UNIVERSITÀ DEGLI STUDI DI TRIESTE

UNIVERSITY OF BERGEN

SEG SOCIETY OF EXPLORATION GEOPHYSICISTS

Seismic on floating ice - acquistion methods and data analysis

Presented by: Prof. Tor Arne Johansen – University of Bergen

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Classroom: Aula Magna via Weiss 1 (pal.C)

Virtual classroom: Join Zoom Meeting

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Abstract:

Geophysical surveying of the Arctic will become increasingly important for future prospecting and monitoring of the terrestrial parts and adjacent areas in this hemisphere. Seismic data acquired on floating ice are hampered with extensive noise due to ice vibrations related to highly dispersive ice flexural waves generated by the seismic source. Several experiments have been conducted on floating ice in van Mijenfjorden in Svalbard in the Norwegian Arctic to specifically analyse the extent of flexural waves recorded using various seismic receivers and sources deployed both on top of ice, in the water below and at the seabed.

Also, seismic experiments on ice on shallow water show prominent guided wave modes often referred to as Scholte waves propagating along the seabed. In this case both flexural and Scholte waves interfere and make a complicated pattern of coherent noise. On shallow water the positioning and type of the seismic source must be evaluated with respect to the coherent noise generated by these waves. The experimental data were overall successfully modeled using a wavenumber integration technique. A seismic source at or near the ice generates high amplitude, slowly propagating and highly dispersive flexural waves. The high amplitudes of the slowly propagating, and highly dispersive flexural waves, are severely reduced when recorded at hydrophones deployed 5 meters or more below the sea ice. The extent of flexural waves generated using an air gun below the ice similarly reduces as the depth of the air gun increases, while the amplitudes of the seabed Scholte waves increase.

Scholte wave data can potentially be obtained when the seismic source and geophone receivers are both placed on top of the floating ice. However, the Scholte wave data become more distinct by using an air gun lowered some meters below the ice. A rock physics model based on a two-step differential effective medium scheme has been tuned to predict seismic properties found for very loose sediments, among these very high P-wave-to-S-wave velocity ratios. The rock physics model potentially enables us to convert seismic velocities obtained from Scholte wave data to quantitative estimates of the sediment composition.

Biography:

Tor Arne Johansen received a PhD in geophysics in 1990 from the University of Bergen, Norway. He is currently a professor at Department of Earth Science at the University of Bergen and holds an adjunct professorship at The University Courses in Svalbard in the Norwegian Arctic. He has for decades been involved in research, supervision and teaching related to seismic reservoir characterization and seismic surveying in the Arctic. He has for the last 15 years regularly given courses on behalf of EAGE, SEG, CSEG and ASEG.