Geophysical Research Abstracts
Vol. 12, EGU2010-5884, 2010
EGU General Assembly 2010

Effectiveness of Complex Frequency Shifted Perfectly Matched Layers formulation for acoustic wave propagation in the context of seismic oceanography

Jean Kormann (1), Valenti Sallares (1), Berta Biescas (1), and Pedro Cobo (2)

(1) CMIMA, Unitat de Tecnolgia Marina (CSIC), Barcelona, Spain (jkormann@hotmail.com), (2) Instituto de Acustica (CSIC), Acustica Ambiantal, Madrid, Spain

Recent research has shown that multichannel seismic data provide images not only from Solid Earth but also from the oceanic interior. The water reflectivity is produced by faint impedance contrasts between neighbouring water masses showing slightly different temperature and salinity. The horizontal resolution of the seismic profiles is two orders of magnitude better than more usual hydrographic sections based on repeated CTD casts, arousing growing interest for seismic oceanography within the oceanographic community. One of the current research lines is developing tools to extract information of oceanographic interest other than the location of the seismic reflectors, such as sound speed, temperature or salinity, from the seismic data. A potential candidate technique is full waveform inversion. Because reflectivity of water masses can be as low as 10^{-4}, the direct modelling of wave propagation to be incorporated in full waveform inversion schemes requires the total control of the boundary reflections. In this work we show that Complex Frequency Shifted Perfectly Matched Layer (CFS-PML) offers a better alternative to classical Perfectly Matched Layer formulation to fulfill these requirements, and has logically been extended to acoustic equations. A Second-order CFS-PML formulation for acoustic wave equation is presented, such that the boundary reflection may be set to be less than a 10^{-5} of the incident wave. Additionally, we show that our CFS-PML, combined with a sixth-order spatial discretization of the Laplacian operator, allows to precisely model the extremely weak wavefield scattered by the oceanic finestructure. The effectiveness of the scheme described above is demonstrated by comparison of a modeled and real data. For this purpose we will use an inverted sound speed map derived from a combination of seismic and hydrographic data as entry for our modeling, and then compare the final result with data acquired along a real seismic section. We conclude by demonstrating that our algorithm is easily extendable to 3 dimensional environments.