Tomsk Polytechnic University
Institute of natural recourses
Geoecology and Geochemistry Department

Atmospheric aerosols in environment

Lecture 3
«Methods of aerosol study»

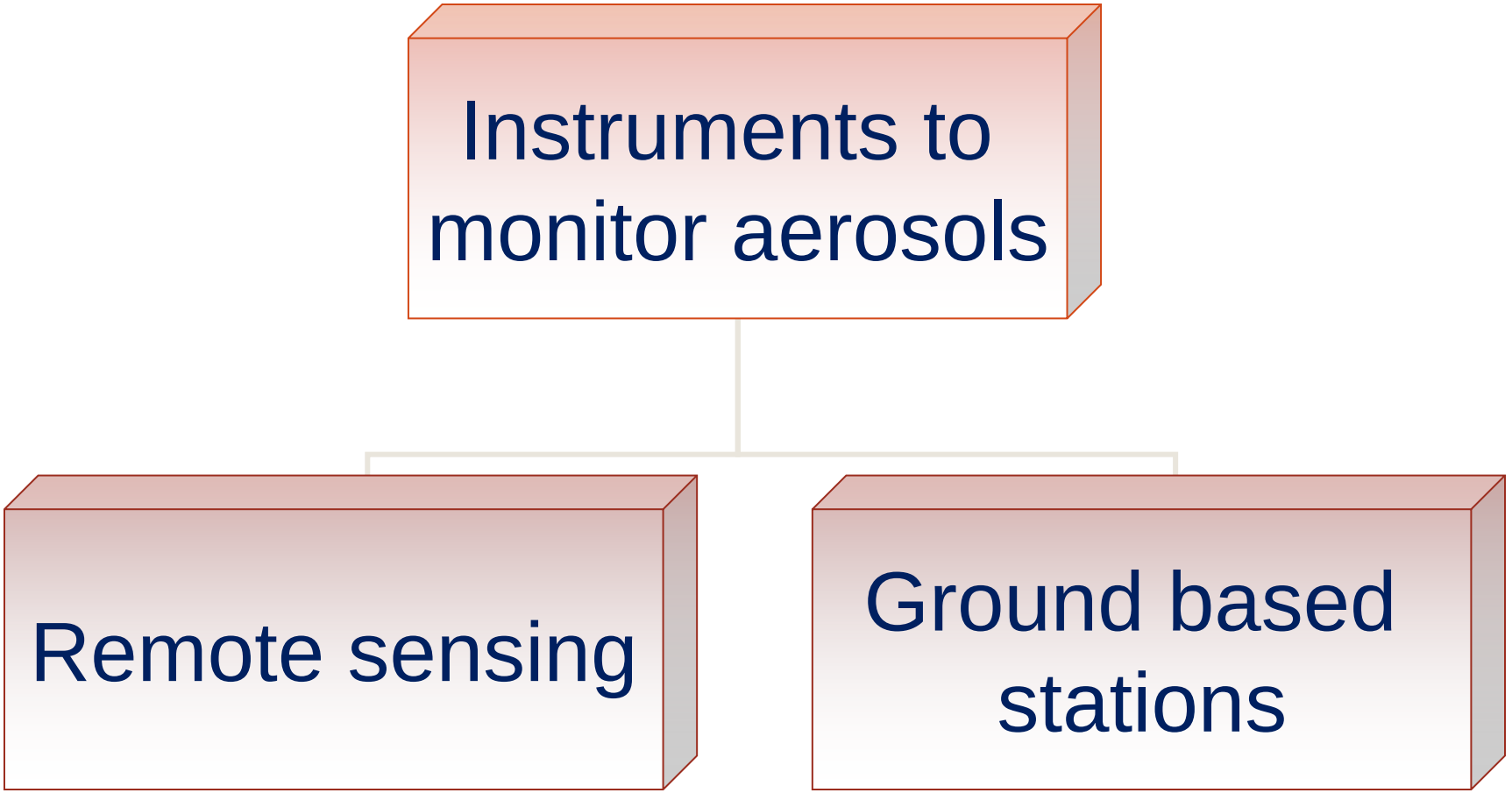
Anna V. Talovskaya

PhD, Associate professor

OUTLINE

1. Remote sensing aerosol networks.
2. Ground-based aerosol networks.

1. Remote sensing aerosol networks



Remote sensing

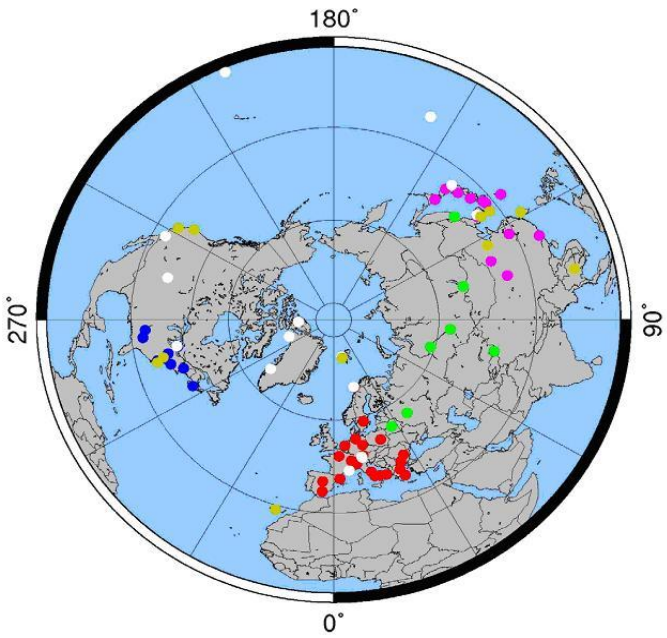
satellite ← **lidar** → **aircraft**

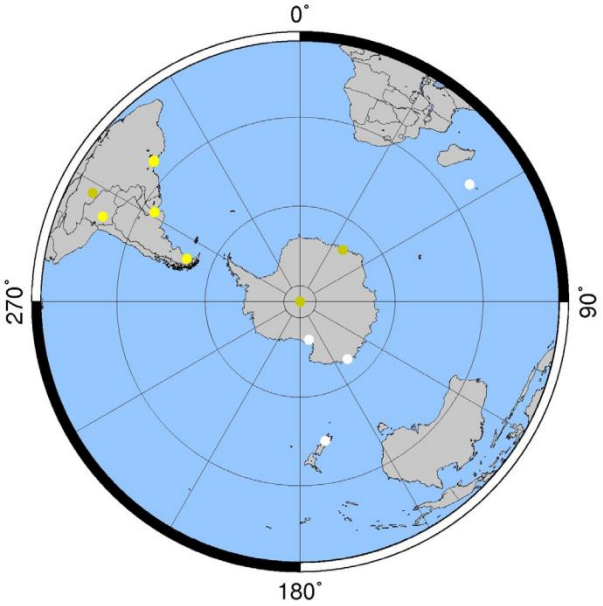
NOAA, TERRA (NASA).

Instrument in satellite MODIS (NASA), CALIPSO, POLDER (France)

Aerosol Lidar Observation Network

Lidar stations

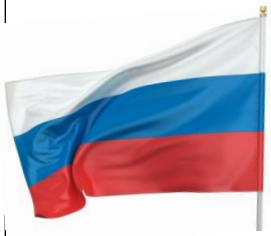




GAW Aerosol Lidar Observation Network (GALION)

Siberian lidar station (in Tomsk city)

The different networks are indicated by the dot colour:
AD-NET violet,
ALINE yellow,
CISLiNet green,
EARLINET red,
MPLNET brown,
NDACC white, REALM blue.



The YAK-AEROSIB transcontinental aircraft campaigns: study the remote Siberian troposphere. Russia-France project

П.Н. Антохин[1], М.Ю. Аршинов[1], Б.Д. Белан[1], С.Б. Белан[1], Г. С. Голицын[2], И.Г. Гранберг[2], Д.К. Давыдов[1], Г.А. Ивлев[1], А.В. Козлов[1], М.В. Панченко[1], И.Э. Пеннер[1], Е.В. Покровский[1], Д.Е. Савкин[1], Д.В. Симоненков[1], Г.Н. Толмачев[1], А.В. Фофонов[1], Д.Г. Чернов[1], В.С. Шаманаев[1], В.П. Шмаргунов[1], G. Athier[3], F. Boumard[4], A. Berchet[4], G. Cayez[3], P. Ciais[4], J.-M. Cousin[3], P. Nedelec[3], J.-D. Paris[4], A. Royer[4], M. Ramonet[4]

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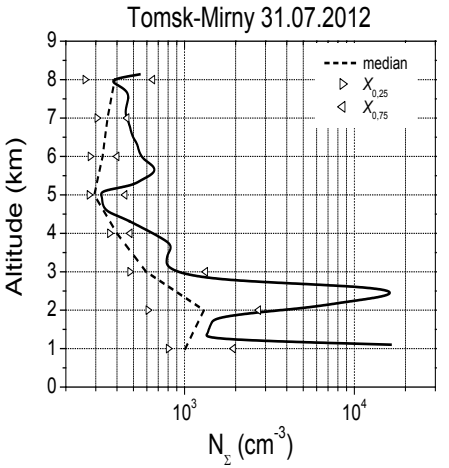
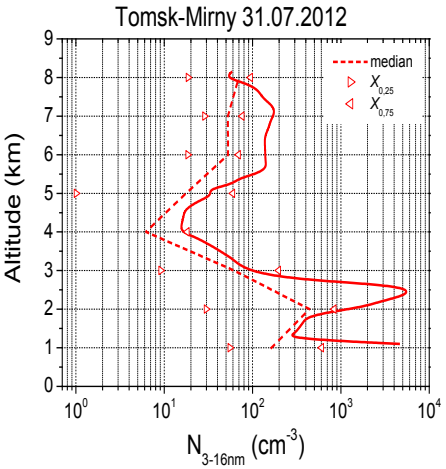
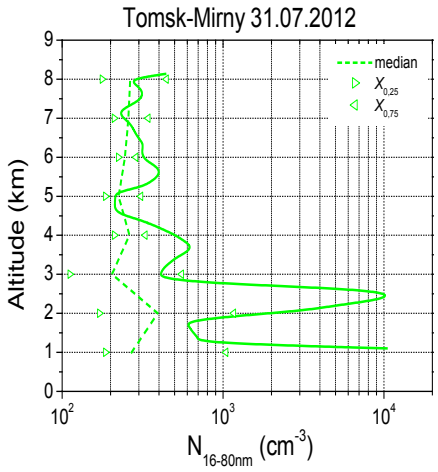
POLARCAT & YAK-AEROSIB

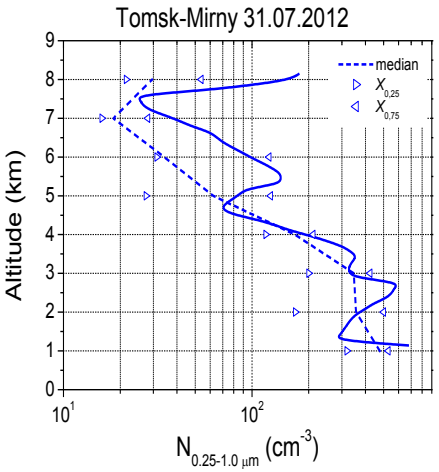
Study dynamics, transmission of CO, O_3, CO_2, CH_4, aerosols concentrations in the troposphere over Eurasia

Distribution of different aerosols fractions (route Tomsk – Mirny in 2012)





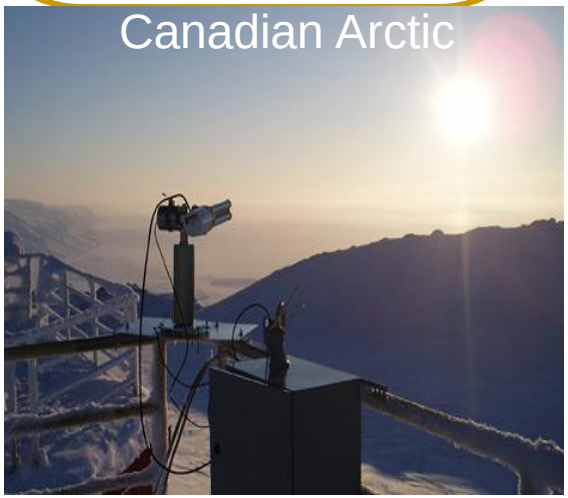




2. Ground based aerosol networks

Ground based

contributing (background) stations

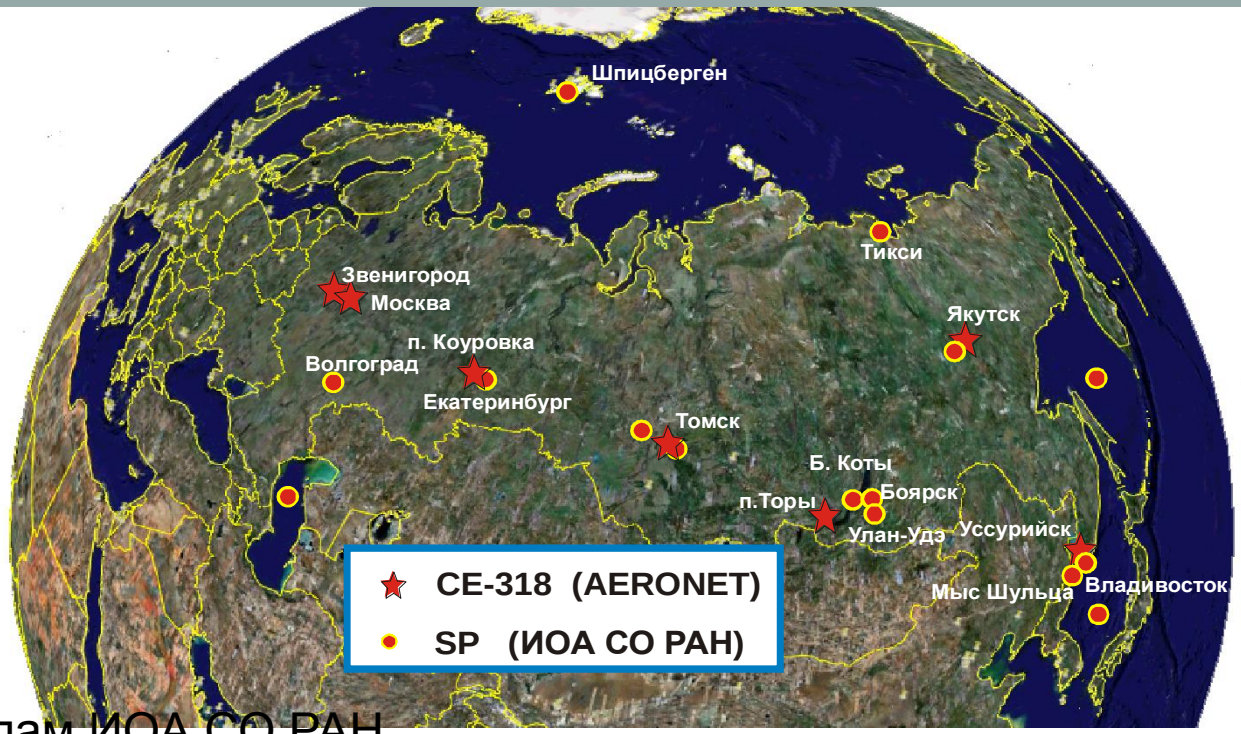


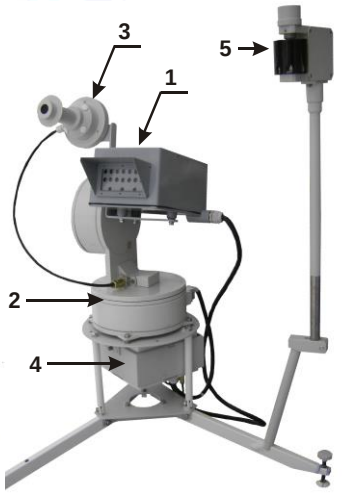
Regional stations

Stations in urban areas

://aeronet.gsfc.nasa.gov/cgi-bin/type_piece_of_map_opera_v2_new?level=3

AERONET (aerosol robotic network) and sun photometers (SP)



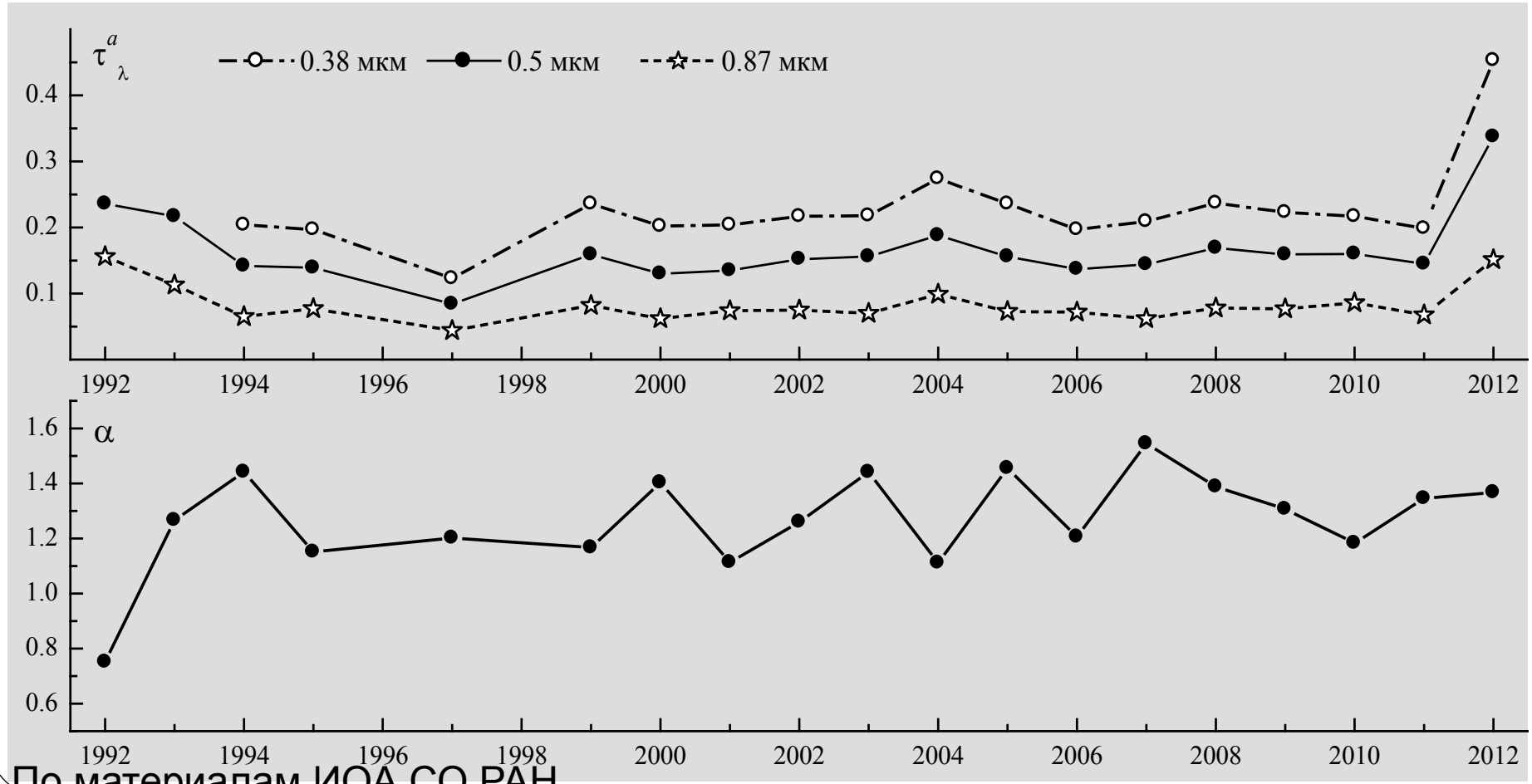


По материалам ИОА СО РАН

Dynamics of aerosol optical depth in Siberia

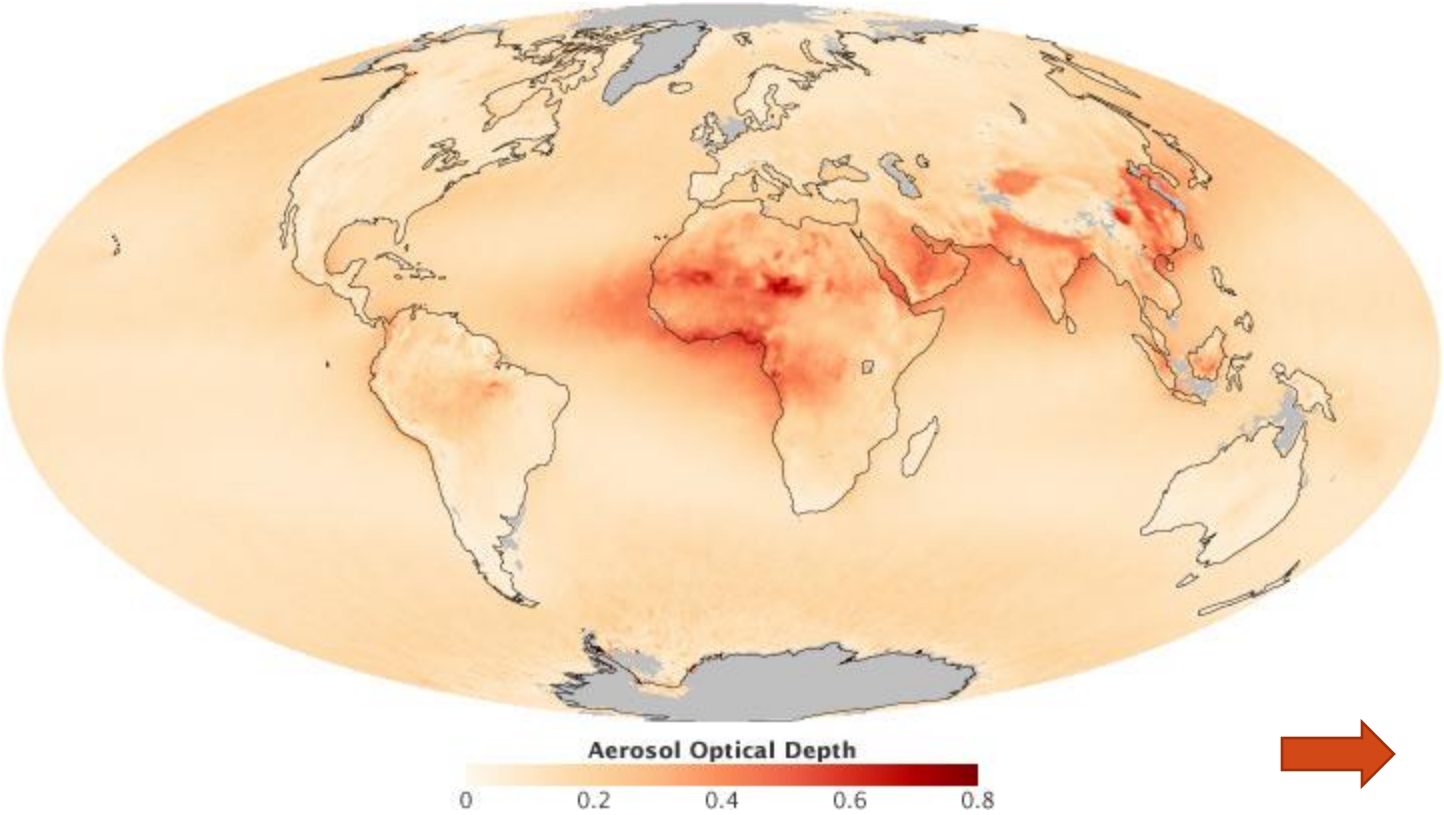
♦ Ранее отмечалось отсутствие тренда АОТ и проявление колебаний (2-5 лет).

♦ Главной особенностью последнего года является существенное увеличение АОТ в Сибири из-за массовых лесных пожаров. Это самое высокое замутнение атмосферы за весь поствулканический период: в области 0.5 мкм среднее АОТ более чем в 2 раза превысило многолетнее значение (0,15) и на 40% больше средних АОТ в 1992 г., наблюдавшихся после извержения вулкана Пинатубо.



По материалам ИОА СО РАН

Data of aerosol optical depth from the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite



palest yellow - crystal clear sky

reddish brown - hazy conditions

Observed period monthly 2005-2011

http://earthobservatory.nasa.gov/GlobalMaps/

Air sampling with portable equipment

Air

Air sampling by multi-gas analyzer

Gas analyzer

Sampling by aspirator

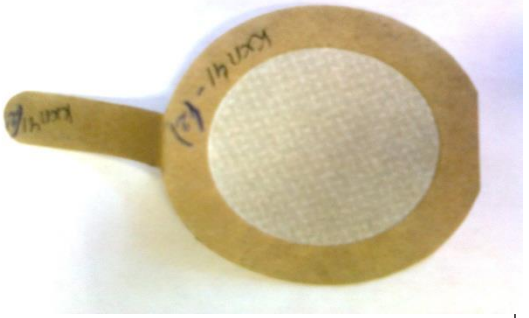
Filter with PM

Weighing

Ashing

Weighing

Analysis



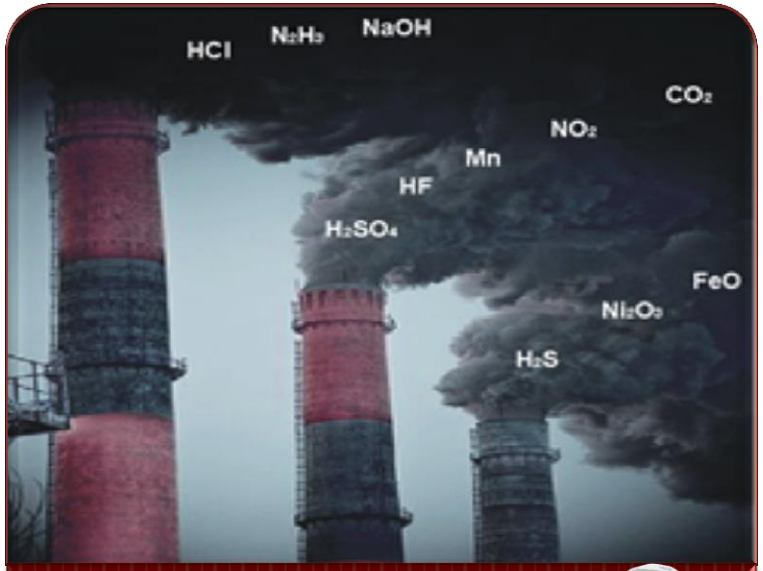
with sorbents

Analyze gases and other pollutants in the lab

Analyze pollutants (e.g. trace elements) in the lab

In Russia stations in urban areas are subdivided into categories

stationary post



mobile post

Stationary observation post is an especially equipped pavilion with apparatus which is necessary to register contaminant concentration and meteorological parameters in line with the established procedure.

- automatic sampler
- gas analyzer
- dust counters
- weather station
- data communication equipment

http://www.newstube.ru/media/syuzhet-dundukovoj-ehkologiya-moskvy-plany-stacionarnogo-punkta-avtomaticheskogo-kontrolya-za-zagryazne

http://www.gov.spb.ru/gov/admin/otrasl/ecology/maps/karta_vozduh

По материалам В.В.Челюканова, 2009 г.

* - в 2 раза меньше в городах с относительно низким уровнем загрязнения

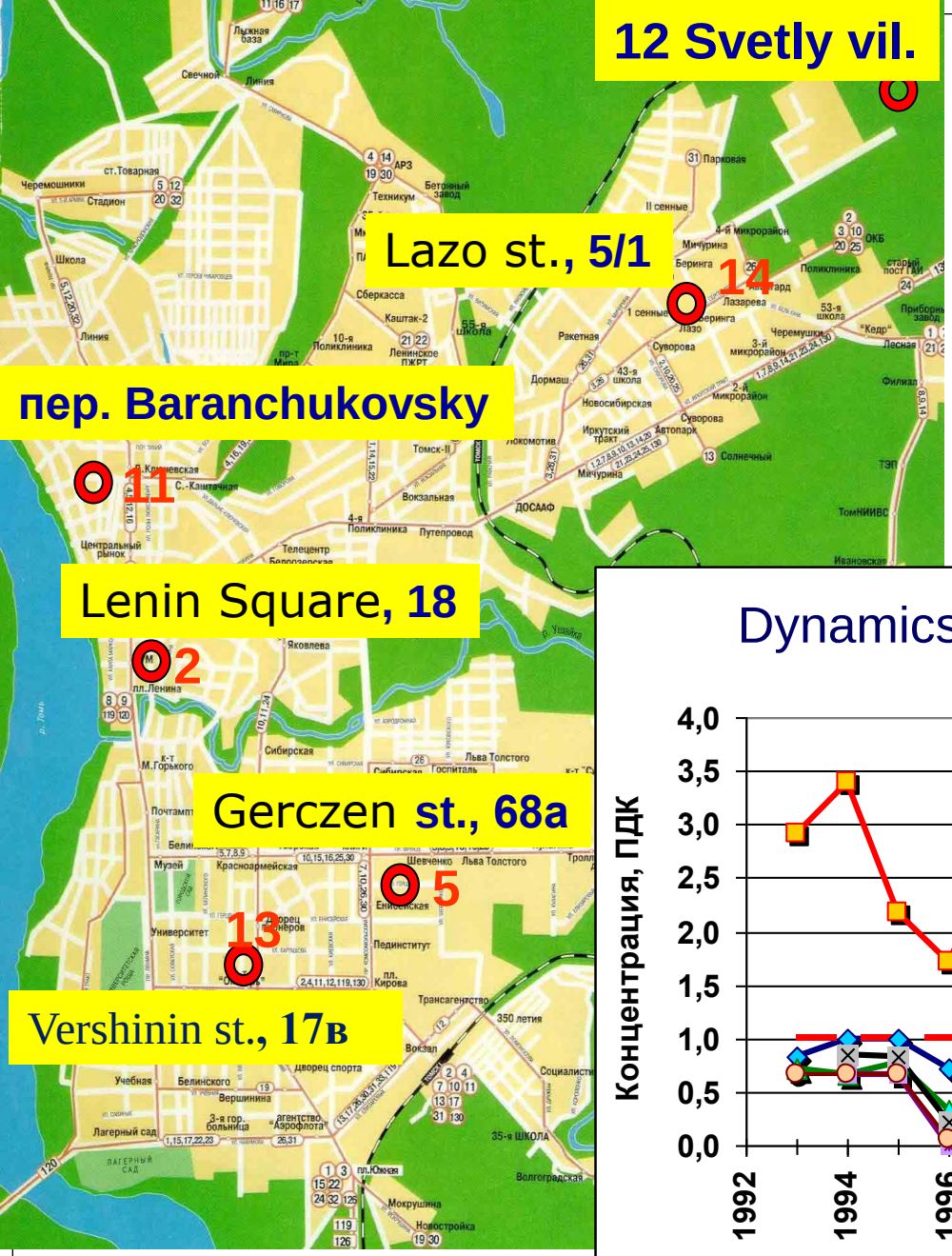
Number of the stationary posts-population size dependence

Population size	Number of posts in Russia GOST 17.2.3.01-86	Number of posts in countries of EU EU Directive 2008/50/EU 21.05.2008
to 50 000	1	1
50000-100000	2	1
100000-200000	2-3	1
200000-500000	3-5	2 (250000-499000)
500000-1000000	5-10	2 (500000-749000)
over 1000000	10-20	3 (750000-9990000) 4-9 (1000000-5900000)* 10 (over 6000000)*

* - в 2 раза меньше в городах с относительно низким уровнем загрязнения

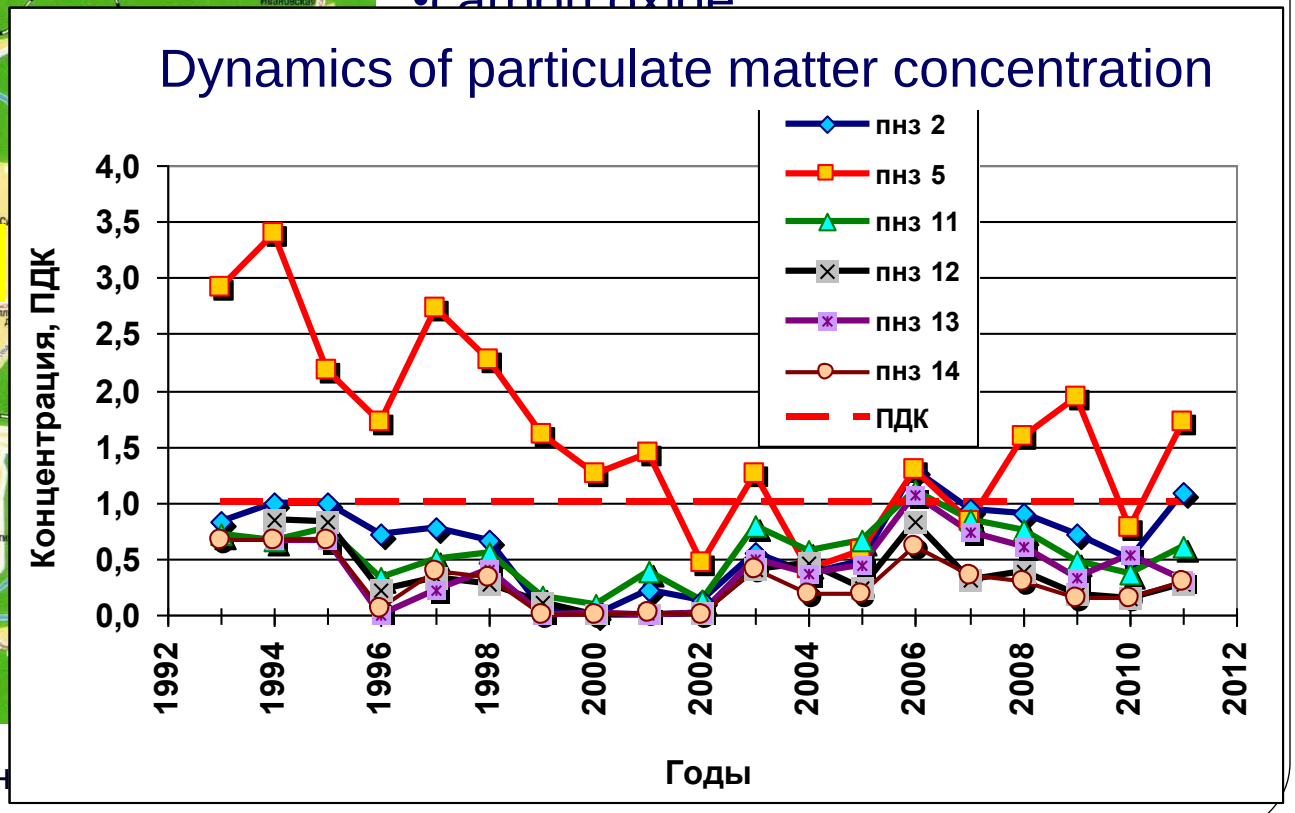
По материалам
В.В.Челюканова, 2009 г.

Stationary observation posts in Tomsk city



Measured pollutants in the atmosphere:

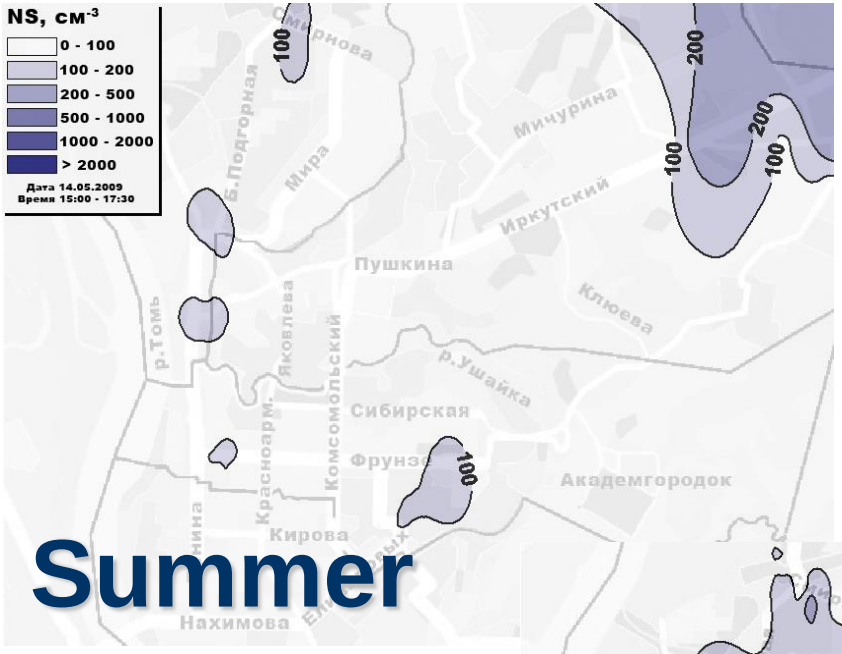
- sulfurous anhydride,
- carbon oxide

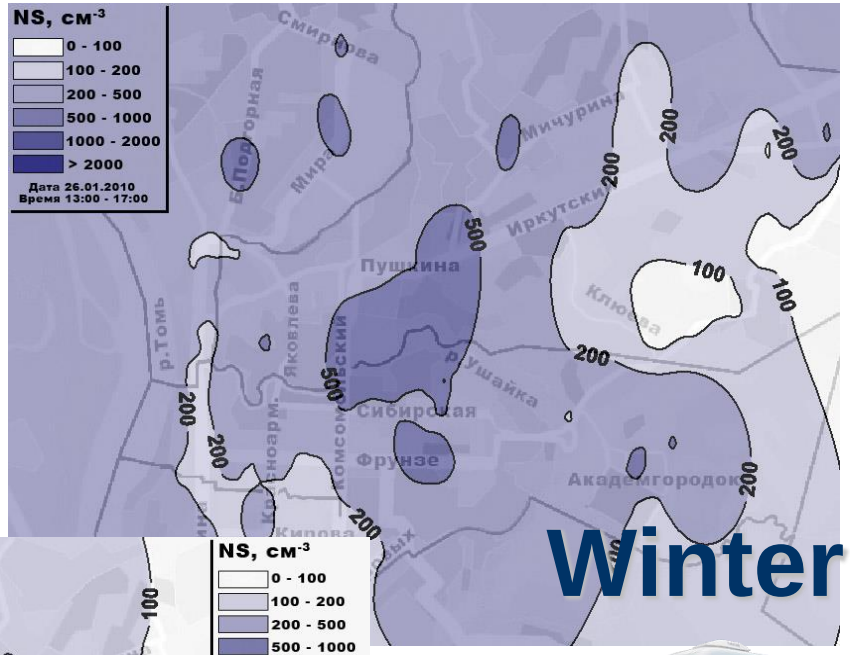


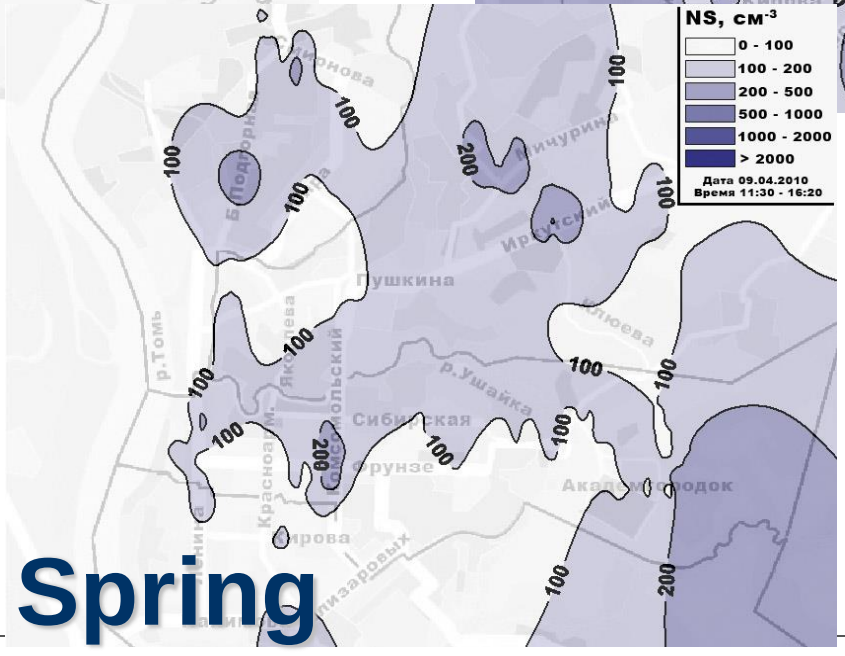
По данным Департамента природн
ресурсов Томской области

Ultrafine aerosol concentration in Tomsk-city, 2009, sm^{-3} (mobile post)

Particle size: 1,3 < r < 15 μm







Ужегова Н.В., Белан Б.Д., Антохин П.Н., Жидовкин Е.В., Ивлев Г.А., Козлов А.В., Фофонов А.В. – ИОА СО РАН