ACQUISITION, PROCESSING AND ANALYSIS OF ARCTIC SINGLE-SENSOR SEISMIC DATA FOR ATTENUATING SOURCE-GENERATED COHERENT NOISE

By

Usama Fathy Abdel Kader Mohamed

B.Sc. Ain Shams University, 2006

A Thesis

Submitted to the Faculty of Science

in Partial Fulfillment of the Requirements

for the Degree of Master of Science in Geophysics

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APPROVAL PAGE

The undersigned certify that, they have read and recommended to the Faculty of Science for acceptance, a thesis entitled **"Acquisition, Processing and Analysis of Arctic Single-sensor Seismic Data for Attenuating Source-generated Coherent Noise"** submitted by **Usama Fathy Abdel Kader** in partial fulfillment of the requirements for the degree of Master of Science in Geophysics.

1. Prof. Dr. Hussein Mohamed Ali El Khashab
Professor of Geophysics, Faculty of Science – Sohag University.

2. Prof. Dr. Adel Ali Ali Othman
Professor of Geophysics, Faculty of Science – Al Azhar University.

3. Prof. Dr. Ahmed Sayed Ahmed Abu El-Ata
Professor of Geophysics, Faculty of Science – Ain Shams University.

4. Dr. Abdel Khalek Mahmoud Mohamed El-Werr
Assistant Professor of Geophysics, Faculty of Science – Ain Shams University.

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Under the supervision of:

1. Prof. Dr. Ahmed Sayed Ahmed Abu El-Ata
Professor of Geophysics, Faculty of Science – Ain Shams University.

2. Dr. Abdel Khalek Mahmoud Mohamed El-Werr
Assistant Professor of Geophysics, Faculty of Science – Ain Shams University.

3. Dr. Pieter Leonard Vermeer
Project Manager, R&D Department – WesternGeco.

ABSTRACT

Three component (3C) accelerometers (VectorSeis sensors), based on Micro-Electro Mechanical Systems (MEMS), and conventional one component (1C) geophones were used in acquiring data of an arctic field test (Northern Russia) to study the benefits of using 3C and 1C sensors.

The 1C data recorded with the VectorSeis sensors and the conventional geophones are similar and characterized by extreme lateral variations in the velocities and amplitudes of coherent noise. The datasets were processed to attenuate the noise, enhance coherency, resolve the statics problems and determine velocity models for stacking.

The terrain features of the test site show variability of the surface. With the opportunity of the MEMS sensors to measure the sensor tilt information, the analysis of the tilts is done and it shows that, there are large tilt angles for many sensors and that these angles are independent from the terrain features. The tilt of the sensors negatively affects data quality. It is expected that tilt correction will be beneficial.

The rotation of the sensors to the vertical is done to correct them for tilt and it shows improvement in data quality. It was found that the 3C rotation has greater impact than the 1C rotation. The 3C rotation enhances the P-wave events and reduces the S-wave and Rayleigh wave events on the vertical component. The stacks show the differences in the amplitude of the 1C and 3C rotation but the 3C difference has higher

amplitudes than the 1C difference. Also the 3C rotated stack shows improvement and enhancement in the resolution of the P-wave reflections in the vertical data.

The VectorSeis data (acceleration data) were converted numerically to be as if they were recorded with geophones (velocity data). The converted data became less noisy than the VectorSeis data and nearly similar to the geophone data. The converted stack section has more high frequency noise than the geophone stack section. The same conversion is applied to the stacked VectorSeis section. The produced post-stack converted stack section is similar, but slightly better than the pre-stack converted stack section.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES