Review of temporal changes in soil solution chemistry over the past 20 years across Europe

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Soil solution chemistry is a valuable indicator to assess soil nutrient availability and the impact of air pollution and other stress factors on forest soils and ecosystems. Soil solution has been monitored in 353 Level II plots of the ICP Forests network between 1990 and 2010. The temporal analysis of the long-term measurements allows us to assess the responses of the soil solution, and indirectly of the soil, to the air pollution abatement that has occurred since the mid-1980s across large parts of Europe.

Several studies investigating the temporal changes in soil solution chemistry over the past decades at regional or national scale have recently been published. They show that soil solution has reacted differently to atmospheric pollution and that other factors (e.g. drought, storm, forest management, sea-salt episodes) have changed their composition for more or less long periods.

Before we start a pan-European temporal analysis of the soil solution chemistry using ICP Forests data, we aim to review published studies to identify the main responses of the soil solution and the explanatory factors for these changes. This review allows us to establish a range of responses typically explained by certain processes (e.g. sulphate adsorption/desorption, cation exchange) or events (e.g. tree harvesting, felling). Based on this typology derived from a "case study" approach, we select the adequate statistical methods (e.g. seasonal Mann-Kendall test, spectral analysis, temporal semi-variogram, linear mixed models) to search for patterns in changes (seasonal or long term cycles, events, monotonic trends) in the soil solution chemistry across Europe.

This presentation presents the different temporal patterns of soil solution chemistry and the recommendations for statistical tools to be applied to a time series analysis of soil solution data.