Resuspension, Sediment Fluxes, and Suspended Sediment Diffusion Coefficients under Wave and Current Forcing in Two Coastal Environments

Lars Chresten Lund-Hansen & Christian Christiansen

Abstract

A stainless steel tripod equipped with five sediment traps placed at 0.35 m intervals above the seabed was deployed both in wave and current dominated shallow water environments. The length of tripod deployments varied between three and seven days. Sedimentation fluxes during resuspension in the wave-dominated environment ranged from 24.1 g m^{-2} *day*$^{-1}$ *at 1.75 m to 36.4 g* m^{-2} *day*$^{-1}$ *at 0.35 m. In the current-dominated environment the fluxes ranged from 5.2 g* m^{-2} *day*$^{-1}$ *at 1.75 m to 573.0 g* m^{-2} *day*$^{-1}$ *at 0.35 m. Maximum shear stresses during the resuspension events in each of the two environments were of similar size, 0.042 and 0.06 N* m^{-2}*, respectively. Additional deployments of the tripod during periods with low current speeds and no surface wave activity showed that the primary sedimentation varied between 3.0 g* m^{-2} *day*$^{-1}$ *and 10 g* m^{-2} *day*$^{-1}$ *in both environments. Sedimentation flux variation with height above the seabed was very small in the wave environment and large in the current environment during periods of resuspension. The increasing vertical component of the wave orbital movement with height above the seabed in the wave-field, together with differences in grain-sizes between the two environments are the main explanations for the observed differences in vertical fluxes.*

Diffusion coefficients of suspended particulate matter, K_s*, in the two environments were estimated on the basis of the measured sedimentation fluxes. Observed* K_s *was on average 92 times larger in the wave environment than in the current environment. Theoretical results of* K_s *were consistent with observations of* K_s *in the current dominated environment if the ratio* $K_s/K_m \approx 0.2$ *where* K_m *is the diffusion coefficient of momentum. Theoretical and observed* K_s *in the wave environment were only of similar size close to the seabed.*

Keywords

Coastal environments, sedimentation fluxes, resuspension, sediment traps, wave-field, current-field, suspended sediment diffusion coefficients.

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Sedimentation fluxes and resuspension are important parameters in mass balance and substance transport studies both in marine (Sanford *et al.* 1991) and fresh water environments (Bloesch 1994). Sedimentation fluxes are the amounts of suspended sediment that per unit area and per unit time are settling towards the seabed. The sediment may subsequently be resuspended by: internal waves (Cacchione and Southard 1974); wind-induced surface waves (Aalderlink *et al.* 1984; Sanford 1994); or currents (Kenney 1985; Sanford *et al.* 1991). Much research has focused on sedimentation fluxes and wave resuspension in coastal zones (Beach and Sternberg 1988; Osborne and Greenwood 1993; Osborne and Vincent 1996), or on sedimentation fluxes and resuspension by tidal currents in estuarine environments (e.g. Wright *et al.* 1992). Diffusion coefficients for suspended matter are normally calculated by means of the gradient in concentration of suspended matter (e.g. Nielsen 1992).

The present study presents results on sedimentation fluxes obtained during deployments of a tripod equipped with sediment traps and instruments for measuring wave and current parameters in each of two environments, dominated respectively by surface waves and by currents. The present study applies a new method of estimating diffusion coefficients by means of sedimentation fluxes obtained from sediment traps (Lund-Hansen *et al.* 1994).

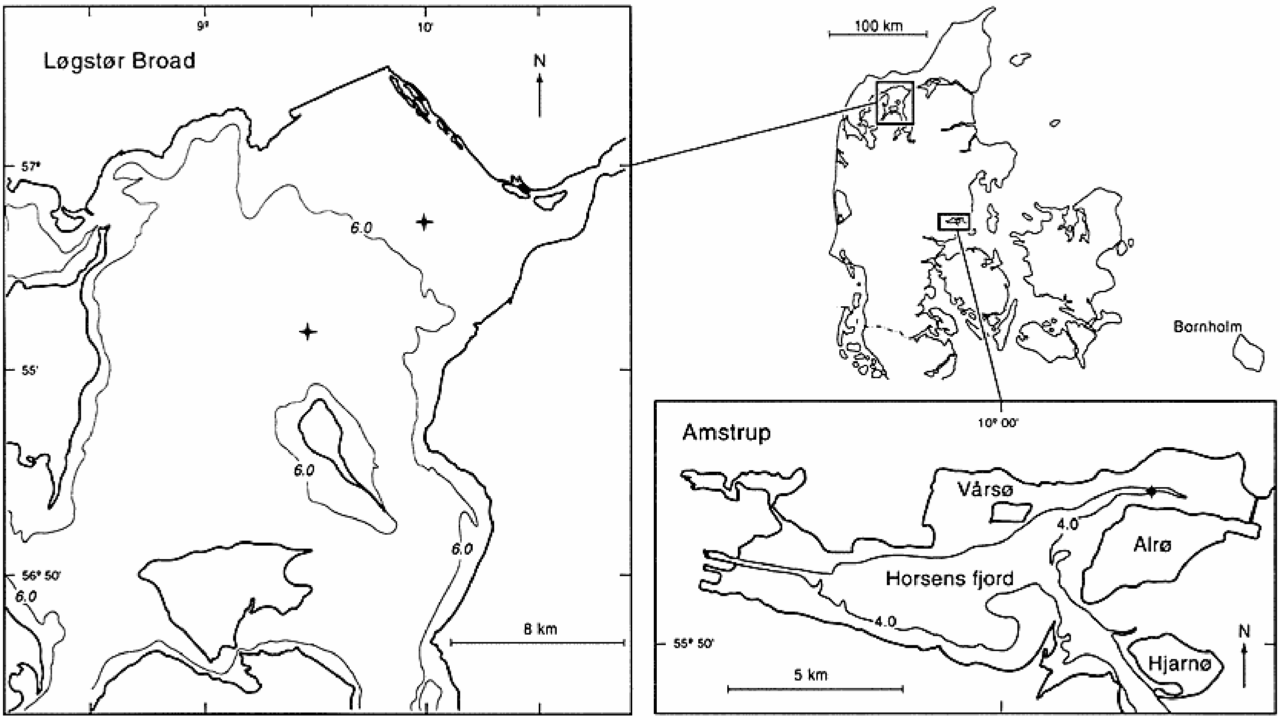

Figure 1:Location of study areas. Dots show study sites.

Study Areas

A position well exposed to winds between southwest and west in the northeastern part of Løgstør Broad (56° 80'10 N; 09° 10'20 E) was chosen as the wave dominated environment (Fig. 1). Water depth at the site is four meters and surface sediments are dominated by very fine sand with a low organic matter content (0.4%). Amstrup Bay in the northern part of Horsens Fjord was chosen as the current dominated environment (Fig. 1). Water depth at this position (55° 52'40 N; 10° 03'90 E) is five meters and surface sediments consist of fine silt and clay with a high organic matter content (12%). Sea level variations at both sites are mainly related to wind speed and direction. The tidal range is about 0.4 m at both positions.

Methods and data analysis

A tripod system consisting of a stainless steel frame equipped with five sediment traps, a pressure recorder, a transmissometer and an Anderaa current meter was deployed at each station. The height of the tripod is two meters (Fig. 2). Sediment traps consisted of stainless tubes closed at the lower end. The tubes were 25.0 cm long with an inner diameter of 5.0 cm giving an aspect ratio of 5. This is considered the optimal aspect ratio for measuring sedimentation fluxes in horizontal flows with moderate current speeds (Hargrave and Burns 1979). Trap openings were placed 0.35, 0.70, 1.05, 1.40 and 1.75 m above the seabed. Pressure recordings (1 m above the seabed) consisted of time series of two measurements per second over four minutes measured every second hour. Pressure recordings were converted into water height using a calibration of the pressure transducer. The transmissometer (DST PC 9202) measured light attenuation of a 630 nm wavelength beam over a distance of 0.5 m at 56 second intervals. The transmissometer was placed 0.5 m above the bed. The Aanderaa current meter measured current speed, conductivity, and temperature every 10 minutes at 1.0 m above the seabed. Material collected in the sediment traps was filtered using a pre-weighed GF/F Whatman filter (0.45 µm) and dried for 24 hours at 60 °C before weighing. Sediment cores for determination of grain-size distribution and organic matter content were collected using a "Haps"-corer (Kanneworf and Nicolaisen 1973) in Amstrup Bay,

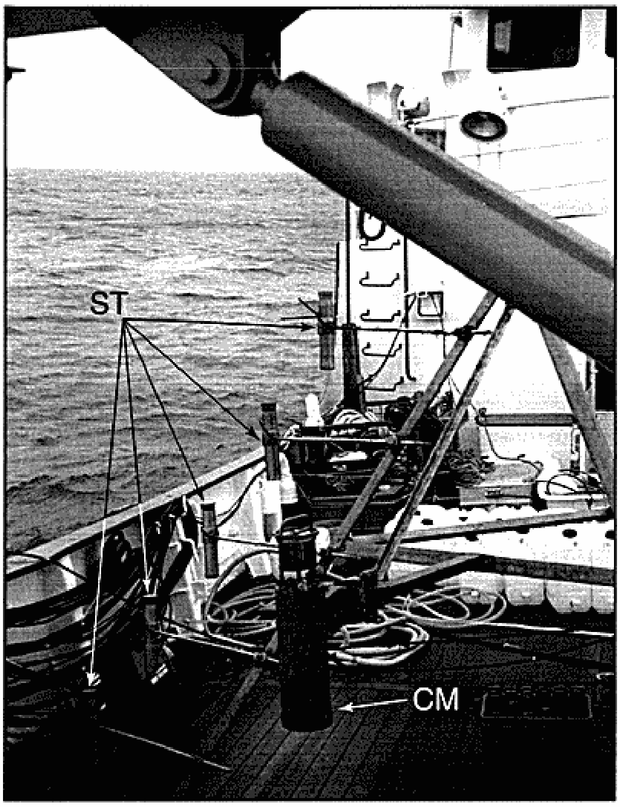

Figure 2: Tripod equipped with sediment traps (ST) and a current meter (CM). The transmissometer (out of sight) is hanging on the tripod leg to the right.

whereas a van Veen grab was used in Løgstør Broad. Only the top 5 mm of the sediment was used for analyses of grain-size distributions and organic matter content. Grain-size distributions were obtained by standard sieving techniques of the fraction > 33 µm and a pipette technique for the fraction < 33 µm. Before the analyses all organic matter was removed using H_2O_2.

Current shear stress (τ_c) (N m^{-2}) was calculated

$$\tau_c = C_d \rho_w U^2 \qquad [1]$$

where C_d is a drag coefficient (Sternberg 1972), ρ_w is water density (kg m^{-3}), and U is current speed (m s^{-1}) measured 1.0 m above the seabed. Wave shear stress (τ_w) (N m^{-2}) was calculated

$$\tau_w = 0.5 \rho_w f_w U_m^2 \qquad [2]$$

where ρ_w is water density (kg m^{-3}), f_w is a wave friction factor (Jonsson 1966), and U_m is the near bottom orbital velocity (m s^{-1}).

The pressure recorder was, however, not functioning during the Løgstør Broad deployment. Therefore, wave parameters were calculated based on observations of fetch, wind speed and direction following Beach Erosion Board (1975). Data on wind speed and direction recorded every hour were obtained from a meteorological station placed about 35 km west of the deployment position in Løgstør Broad. Maximum near-bottom orbital velocity, U_m (m s^{-1}) was calculated using Airy wave theory

$$U_m = \frac{\pi H}{T \sinh(2\pi \frac{h}{L})} \qquad [3]$$

where H is wave height (m), T wave period (s), h the water depth (m), and L the wave length (m) (Komar and Miller 1973). Transmissometer recordings were transformed into a light attenuation coefficient (m^{-1})

$$C - C_w = -\ln(\frac{F}{F_o})/r \qquad [4]$$

where C_w is the ambient light attenuation in the water, F the actual measured light intensity, F_0 the initial light intensity (V), and r the distance (m) between light emitter and receiver (Wells and Seok-Yun 1991).

Results

Løgstør Broad

Wave resuspension

The tripod was deployed in Løgstør Broad between 18 and 27 April 1995 in three consecutive periods. However, only the recordings obtained during the first deployment (18–20 April) – a high energy period – and data from the third deployment (25–27 April) – a low energy period – are reported here. Wind speed increased during 18–19 April and reached a maximum of 11 m s^{-1} from a westerly direction about 1000 h on 19 April (Fig. 3a). The wind speed ceased quite fast after the maximum, and wind direction changed to a more southerly direction. Wave and current shear stresses and light attenuation coefficients during the 18–20 April deployment are shown in Fig. 3b. Maximum

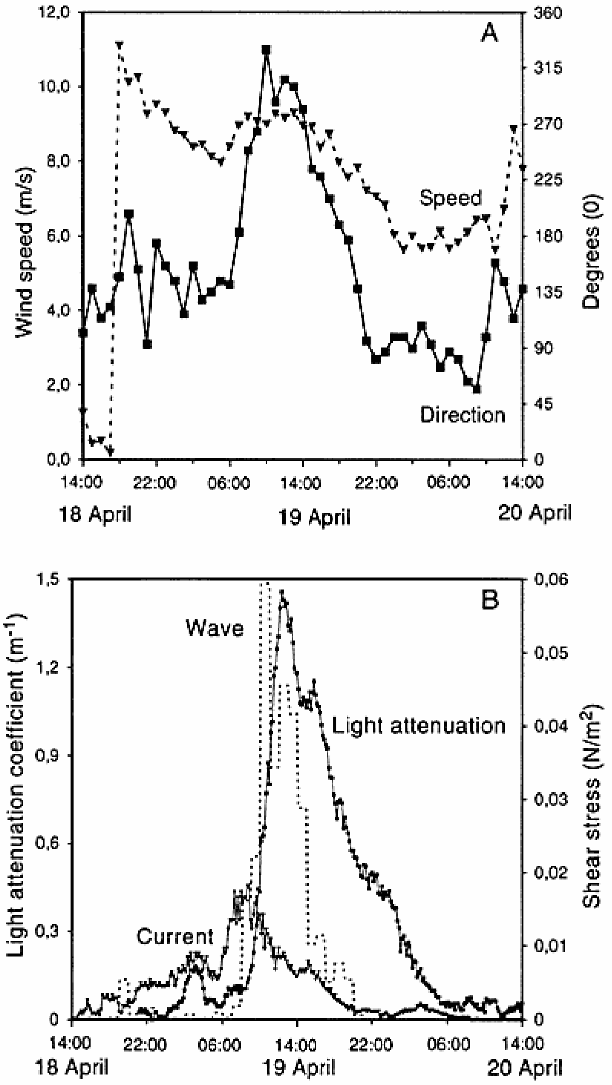

Figure 3: (a) Time series of vind direction (^{0}) and wind speed (m s^{-1}) in Løgstør Broad during 18-20 April 1995 and (b) time series of light attenuation coefficient (LAC) (m^{-1}), and wave and current shear stress (N m^{-2}).

light attenuation coefficient (LAC) was reached at 1200 h on 19 April, whereas the maximum wave shear stress was recorded at 1000 h. LAC reached the background level of 0.05 (m^{-1}) about 17 hours later, whereas wave shear stress decreased rapidly and reached a value 11 times lower than the maximum value about six hours later. It is seen that changes in LAC are very closely related to changes in wave shear stress which indicates strongly that the resuspension, expressed by the raised LAC, was caused by surface wave activity. This is further emphasized by the fact that the maximum wave shear stress (τ_w) was about 3.5 times higher than the maximum current shear stress (τ_c) (Fig. 3b). Surface sediments consist of about 98% fine and medium sand with only 0.2% > 1 mm (Fig. 7). The wave friction velocity was calculated by equation [9] in order to estimate the grain-sizes which could be lifted into suspension or transported as bed load (McCave 1984). Results show that the wave friction velocity was large enough to lift grains with diameters < 0.8 mm into suspension whereas grains with diameters up to 3.0 mm could be transported as bed load. As grains with sizes < 0.8 mm make up most of the sediments on the seabed, these results show that the maximum wave orbital velocity was large enough to induce resuspension of the sediment grains.

Sedimentation fluxes

Sedimentation fluxes (g m^{-2} day^{-1}) measured by the sediment traps during the two tripod deployments are shown as a function of height above the seabed (Fig. 4). LB-1 refers to the high energy period (18–20 April) and LB-3 to the low energy period (25–27 April). It is seen that the fluxes recorded during the high energy period dominated by surface waves (Fig. 3b) are about seven times larger than the fluxes obtained during the low energy period, when current speeds were low (≈ 5-10 cm s^{-1}) and surface wave

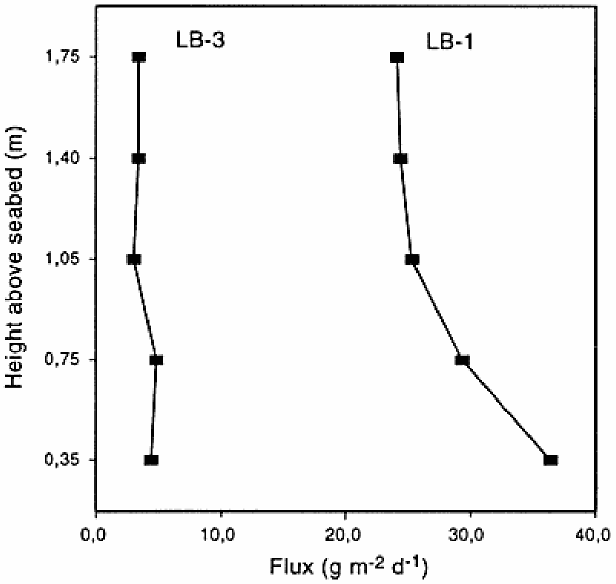

Figure 4: Sediment fluxes (g m^{-2} day^{-1}) in Løgstør Broad during a high (LB-1) and low energy period (LB-3).

activity was absent (not shown). The average sedimentation flux of about 4.0 g m^{-2} day^{-1} (measured during the low energy deployment) is considered primary sedimentation, i.e. a sedimentation flux not influenced by resuspension. In comparison, sedimentation fluxes were larger at all trap levels during the high energy deployment that was dominated by strong surface wave activity. A significant difference between the two sedimentation flux profiles is the flux variation with a height above the seabed (fig. 4). This variation is very small during the low energy period (LB-3) whereas the flux increases exponentially towards the seabed during the high energy period (LB-1).

Amstrup Bay

Current resuspension

The tripod was deployed in Amstrup Bay between 14 and 21 June 1994. A similar sediment trap set up was deployed from a platform between 3 and 10 October 1995 (see later). Fig. 5 shows water level variations (5a) and current shear stress (5b) during the June 1994 deployment. A strong tidal signal can be recognized in the recordings which show an average tidal range of about 0.5 m. A comparison between τ_c (Fig. 5b) and water level changes (Fig. 5a) shows that maximum τ_c occurs almost concurrently with the strong water level changes at 1730 h on 18 June. These water level changes were caused by the wind set up. The deployment is dominated by a high current shear stress, as τ_c is about 14 times higher than maximum wave shear stress of 0.004 N m^{-2} reached about 1200 h on 19 April (not shown). Surface sediments are dominated by silt (86.6%) and clay (12.4%) with a mean grain diameter of 0.04 mm (Fig. 7). Using [6] for maximum current speed recorded gives a friction velocity of 0.011 m s^{-1}

$$\frac{u}{u_*} = \frac{1}{0.4}\ln\frac{z}{z_0} \qquad [6]$$

which is capable of lifting into suspension most of the grains with diameters < 0.1 mm (McCave 1984). In equation [6] $z_0 = 0.001$ for a plain smooth seabed (Heathershaw 1981), u_* the friction velocity (m s^{-1}), and u the measured velocity (m s^{-1}) at the height z above the seabed. This result indicates that resuspension of the sediment was possible as more than 99% of the surface sediment grains have diameters < 0.1 mm (Fig. 7).

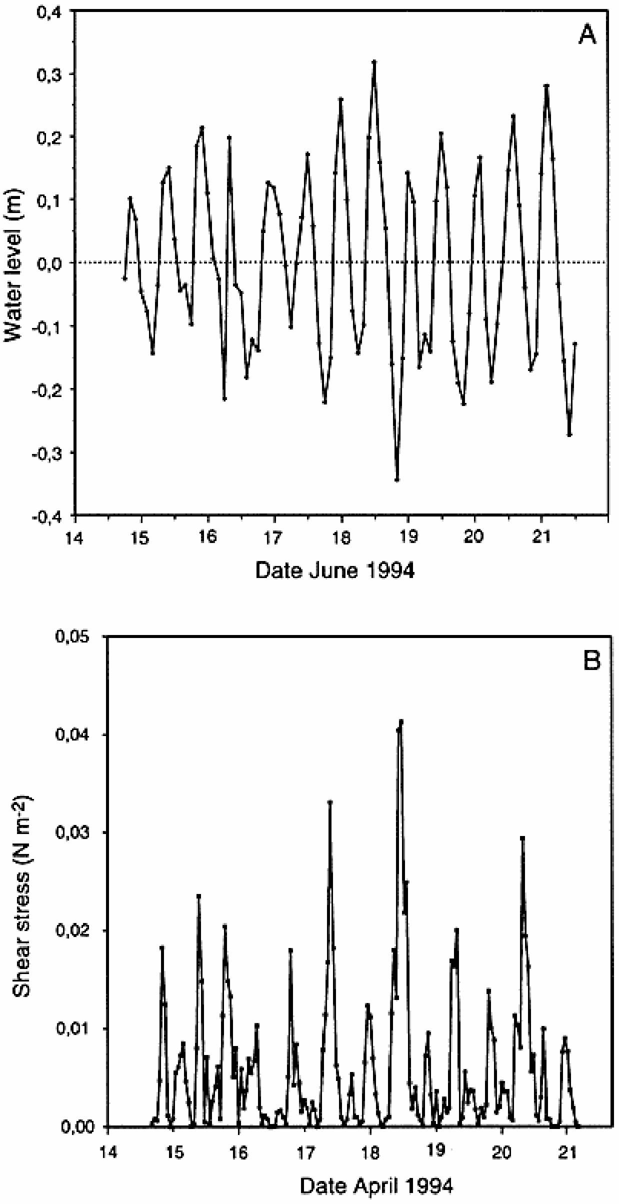

Figure 5: *(a) Water level changes (m) during tripod deployment in Amstrup Bay during 14-22 June 1994, and (b) wave and current shear stress (N m^{-2}).*

Sedimentation fluxes

Large sedimentation fluxes were recorded close to the seabed during the Amstrup Bay deployment where a maximum of 573.0 g m^{-2} day^{-1} at 0.35 m above the seabed was reached (Fig. 6). In comparison, very low fluxes of 7.6 g m^{-2} day^{-1} at 1.75 m and 12.6 g m^{-2} day^{-1} at 0.75 were

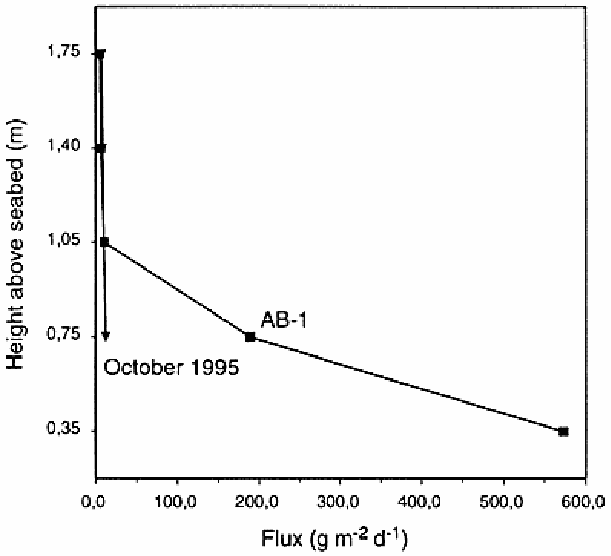

Figure 6: Sediment fluxes (g m^{-2} day^{-1}) in Amstrup Bay during the high (AB-1) (14-22 June 1994) and low energy period (October 1995).

obtained during the October 1995 low energy period, when low current speeds (≈ 5-10 cm s^{-1}) prevailed and surface wave activity was absent (not shown). Data on sedimentation fluxes from 0.35 m above the seabed are missing from the October 1995 deployment due to loss of a sediment trap. These low sedimentation fluxes are also considered as a result of primary sedimentation. This shows that strong resuspension took place during the June 1994 deployment. Sedimentation flux variation with height above the seabed during the two deployments is quite similar at the upper sediment trap levels, whereas the flux increases significantly towards the seabed during the high energy period (Fig. 6). Sedimentation fluxes at the upper trap levels (> 1.05 m) are not affected by the resuspension events in this current-dominated environment. CTD measurements carried out at the position showed no stratification of the water column at the time of tripod deployment in June 1994. A stratified water column could have been an explanation for the observed vertical distribution of the sedimentation fluxes in AB.

Table 1: Diffusion coeffcients (K_s - cm^2 s^{-1}) of suspended particulate matter in Løgstør Broad between 18 and 20 April 1995 and Amstrup Bay between 14 and 21 June 1994. Also shown are model results.

Elevation	*Løgstør*		*Amstrup*		
z(m)	*Observation*	*Model*	*Observation*	*Model ($\beta = 1$)*	*Model $\beta = 0.2$)*
1.58	1.974	166.3	21.2	46.4	9.3
1.22	677.3	153.3	7.8	35.6	7.1
0.9	167.4	132.2	0.3	26.3	5.3
0.55	115.0	97.4	2.4	16.1	3.2

Diffusion coefficients

The downward sediment flux, Cw_s, *i.e.* the concentration of suspended particulate matter (C) times the particle settling velocity (w_s), must be balanced by the upward diffusion, which depends on the concentration gradient:

$$Cw_s = -K_s\frac{\partial C}{\partial z} \qquad [7]$$

where K_s is the diffusion coefficient (m^2 s^{-1}) (Dyer 1986). Equation [7] can be rewritten (Gardner *et al.* 1983) as:

$$\frac{Cw_s}{\Delta Cw_s/\Delta z}w_s = -K_s \qquad [8]$$

where Cw_s is the flux measured by sediment traps and Δz is the distance between the traps. Particle settling velocities (w_s) were calculated by means of Stroke's law using the mean diameter of the surface sediments at each site. Table 1 documents the size and vertical distribution of K_s at both localities during the high energy periods. It is seen that observed diffusion coefficients increase with height above the seabed at both sites and that observed K_s is larger in the wave-field than in the current-field, on average by approximately 92 times. K_s variation in the wave and current fields was modeled to compare observed results with model results. Such a comparison requires a determination of wave and current friction velocities. The latter was calculated by equation [6], using a current speed of 0.12 m s^{-1} recorded during several current peaks (Fig. 5b). The wave friction velocity was calculated by the Grant and Madsen (1982) formulation:

$$U_{*w} = (\frac{f_w}{2})^{1/2}u_m \qquad [9]$$

where f_w is a wave friction factor and u_m is the maximum near-seabed orbital velocity (m s^{-1}). The variation of K_s

with height above the seabed in the current-field was calculated

$$K_{s,c} = \beta\kappa u_* z \qquad [10]$$

where $\kappa = 0.4$ and z is the distance above the seabed (Dyer 1986). The variation of K_s with height above the

$$K_{s,w} = \beta\kappa u_* z(e^{-2z/h}) \qquad [11]$$

seabed in the wave-field (Beach and Sternberg 1988) was calculated: where z is the distance above the seabed and h the water depth. The constant of proportionality, β, included in equations [10] and [11] is derived from $K_s = \beta K_m$ where K_m is the diffusion coefficient of momentum and β is generally considered to be 1. Model results are shown in Table 1 and it is seen that the theoretical values of K_s increase with height above the seabed at both sites, and these values of K_s, on average, are about four times higher in the wave-field than in the current-field – for $\beta=1$. The theoretical wave-induced K_s is of the same size as the measured K_s close to the seabed, whereas the theoretical K_s in the current-field, on average, is about five times larger than the observed K_s - for $\beta=1$. A better fit of theoretical and observed current-induced K_s is obtained by applying a β value of 0.2 in equation [10] (Table 1) following a study by West *et al.* (1990).

Discussion

Sediment traps and resuspension measurements

Many studies of sediment traps have been made to achieve an optimum trap design in relation to the sedimentation flux (Gardner 1980, 1980a). It is generally agreed that sedimentation fluxes measured with cylindrical sediment traps (Hargrave and Burns 1979) with aspect ratios of about five or higher will record values very close to the real sedimentation fluxes (Blomqvist and Håkansson 1981). These sediment trap test studies have, as far as the present authors can determine, only been carried out in unidirectional flows and not in wave-fields. The trap aspect ratio is also important in wave-fields as high turbulence intensity is likely to resuspend sediment from sediment traps with low aspect ratios. Vertical displacement of particles in the elliptical wave orbit at the trap levels (0–1.75 m above the seabed) will not exceed 0.05 m for the recorded maximum wave height of 0.35 m (Beach Erosion Board 1975). The height of the traps used in the present study was 0.25 m and thus vertical displacement by orbital currents should not be able to resuspended sediment from the traps. The tripod used in the present study has also been deployed in the swash zone at Skallingen on the wave and tide dominated southwest coast of Denmark. These deployments showed that the distribution of sedimentation fluxes with height above the seabed during periods of strong wave activity were near exponential (Aagaard *et al.* 1995). This is similar to the results of the present study where sedimentation fluxes also followed a near exponential distribution during the high energy deployment in Løgstør Broad (Fig. 4). In contrast, during periods of moderate to low wave energy conditions at Skallingen the flux profile was divided into two straight lines. This is again very similar to the flux distribution observed in Amstrup Bay during the high energy period (Fig. 6). These results might indicate that the shape of the flux profiles also reflects the level of energy conditions during resuspension at a given site.

Resuspension in wave and current-dominated environments

The sedimentation flux in Løgstør Broad increased only little towards the seabed during the high energy deployment compared with the Amstrup Bay high energy deployment. This implies that Cw_s was nearly constant with height above the seabed in the wave-field, and that sediment diffusion must have been large during resuspension. Maximum shear stress during the high energy period exceeded the threshold for resuspension of grains with diameters smaller than 3.0 mm, but only grains with diameters < 0.8 mm could be lifted into suspension. Beach and Sternberg (1992) showed that concentrations of suspended sediment as a function of height above the seabed were nearly uniform in wave-fields up to a height of about 0.5 m above the bottom. Clarke *et al.* (1982) measured high suspended sediment concentrations in a wave-field at 1.0 m above a coarse-grained seabed (mean grain-size = 0.3 mm). These large concentrations were related to turbulence bursts. Our calculations, following the Beach Erosion Board (1975), of the horizontal and vertical water displacement in the elliptical movement above the seabed in the wave-field showed that the vertical displacement

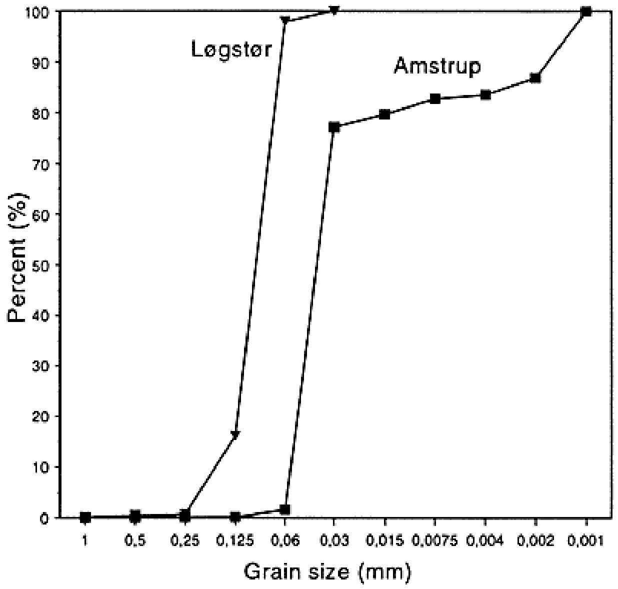

Figure 7: *Cummulative grain-size distributions of surface sediments from Løgstør Broad and Amstrup Bay.*

increased more strongly than the horizontal displacement. The presence of a vertical water displacement in the wave-field may also be part of the explanation for the homogenous distribution of the sedimentation fluxes in the wave-field. Previously, Osborne and Greenwood (1993) have shown that time averaged vertical gradients in suspended matter concentrations decreased markedly by increases in the intensity of turbulence associated with larger oscillatory current speeds. The present calculations were carried out for individual waves. Osborne and Greenwood (1993) also showed that the presence of wave groups had a strong influence on vertical mixing of suspended matter. In wave groups, turbulence from a previous wave may persist into the following wave cycle and therefore, turbulence may be advected to higher elevations above the bottom.

Bed shear stress in Amstrup Bay during the high energy period exceeded the threshold necessary for resuspension of grains smaller than 0.1 mm. A comparison with the grain-size distribution of the surface sediments (Fig. 7) suggests that more than 99% of the sediment would have been available for resuspension. However, cohesive sediments are more resistant to erosion as a result of cohesive forces between the small particles and the great increase in adhesive forces caused by the presence of algae and bacteria in the sediment (McCave 1984). Subsurface video recordings in Amstrup Bay carried out by divers after recovery of the tripod showed that the seabed was covered by a loosely packed fluffy layer very similar to that shown by Stolzenbach *et al.* (1992). This layer was very easy to resuspend by moving a hand forward and backwards near the sediment surface. The video recordings also showed that small burrows were common in the surface of the sediment. The reworking and alteration of sediment structures by bottom fauna may increase the sediment resuspension potential (Rhoads and Young 1970). The small grain sizes, low ability of the sediments to withstand resuspension and the presence of a bottom fauna, all contribute to high resuspension potential. These factors explain, at least in part, the very large near-seabed fluxes observed in Amstrup Bay.

Diffusion coefficients

The present method of using sediment traps to estimate the diffusion coefficients of suspended particulate matter has already been applied in Århus Bay (for a discussion on the method see Lund-Hansen *et al.* 1993). The vertical distance between sediment traps in the Århus Bay deployment varied between 0.2 and 2.0 m. The Århus Bay results showed that K_s varied from 0.3 cm^2 s^{-1} near the seabed to 47.0 cm^2 s^{-1} at the upper sediment traps. The size and vertical distribution of K_s in Århus Bay in general corroborates the results of the present study, especially the results from the current-dominated Amstrup Bay. However, an examination of the expression applied to calculate K_s [8] shows that K_s is directly proportional to the squared settling velocity (w_s) and inversely proportional to (C/ z)/c. A low K_s value is thus related to a high relative concentration gradient combined with a comparatively low particle settling velocity as observed in Amstrup Bay.

The settling velocity of $7.0*10^{-3}$ m s^{-1} for grains with a mean diameter of 0.09 mm as on the seabed in the Løgstør wave-field was applied in the modeling of K_s and results only corroborated with observations of K_s close to the seabed (Table 1). A recalculation of the settling velocity – w_s - in equation [8], based on the observed values of K_s, showed a clear vertical gradient with settling velocities of $5.9*10^{-4}$ m s^{-1} at 1.58 m above the seabed and of $5.9*10^{-3}$ m s^{-1} at 0.55 m. The applied settling velocity may therefore be too high. This is also indicated by the light attenuation measurements during the resuspension, which show that the background level was reached after 17 hours following the maximum resuspension (Fig. 3b). This gives a settling

velocity of $6.5*10^{-5}$ m s^{-1} for the smallest resuspended particles, anticipating that the particles settled from a height of four meters above the seabed.

The diffusion coefficient of suspended matter and momentum (K_m) is related by $K_s = \beta K_m$ (Dyer 1986). A value of $\beta = 1$ was applied in equations [10] and [11]. However, a study by West *et al.* (1990) in a fine grained silt-dominated tidal environment showed that $\beta = 0.2$. Observation and model results are very similar in the current-field both in size and in vertical distribution if $\beta = 0.2$ is applied in equation [10]. These results are labeled ($\beta = 0.2$) in Table 1. K_s in equations [10] and [11] is proportional to a friction velocity (u_*) and these results indicate that the induced sedimentation flux, given by K_s, is only about 1/5 of the friction velocity in the current-dominated environment. Suspended particles in fine-grained environments are flocculated, consisting of clay and silt particles with organic material. These flocs have very low density relative to surface area. Density difference between water and solid material is the governing relation for particle motion in water, and accordingly flocculated particles with low density and large surface areas are relatively more easy to bring into suspension. Maximum shear stress applied during the high energy deployments in the two environments is of similar size but near bed sedimentation fluxes are about 16 times larger in the current-field. This, together with the low particle densities, shows that the vertical water movement and sedimentation fluxes in the current-field are low compared with the conditions in the wave-field. This is also shown by the size and vertical distribution of the diffusion coefficients of suspended matter in the two environments.

Conclusions

Resuspension occurred at both sites during tripod deployments in high energy periods. Very large near bed fluxes occurred in the current-field, whereas small and vertical nearly homogeneous fluxes were measured in the wave-field.

For shear stresses of the same order, sedimentation flux magnitude during resuspension appears to depend on sediment characteristics such as grain-size, consolidation and biological activity, whereas flux profiles appear to depend on energy dissipation in the water column. Flux profiles above the seabed may be very different in a wave-field, compared with a current-field.

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