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Abstract title

SEDIMENTS OF LAGOONAL FLATS ANALYSED BY SETTLING GRAIN SIZE ANALYSIS, STREAM-SCANNING LASER SYSTEM AND SETTLING TUBE SYSTEM: CAN THE RESULTS BE COMPARED?

Authors

DE FALCO GIOVANNI ¹, MOLINAROLI EMANUELA ², MATTEUCCI GABRIELE ³, GUERZONI STEFANO ⁴, TENTONI PIERPAOLO ³

presenter's e-mail: gmatteucci@csaricerche.com

1 - CNR - Istituto sull'Ambiente Marino, Torregreande-OR

2 - Università Ca' Foscari Venezia, Dipartimento di Scienze Ambientali

3 - Gruppo CSA - Istituto di Ricerca, Rimini

4 - CNR - Istituto di Scienze Marine, Venezia

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Abstract

Although grain-size and grain-size distribution are key factors in sedimentology and landscape evolution, common standards have not yet been established by the scientific community. These parameters determine the mechanical properties of sediment and provide information on the origin and evolution of the landscape. The problem of comparing grain-size analyses based on different techniques and physical principles is a major issue and has been discussed by several authors. From the literature we know that with fluvial, aeolian and lacustrine sediments, an 8- μ m laser reading corresponds to 2 μ m measured by settling analysis. Other authors showed that the laser sizer increasingly overestimates the 10-63 μ m fraction as the fine silt/clay content measured by Sedigraph rises, and the differences between laser and Sedigraph measurements become negligible when the 10-63 μ m fraction is higher than 40%. Molinaroli et al. (2000) found a correspondence between <4 μ m (measured by laser) and <2 μ m (measured by Sedigraph), although when the time-of-transition laser technique was used, the differences were less accentuated than those resulting from laser diffraction. In any case, the results provided by the different techniques cannot be directly used for objective comparison unless some normalisation procedures are applied. Thirty sediments collected in shallow lagoonal flats from the Lagoon of Venice were measured by three different devices: SediGraph 5000D, Cis-1, and Hydrometer. The sediment textures determined by each method ranged between silty clay and clayey silt, with 15-35% clay and 60-85% silt. The data obtained were compared by means of variation/residuals and regression analyses. Compared to the Hydrometer, the Cis-1 was found to overestimate the coarse-silt fraction (16-63 μ m) by ~5% and the finest fraction (<1 μ m) by ~8%, whilst it slightly underestimated fine silt and clay (2-5%). The Sedigraph was also found to overestimate the 16-63 μ m fraction by ~5% but underestimated the finest fraction (<2 μ m) (~10%). We found a good correspondence between the Sedigraph, Cis-1, and Hydrometer for the <16 μ m and the <8 μ m fractions. The equations were:

% Cis-1 = 1.055 x % Hydrometer ($r=0.75$; $p<0.001$) for the <16 μ m

% Cis-1 = 1.035 x % Hydrometer ($r=0.82$; $p<0.001$) for the <8 μ m

% Sedigraph = 1.06 x % Hydrometer ($r=0.94$; $p<0.001$) for the <16 μ m

% Sedigraph = 1.10 x % Hydrometer ($r=0.94$; $p<0.001$) for the <8 μ m.

Both the <16 μ m and <8 μ m fractions are known as the non-sortable silt fraction, consisting of both single particles and an aggregated or flocculated fraction, whereas the 8-63 μ m fraction may be regarded as non-aggregated silt particles (Molinaroli et al., 2009). Thus, both the <16 μ m and <8 μ m fractions are descriptors for the transition between cohesive flocs and aggregates and non-cohesive single mineral grains. As a result, the percentages of sediment accounted for by the two fractions (<8 μ m and <16 μ m) are comparable regardless of the three techniques used, and the grain size data obtained from the various sedimentation techniques may be converted into laser-time of transition data by using simple linear relationships.

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