Geophysical Research Abstracts
Vol. 15, EGU2013-250, 2013
EGU General Assembly 2013
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Remote assessment of instantaneous changes in water chemistry after liming in a Nova Scotia catchment

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Southwestern Nova Scotia has some of the most acidic freshwaters in North America due to its location downwind of the major emission sources in eastern Canada and the US and due to a resistant geology which offers little acid buffering capacity (Clair et al. 2007). Because of the poor buffering and regionally high runoff values, hydrological events such as snowmelt and rain storms are frequent and can cause sudden changes in water chemistry which can have devastating effects on freshwater biota due to increases in acidity and metals (Dennis and Clair in press). Clair et al. (2001) have estimated the potential frequency of acidic episodes in this region based on a number of hydrological factors, though the technology available at the time to monitor short-term changes was not dependable. Recent advances in equipment have made the assessment of the frequency and severity of acidic episodes easier and more accurate, allowing better interpretation and prediction of hydrogeochemical changes with variations in weather and deposition patterns. Here we take advantage of these recent advances to monitor water chemistry in an experimental catchment, and explore the response to catchment liming.

Catchment liming is one way of mitigating the effects of acid deposition in sensitive areas. We limed a 50 ha catchment at a rate of 5 t/ha in the Gold River watershed of southwest Nova Scotia to examine the interactions between application of lime with the geological and climatological conditions of this region and acid episode frequency. In order to assess changes of episode frequency caused by liming, we established two mobile environmental monitoring platforms in the catchment: a control site located immediately above the limed area, and a treatment site 10 m below the limed area. We monitored pH, DO, water temperature, conductivity, stage height, air temperature, wind speed and direction as well as precipitation every 15 minutes since November 2011 with the data being accessed in real-time. The high frequency measurements were supplemented by a full chemical analysis of bi-weekly to monthly grab-samples at the site since December 2010. Pre-treatment stream chemistry and hydrology data at the control and treatment sites show identical patterns. pH values before treatment were as low as 4.9 and Ca2+ as low as 0.7 mg•L-1 demonstrating the need for the lime treatment. In this work, we show real-time outputs of pre- and post-treatment stream chemistry and present the short-term effects of liming on this uniquely acid sensitive ecosystem.

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