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Supporting Information for

Distributed Acoustic Sensing (DAS) for natural microseismicity studies: A case study from Antarctica

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Introduction

Here we provide additional information on the DAS system specification and setup for the experiment detailed in the main text. This is included in Text S1, Table S1, Table S2, and Figure S1. We also show additional DAS source mechanism inversion results, which are described in Text S2 and Figure S2.

Text S1.

Distributed Acoustic Sensing (DAS) interrogator and fibre specifications

Here we provide an overview of the Silixa iDASTM interrogator and fibre specifications that may affect the observations made in this study. The interrogator specification is given in Table S1 and the 6 channel tight buffered fibre optic cable specification in Table S2. An example of the fibre buried and unburied is also included in Figure S1.

Table S1. Table summarizing the Silixa iDAS™ specifications relevant to this experiment.

Sampling frequency	1000 Hz
Instrument bandwidth	0.01 to 1000 Hz
Gauge length	10 m
Dynamic range	120 dB
Time reference	GPS

Table S1 – Table summarising the optical fibre cable specifications relevant to this experiment.

Table S2. Table summarizing the optical fibre cable specifications relevant to this experiment.

Fibre Part Number	PS-2S4M-1PU065-01-Y
Fibre type	Single mode
Core diameter	$9\ \mu m$
Cladding diameter	$125\ \mu m$
Primary coating diameter	$500\ \mu m$
Secondary buffer diameter	$9\ \mu m$
Overall cable diameter	$6.5\ mm$
Wavelength	$1310\ to\ 1550\ nm$
Attenuation	$0.5\ dB\ km^{-1}$
Length of fibre	$1\ km$

Figure S1. Image showing example of the DAS fibre uncovered and buried.

Text S2.

Other source mechanism solutions

Figure S2 shows additional source mechanism solutions for icequakes with both DAS geometries. These results indicate how events at more significant offsets and incidence angles relative to the fibre are less well constrained than the event presented in the main text. The DAS line results show less constraint as the events move to greater offsets, with the event in Figure S2b showing a result that is consistent with that in Figure 5 of the main text when taking into account the higher uncertainty, whilst the event at further offsets has over 300 degrees of azimuthal uncertainty. The triangle event constraint is poor in all cases, with nearly 360 degree azimuthal uncertainty in Figure S2d. The triangle inversion results have such poor constraint partly due to the greater source-receiver hypocentral distances, and also because of the poorer spatial coverage of the focal sphere. These results therefore backup the findings and recommendations described in the main text, which are that a sufficient area of the focal sphere has to be sampled and that the SNR of DAS is lower than geophones and so performs poorly at greater source-receiver distances.

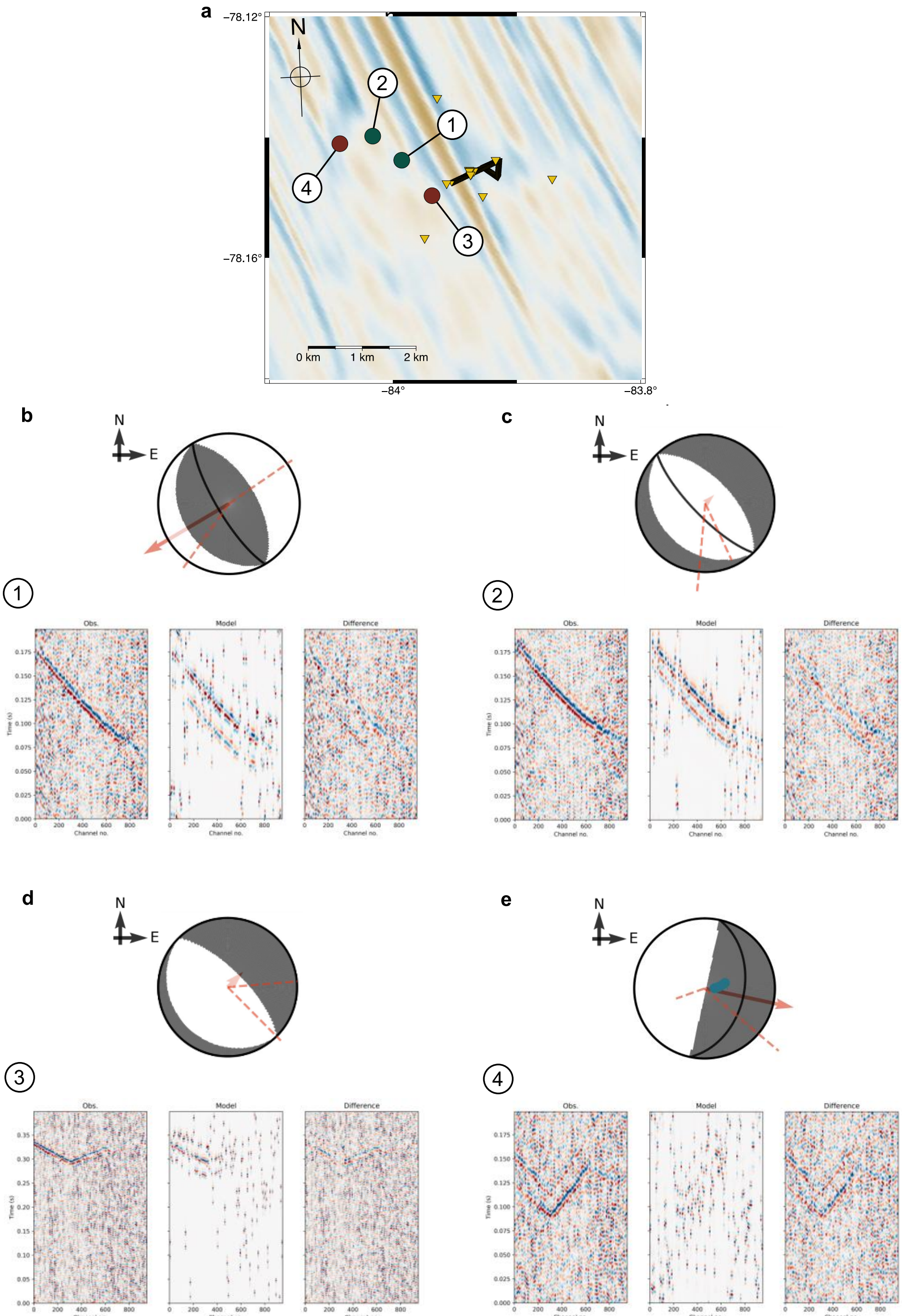

Figure S2. Additional source mechanism solutions for both the DAS line and DAS triangle geometries. a) Map showing where the icequakes' source mechanisms are located. b) and c) Icequake source mechanisms for the DAS line geometry. d) and e) Icequake source mechanisms for the DAS triangle geometry. See Figure 5 in the main text for a detailed description of plotted features.