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Assessment of atmospheric acidified pollutants trends observed by EANET in North-East Asia in the first decade of XXI century

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Owing to rapid development and subsequent enormous increase in energy consumption/fossil fuel use, anthropogenic emissions of sulphur and nitrogen oxides in China and other Asian countries surpass those in North America and Europe since mid-1990s. Consequently, regional air pollution has become an issue for the most of developing countries in North-East Asia. Since 1998, the Acid Deposition Monitoring Network in East Asia (EANET, http://www.eanet.asia/) provides constant monitoring of the air quality and precipitation (including gaseous and particulate phase chemistry) in 13 countries of the region. The measurements are conducted at 45 rural and remote stations using both filter pack sampling techniques and automatic monitoring equipment.

In this study we present a comprehensive trend analysis of the long-term (last 15 years) air pollution monitoring data from selected EANET monitoring sites. Using several statistical approaches, we estimate the quality of the data and perform distribution tests, single out special events (detect outliers) and calculate an ensemble of trends (monthly, seasonal, long-term and quartile) and their statistical significance for a suite of observed compounds. Based on this analysis, we further estimate the statistics and overall significance of the observed temporal dynamics for each pollutant. Ultimately we derive more than 20 trend estimates for a total of up to 12 gas-phase and particulate compounds for each station.

Our calculations ascertain that about half of the trends (either negative or positive) observed at the EANET stations in Russia, Korea and Japan are significant. Whilst an increase in SO_2, HCl, Cl^-, NO_3 (except for the stations in Russia) concentrations is distinct, small or insignificant trends are reckoned for HNO_3^-. A marked decrease in K^+ content is seen at all regarded stations. We commonly find station-wise correlation for the trends of the remaining compounds, and for several species we conclude a general spatial pattern, *viz.* an eastward increase in trend magnitudes in the north-south direction. We further identify special cases of statistically significant seasonal trends for the series that otherwise do not exhibit apparent long-term dynamics, *i.e.* show an insignificant overall trend. A case in point is the NH_3 observational record at Mondy station (Russia), for which the spring-summer negative trends are comparable to the winter positive trends, and both significant. Finally, we discuss and compare these first results with an evaluation of changes in acid deposition over region from 2000 provided by WMO PC-SAG in its global wet deposition assessment (Vet *et al.*, 2014).

References:

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