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Chemical composition of fog and cloud water at the Erzgebirge summit, Germany

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The Erzgebirge as part of the former "Black Triangle" was one of the most polluted forested areas in Central Europe. The local climate is characterized by above-average stable air stratification leading to an above-average amount of inversions with advection fog. Thus, "acid fog" was thought to play an important role in the acidic deposition and in the forest decline on both sides of the Erzgebirge ridge (800 – 900 m a.s.l.). The last data on chemical composition and deposition of fog and cloud water were reported from the 1990's. This work determined the current chemical composition of fog and cloud water from the region.
Chemical composition data of fog samples are reported from two sites: (1) Zinnwald, 877 m a.s.l., eastern Erzgebirge, and (2) Fichtelberg, 1214 m a.s.l. The latter results are the first data on the chemical composition of cloud water from that site. Passive fog collectors were used, and only exposed when fog occurred. Two collectors at Zinnwald (one for ion analysis and one for trace elements) and two collectors at Fichtelberg (one for ion analysis and one for carbon analysis) were used. Electrical conductivity, pH-value, and the concentration of major ions and trace metals (Ba, Pb, Zn, Al, Mn, Ti, V, Ni, Cu, Sr, Cd, Sb, As, Cr) as well as TOC and OC were determined.
The measurements comprise three individual periods: two within the winter months (10.2009 – 12.2009 and 10.2010 – 11.2010) and one in summer (05.2010 – 09.2010). The Fog frequencies in the investigation periods were comparable to long-term observations. Modelled liquid water contents (LWC) were in the range of typical values for German low elevation mountains. Minimum pH values, 3.5 for Zinnwald and 3.7 for Fichtelberg, were still of phytotoxic relevance. The chemical composition of fog and cloud water differed considerably between the sites. Zinnwald still is a polluted site with high concentrations of sulphate, nitrate, ammonium and organic compounds, while Fichtelberg is much less influenced by air pollution. There, sodium and chloride dominated the composition. At Zinnwald, Al, Zn, Pb, and Cu showed the highest trace metal concentrations, while As, Ni, Cr, and Cd were also detected. Sulphate concentrations were lower than in the late 1990s, while nitrate concentrations were considerably higher than before. This is surprising in the light of decreasing $NO_x emissions in Saxony and needs further investigations.$