

SURFACE OZONE IN HUNGARY

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In Hungary if somebody mentions the word ozone, naturally at first, most people think about the nowadays fashionable problem of the ozone hole, then to the expression: 'descent, good, ozone-rich air'. Although, from the 1970s several Hungarian authors mentioned that ozone is not a totally positive notion, somehow, almost exclusively the bright side of ozone have remained in the public thinking. On the internet if we search on the word ozone, then most of the displayed Hungarian homepages are the sites of hotels or pensions, and advertisements similar to the following: "Ozone Pension – the pension of ozone-rich air, silence, comfort and peace"/1998/¹ are not rare either.

Is it a kind of laziness, self-protection or something else that we care more about problems that exceed our competence than those we could affect? Or maybe the media does not emphasise the problem properly, or it would bring uncomfortable changes, and who knows how many other alternative reasons are there to justify ignorance?

An informing programme that aims at to change public attitude could result positive changes, but unfortunately no programs of this kind have been started yet. TV and radio rarely speaks about the problem of surface ozone or the summer smog and if they do so, it is often broadcasted in environmental programmes which do not reach to everybody. "Only one, out of date device monitors the dangerous gas" – wrote the journalist of the newspaper *Blikk* on 15th of June 1998. Although this statement is not true, the situation is far from rosy.

After a long lasting inquiry and telephoning we found four organisations that perform ozone-measurements beside the monitoring of other air pollutants. There are 5 stations in Budapest and other 25 in the rest of the country that currently measure ozone concentration, 4 others measured it previously for a short term, and several stations plan to measure ozone in the near future (*Fig. 1*).

The four organisations are: Hungarian Meteorological Service [Országos Meteorológiai Szolgálat] (OMSZ), Public Health and Medical Officer's Service [Állami Népegészségügyi és Tisztiorvosi Szolgálat] (ÁNTSZ), Environmental Inspectorate [Környezetvédelmi Felügyelőség] (KÖFE), and the former Northeast Hungarian - Japanese monitoring system's (Djayka Programme) only remained station, that is operated by the local ÁNTSZ. Unfortunately, even the authorities, organisations that deal with the problem do not have an overall, up-to-date view of the situation, and they do not know about each other's similar programmes.

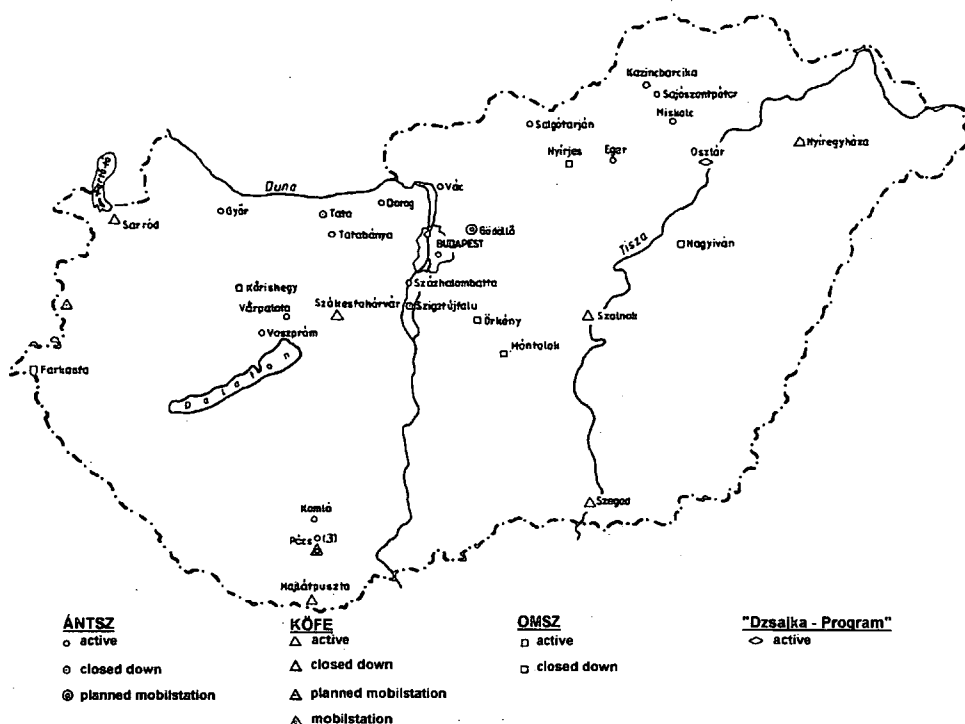


Figure 1 Stations in Hungary

In principle, data are free to get for scientific purposes, but in practise this does not work everywhere. At some stations it is not clear either, who has the right to deliver and to receive these information. A year ago we asked 36 stations, first on phone then in letter, to provide us hourly data from 1997 for a comparing research of mine. Up till now 18 stations have sent the asked information. We chose the 1997 data, because this was the latest available data series that was already processed by computers, and in many places, e.g. in Szeged, the monitoring was launched in that year. There were institutions that asked for money, others wanted to deliver half-year mean results. In the end some stations sent annual means saved on disc (at best) or in the form of a printed diagram (at worst). However, there were positive examples, too: Eger, Szolnok and the OMSZ sent the required data immediately in e-mail. Finally, we have to stress that as an outstanding example – in Hungary – the latest hourly results and the previous week's data of Eger are published on the Internet.

In Hungary the first measurements were carried out with the Schönbein - method in the middle of the 19th century. As a result of this, we have daily data from Sopron and Szeged, where two measures were performed a day from 1874 to 1881 and from 1855 to 1856, respectively.² After the trials at the end of the 19th and the beginning of the 20th century, surface ozone measurements were started again only at the end of the 1980s. The first station /a background station/ was established near Kecskemét, at K-pusztá (at Méntelek) in 1990.

Most of the instruments (22 pieces) in Hungary were installed in the framework of a PHARE programme in 1992 (now 17 instruments are operating).³ None of these were installed in Szeged, that is called the "city of sunshine" (not insignificant regarding ozone), and that is the 5th on the ranking list of the 23 most polluted Hungarian cities.⁴ In Szeged the first and till now the only instrument was installed near an avenue with heavy traffic in 1997 with the financial aid of some great local companies. Regarding ozone measurements the place of installation is not really ideal, but in the Hungarian practise this failure is not unusual. With the exception of six background stations, operated by the OMSZ and the KÖFE, measurements are mainly carried out by traffic and city background stations (previous ones are more characteristic). The reason for this is that these instruments also measure the concentrations of other pollutants that are present in the greatest amount where traffic is heavy. The place of measurements is determining, since, where the concentration of certain primal air pollutants (CO, NO_x, VOC) is high, there the ozone breaks down quicker, and lower values are measured than e.g. in a low traffic area of the city /park, playground/.

The financial situation of organisations dealing with ozone measurement is very different. The ÁNTSZ is subsidised by the Ministry of Health. The ÁNTSZ claims that one third of the necessary money is covered by the subsidy, and the remaining amount has to be raised by themselves. Regarding ozone measurements the KÖFE and the OMSZ belongs to the Ministry of Environment, but the structure of the budget of the KÖFE is similar to that of ÁNTSZ.

The price of a measuring instrument is 2-3 millions HUF, and the maintenance is also expensive. In case of some stations, even operation costs are a problematic issue. This is how it could happen that a station's whole 1995 database is invalid, since in that year, partly because of financial reasons the instrument was not calibrated. Failures the reparation of which may take weeks are regular. Naturally, the data of these failure periods are missing. Among others, heat was emphasised as a reason for faults, since the instruments, placed in containers, cannot stand extreme heat, and they stop. This means that the devices go wrong exactly when they would be the most necessary, i.e. on the hot days, occurring regularly, between May and September.

"Health and environmental institutions – due to reduced financial circumstances – in a limited degree but continuously carry out the evaluation of air quality and its effect on the health of the population".⁵

In Hungary, the directive on the acceptable threshold limit values of ozone concentration is recorded in the MSZ 21456-26:1994 standard. It gives a 110 µg/m³ hourly and a 100 µg/m³ daily mean value as a limit for ozone concentration.⁶

In Budapest a smog raid is to declare if at least at two stations of the monitoring system the imission values reach or exceed the threshold value, and if no significant change can be expected in the weather situation. Consequently, the declaration of a smog raid is partially based on the forecast of the OMSZ. The problem is that two out of the three standard instruments ('monitoring system') are at traffic stations and it is not very probable that the given threshold value will be reached there. According to smog raid regulations, the raid must be declared by the competents of the Council of Budapest on the basis of the suggestion of the ÁNTSZ and the OMSZ. Restrictions on traffic can be declared, or industrial emitters can be requested to cut back their emission.⁷ Budapest's action plan can be found in the Fővárosi Önkormányzat Hatályos Rendeletei (1st December 1994, 31st August 1998) and in the Fővárosi Közlöny (25th March 1998).

As a comparison, in *Table 1* the threshold values of Budapest can be seen together with the corresponding German whole-country values. Differences can be noticed not only in the values but in the referential temperature, as well. While according to the EU standards, the members, so as Germany, apply 20 °C and 101,3 Pa for reference, in Budapest the results are referred to 25 °C and 101,3 Pa. ⁸ (Obviously, the higher the referential temperature is, the lower ozone values we get).

| | preparedness | raid I. | raid II. |
|----------|-----------------------|-----------------------|-----------------------|
| Budapest | 200 µg/m ³ | 200 µg/m ³ | 200 µg/m ³ |
| Germany | 200 µg/m ³ | 200 µg/m ³ | 200 µg/m ³ |

Table 1 Limit values for ozone in case declaring smog raid

According to the laws, every local government can decide whether it needs or not an action plan for smog raid situations, thus, the above mentioned plan refers only to the capital. Beside Budapest, only Pécs has compiled a similar plan yet. However, the drawing up of local action plans is not effective – as it was proved in several researches –, since surface ozone is not a local problem. Exactly because of this, most of the western countries usually prepare a regional or countrywide action plan.

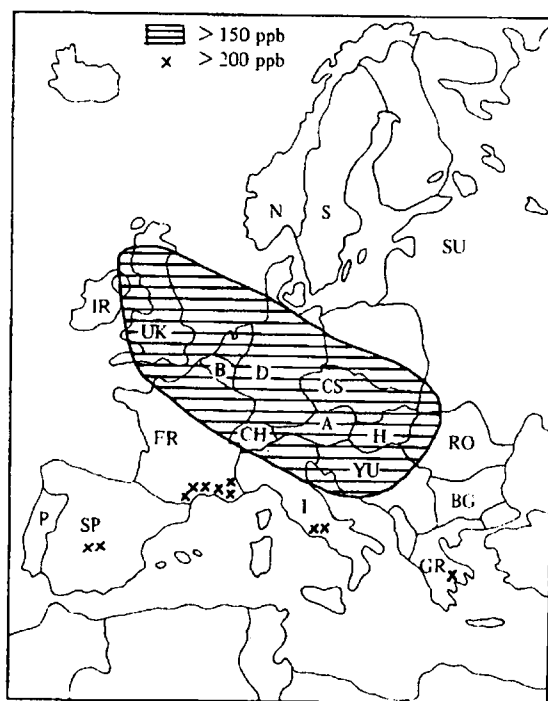


Figure 2 Phoxa Model

"No summer smog has occurred in Hungary yet" – claimed an ÁNTSZ employee. "That is how, unfortunately, there has not been any chance to test the suitability of the smog raid

plan." The question then is: how is it possible that there has not been summer smog and smog raid in Hungary yet, if in other European countries (e.g. Germany, or the neighbouring Austria) this is a permanent problem in the summer. On the basis of certain models, we can also question the absence of summer smog in Hungary.

On *Fig. 2* those parts of Europe are coloured where according to the German - Dutch Phoxa Model (Photochemical Oxidants and Acid Deposition), the hourly mean ozone concentration can reach 150 ppb, i.e. $300 \mu\text{g}/\text{m}^3$. In 1985 for mapping the real situation and to support previous models, in the framework of the so-called OXIDATE Project a measuring system of 25 stations was established in Western Europe. The results of this project have shown that due to the spatial distribution of emitters and the predominant climatic circumstances, the concentration of surface ozone has a distinct NW - SE gradient, therefore, ozone concentration significantly increases towards Hungary⁹. *Fig. 3* was compiled by the EMEP (Co-operative Programme for Monitoring and Evaluation of long Range Transmission of Air Pollutants in Europe), and it was published in the 1995 and 1998 report of the European Environmental Agency both. On the figure almost the whole territory of Hungary is coloured dark, which refers to those areas of Europe where the daily means in the summer can be expected to exceed 52 ppb.¹⁰

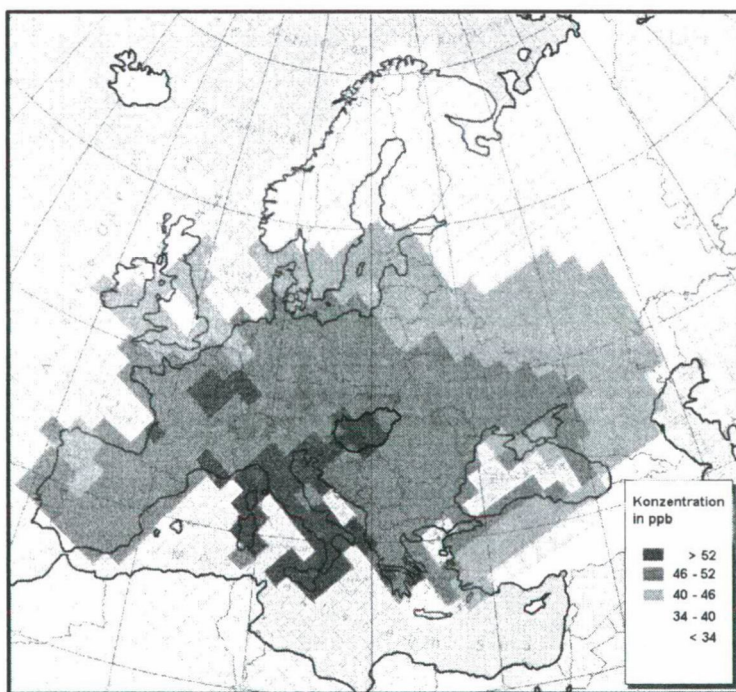


Figure 3 Five year mean of daily maximums in the summer, based on the EMEP-150-Raster /EMEP Model/

Based on the above two examples, the fact that the concentration of ozone in Europe increases from West to East, and according to the reports of the European Environmental Agency – their annual report announces the limit oversteps, and e.g. it reports on threshold value oversteps in Austria regarding stations close to the Hungarian border – in Hungary

similarly high values should be found as in Austria and Germany. The following figure of the 1995 ozone-report of the European Environmental Office marks limit ($180 \mu\text{g}/\text{m}^3$) oversteps measured in background stations. In the ozone-report of the EU the results of the background stations are referred to a circle of a radius of 100 km around the measuring point. In case of Austrian stations that are a few km far from the Hungarian border, a series of daily means exceeded the threshold value. At most of the stations close to the border, the number of days with overstepping results ranges from 1 to 5 days, and 'only' one station was ranked to the 5 to 10 days category (*Fig. 4*).

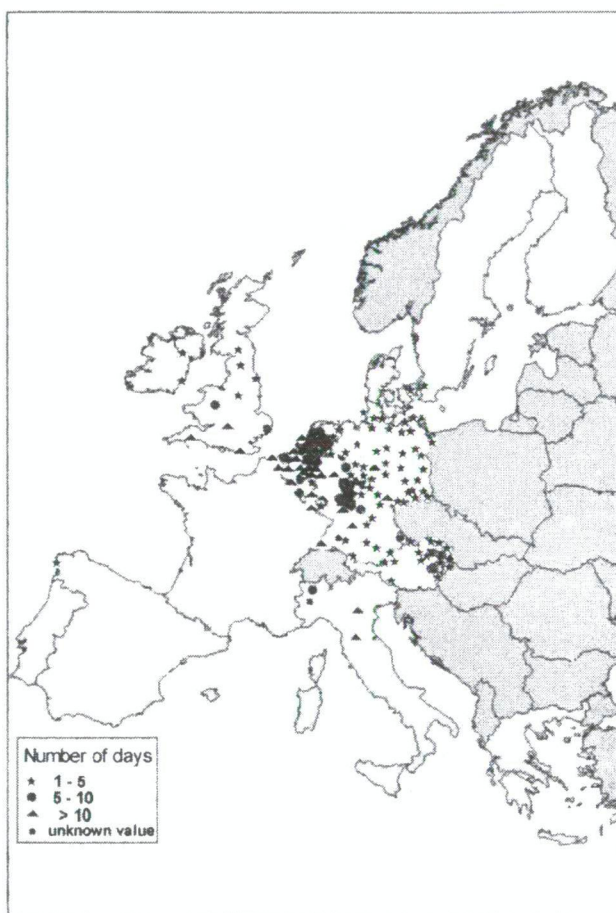


Figure 4 Number of days on which an hourly mean exceeded $180 \mu\text{g}/\text{m}^3$, at background stations in 1995 ¹²

Although, the increase of ozone concentration toward the border has been proved by all means, no increase has been detected eastward of the border. What can be the reason for this? Is there really a dividing line that terminates regularities?¹¹ Or maybe the instruments are operating between different circumstances, with different settings?

Beside the automatic calibration, devices must be checked in referential laboratories from time to time. Such referential laboratory works in Budapest at the Environmental Institution [Környezetvédelmi Intézet], but the service is not free, and as we have seen, the measuring organisations are in short of money. One of the answers for the question: where and how often are instruments calibrated, was the following: "the station has to decide: it pays for maintenance or for calibration, both tasks, because of financial reasons cannot be carried out everywhere".

In principle, the calibration of the Hungarian instruments and the devices of the OMSZ belongs to the Central European Central Laboratory in Prague. The Czech laboratory offered a co-operation for the Hungarian referential laboratory, but at the measuring organisations it is not known whether they accepted the offer or not.¹³

Hungarian researches concerning surface ozone have started in the middle of the 1980s. At the end of 1987 Hungary joined to the EUROTRAC (European Experiment on the Transport and Transformation of Environmentally Relevant Trace constituents on the Troposphere over Europe), a sub-programme of the EUREKA Project. In the framework of the EUROTRAC, in the TOR (Tropospheric Ozone Research) Programme we participated in a research that examined the changes of tropospheric ozone concentration over Europe with exact measurements and modelling. One of the stations of the network was placed near Kecskemét at K-pusztá. This station is one of the most eastern stations in Central Europe.⁹ The major issue of the Meteorological Scientific Days [Meteorológiai Tudományos Napok] held in Budapest in 1990 was also ozone. Consequently, the actual problem is not the lack of Hungarian researchers dealing with this issue, but rather the communication of the results toward the public. Most of the papers dealing with surface ozone in Hungary are published in scientific periodicals that do not get to average citizens. Besides, many of these periodicals are written in English recently which is useful if we consider that foreign scientists can get a view of the Hungarian situation, but on the other hand, those who live here and do not speak English – although this is the language of natural sciences – cannot always utilise these writings.

One can receive air pollution data in terms of only a few cities (supposedly with a week delay) in the TV's weather report, nevertheless; at most places results by no means get to the citizens.

What could be improved easily is the informing work of the media. Basically a general informing should be started about the effects, measurements, and researches in order to avoid desinforming, what is unfortunately quite regular regarding this issue. Even the latest instruments, the best measuring systems are unworthy, if there is no environmental commitment and feeling of concern.

The already mentioned Blikk article also quotes the president of the Environmental Committee of Budapest: all of the smog measuring instruments are out of date, some are always wrong, no spare components are available. The price of a new device is 20 million HUF. Environmentalists claim that 30 stations would be necessary in Budapest, the president says 14 -15 would be enough. This would require a 300 millions HUF investment from which 214 millions HUF was approved by the Council of Budapest. Although, the article deals only with ozone, the situation is naturally similar in case of the measurement of other pollutants, as well. According to the examples of other countries, in case of an accurate installation 5 -6 operating instruments would be enough in a city, like Budapest. However, the project mentioned above remains a plan, since it cannot be carried out because of financial reasons.

According to an article published in a leading Hungarian newspaper (Népszabadság) in 1997: "Today almost every child in Budapest knows what is surface ozone". We find this statement a bit strange. But let it be true, then it might be better to inform adults of this problem, too, and waiting not until children grow up.¹⁴

References

- ¹ <http://www.rompage.hu/HOTEL/M/MAIN/155100.HTM>
- ² László Haszpra - Munkaértekezlet a troposzférikus ózon kutatásáról Léggör 93/2 S. 30-33
- ³ Halbjährige Meldung über Luftverschmutzung im Zeitschrift von ANTSZ
- ⁴ <http://www.gridbp.meh.hu/GRID3VER/ALLAPOT/LEVEGO/2LEGALL.HTM>
- ⁵ A levegőminőség egészségügyi hatása – <http://www.joboki.hu/nekap/rlev.htm>
- ⁶ http://antszbar.hu/levego/doc/wszabvanyok_hatarertekek.htm
- ⁷ Kerekes-Sándor-Török: A meteorológia a közlekedés és a környezet szolgálatában, Léggör 93/3 p. 8
- ⁸ A szmogriadó intézkedéseit megalapozó szennyezőanyag határértékek – <http://www.met.hu/kerszi/kerszi4.htm>
- ⁹ Haszpra László – A felszinközeli ózon-koncentráció alakulása Európában – Idjárás speciális szám/ A léglőri ózon Március-Június 1991. Budapest p.123-126.
- ¹⁰ <http://www.eea.dk/Document/3-yearly/Dobris2/summary/de/ozonec.htm>
- ¹¹ Persönliches Gespräch mit László Haszpra
- ¹² <http://eea.eu.int/document/Elecpro/ozone95>
- ¹³ Telefongespräch mit Antal Bánházy am 02.03. 1999
- ¹⁴ M.F.B.-D.M. – Szigorú levegőszabványok, drága ellenőrzés – Népszabadság 1997. December 1. Budapesti melléklet 28. old.

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