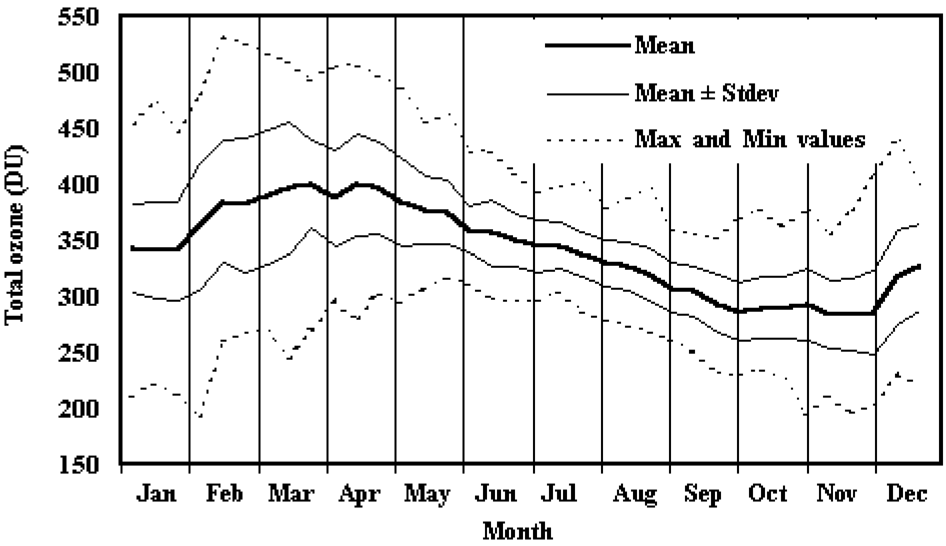
ESTONIA

Regular direct sun total ozone measurements in Estonia (at Tõravere, 58.3° N, 26.5° E, 70 m above sea level) have been carried out since January 1994, using the laboratory spectrometer SDL-1 supplied with a mirror system and Dobson retrieval algorithm. The site is the Tartu/Tõravere Baseline Surface Radiation Network (BSRN) meteorological station. Direct sun measurements of total ozone have been possible during about one third of days since March to October and available in few cases in winter months. For climatological studies the total ozone data from the Nimbus–7 Total Ozone Mapping Spectrometer TOMS (1979-1993) and other TOMS (http://jwocky.gsfc.nasa.gov/) were used. Since July 1996 the available Earth Probe TOMS data have been regularly compared with ground level measurement data obtained at Tõravere. The best agreement appeared in 1999 when the mean ratio of 124 compared values TOMS/Tõravere was 0.998 with the standard deviation 0.031.

A mean annual cycle of total ozone over Estonia in 1979–2000, composed using the averaged over ten-day values, is presented in Fig. 1 as well as the standard deviation limits and the ten-day extreme values. The years subjected to strong stochastic forcing by El Chichon (1983) and Mt. Pinatubo (1992 and 1993) volcanic aerosol were excluded. Due to the gap in the used data set the year 1995 and partly 1996 have also been excluded. Post-volcanic low values of total ozone are systematically met from January to September. No volcanic influence was noticed during late autumn total ozone minimum.

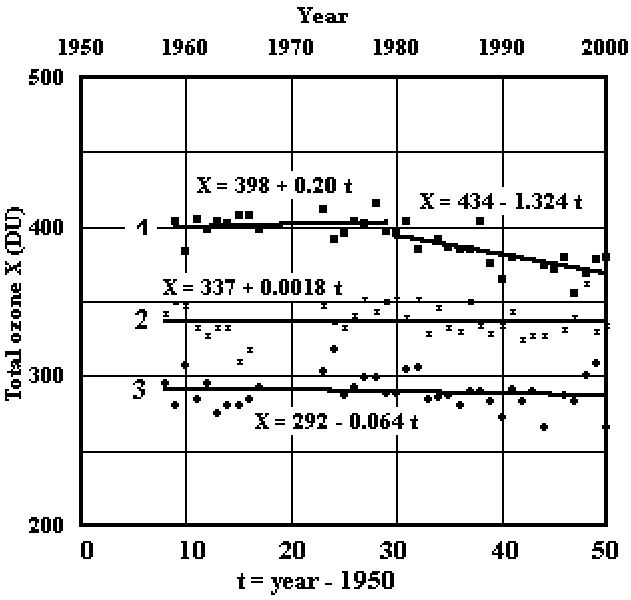
Fig. 1. Total ozone mean annual cycle.



To detect the seasonal trends for longer time interval the published monthly mean data of 1957-1967 and the interpolated monthly mean values from Riga and St. Petersburg stations data in 1973-1978 were included (htpp://www.tor.cc.gc.ca/woudc). The results presented in Fig. 2 manifest no systematic trend in summer months June to August as well as in the late autumn minimum (October-November). The highest variability of total ozone occurs in winter/spring (February to April) when the poleward transport of ozone peaks and the synoptic frequency variations as well as the QBO related year-to-year differences are the strongest. The downward trend in winter/spring total ozone began since about 1980. The estimated trend before 1980 was not statistically significant.

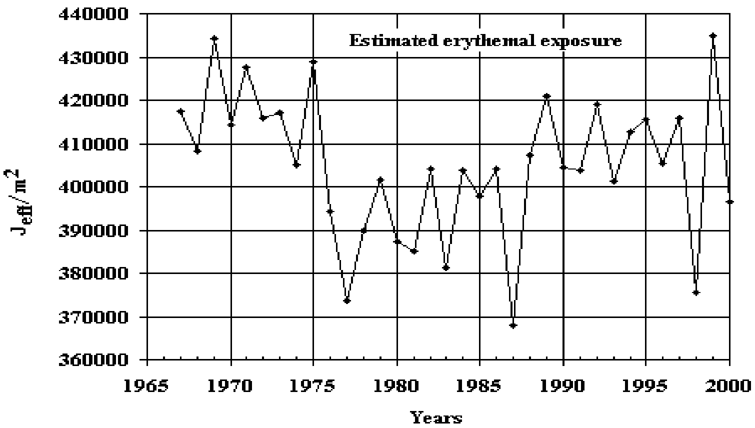
In 1980-2000 it was -3.0±2.6 % per decade. Since 1987 low ozone events have been recorded in late April or early May in 1987, 1990, 1993, 1995 and 1997. The deepest ones exceeding 2σ (standard deviation) below mean were recorded in 1993 and 1997 (both 295 DU) and close to that (307 DU) in 1990 and 1995. On the average the daily total ozone value exceeds ±σ in 116 days per year (58 below and 58 above). In post-volcanic years 1992 and 1983 the numbers of low ozone days were 114 and 92 containing relatively high contribution in summer months. Since 1986 large numbers of low ozone days tend to occur more often. The number 97 in 1997 even exceeded the value of post-volcanic 1983 and the number 85 in 2000 occurred close to it.

Fig.2. Total ozone trends in Estonia
1 – Feb-Apr; 2 – June-Aug; 3 – Oct-Nov.



Regular measurements of the erythemal UV irradiance at the same site have been performed since January 1, 1998. Since February 2002 the narrow-band UV-B measurements are regularly performed at effective wavelength 306 nm. The mean features of the erythemal UV have been studied and the summer half-year (since spring equinox to autumn equinox) erythemal doses for past years 1967-2001 estimated using the sunshine duration and cloudiness data. The results are presented in Fig. 3.

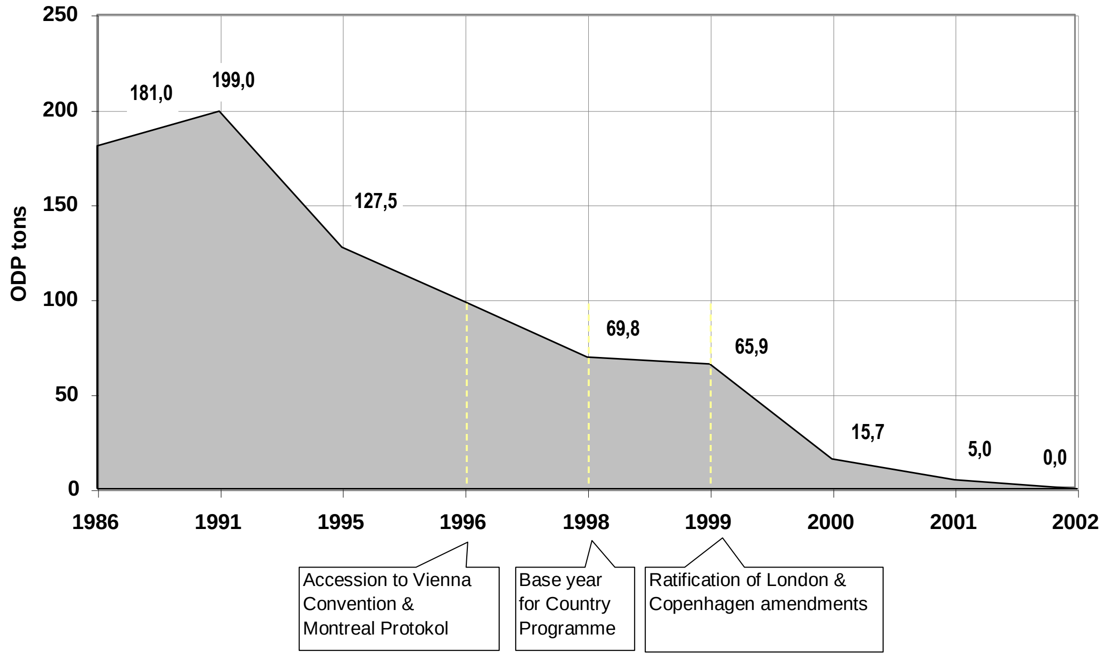
Fig. 3. Estimated summer half-year erythemal exposure
in Estonia (58.3^{0}N, 25.5^{0}E, 70 m asl).



Estonia acceded to the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer on October 17, 1996 and ratified the London (1990) and Copenhagen (1992) amendments on April 12, 1999. The Montreal amendments have been submitted to the Parliament for ratification. The ratification of Peking amendments is scheduled in 2002. Estonia has never produced any type of ozone depleting substances and the per capita CFCs consumption has dropped in 1998 under 0.05 kg.

All legal acts concerning ozone depleting substances are based on The Ambient Air Protection Act (1998 Estonia does not produce any substances regulated by the Montreal Protocol. The total consumption of ODS in Annexes A and B in the base year of 1998, was 69.8 ODP tonnes. Implementation of passed legal acts has resulted in a steady decline in consumed CFCs (see Figure 4).

Fig. 4. Consumption of Annex 1 Group 1 substances and projections up to year 2002



Import of all ozone depleting substances from countries not acceded to the Montreal Protocol was prohibited from May 1999. The import of virgin CFCs was prohibited from 1 January 2002. The system for licensing the import and export of virgin, used, recycled and reclaimed controlled substances in Annexes A, B, C and E was established and implemented in 1999. Due to the measures taken by the Estonian Government the import of ODS dropped from 407 tons in 1997 to zero tons in 2002. Estonia does not produce products containing CFCs and import of such products was prohibited from May 1999.

The Estonian Government allows continued use of CFC in installed equipment and domestic refrigerators as long as these refrigerants are available on the market. The use of CFCs for solvent application is officially finished, however, some companies still have CFCs in stock. In cooperation with local authorities, waste handers and companies involved in the recovery and recycling project efforts have been made to set up a system for collection of used refrigeration equipment covering the whole Estonia.

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