Long-term record of open field precipitation and throughfall in a medium altitude forested environment (Strengbach watershed – NE France): Response to atmospheric pollution trend.

PIERRET M.C.[1], VIVILLE D.[1], DAMBRINE E.[2], COTEL S.[1] AND PROBST A.[3]

[1]LHyGeS UMR7517 CNRS/UdS, Strasbourg ; marie-claire.pierret@unistra.fr

[2] CISM UMR 042 INRA-Université de Savoie, Chambery

[3] ECOLAB Université de Toulouse, CNRS, INPT, UPS, France

Among the anthropogenic perturbations, atmospheric acid depositions have impacted, sometimes deeply, the biogeochemical cycles of many elements implying acidification of stream, soils and forest declines. The small granitic Strengbach watershed (80ha) has been monitored for meteorological, hydrological and geochemical parameters since 1985 in order to better understand the relationships between acid atmospheric deposition and forest decline. Open field precipitation (OFP) was measured in clearings, and throughfalls under spruce (TF-S) and beech (TF-B) plots.

The annual water fluxes are different between OFP and TFs because of interception process, which is two times higher under spruce than under beeche. The concentrations of elements mainly or partly coming from atmospheric dry deposits (Na, Cl, Ca, Mg, SO_4, NH_4) are notably higher in TF-S than in TF-B. The long-term monitoring (3 decades) of atmospheric inputs allows us to identify some significant temporal trends (pH, conductivity, sulphate, Cl, NO_3, Ca, Mg, K), which could not be detected on shorter time periods.

The decreases of anthropogenic SO_2 and NO_x (H precursors) emissions observed since the 80's in the Northern hemisphere resulted in a significant decrease of acidity and sulphate concentration in OFP and TF, even if a slight increase in sulphate concentrations was recorded during the period 2000-05. This latter can be related to the worldwide emissions pattern (link with Asia emissions), underlining the influence of Long Range Transboundary Air Pollution (LRTAP). Spruce needles efficiently trap dry deposition which accentuates throughfall acidity leading to soil acidification and then to nutrient leaching in soils and forest decline. On the opposite, beech leaves are able to neutralize part of the atmospheric protons, which minimizes the negative effects of acid rain. This study underlines the importance of long-term records of both OFP and TF in forested ecosystems to accurately evaluate the inputs of elements to soils, and among them essential nutrient elements.