

Long-term trends of tropospheric ozone in The Czech Republic in 1992-2015

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The regular measurement of tropospheric ozone in the Czech Republic began within the National Air Pollution Monitoring Network operated by the Czech Hydrometeorological Institute in 1992. The aim of presented study is to assess the long-term trends of tropospheric ozone in the Czech Republic in the period 1992-2015. The study is based on the data from the stations with the longest homogeneous data series: Košetice and Svatouch (EMEP stations), Praha-Libuš (suburban area of the capital Prague) and Churáňov (mountain site). Non-parametric Mann-Kendall method was used for trend evaluation. Significant downward trend was found at EMEP stations during the period under review, after 2000 the significance was lower. The mountain station is characterised by the slightly decreasing trend both in the whole period and in the last decade. Warm period (April-September) display similar patterns as whole year at regional and mountain level. On contrary, only very slightly (and statistically not significant) declining tendency was found in the cold period (October-March). Suburban station is characterized by slightly increasing tendency, which is not statistically significant. The difference between mean annual concentrations at regional and suburban stations dropped from 20 $\mu\text{g.m}^{-3}$ in the 90' to 12 $\mu\text{g.m}^{-3}$ in last five years. Tropospheric ozone concentrations at the Czech stations have a marked annual variation with maxima at the end of spring. In June and sometimes also in July there is a decrease caused by the onset of the so-called "continental monsoon", which brings increased cloud cover and a drop in solar radiation. We then register a second maximum in July and August. Comparison with current Czech ambient pollution limits was used in this study. Target value of tropospheric ozone for protection of human health is exceeded when 8-hour running mean is higher than 120 $\mu\text{g.m}^{-3}$ 25times in average for 3 years. The limit was exceeded at all selected stations almost during the whole period 1992-2010, only at suburb station the values varied round the target limit in the period 1998-2002. Generally, significant drop was found during the period under review at all station types. The hottest summer in the history of climatological measurements in 2003 caused the short-term increasing tendency. After 2010 significant drop of high ozone episodes was found and 3-year mean declined under the target limit at all station types. The limit for protection of ecosystems is based on AOT40 index (the sum of differences between the hourly concentration higher than 80 $\mu\text{g.m}^{-3}$ and the value 80 $\mu\text{g.m}^{-3}$ by using only hourly values measured between 8:00 and 20:00 CET). The target value is surpassed when AOT40 index, calculated between May and July is higher than 18 000 $\mu\text{g.m}^{-3.h}$ in average for 5 years. Assessment of the ozone impacts, using the AOT40 index, suggests that critical level was exceeded for long periods not only in the regional areas but almost over the whole Czech Republic. In the last decade there was a decline tendency towards the requested values and after 2010 the AOT index dropped under the target value.