ELSEVIER

Marine Geology 209 (2004) 147–172

MARINE GEOLOGY
INTERNATIONAL JOURNAL OF MARINE GEOLOGY, GEOCHEMISTRY AND GEOPHYSICS

www.elsevier.com/locate/margeo

Seabed characterization on the New Jersey middle and outer shelf: correlatability and spatial variability of seafloor sediment properties

John A. Goff[a,b,*], Barbara J. Kraft[c], Larry A. Mayer[c], Steven G. Schock[d], Christopher K. Sommerfield[e], Hilary C. Olson[a,b], Sean P.S. Gulick[a,b], Sylvia Nordfjord[a,b]

[a] *Institute for Geophysics, University of Texas at Austin, 4412 Spicewood Springs Road, Building 600, Austin, TX 78759, USA*
[b] *John A. and Katherine G. Jackson School of Geosciences, University of Texas at Austin, Austin, TX 78712, USA*
[c] *Center for Coastal and Ocean Mapping, Chase Ocean Engineering Lab, University of New Hampshire, Durham, NH 03824, USA*
[d] *Department of Ocean Engineering, Florida Atlantic University, Boca Raton, FL 33431, USA*
[e] *College of Marine Studies, University of Delaware, Lewes, DE 19958, USA*

Received 4 September 2003; received in revised form 28 May 2004; accepted 28 May 2004

Abstract

Nearly 100 collocated grab samples and in situ 65 kHz acoustic measurements were collected on the New Jersey middle and outer shelf within an area that had previously been mapped with multibeam backscatter and bathymetry data, and more recently with chirp seismic reflection profiling. Eighteen short cores were also collected and probed for resistivity-based porosity measurements. The combined data set provides a basis for empirically exploring the relationship among the remotely sensed data, such as backscatter and reflection coefficients, and directly measured seabed properties such as grain size distribution, velocity, attenuation and porosity. We also investigate the spatial variability of these properties through semi-variogram analysis to facilitate acoustic modeling of natural environmental variability.

Grain size distributions on the New Jersey shelf are commonly multi-modal, leading us to separately characterize coarse % (>4 mm), fine % (<63 μm) and mean sand grain size to quantify the distribution. We find that the backscatter is dominated by the coarse component (expressed as weight %), typically shell hash and occasionally terrigenous gravel. In sediment types where coarse material is not significant, backscatter correlates with velocity and fine weight %. Mean sand grain size and fine % are partially correlated with each other, and combined represent the primary control on velocity. The fine %, rather than mean grain size as a whole, appears to be the primary control on attenuation, although coarse % may increase attenuation marginally through scattering. Vertical-incidence seismic reflection coefficients, carefully culled of unreliable values, exhibit a strong correlation with the in situ velocity measurements, suggesting that such data may prove more reliable than backscatter at deriving sediment physical properties from remote sensing data. The velocity and mean sand grain size semi-variograms can be fitted with a von Kármán statistical model with horizontal scale ~12.6 km, which provides a basis for generating synthetic realizations.

* Corresponding author. Institute for Geophysics, University of Texas at Austin, 4412 Spicewood Springs Road, Building 600, Austin, TX 78759, USA. Tel.: +1-512-471-0476; fax: +1-512-471-0999.
E-mail address: goff@ig.utexas.edu (J.A. Goff).

0025-3227/$ - see front matter
doi:10.1016/j.margeo.2004.05.030