Session 1pUWc

Underwater Acoustics: Topics in Underwater Acoustics (Poster Session)

Vaibhav Chavali, Chair
Electrical Engineering, George Mason University, 4217 University Dr., Fairfax, VA 22030

All posters will be on display from 1:20 p.m. to 4:20 p.m. To allow contributors in this session to see the other posters, authors of odd-numbered papers will be at their posters from 1:20 p.m. to 2:50 p.m. and authors of even-numbered papers will be at their posters from 2:50 p.m. to 4:20 p.m.

Contributed Papers

1pUWc1. Determining the bottom surface in the randomly inhomogeneous media. Andrei Sushchenko (School of Natural Sci., Far Eastern Federal Univ., Sukhanova 8, Vladivostok, Primorskii krai 690090, Russian Federation, sushchenko.aa@dvfu.ru), Igor Prokhorov (Inst. of Appl. Mathematics FEB RAS, Vladivostok, Russian Federation), and Kristina Sushchenko (School of Natural Sci., Far Eastern Federal Univ., Vladivostok, Russian Federation)

The authors study a problem of determining the bottom topography of a fluctuating ocean using the data of side-scan sonars. Based on a kinetic model of acoustic radiative transfer authors obtain a formula for determining a function describing small deviations of the bottom surface from a middle level. The impulse parcels of source and width of the directivity pattern of the receiving antenna are constructed unfocused sebottom image. For solving it, authors used iterative algorithm for focusing objects on the seabottom. Numerical experiments have been done on modeling data that demonstrate the accuracy of the obtained formula. Numerical analysis of the volume scattering influence is done. The volume scattering filter allows to reconstruct sea bottom relief from long range, e.g., signal from 150 m includes more than 50% of volume scattering, hence object recognizing is not possible without filtering. The width of directivity pattern affects to the object defocussing. This effect is increased with slant range increasing. Moreover, authors designed the algorithm of determining shaded areas on the sea bottom. It allows to recognize each invisible point on the sea bottom in case of non-static source. Thus, authors researched influence of volume scattering on the seabottom relief reconstruction.

1pUWc2. Interferometric reconstruction of plate waves from cross correlation of diffuse field on a thin aluminum plate. Aida Hejazi Nooghabi (Univ. of Pierre and Marie Curie, 4, Pl. Jussieu Case 129, T.46-00, Et.2, Paris 75252, France, aida.hejazi@gmail.com), Julien de Rosny (Institut Langevin, Paris, France), Lapo Boschi (Univ. of Pierre and Marie Curie, Paris, France), and Philippe Roux (Laboratoire ISTERRE, Grenoble, France)

This study contributes to evaluating the robustness and accuracy of Green's function (GF) reconstruction by cross-correlation of noise, disentangling the respective roles of ballistic and reverberated ("coda") signals. We conduct a suite of experiments on a highly reverberating thin aluminum plate, where we generate an approximately diffuse flexural wavefield. We validate ambient-noise theory by comparing cross correlation to the directly measured Green's function. We develop analytically a theoretical model, predicting the dependence of the symmetry of the cross correlations on the number of sources and signal-to-noise ratio. We validate this model against experimental results. We next study the effects of cross-correlating our data over time windows of variable length, possibly very short, and taken at different points in the coda of recordings. We find that, even so, a relatively dense/uniform source distribution could result in a good estimate of the GF; we demonstrate that this window does not have to include the direct-arrival signal for the estimated GF to be a good approximation of the exact one. Afterwards, we explicitly study the role of non-deterministic noise on cross correlations and establish a model which confirms that the relative effect of noise is stronger when the late coda is cross-correlated.

1pUWc3. Reflecting boundary conditions for interferometry by multidimensional deconvolution. Cornelis Weemstra, Kees Wapenaar (Dept. of GeoSci. and Eng., Delft Univ. of Technol., Stevinweg 1, Delft 2628 CN, Netherlands, kweemstra@gmail.com), and Karel N. van Dalen (Dept. of Structural Eng., Delft Univ. of Technol., Delft, Netherlands)

Seismic interferometry (SI) takes advantage of existing (ambient) wavefield recordings by turning receivers into so-called "virtual-sources." The medium's response to these virtual sources can be harnessed to image that medium. Applications of SI include surface-wave imaging of the Earth's shallow subsurface and medical imaging. Most interferometric applications, however, suffer from the fact that the retrieved virtual-source responses deviate from the true medium responses. The accrued artifacts are often predominantly due to a non-isotropic illumination of the medium of interest, and prohibit accurate interferometric imaging. Recently, it has been shown that illumination-related artifacts can be removed by means of a so-called multidimensional deconvolution (MDD) process. However, The current MDD formulation, and hence method, relies on separation of waves traveling inward and outward through the boundary of the medium of interest. As a consequence, it is predominantly useful when receivers are illuminated from one side only. This puts constraints on the applicability of the current MDD formulation to omnidirectional wavefields. We present a modification of the formulation of the theory underlying SI by MDD. This modification eliminates the requirement to separate inward-and outward propagating wavefields and, consequently, holds promise for the application of MDD to non-isotropic, omnidirectional wavefields.