NS33B-0641 Diffraction imaging of subsea permafrost discontinuities

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Poster Hall A-C - South (Exhibition Level, South, MC)

Abstract

Laterally discontinuous subsea permafrost is present in the Arctic along the Beaufort Sea margin. Discontinuities within the permafrost include unfrozen zones from which fluids are free to migrate vertically or laterally, potentially accelerating permafrost degradation. This process releases greenhouse gases that further contribute to global warming. Generally, because of its contrasting viscoelastic properties compared to unfrozen sediments, permafrost can be easily detected by seismic methods. A discontinuity in subsea permafrost corresponds to the termination of a frozen layer. At this termination, seismic energy is diffracted rather than reflected or refracted. This condition is well suited for diffraction imaging. Here, we present a processing workflow to identify subsea permafrost discontinuities using the diffracted wavefield. This workflow aims to extract diffractions from seismic data collected on the continental shelf of the Canadian Beaufort Sea. The shallow water environment combined with the occurrence of subsea permafrost generates highly energetic free surface multiples that overprinted diffractions. Thus, preliminary steps of the processing flow focused on multiple attenuation. A recursive velocity analysis, starting with a 100 common-midpoint (CMP) interval and ending with a 5 CMP interval, is also performed to better capture lateral permafrost discontinuities. Then, the full wavefield data are migrated, collapsing the energy distributed along the hyperbolic trajectory of the diffractions at their apexes. Afterwards, reflections are adaptively subtracted from the migrated data. Finally, demigration of the residuals (i.e., collapsed diffractions) is performed. The resulting image reveals several near-surface diffractions attributed to discontinuities at the

top of the subsea permafrost. Diffractions present distinct amplitude, frequency and velocity characteristics suggesting that various permafrost conditions coexist across the continental shelf.

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