Comparison of the dynamics and manifestation of the weekend effect of atmospheric aerosols in industrially developed regions and in Antarctica

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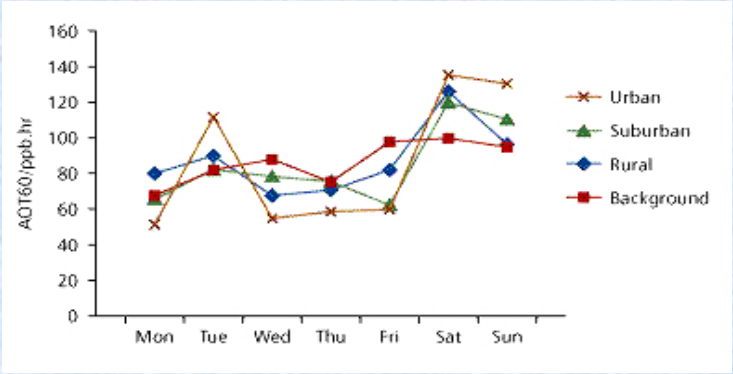
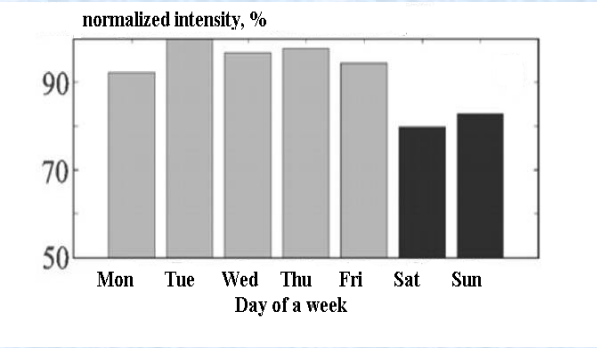
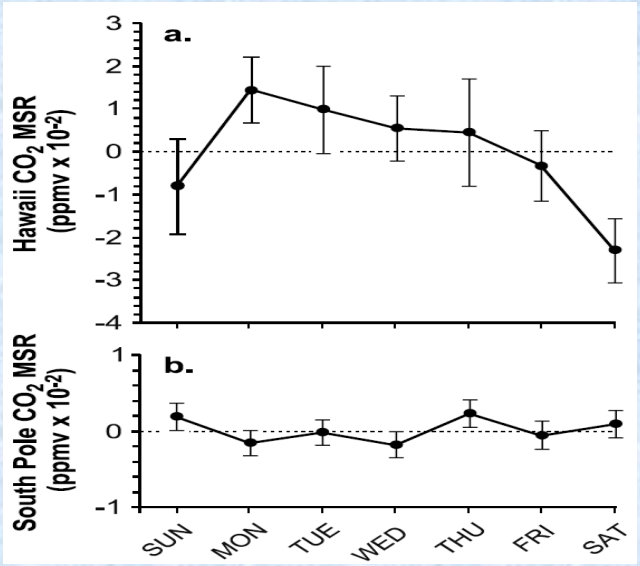
The weekend effect is various researches



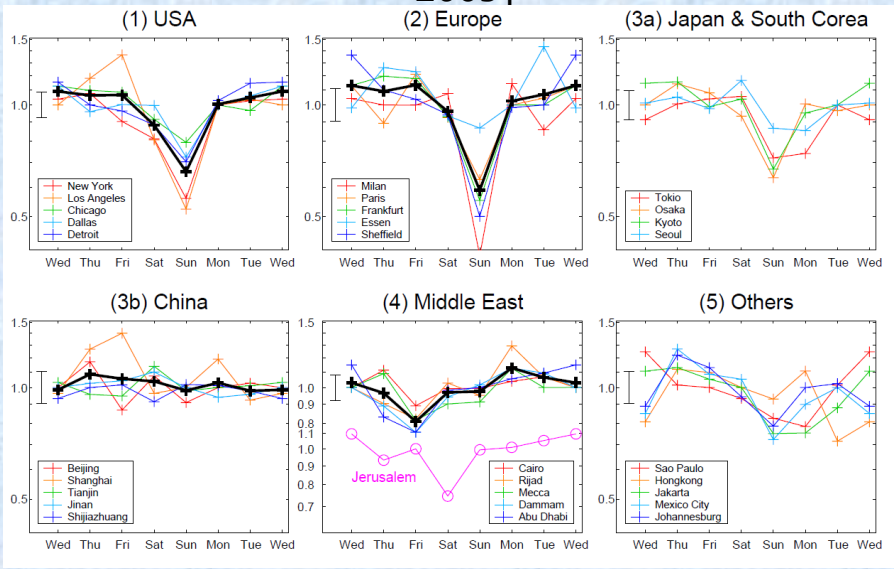
Seven-day variations in tropospheric ozone concentration [Bruckmann P., 1997]



Recordings of a line with an intensity of 60 Hz per week (03.2003 - 02.2004) [A.V.Koloskov Yu.M.Yampolsky, 2009]

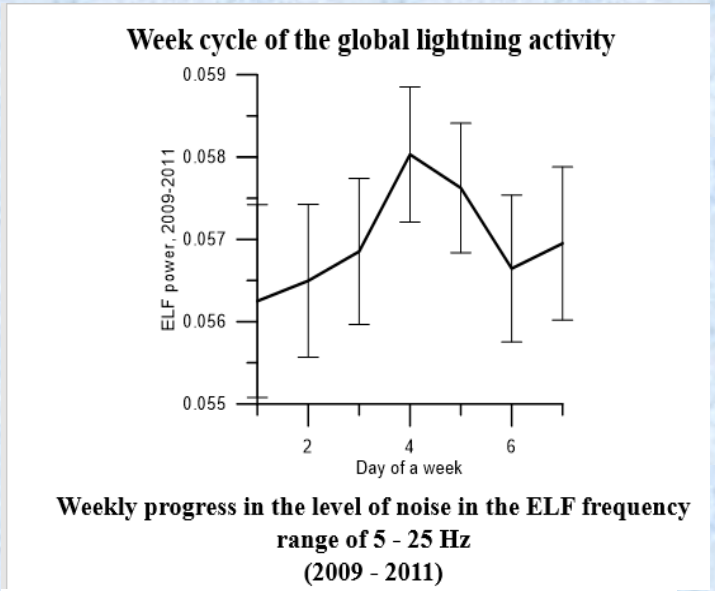


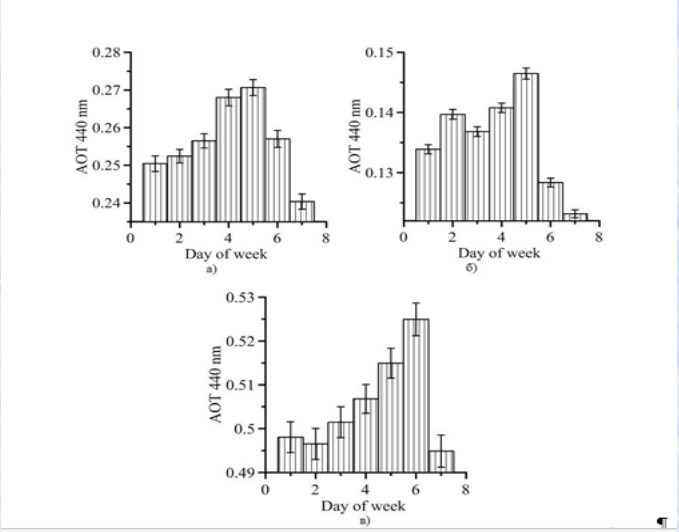
Average values of CO2 concentration (ppmv) as a function of day of the week:a) Measurements from Mauna Loa, Hawaii; b) Measurements from the South Pole.[Randall S. Cerveny and Kevin J. Coakley, 2002]



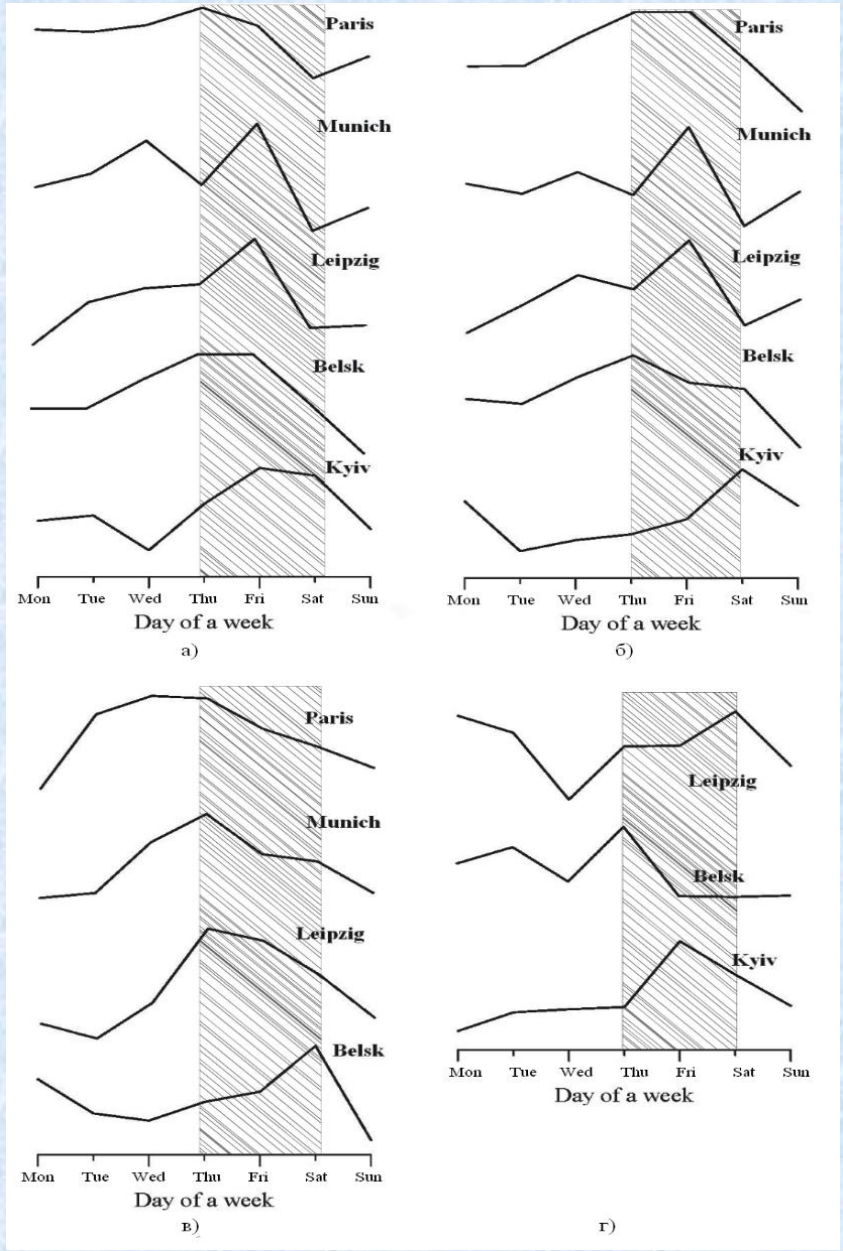
Weekly cycle of mean (1996–2001) tropospheric NO2 for different regions. The value is normalized relative to the average weekly value (relative units). Black lines are averaged curves. The scale is logarithmic. [S.Beirle, U. Platt, M. Wenig, and T. Wagner, 2003]

Examples of the weekend effect from previous research of authors



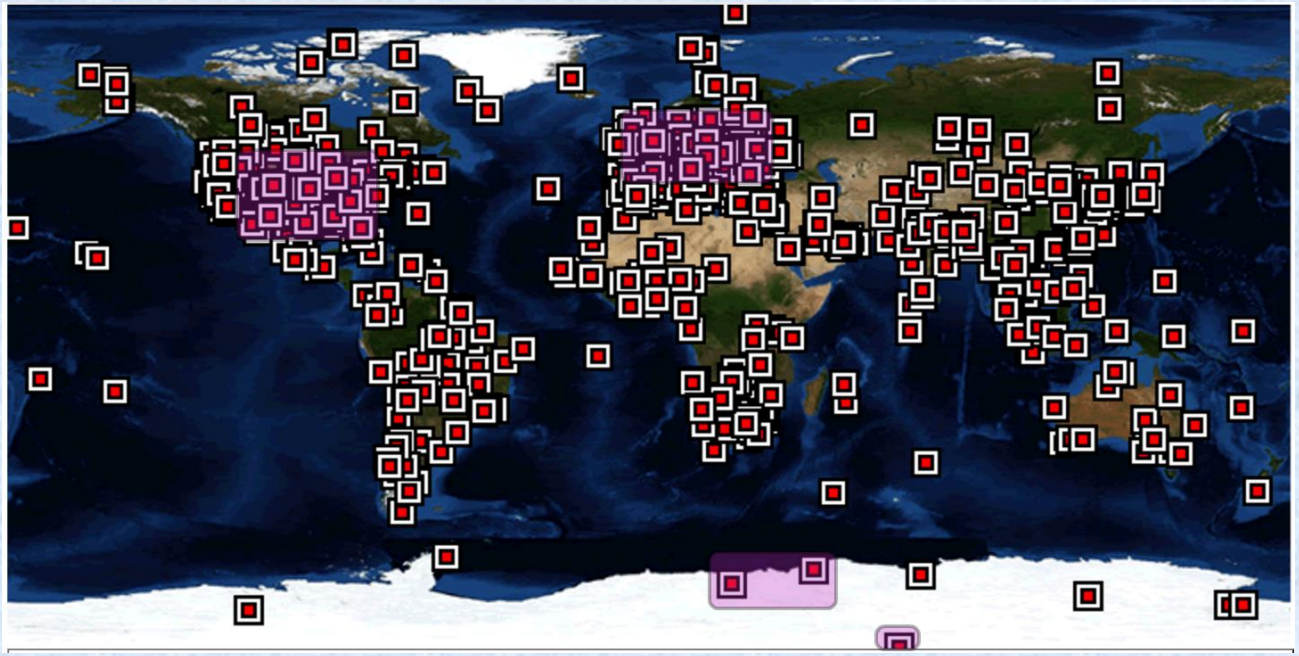


Seven-day variations of AOT440 (2009-2013) for: (a) Western Europe; (b) North America; (c) Asia



Comparative analysis of weekly cycles for various settlements

Purpose of the report and data



Map of distribution of AERONET monitoring points and search areas for weekly cyclicity in atmospheric aerosols

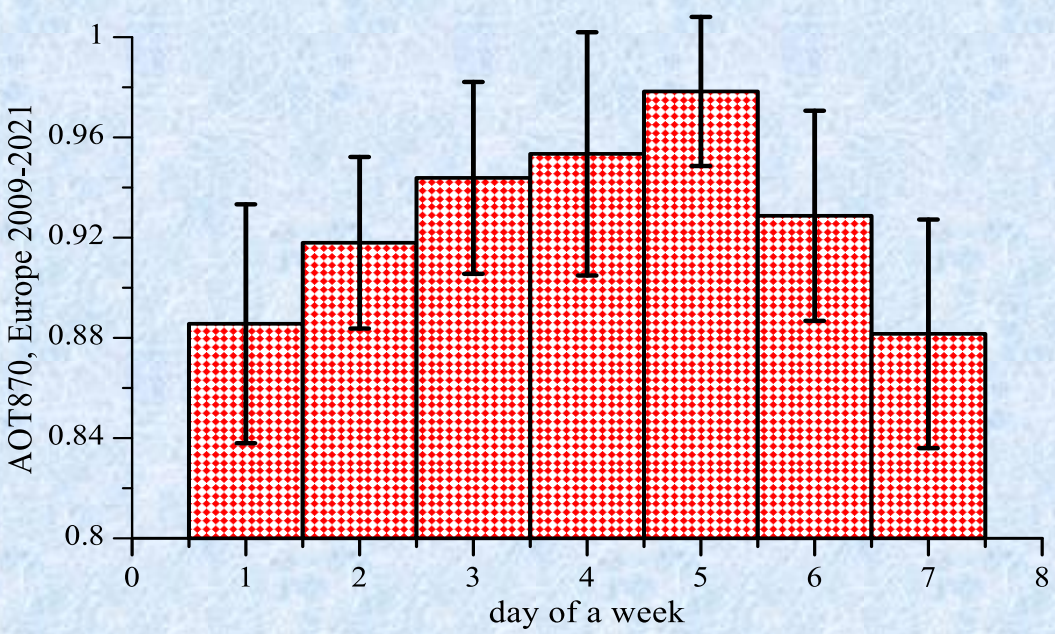
Sunphotometer Cimel CE318 in Martova AERONET site

Our research aims to further analyze in more detail the seven-day periodicity in aerosol parameters in the Antarctic compared with the planet's industrially developed regions.

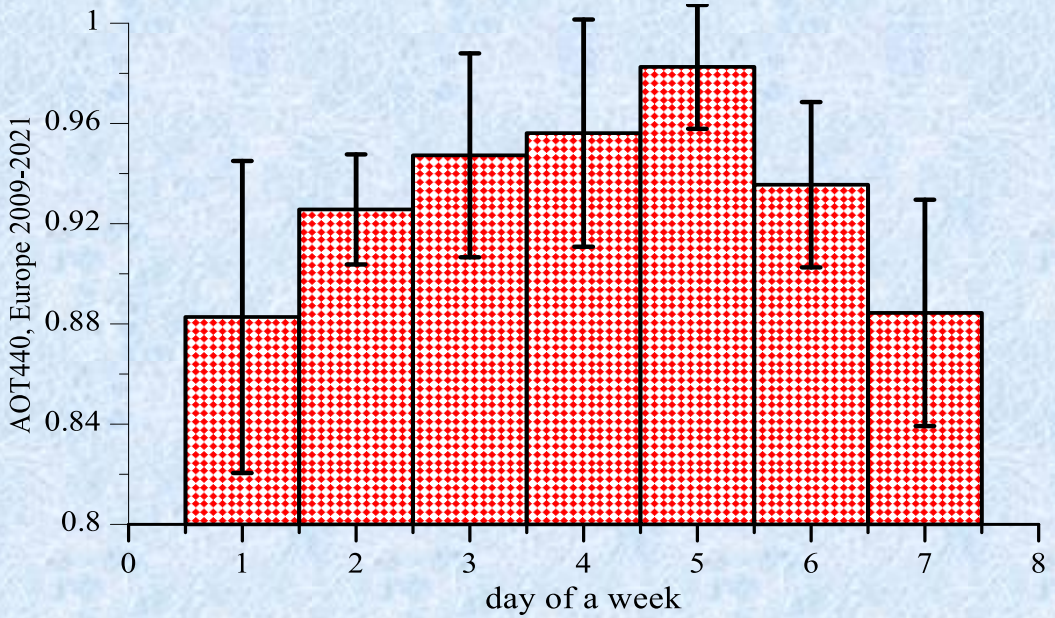
AERONET network sites used in the study

AERONET observation point	Coordinates	Height above sea level, m
Antarctica		
South Pole Obs NOAA	89°59'45'' S 70°17'60'' E	2850
Vechernaya Hill	67°39'36'' S 46°09'28'' E	80
Utsteinen	71°57'00'' S 23°19'58'' E	1396
Europe		
Paris (France)	48°52'01" N 02°19'58" E	50
Munich University (Germany)	48°08'52" N 11°34'22" E	533
Leipzig (Germany)	51°21'07" N 12°26'06" E	125
Belsk (Poland)	51°50'13" N 20°47'31" E	190
Kyiv (Ukraine)	50°21'50" N 30°29'49" E	200
North America		
Cartel X (USA)	45°22'24" N 71°55'51" W	300
Table Mountain (USA)	40°07'30" N 105°14'13" W	1689
Toronto (Canada)	43°46'48" N 79°28'12" W	300
Univ of Houston (USA)	29°43'04" N 95°20'31" W	65
Harvard Forest (USA)	42°31'55" N 72°11'16" W	322

Weekend effect, Europe



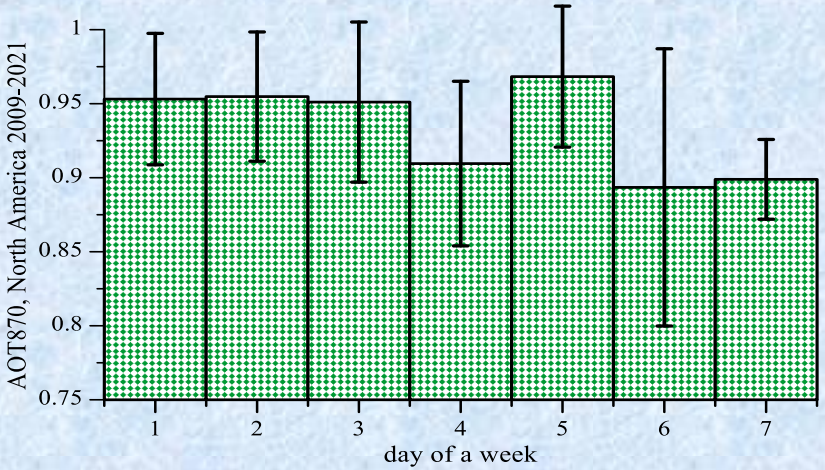
a)



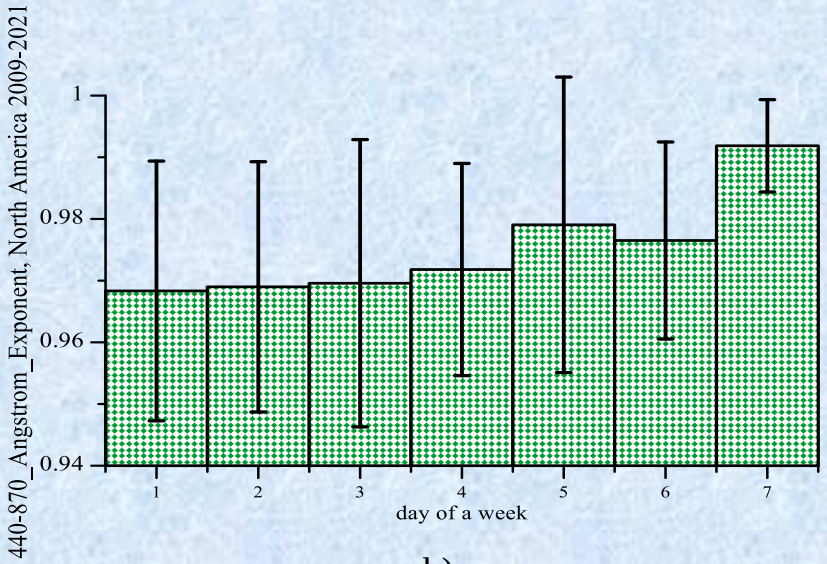
b)

Weekly AOT variations in Europe 2009-2021, excluding 2010 (due to the impact of volcanic eruptions and fires): a) AOT870; b) AOT440;

Weekend effect, North America



a)



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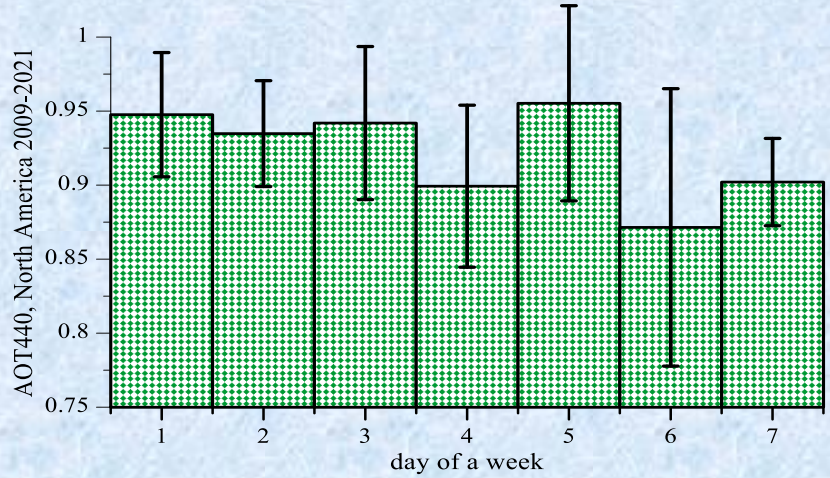

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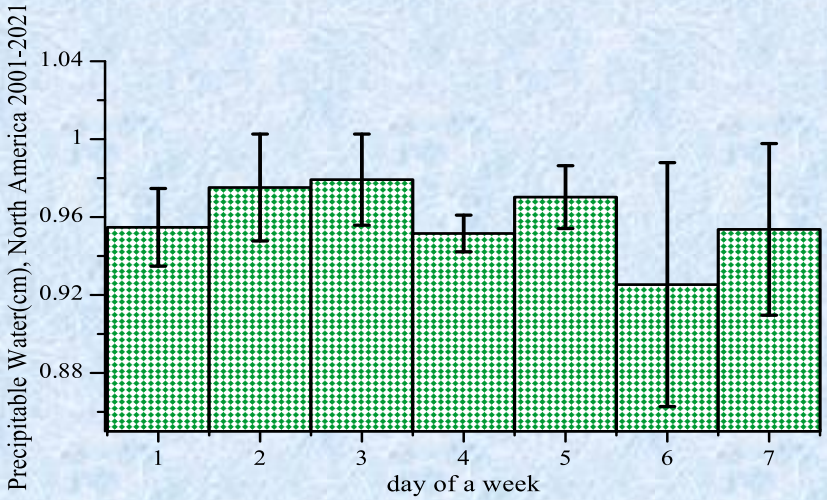
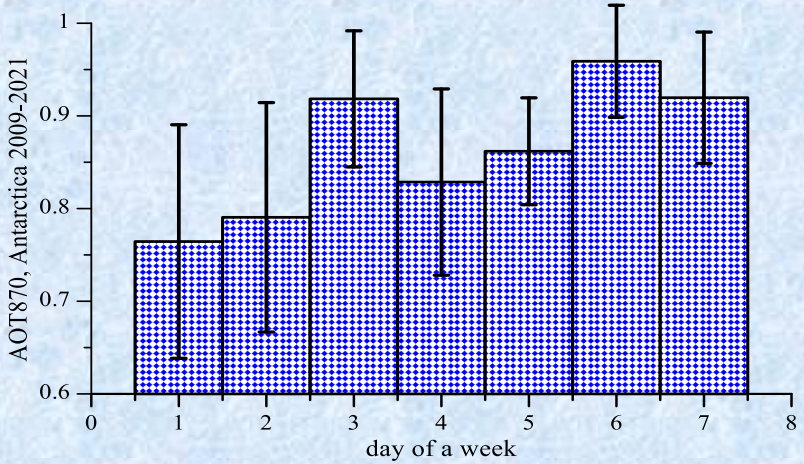


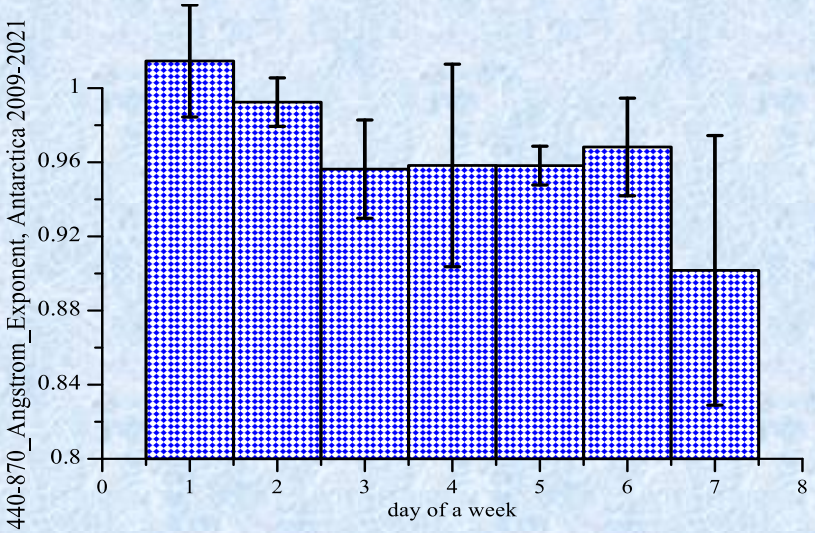
d)

Weekly aerosol variations in the atmosphere over North America, AERONET sites, 2009-2021: a) AOT870; b) Angstrom parameter; c) AOT440; d) Precipitable water vapor

Weekend effect, Antarctica



a)



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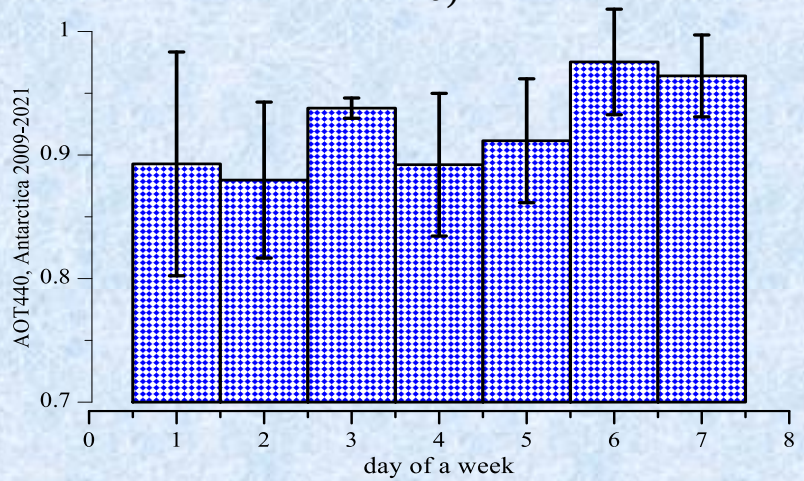

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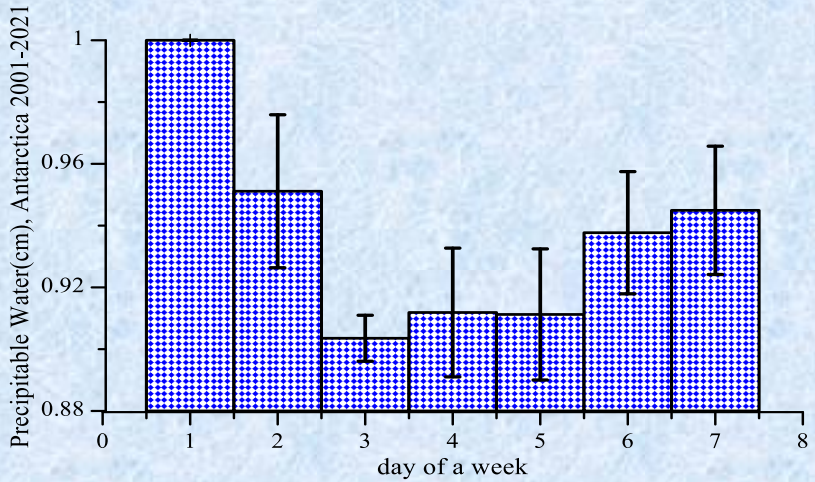
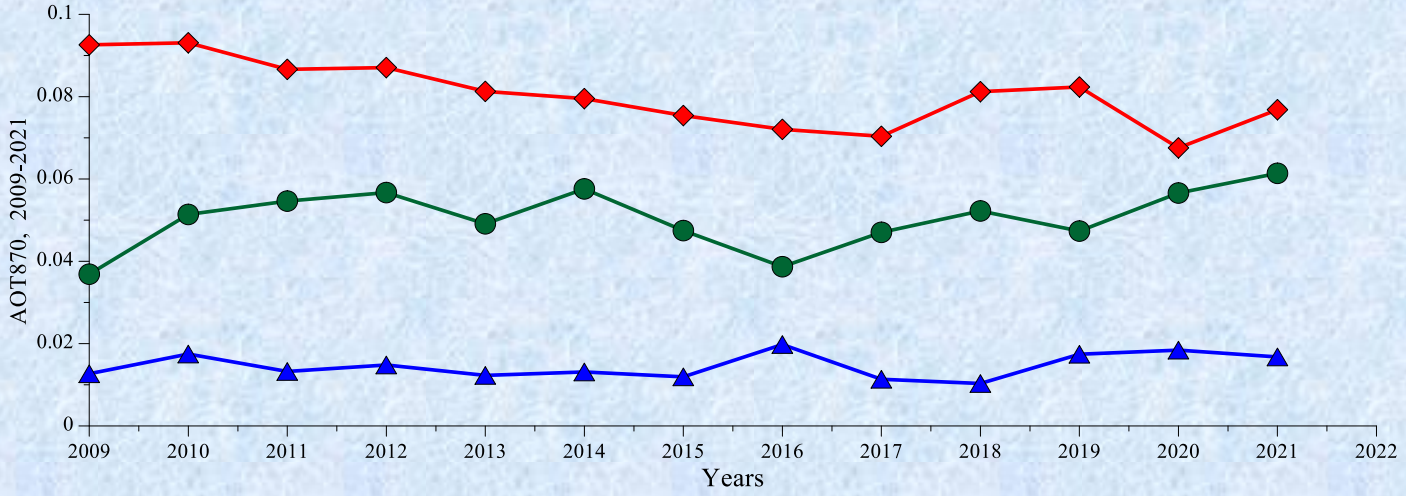


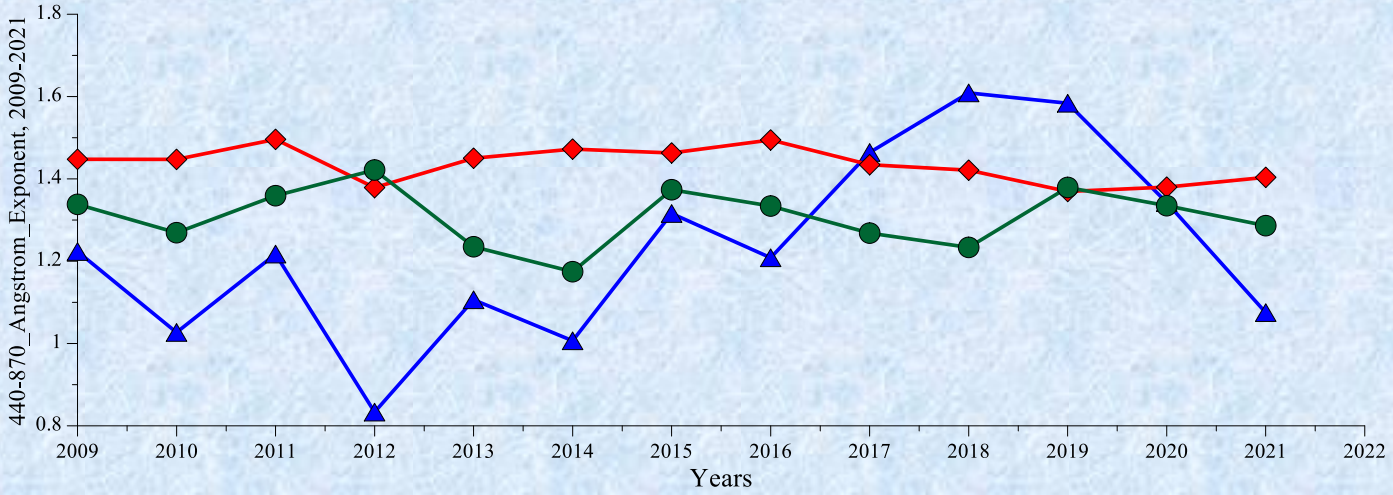
d)

Weekly variations, Antarctica, 2009-2021: a) AOT870; b) Angstrom parameter; c) AOT440; d) Precipitable water vapor

Dynamics of aerosol in the atmosphere, 2009-2021



a)



b)

The trend and year-by-year variations of aerosols in the atmosphere, blue line - Antarctica, red line - Europe, green - North America:

a) AOT870

b) Angstrom exponent

Conclusions

1. An analysis of thirteen-year systematic observations of the characteristics of atmospheric aerosols over the urbanized territories of three continents: Europe, North America, and Antarctica (ecologically clean region), was carried out.

2. The manifestation of seven-day periodicity in the behavior of aerosol optical thickness (AOT440 and AOT870) over Europe and North America was established. Their maximum values occur at the end of the working week (Thursday - Friday), and the minimum values are observed on weekends (Saturday - Sunday). The weekend effect in North America is much less pronounced than in Europe.

3. It was established that aerosol parameters are not dependent on the day of the week over Antarctica. However, there is a slight increase in AOT870 and AOT440 on weekends. But an interesting feature of the weekend effect is seen in precipitable water vapor.

4. The dynamics of changes in some atmospheric parameters for the period from 2009 to 2021 in the studied regions were analyzed. It was established that in all cases, except for the Angstrom parameter, the annual average values are the smallest over Antarctica. There is also a decrease in AOT870 and AOT440 values in Europe, while in North America, on the contrary, this indicator is gradually increasing.