Insights into glacial weathering from a new hydrochemical database from 95 glaciated catchments

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Chemical rock weathering in glaciated areas is involved in several feedback loops in the earth system. The fluxes and geochemical characteristics of glacial weathering have been assessed at many single locations, but only a few studies have compared multiple sites [e.g. 1] to draw broader conclusions.

Here we present a new database compiled from 95 glaciated catchments, published by 46 sources. This database allows to analyze general patterns associated with the effect of glaciers on chemical weathering.

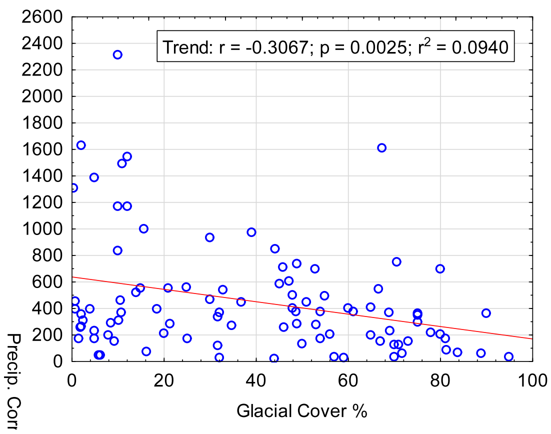

Figure 1: Precipitation corrected cation concentrations against glacial cover. Each point represents one catchment.

The first analysis of the database shows that cation concentrations decrease with increasing glacial cover (Figure 1). Mean concentrations are below the global average of 875 μMol/L [2], but cation denudation rates are on average 21.4 t km^{-2} a^{-1}, above the global average of 10 t km^{-2} a^{-1} [3].

The database will be analyzed in depth to identify relations between ion concentrations, weathering rates, stochiometry and seasonality with potential influencing factors (e.g. dominating lithology).

[1] Anderson *et al*. (1997) Geology **25**, 399-402. [2] Livingstone (1963) In: Fleischer (Ed.), Data of Geochemistry, Sixth Edition. USGS Professional Papers, pp. 1-61. [3] Hartmann *et al*. (in prep).

Dust direct radiative forcing and the complex refractive index of hematite

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Ambient light absorption of entrained mineral dust in the visible and near-visible spectral region is generally dominated by iron oxides, in particular by hematite (α-Fe_2O_3) [1, 2]. Therefore, sign and magnitude of mineral dust direct radiative forcing are critically dependent on the complex refractive index spectrum of hematite, especially its imaginary part. Here, we discuss the sensitivity of mineral dust shortwave radiative forcing on the imaginary part of the hematite refractive index.

Spectra of the imaginary part of the hematite refractive index have been reported in more than 15 publications. Unfortunately, these literature values vary greatly, between one and nearly five orders of magnitude for different parts of the spectrum (Fig. 1). In addition, virtually all of these publications fail to give an error estimate for their results.

Here, we review these published values together with the respective methods of determination. attempting to give a recommendation for values and errors that should be used. Furthermore, we estimate the error in dust radiative forcing originating from the uncertainty in hematite refractive index.

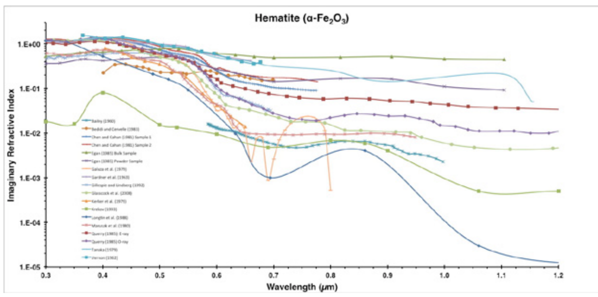

Figure 2: Imaginary part of the hematite refractive index as function of wavelength as obtained from 15 different publications.

[1] Lafon *et al*. (2006) *J. Geophys. Res*., **111**, doi:10.1029/2005JD007016. [2] Moosmüller *et al*. (2012) *J. Geophys. Res*., **117**, doi:10.1029/2011JD016909.

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