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Riverine carbon fluxes and MODIS terrestrial gross and net primary production in North-eastern Iceland

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Regions dominated by exposed reactive Mg-Ca silicate rocks, high rainfall, and high relief are the most important long term CO_2 sinks on land. The basaltic terrain of North-eastern Iceland is one of these regions. The objective of this study is to compare the river carbon fluxes stemming from weathering; dissolved inorganic carbon DIC, dissolved organic carbon, DOC and particulate organic carbon, POC with those of the vegetation in the catchments: gross primary production, GPP and net primary production, NPP. The DIC, DOC and POC fluxes were measured in 8 river catchments for the 6 years period between 1998 and 2003. The terrestrial GPP and NPP for the same catchments are based on MODIS primary production products. These remotely sensed fluxes are spatially calculated for every year in the period between 2000 and 2003. The DIC and POC fluxes out of the catchments are studied in relation with the spatial distribution of the vegetation, i.e. with the terrestrial MODIS GPP and net primary production MODIS NPP. Thus it was possible to define the climate effect on all the fluxes and the correlation between them. For example whether the chemical weathering fluxes responded to decline/increase in the net primary production from one year to another.

The 8 catchments cover $1/10^{th}$ of Iceland and they differ in bedrock age, vegetation and glacial coverage, precipitation and temperature. Holl and Grimsstadir are the catchments with the highest (11.4 and 10.9 g C m^{-2} yr^{-1}) chemical DIC weathering rate while Fjardara is the lowest (3.9 g C m^{-2} yr^{-1}) mainly due to the old age of the bedrock. The POC flux for the Holl catchment is highest for all of the years of study (1.0 g C m^{-2} yr^{-1}) and the reason is the extensive area of wetlands in the catchment, whereas Grimsstadir, Fellsa, Grimsa and Lagarfljot produce the lowest POC fluxes

(0.3 g C m^{-2} yr^{-1}).

The GPP and NPP fluxes are highest in the catchments Lagarfljot (92.9 and 23.6 g C m^{-2} yr^{-1}) and Grimsa (97.7 and 20.0 g C m^{-2} yr^{-1}) and the lowest in Grimsstadir (3.5 and 1.7 g C m^{-2} yr^{-1}). The year 2001 is the lowest in terrestrial carbon production while 2003 is the highest one.

The preliminary results indicate correlation between DIC flux and GPP for the catchments of Jokulsa a Dal at Bru (78%) and Jokulsa a Fjollum (55%), small correlation for Jokulsa a Dal at Hjardarhagi (44%) and Holl (38%) and almost no existence of correlation for the other catchments. DIC correlates better with NPP than GPP for the same catchments, except Holl. POC flux relates to GPP in the similar manner as DOC, but correlates very strong with NPP in the catchments of Jokulsa a Dal at Bru (94%), Jokulsa a Fjollum (83%), Jokulsa a Dal at Hjardarhagi (64%). Thus it is evident, that there is no a simple general correlation between the terrestrial carbon fluxes in vegetation and riverine carbon fluxes in the sparsely vegetated catchments of North-eastern Iceland and it is a complex mix between spatially distributed natural phenomena.