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2-D magnetotelluric experiment to investigate the Nassugtoqidian orogeny in South-East Greenland

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The northwest-trending Palaeoproterozoic Nagssugtoqidian orogen extends over 250 km along the east coast of Greenland in the area around the village Tasiilaq. The geological evolution of this area closely compares with the ones of the Lewisian complex of Scotland and the Nagssugtoqidian orogen in western Greenland and, hence, leads to the suggestion that they belong to the same continental-scale orogenic belt. However, an accurate correlation across the inland ice is challenging and still ambiguous and therefore more detailed knowledge about the individual orogens might help to understand their relationship. Details about the large-scale tectonic evolution during the Nagssugtoqidian orogeny in this remote Arctic region are not known due to complex geology, relatively coarse geological mapping and the lack of extensive geophysical investigations. E.g. the vergence of the orogen, subduction-related magmatism and accretion history are matters of ongoing discussion (Kalsbeek et al., 1993; Nutman et al., 2008 and Kolb, 2013).

We performed a 2-D magnetotelluric (MT) experiment across the southern part of the orogen along the Sermilik Fjord in order to improve our understanding of the orogenic process in general and to better constrain the location and vergence of the suture zone. However, because of the rough climate and the lack of infrastructure, this study is considered as a first test to investigate how MT surveys can be most efficiently performed in this remote part of the world. The NE-SW trending profile consists of eight MT stations and has a total length of $\sim$70 km using long period LEMI-420 systems. The quality of the data is severely affected by polar electrojets that do not satisfy the plane wave assumptions, which is typical for regions close to the magnetic poles. In order to reduce the distortion from these signals onto the impedance estimates, we tested different advanced processing schemes. In addition to the more conventional robust response function estimator BIRRP from Chave and Thomson (2004), we applied a recent technique that is based on empirical mode decomposition EMD proposed by Chen et al. (2012). This method works rather in the time than in the frequency domain and appears promising to reduce the impact of such time limited noise signals typically associated with electrojets.

As first results, we present obtained impedance estimates, induction vectors and dimensionality analysis. Experience from this first feasibility study will be to develop strategies for larger MT surveys for the challenging conditions in Greenland.