Effects of seasonal variation of permafrost on the behavior of dissolved iron in Russian Far East

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The primary production of the sea of Okhotsk is supported by abundant iron (mostly organic connected iron) derived from wetlands and forests in Amur basin. Dissolved iron(dFe) concentration in Amur river, however, appears to be influenced by degradation of permafrost which widely exists under the ground of Amur basin. Towards a better understanding of iron transport mechanism in permafrost-affected surface environments, we regularly sampled soil waters and river waters in Far East Russia, as permafrost thaws seasonally during May and November 2017, and we analyzed the concentration of dFe(<0.45 μm) and as well as other basic parameters.

In 2017, during snow-melt season in May, dFe in river increased rapidly with the highest concentrations of 1.1 mg/L, and topsoil waters also had high dFe with the value of 3~5 mg/L. The permarfost table was located just under the ground at that time, hence melted water can not infiltate and covered the topsoil. In that case, organic acids can be leached from vegetation litter and organic rich topsoil, so it would be easy to form organic connected iron in the pore water which can leach rapidly along the shallow permafrost table. From May till July, dFe in river went down to 0.15mg/L, and soil water keeped dFe around 1mg/L. In August and September: the period of most melted season of permafrost, dFe of some soil water indicated much increase. So June and July might be the time to develop the reductive condition to take place reducing of iron (Fe(Ⅲ)). Addition to production of dFe, Fe (Ⅱ) transport through diffuing from deep mineral soil layer can be the caution of increasing dFe concentraion in late summer. Although the soil water had high dFe concentration in late summer, dFe in the river did not show increasing trend. Since dFe in the river had the positive significant relationship with DOC during all sampring periods (R^2 = 0.51, $p<0.01$), most of dFe can be orgaic connected iron in the river. Therefore, dFe production and Fe (Ⅱ) diffusing in late summer might be the important behavior to form run-out possible dFe (mostly organic-iron) in active layer especially peat soil. Furthermore, rive dFe concentration could be influenced by seasonal hydrological events such as spring flood or summer precipitation rather than dFe concentration in active layer.

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