Insensitivity of glacial Iron export to climate forcing

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Mass loss from Greenland's Ice Sheet has quadrupled from the 1990s to 2010s. Approximately 90% of freshwater discharge is drained via marine-terminating glacial outlets, the stability of which is affected by atmospheric and oceanic warming. How this affects iron fluxes to the ocean is not yet fully understood. In August 2016, GEOTRACES cruise GN05 (PS100) proceeded to within 1 km of the 79°N ice-tongue and was able to investigate the physical and chemical properties of glacially modified seawater immediately adjacent to one of Greenland's largest marine-terminating glaciers. Analyses of total dissolvable (TdFe), dissolved (dFe) and soluble Fe (sFe) revealed the decoupling of dFe from particulate inputs with minor efflux of colloidal Fe to the shelf. Offshore transport was evident only for the 'truly solubile' sFe fraction. Contrary to earlier findings of increasing dFe efflux from enhanced discharge volumes, we show that glacial Fe offshore transport is controlled by ocean-to-fjord currents that provide dissolved organic material essential for Fe stabilization. Such 'ligand-restricted' off-site export may describe many of Greenland's large marine-terminating glaciers.