Geophysical Research Abstracts
Vol. 17, EGU2015-2822-1, 2015
EGU General Assembly 2015

Imaging of 3D Ocean Turbulence Microstructure Using Low Frequency Acoustic Waves

Alexander Minakov (1), Dmitriy Kolyukhin (2), and Henk Keers (3)

(1) University of Oslo, Norway (alexander.minakov@geo.uio.no), (2) Trofimuk Institute of Petroleum Geology and Geophysics SB RAS, Novosibirsk, Russia, (3) University of Bergen, Norway

In the past decade the technique of imaging the ocean structure with low-frequency signal (Hz), produced by air-guns and typically employed during conventional multichannel seismic data acquisition, has emerged. The method is based on extracting and stacking the acoustic energy back-scattered by the ocean temperature and salinity micro- and meso-structure (1 – 100 meters). However, a good understanding of the link between the scattered wavefield utilized by the seismic oceanography and physical processes in the ocean is still lacking.

We describe theory and the numerical implementation of a 3D time-dependent stochastic model of ocean turbulence. The velocity and temperature are simulated as homogeneous Gaussian isotropic random fields with the Kolmogorov-Obukhov energy spectrum in the inertial subrange. Numerical modeling technique is employed for sampling of realizations of random fields with a given spatial-temporal spectral tensor.

The model used is shown to be representative for a wide range of scales. Using this model, we provide a framework to solve the forward and inverse acoustic scattering problem using marine seismic data. Our full-waveform inversion method is based on the ray-Born approximation which is specifically suitable for the modelling of small velocity perturbations in the ocean. This is illustrated by showing a good match between synthetic seismograms computed using ray-Born and synthetic seismograms produced with a more computationally expensive finite-difference method.