
in the laboratory

References methods for concentration measurement

Pollutant	Norm	Measurement methods
SO_2	PN-EN 14212	Fluorescence in ultraviolet
NO, NO_x, NO_2	PN-EN 14211	Chemiluminescence
O_3	PN-EN 14625	UV photometry
CO	PN-EN 14626	Nondispersive infrared spectrophotometry (NDIR)
PM_{10}, $PM_{2,5}$	PN-EN 12341	Collection of PM_{10} on filters and mass measurement (gravimetric) (equivalent methods accepted: TEOM, BETA etc.)
C_6H_6	PN-EN 14662	ionic chromatography
BaP	PN-EN 15549	high performance liquid chromatography with fluorescence detection
Pb, As, Cd, Ni	PN-EN 14902	atomic absorption spectrometry with atomization in graphite furnace

Measurement stations in Poland



Station type

- (•) Wszystkie
- ( ) Ochrona zdrowia
- ( ) Ochrona roślin
- ( ) Narażenie na pył PM2,5
- ( ) Program EMEP
- ( ) Specjalistyczne stacje tła regionalnego UE

http://powietrze.gios.gov.pl/pjp/maps/measuringstation/Z

Automatic measurement stations - examples

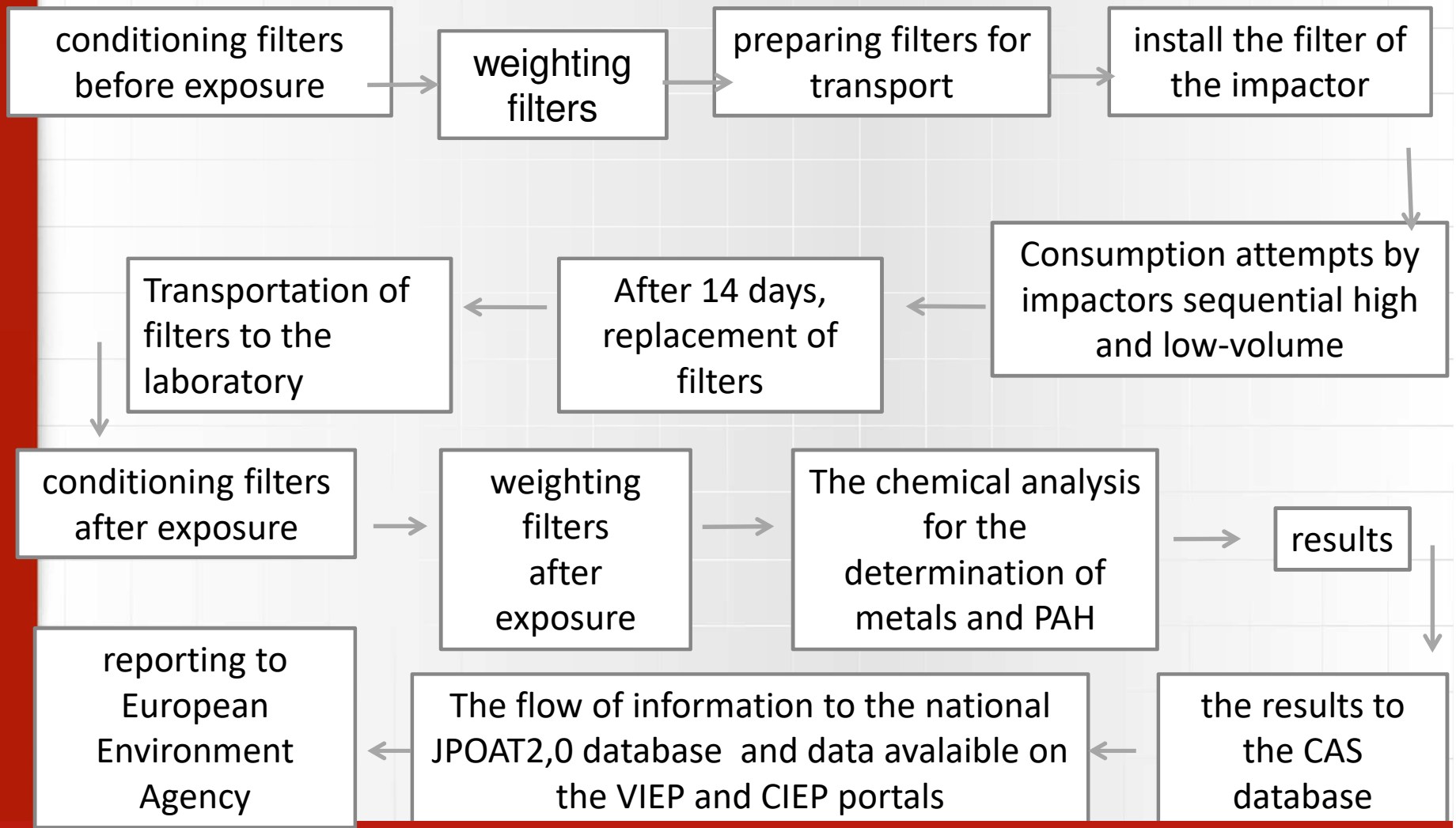
KALISZ

MCZ Umwelttechnik MicroPNS LVS16 x 2

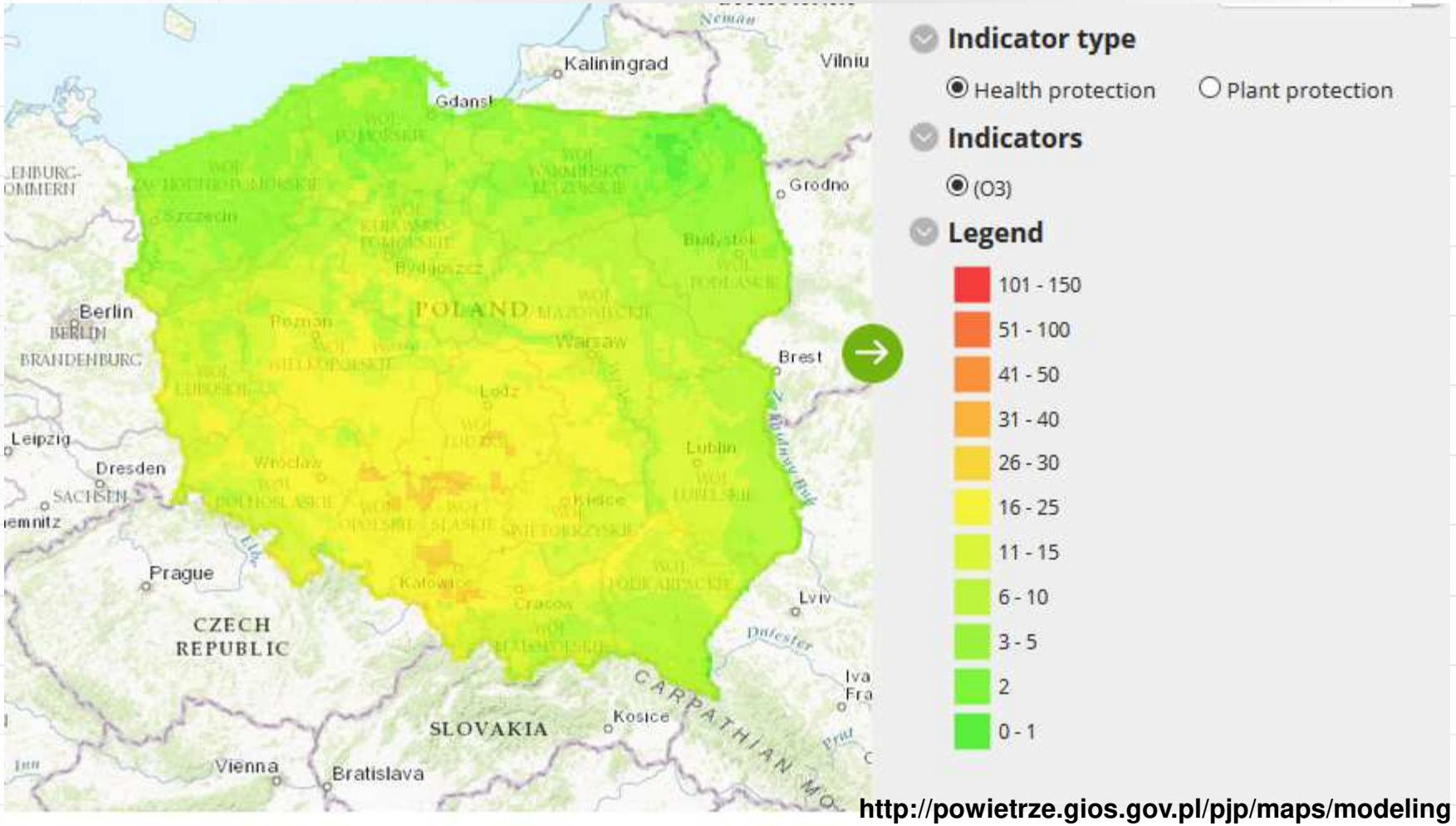
Manual measurements station - PLESZEW

examples

Manual sampling

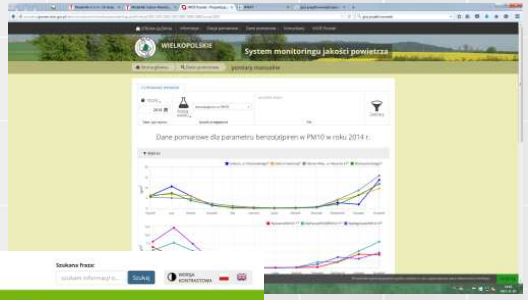


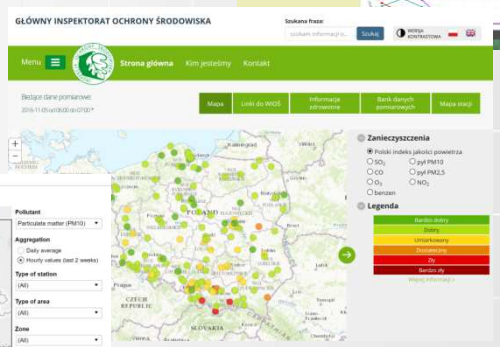
Modeling for Air Quality Assessment

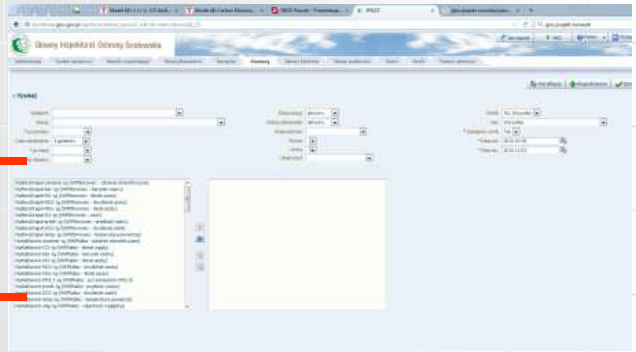


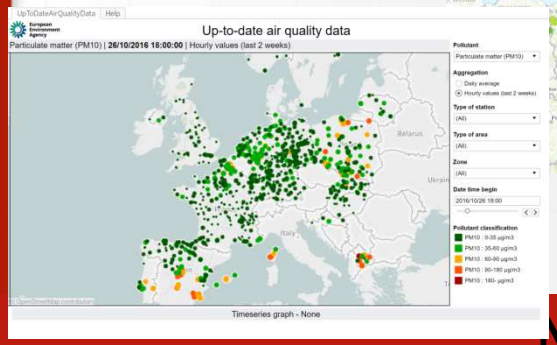
http://powietrze.gios.gov.pl/pjp/maps/modeling

Information flow









Teledyne- API T-400

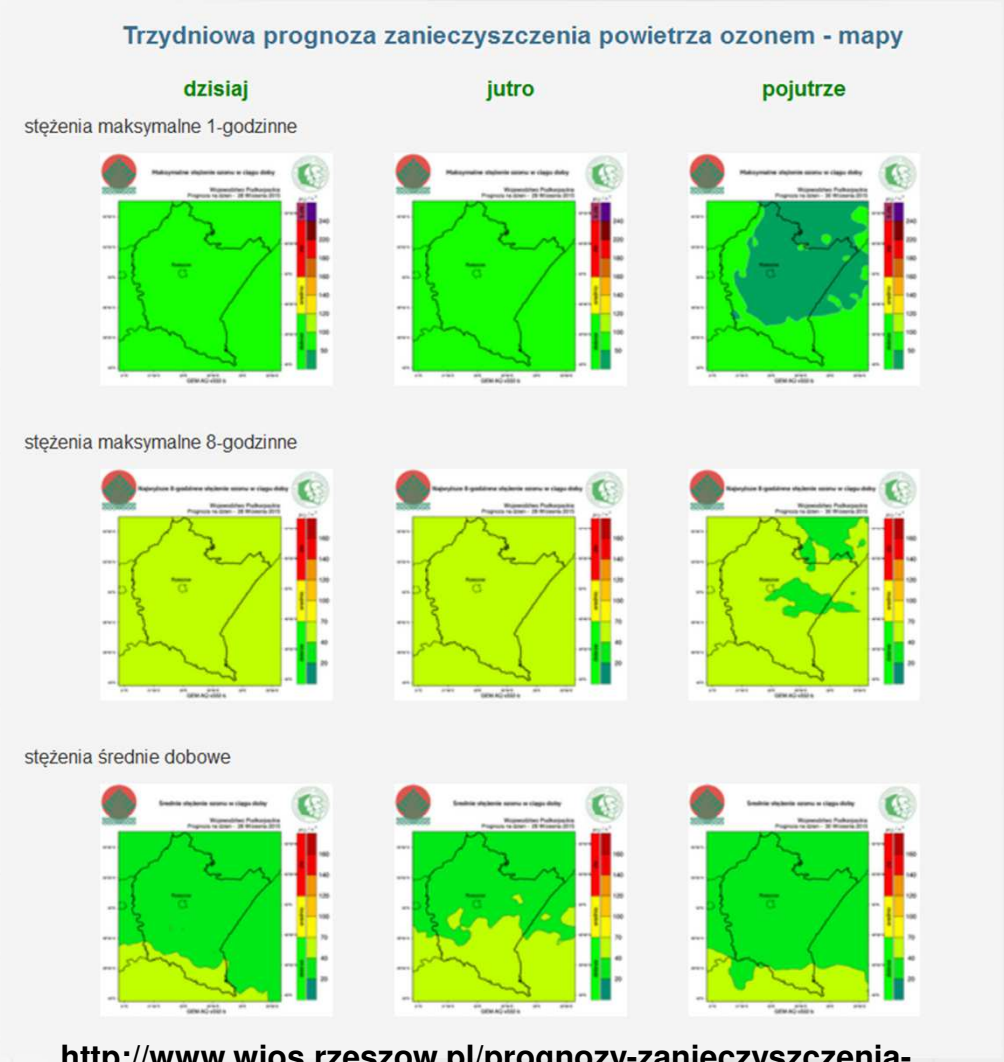
Air quality forecasting - ozone

The forecasting is carried out at the request of the Chief Inspectorate of Environmental Protection by the Faculty of Building Services, Hydro and Environmental Engineering Warsaw University of Technology and is funded by the National Fund for Environmental Protection and Water Management.

The forecasting of ozone pollution for the area of Polish and individual provinces is calculated daily for the next 3 days on a grid with a resolution of 5 km.

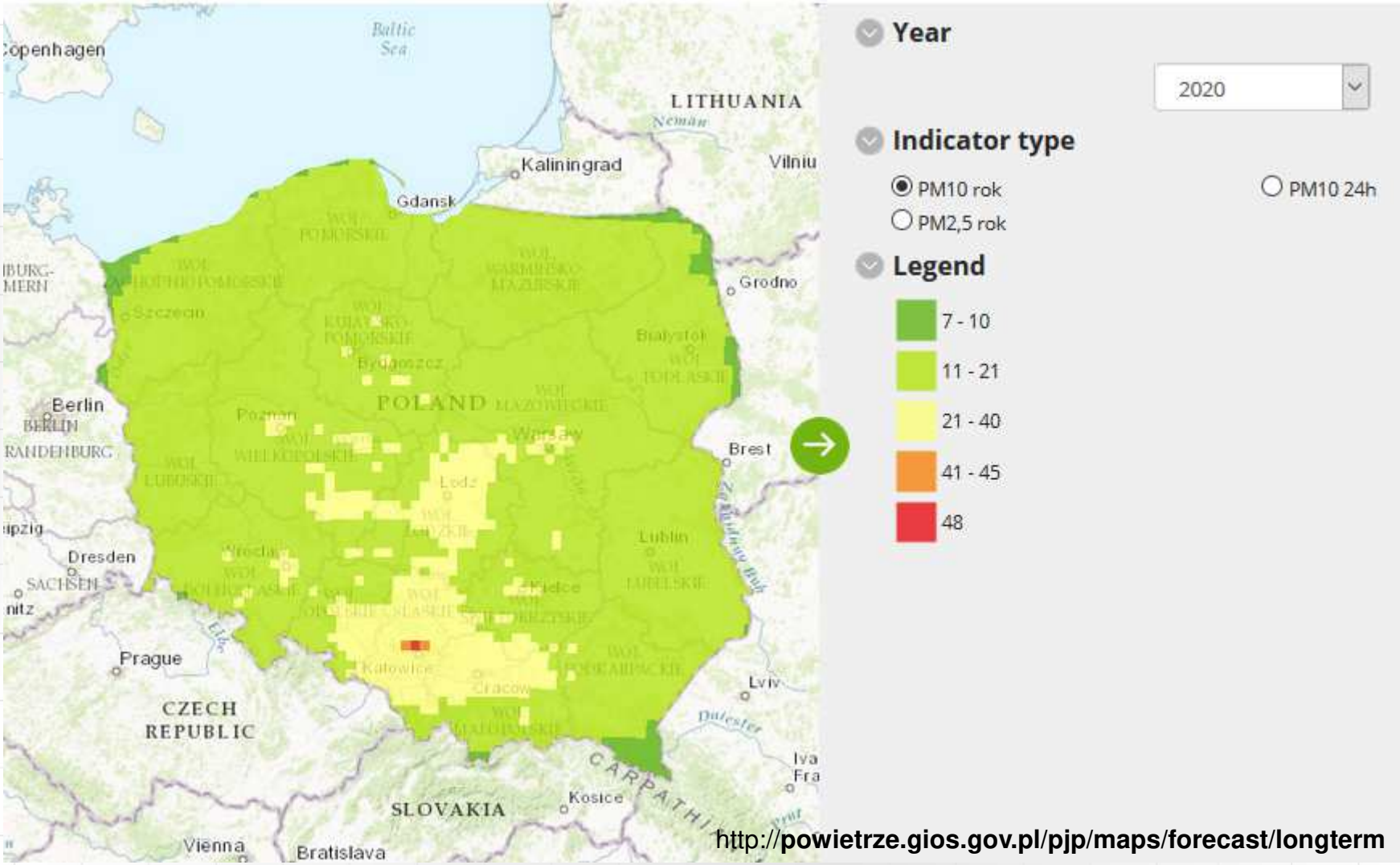
- ✓24-hour average
- ✓Highest 8-hour moving average
- ✓highest concentrations of ozone per day.

Short term forecasts for ozone



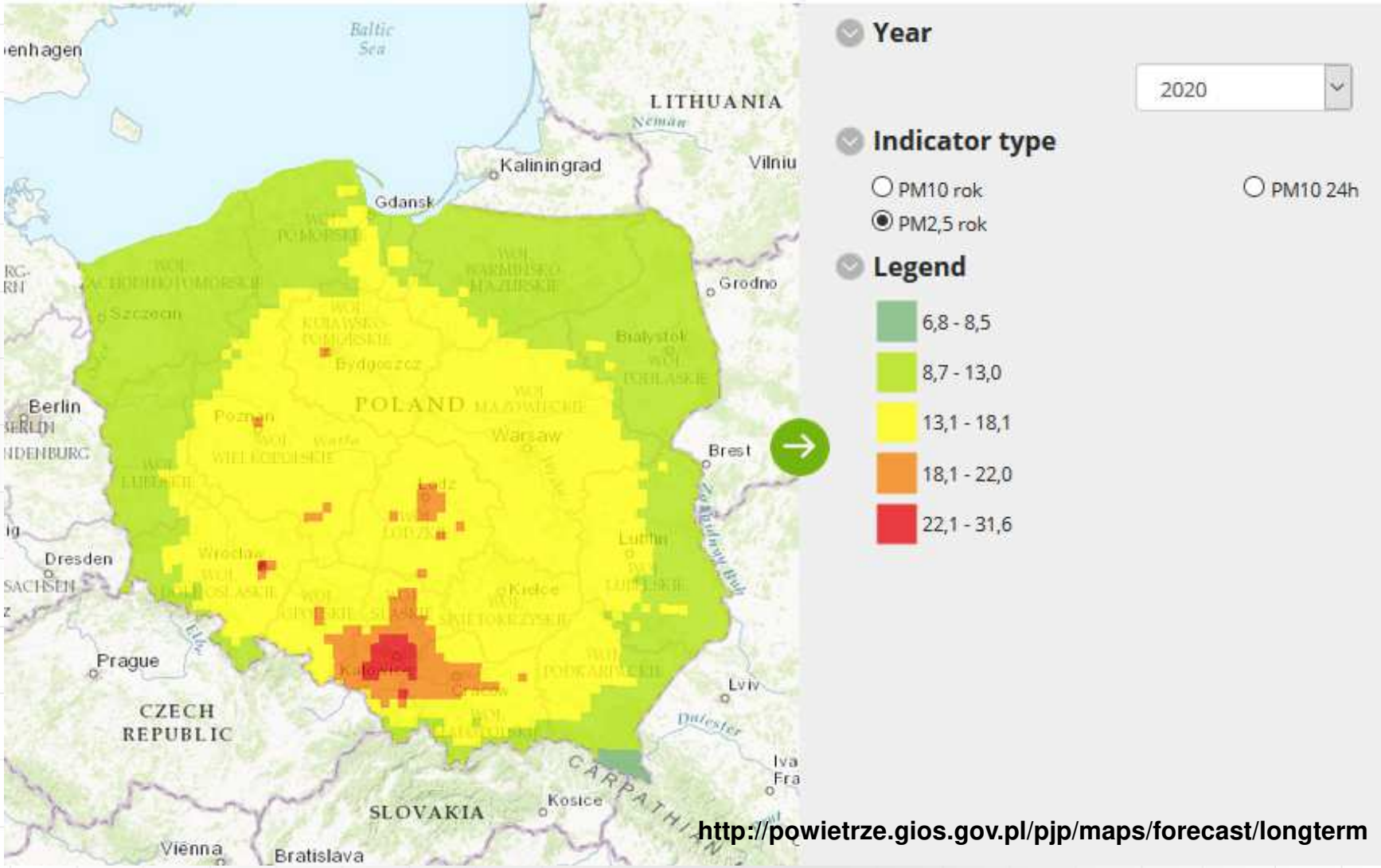
http://www.wios.rzeszow.pl/prognozy-zanieczyszczenia-powietrza-ozonem/

Long term forecasts for PM10



http://**powietrze.gios.gov.pl/pjp/maps/forecast/longterm**

Long term forecasts for PM2.5



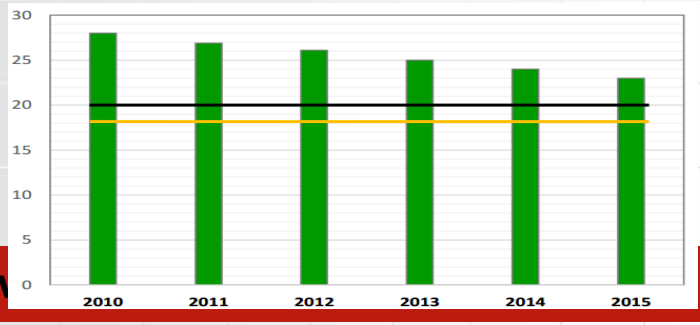
http://powietrze.gios.gov.pl/pjp/maps/forecast/longterm

Exposure to particulate matter PM2.5

According to art. 86a paragraph. 2 of the Act of 27 April 2001. - Environmental Protection Law Inspectorate Chief Of Environmental Protection calculates the value of the Average Exposure Index to PM2.5 for the city having a population greater than 100,000, and the agglomeration and the value of the national Average Exposure Indicator (AEI). These indicators are calculated according to the method set out in the Regulation of the Minister of Environment of 13 September 2012. On the calculation of the indicators of average exposure and the method of assessing compliance with the ceiling concentration exposure (Dz.U. z 2012 r., poz. 1029).

The values of national Average Exposure Index for PM2.5:

- for **2015** calculated as the average of the years **2013-2015** was **23 µg / m^3**
- for **2014** calculated as the average of the years **2012-2014** was **24 µg / m^3**
- for **2013** calculated as the average of the years **2011-2013** was **25 µg / m^3**
- for **2012** calculated as the average of the years **2010-2012** was **26,1 µg / m^3**
- for **2011** calculated as the average of the years **2010-2011** was **26,9 µg / m^3**
- for **2010** calculated as an annual average was **28 µg / m^3**



Exposure to particulate matter PM2.5 – measurement stations

http://powietrze.gios.gov.pl/pjp/maps/measuringstation/Z

Regional background pollutions – program: European Monitoring and Evaluation Programme (EMEP)

Main target:

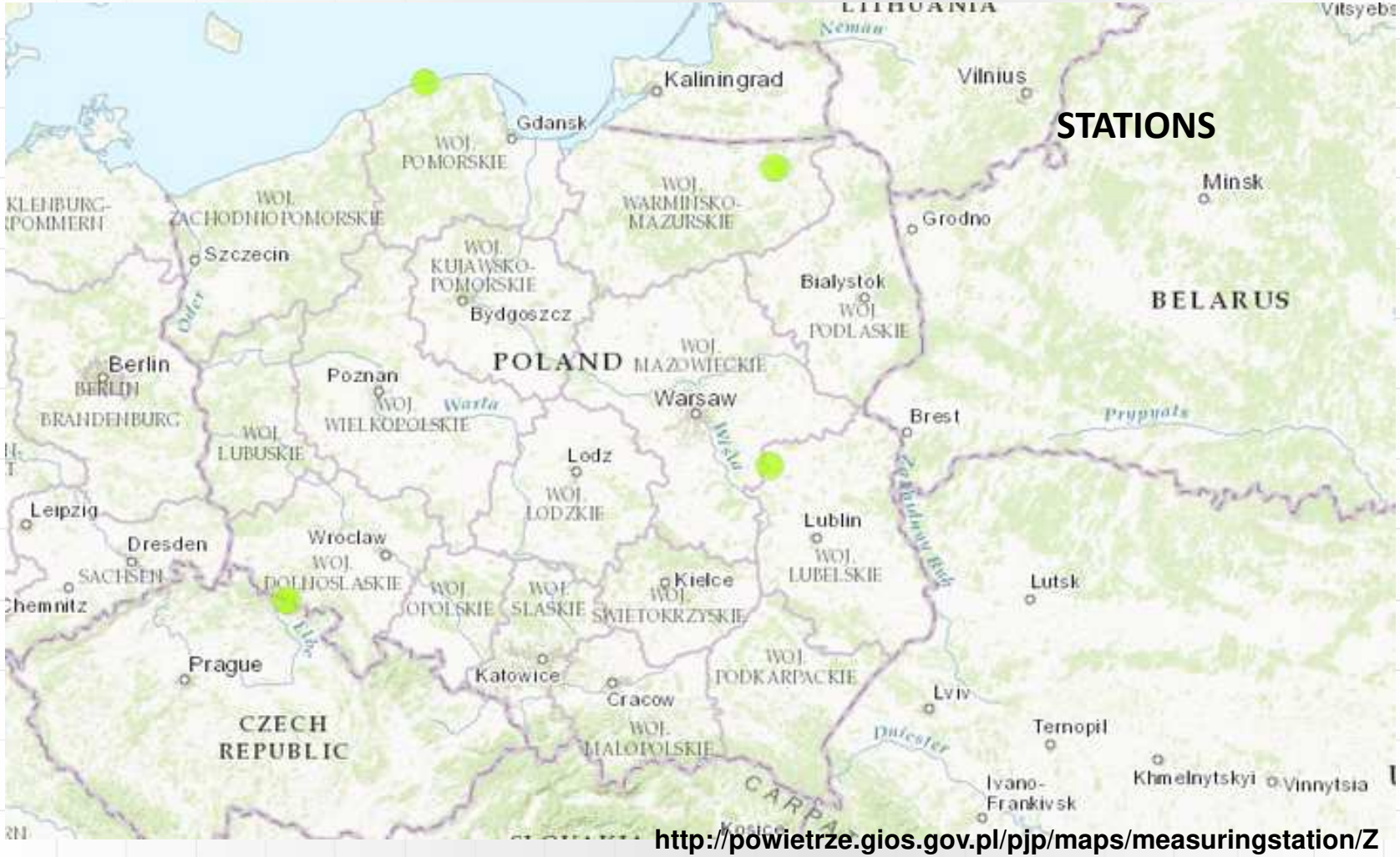
- ✓ giving information on concentrations and streams of selected pollutants reaching the ground
- ✓ assessment of background pollution with heavy metals and PAHs,
- ✓ providing information about the concentration and chemical composition of PM2.5,
- ✓ providing data for national air quality assessment systems ,
- ✓ provide information subject to international exchange, in accordance with the requirements of the European e-Reporting system (managed by the European Environment Agency)

Regional background pollutions – program EMEP

Measurement range:

- ✓ in the gas phase: SO_2, NO_2, O_3
- ✓ in aerosols: SO_4^{2-}, NO_3^-, NH_4^+,Cl^-,
- ✓ in atmospheric precipitation: SO_4^{2-}, NO_3^-, NH_4^+,Cl^-, Na^+, Ca^{2+}, K^+, Mg^{2+},
- ✓ electrolytic conductivity,
- ✓ pH,
- ✓ heavy metals (stations in Łeba and Puszcza Borecka)

Regional background pollutions – program EMEP



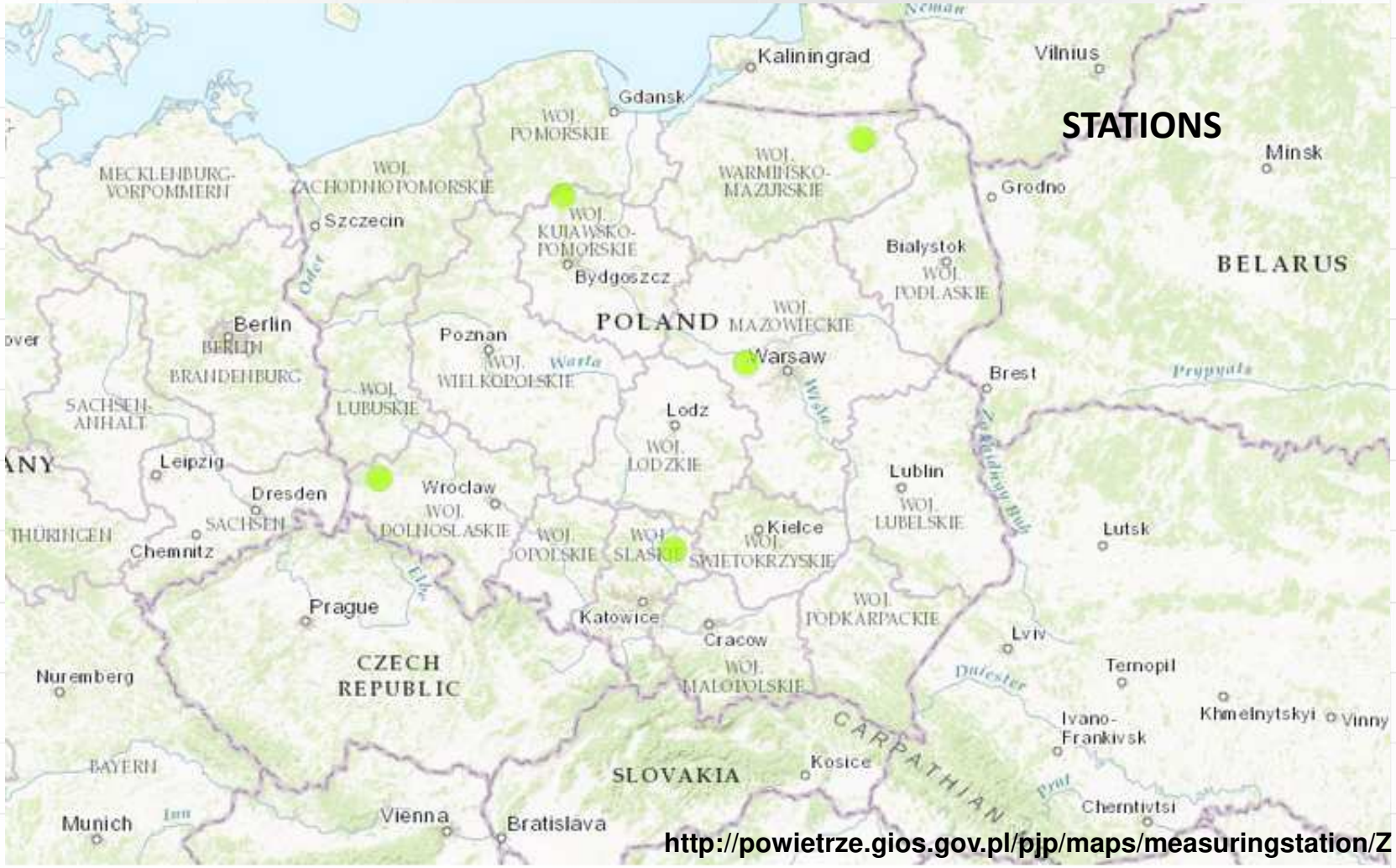
http://powietrze.gios.gov.pl/pjp/maps/measuringstation/Z

Regional background monitoring – UE program

Measurement programs carried out at the regional background stations:

- ✓ measurement heavy metals and PAHs in the air:
  - • stations Osieczów, Zielonka and Puszcza Borecka: arsenic, cadmium, nickel, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene and dibenzo(a,h)anthracene in PM10 and total deposition of these pollutants, mercury in total deposition
- ✓ measurements of air pollution by mercury in gaseous state:
  - • stations Osieczów, Zielonka, Puszcza Borecka, Granica and Złoty Potok: total mercury in gaseus mass
- ✓ study of the chemical composition of PM2.5:
  - • stations Osieczów, Zielonka, Złoty Potok and Puszcza Borecka: PM2.5, Na^+, K^+, Ca^{2+}, Mg^{2+}, NH_4^+, SO_4^{2-}, NO_3^-, Cl^-, OC and EC in PM2.5
- ✓ measurements of ozone precursors (VOCs):
  - • station Zielonka

Regional background pollutions – UE program



Chemistry of precipitation

Main targed is determine the nationwide distribution of pollutant loads discharged from wet precipitation to the ground, in terms of spatial and temporal.

Measurement network consists of 23 measuring stations located at synoptic stations IMGW - PIB representing the whole area of Polish

The monitoring system operates on the basis of automatic stationary collectors. The research includes the collection of precipitation samples and analyzing them on a monthly basis. Additionally - in separate collectors - also are collected samples of daily rainfall for measuring the pH value performed directly at the stations.

Chemistry of precipitation

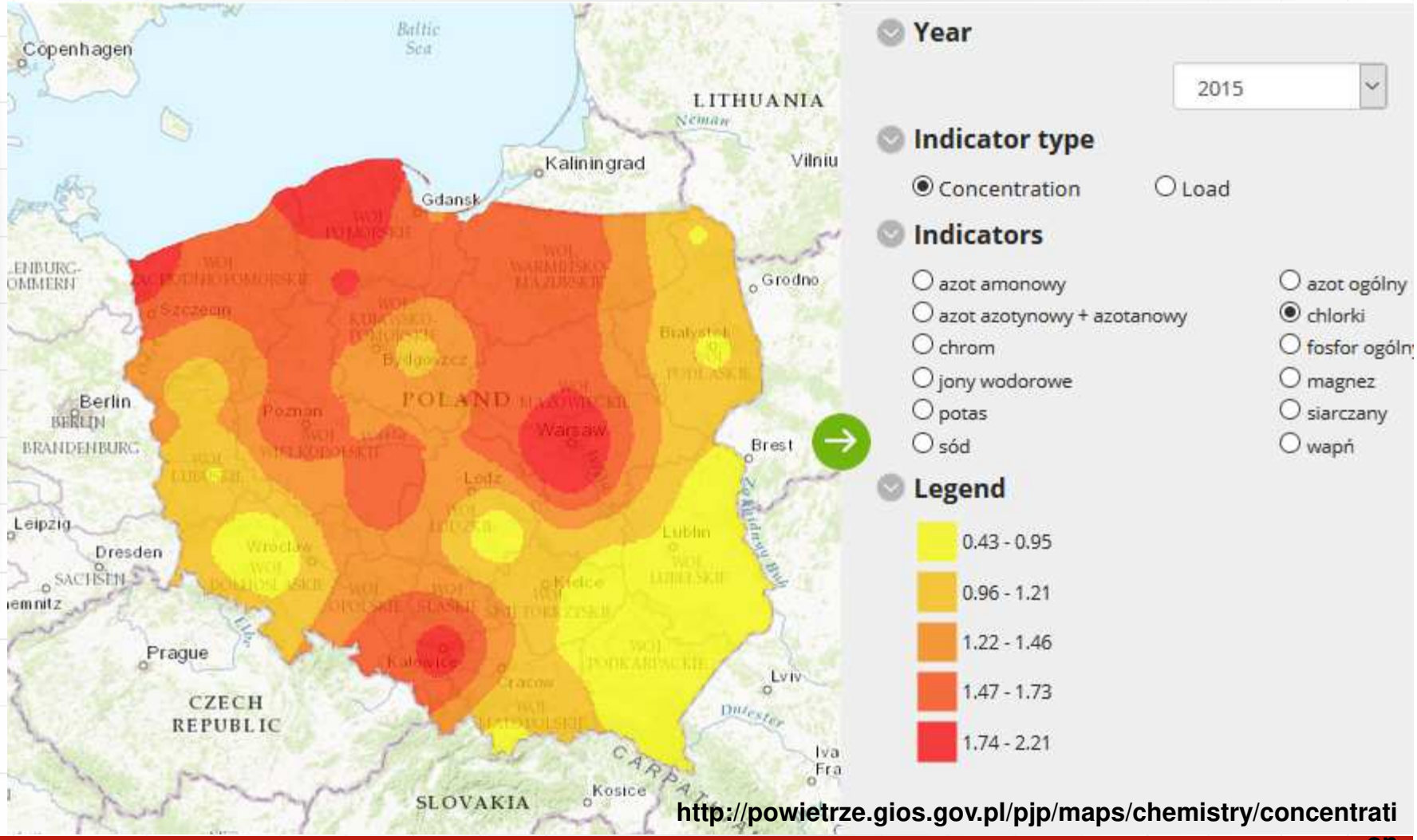
Measurement range:

- ✓ electric conductivity,
- ✓ pH,
- ✓ heavy metals: Zn, Cu, Fe, Pb, Cd, Ni, Cr, Mn
- ✓ Anions: Cl^-, SO_4^{-2}, NO_2^- i NO_3^-
- ✓ Kations: NH_4^+, Na^+, K^+, Ca^{+2}, Mg^{+2}
- ✓ total nitrogen
- ✓ total phosphorus

Chemistry of precipitation - stations

http://powietrze.gios.gov.pl/pjp/maps/measuringstation/Z

Chemistry of precipitation – concentrations and loads



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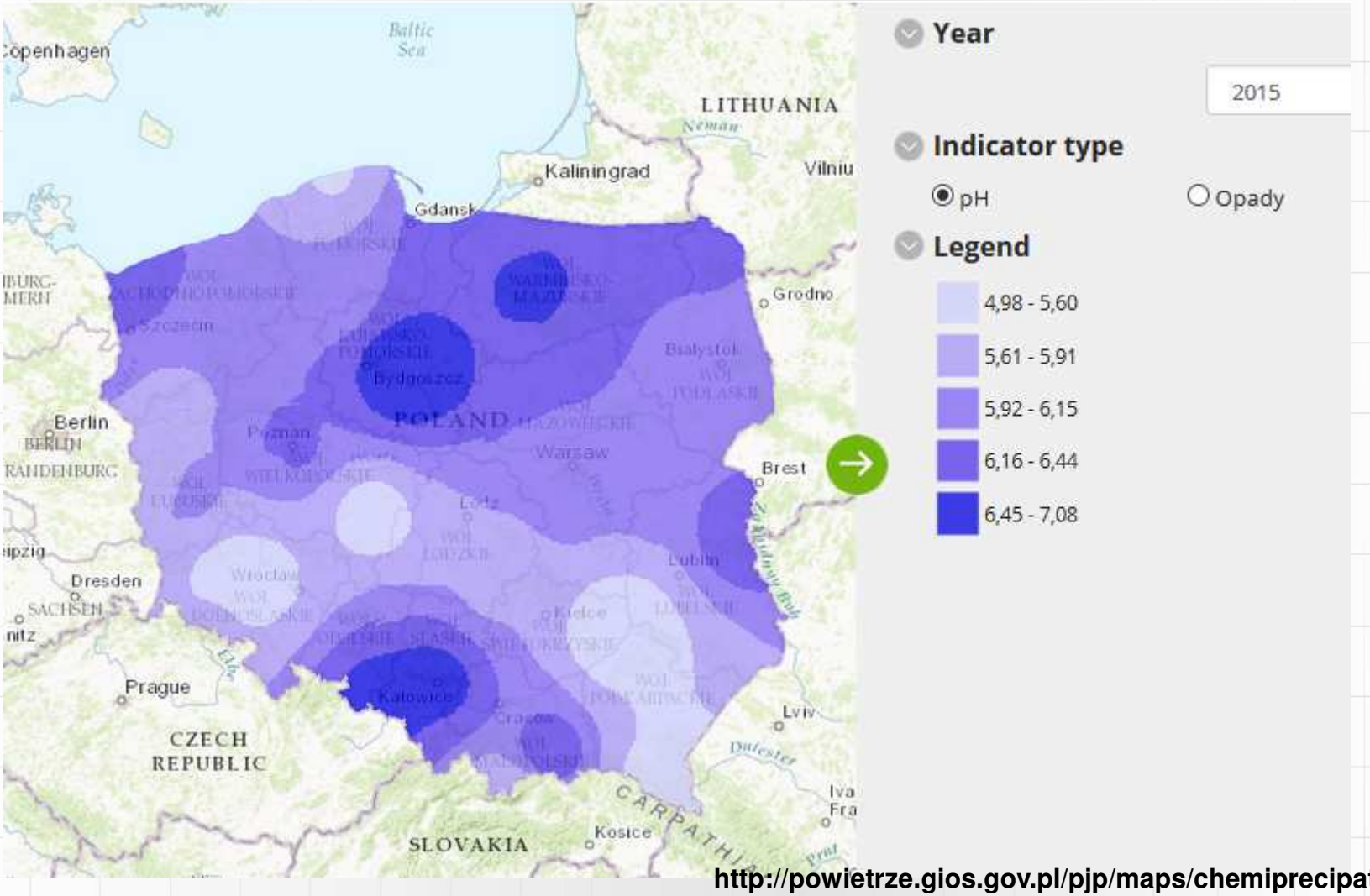
Chemistry of precipitation – precipation



http://powietrze.gios.gov.pl/pjp/maps/chemiprecipation

National Reference Laboratory

QUALITY ASSURANCE AND TRACEABILITY PROVINCIAL NETWORK OF AIR QUALITY MONITORING

Main tasks:

- ✓ maintaining a reference standards
- ✓ performing calibration of the equipment in air quality monitoring networks
- ✓ conducting audits / exams for monitoring stations (automatic analyzers, sampling systems), including checks of the auxiliary measuring equipment
- ✓ organizing and executing national comparisons between laboratories / intercalibration measurements for dust and gas pollutants
- ✓ organizing training courses for air monitoring network operators,
- ✓ implementation of new measurement methods,
- ✓ performing an advisory role for VIEPs in the field of air pollution measurement,
- ✓ Polish representation in international commissions and networks, eg. in the European network of National Reference Laboratories for air - AQUILA.

Summary

- EU law transposed into Polish law
- Air quality management at the national, provincial and local government levels
- Annual assessment of air quality is made until the end of April of the next year for the provinces and national annual air quality assessment is developed on their basis
- Monitoring networks - mostly automatic and manual measurements, supported by modeling results
- Numerous research programs (EMEP, the EU, the chemistry of precipitation)
- National Reference Laboratory and Calibration

´AIR QUALITY INFO EVERY DAY´

- Web information sources
- Mobile applications

References

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THANK YOU FOR YOUR ATTENTION

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