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Glacial parts of Greenland ice cores matched by volcanic markers

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The glacial sections of the NGRIP, GRIP and GISP2 ice core records have been matched by synchronising volcanic signals observed in the three cores. Available high resolution data series that are known to have peak values associated with volcanic deposition, such as ECM, DEP, $[SO_4^+]$ and $[Ca^{2+}]$, have been inspected manually in order to match synchronous volcanic events in the three cores. A graphical Matlab program has been designed to facilitate the comparison of the data profiles and check the quality of the matching.
To assure that the resulting match points do represent synchronous volcanic depositions, the ratio of the distance between adjacent match points in one core to the other core has been evaluated. Assuming that the accumulation rate at each site is stable within a certain climate period, this ratio should not change significantly within a certain climate section.
Within some intervals of the NGRIP and GRIP records it has been possible to make a detailed synchronisation down to an annual scale. The coarsely spaced match points from the volcanic events define sections within which one can look in detail for similar patterns in corresponding data series of the two cores. As is the case for the Holocene part of the NGRIP and GRIP cores, the $[NH_4^+]$ profiles are excellent for high resolution matching. Finding these high resolution similarities between the $[NH_4^+]$ furthermore supports that the volcanic match points are correct.
The synchronisation is performed using climate-independent data only, providing an important basis for comparing climate records from the three Greenland ice cores, such as the stable isotope profiles. Hereby, possible regional differences related to climate transitions can be investigated more deeply. Also, the new match points can be used to provide a common timescale for the three ice cores.
Current and upcoming projects conducting tephrochronological investigations of the

glacial sections of the NGRIP and GRIP cores, as well as the Eemian part of the NGRIP core, will hopefully refine the present synchronisation of the glacial part of the Greenland ice cores, as well as the synchronisation with other paleoclimate archives in the North-Atlantic region.