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Soil solution sensitivity to low pollution load

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Murmansk region (Russian Federation) is included in environmental hot spots list (2003 report of NEFCO and AMAP). Annual emissions of SO_2 from stationary sources (largest is Kola Mining and Metallurgical Company) and autotransport decreased in XXI century and sustained (tons) as: 282942 (2000); 2002 – 249400 (2002); 240110 (2003); 225573 (2005); 217872 (2006); 215910 (2007); 206910 (2008); 211210 (2009); 21554 (2010); 199500 (2011); 194600 (2012). Kola Peninsula terrestrial ecosystems tolerance to atmospheric S deposition was assessed on the basis of the critical load concept: most sensitive ecosystems (critical sulfur load less 400 equiv per ha per year) occupy 58% of the total area; zones at risk of excess sulfur input into ecosystems cover more than 20% of the Kola Peninsula (Koptsik *et al*., 2008).

We attempted to estimate soil solution sensitivity to long-term, but low pollution load by sulfur dioxide in south-west direction from Monchegorsk smelter: (1) - 260 km away, 66^{o}50,45'N; 30^o 12,34'E) and (2) – 100 km away, 67^{o}22,837'N; 32^{o}26,016'E). The investigations were carried out during 2003-2008 period on permanent monitoring plots of INEP equipped by deposition collectors and zero-tension lyzimeters. Monitoring plots are located in similar native conditions: Site altitude – 170 m (2) vrs. 132 m (1); Forest type - *Piceetum empetroso-myrtillosum-hylocomiosa*; Stand history- no thining, no fires; Silvicultural history - no. Soil properties are similar too: Soil type (FAO) - ferric podzol (both plots); organic layer thickness 0-16cm (2) vrs. 0-11cm (1), E horizon thickness 16-27cm (2) vrs. 11-22cm (1), B horizon 27-51cm (2) vrs. 22-47 cm (1); parent material - glacial till (both plots). Plots are differed by annual sulfate pollution load (estimated as snow plus rain): 0.09-0.26 gm^{-2} (1) vrs. 0.14-0.43 gm^{-2}(2), but both plots are refered to background plots. So, background modelled data of S deposition in the Border Areas of Norway and Russia is 0.1 - 0.2 gm^{-2} (Sivertsen *et al.,* 1994), the natural background of S deposition is 0.7 - 1.5 kg per ha per year (Granat *et al*., 1976, Husar and Holloway, 1982). Our results suggested about high soil solution sensitivity to S pollution load on permissible level even (far from critical load). According to sulfate mass flow estimate, organic horizon on plot (2) functioned as sulfate investment source during most periods, but more pronounced after snow melting (up to 3-4 times increasing compared to atmospheric deposition). In own turn, organic horizon of plot (1) (with lesser pollution load) plays as natural biogeochemical barrier to sulfate load or transit layer. With regard to observed S bioaccumulation in L layer on plots (2) such difference could be explained by well-recognized organic S cycling role over a wide range of atmospheric S inputs (from 13 to 130 kg S per ha per year) in 13 Central European forested catchments (Novark *et al.*, 2000; Alewell, 2001).