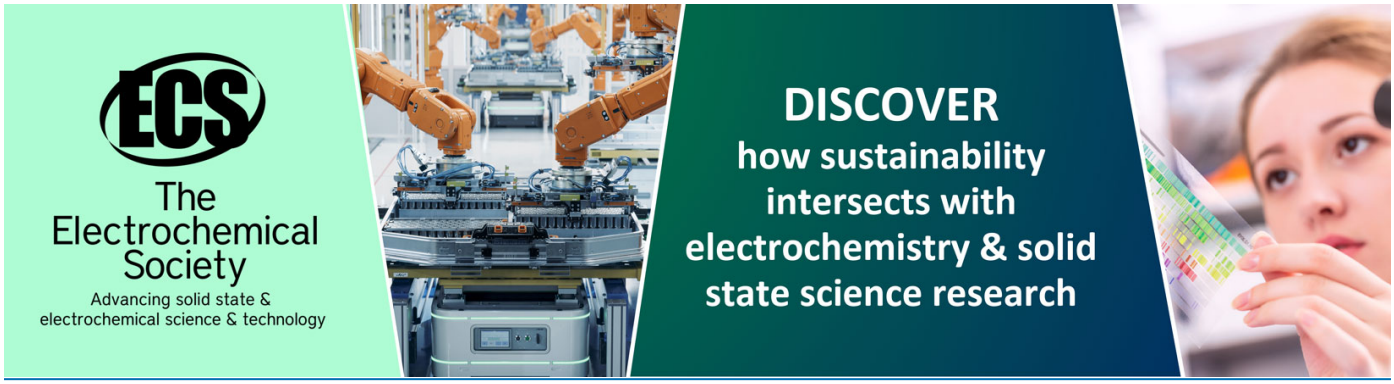
Can geoengineering save the Greenland ice sheet?



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We address the question of whether three different geoengineering schemes are capable of mitigating against the possible collapse of the Greenland ice sheet and the subsequent sea level rise. Using the UK Met Office General Circulation Model (GCM), HadCM3, we carry out simulations of a sunshade geoengineered world, a sulphate geoengineered world, a crop-albedo geoengineered world, and an ungeoengineered world. The sunshade geoengineering reduces incoming solar radiation over the entire earth. The crop-albedo geoengineering raises the albedo of crops (most likely by genetic engineering). The sulphate geoengineering raises planetary albedo and is assumed to be focused at high northern hemisphere latitudes. In order to assess whether any of these forms of geoengineering can avert 'dangerous' climate change, we carry out equilibrium ice sheet model simulations of the Greenland ice sheet, using the high-resolution ice sheet model GLIMMER. Under 4*CO2 forcing, the ungeoengineered world results in a collapsed Greenland ice sheet, and approximately 6m of sea-level rise. Despite residual warming in the arctic, sunshade geoengineering mitigates against almost all the sea level rise, maintaining all of the ice sheet except a few centimetres of sea level equivalent. Crop-albedo geoengineering fails to maintain the ice sheet. Unsuprisingly, the success of the sulphate geoengineering depends on the amount of aerosol which is injected into the atmosphere.

