

EstProc

DEFRA project FD1905

Work in Progress report October 2002 to March 2003 (18 pages long)

(Paper copy of early version shared with J Rogers/M Thorn)

Project Manager: Richard Whitehouse, HRW, email: rjsw@hrwallingford.co.uk

Date completed: 30th April 2003

Management activities completed:

- Liaison with project team, funders, external parties
- Project website maintained
- Minutes from October 2002 meeting, placed on project website
- Inception report available from project website
- Meeting do discuss metadata format with ABPmer
- Payments with respect subcontracts
- Abstract for DEFRA conference (accepted) [paper written and circulated to partners]
- CSG12 form (annual report)
- Preparations for week commencing 9 June 2003 workshop in St Andrews

Short reports prepared by each of the project partners are appended:

1. HRW - Hydraulics Research Wallingford
2. POL - Proudman Oceanographic Laboratory
3. KRD/UoP - Keith Dyer/University of Plymouth
4. GML - Gatty Marine Laboratory, St Andrews
5. ABPmer - Associated British Ports, marine environmental research
6. WLD - WL | Delft Hydraulics
7. PML - Plymouth Marine Laboratory
8. CCRU - Cambridge Coastal Research Unit
9. SOES - School of Ocean and Earth Sciences, Southampton
10. DHH - Digital Hydraulics Holland
11. CEFAS - Centre for Environment, Fisheries and Aquaculture Science

These reports were designed to capture the following information:

- Description of work completed by partner in last 6-month period
- Any problems identified
- Interactions with other partners in last 6-months, relevant meetings attended
- Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc
- What material can be presented at June workshop
- Reports/papers produced in last 6-months

HR Wallingford

30th April 2003

EstProc FD1905

Progress report to October 2002 to March 2003

Please complete one form per organisation, replace “partner” in file name with abbreviation for partner organisation and email back to Richard Whitehouse (rjsw@hrwallingford.co.uk)

Deadline: latest return on morning of Monday 17 March 2003

Partner Organisation:	HR Wallingford
Completed by:	J Spearman/R Soulsby/R Whitehouse
Date completed:	17 March 2003
Work description	
	Identify any specific target dates or miletones
Description of work completed in last 6-months (breakdown by task):	
<u>Task 1(a) and (b)</u>	
<ul style="list-style-type: none"> • Progressing a series of tests using intetidal wave measurements from the Outer Thames Estuary. The estuary is characterised by a series of intertidal banks and channels. Offshore waves are predominately northerly/easterly, but winds south/westerly. The data set consists of two sources of wave measurements situated at opposite sides (N+S) of Estuary. <p>A series of tests will be undertaken including:</p> <ul style="list-style-type: none"> - Testing of SWAN in steady and non-steady mode (this is particularly relevant for these estuary conditions) - Comparison of SWAN results with TOMAWAC results (TOMAWAC is an finite-element area wave model from the TELEMAC suite, similar to SWAN in many ways but with specific differences) <ul style="list-style-type: none"> • Organised a series of measurements in the Orwell Estuary in collaboration with HHA. These will be used as a further test bed for SWAN. • Continued Liaison with Japan (Dr N. Hashimoto, Port and Airport Research Institute) <ul style="list-style-type: none"> - Positive response to proposal to test new SWAN code. - If liaison progresses will use SWAN code to test Gt Yarmouth [for examining offshore to nearshore wave transformation, measured data either side of a sandbank] and/or CCRU Dengie data set. • Attended December 20th Workshop on bio-geomorphology at Delft Hydraulics • Discussed Dengie with CCRU and allocated responsibilities for testing different aspects of the Dengie measurements • Ordered LiDAR for the Dengie area 	

<p><u>Task 2 (c)</u></p> <ul style="list-style-type: none"> • Initial tests of functionality • Provision of Abbots Hall LiDAR data for ABP • Development of algorithm for representation of sub grid processes in TELEMAC <p><u>Task 3</u></p> <ul style="list-style-type: none"> • Collaboration with Plymouth University including part funding Andy Manning’s contribution to EstProc in Task 3. • See report from University of Plymouth <p><u>Task 4 (a)</u></p> <ul style="list-style-type: none"> • Located lab and field data for wave+current bed shear-stresses on rough and smooth beds in tabular form and plotted them in standard format • Evaluated a very recent paper on modelling of shear-stresses (Carmo et al) • Devised new analytical models of shear-stresses based on the hypothesis of no enhancement of wave stresses by currents (from lab experiments by Simons) <p>Any problems identified:</p>	
<p>Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external):</p> <p><u>Task 1(a) and (b)</u></p> <ul style="list-style-type: none"> • December 20th Workshop on bio-geomorphology at Delft Hydraulics. • Continued Liaison with Japan (Dr N. Hashimoto, Port and Airport Research Institute) • Collaboration with Harwich Haven Authority over field measurements to be undertaken in the Orwell Estuary in April. <p><u>Task 2 (c)</u></p> <ul style="list-style-type: none"> • Provision of Abbots Hall LiDAR for ABP <p><u>Task 3</u></p> <ul style="list-style-type: none"> • Collaboration with Plymouth University 	
<p>Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc:</p> <p><u>Task 1(a)</u></p> <ul style="list-style-type: none"> • April: Field measurements of waves to be undertaken at Shotley in the 	

<p>Orwell Estuary</p> <ul style="list-style-type: none"> • April, May: Complete initial appraisal of stationary/non-stationary SWAN and commence comparisons with TOMAWAC • April, May: Continued Liaison with Japan (Dr N. Hashimoto, Port and Airport Research Institute) seek to conclude agreement and commence Gt Yarmouth and/or Dengie testing <p><u>Task 2 (c)</u></p> <ul style="list-style-type: none"> • April/May: Coding and testing of algorithm for representation of sub grid dendritic processes in TELEMAC <p><u>Task 3</u></p> <ul style="list-style-type: none"> • See report from University of Plymouth <p><u>Task 4 (a)</u></p> <ul style="list-style-type: none"> • Test Carmo et al method against assembled data • Test newly devised analytical models against assembled data • Improve methods as guided by data • Choose best method and write up <p>Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful:</p> <p><u>Task 1 (a)</u></p> <ul style="list-style-type: none"> • Reporting of SWAN comparisons with Outer Thames data <p><u>Task 2 (c)</u></p> <ul style="list-style-type: none"> • Reporting of dendritic algorithm tests <p><u>Task 4</u></p> <ul style="list-style-type: none"> • Reporting on predicting combined wave+current bed shear stresses on smooth and rough beds 	
<p>Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project:</p>	

Partner Organisation:	POL	
Completed by:	D PRANDLE	
Date completed:	11/03/03	
Work description		Identify any specific target dates or miletones
Description of work completed in last 6-months (breakdown by task): Completion of 1-D single-point,tides/SPM model Development of generalised theory of estuarine dynamics/SPM/bathymetry Any problems identified:		
Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external): 1-D model circulated to partners		
Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc: Paper accepted for DEFRA Conference: Abstract : Equilibria between estuarine bathymetry and tides,river flow and sediment supply Assessment/ evaluation phase of generalised theories scheduled for second half of 2003 Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful: Presentation of DEFRA Conference paper		24/03/03 Abstract 16/07/03 Presentation
Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project: PAPERS submitted to: RCEM 2003 3 rd IAHR Symposium Dynamics ,saline intrusion,sedimentation and bathymetry in shallow tidal estuaries . D Prandle Dynamics,sediment transport & bathymetry in the Mersey Estuary A Lane		1-5/09/03 Barcelona

Partner Organisation:	University of Plymouth	
Completed by:	Prof. K Dyer (denoted by KD) and Dr A. Manning (denoted by AM)	
Date completed:	March 2003	
Work description		Identify any specific target dates or miletones
Description of work completed in last 6-months (breakdown by task):		

<p>KD. Data on high concentration suspensions obtained in the Tamar estuary (EC MAST III COSINUS experiment) have been analysed for turbulence characteristics. A paper submitted to ECSS has been returned with referees comments. These comments are being considered. The possibility of negative diffusion is being investigated.</p> <p>AM. A new empirically based model for estuarine flocculation has been formulated from data sets obtain <i>in-situ</i> from the Tamar, Gironde and Dollard estuaries. The model comprises three separate equations, each one representative of the distribution patterns demonstrated by the following principle floc characteristics: <i>i.</i> W_{SMACRO} - settling velocity of the macrofloc sub-population (Floc sizes > 160 μm), <i>ii.</i> W_{Smicro} – the settling rate of the microfloc sub-population (Floc sizes < 160 μm) and <i>iii.</i> SPM_{ratio} – the relative apportioning of the suspended particulate matter across the two floc fractions within a specific floc population. When the three equations are combined, the model can estimate mass settling flux values, requiring the input solely of SPM concentration and turbulent shear stress values. Preliminary tests on the model’s predictability and robustness have proved very encouraging, showing a significant improvement over a variety of alternative parameterisation techniques. I have also been involved in the processing of the individual high frequency turbulence data sets, from which the mean burst characteristics are derived, for the assessment of the "negative diffusion" phenomenon.</p> <p>Any problems identified:</p> <p>none</p>	
<p>Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external):</p> <p>KD. We have tried unsuccessfully to run the POL 1-D computer model.</p> <p>AM. Work with Delft Hydraulics is in progress to investigate the possibility of a multi-fractal representation of a floc population. An initial theoretical model has been compared with a selection of real floc images which were acquired <i>in-situ</i> during the COSINUS experiment in the Tamar estuary.</p>	
<p>Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc:</p> <p>KD. Finish work on negative diffusion and prepare paper</p> <p>AM. Prepare a paper based on the empirical flocculation model for the Journal of Geophysical Research (JGR). Collect new <i>in-situ</i> floc + hydrodynamic data in a Tamar estuary experiment planned for Spring 2003. Prepare a first collaborative paper with Delft Hydraulics on initial multi-fractal work.</p>	

<p>Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful:</p> <p>KD. Yes. Title: “Is negative diffusion possible in high concentration suspensions ?”</p> <p>AM. Yes. Title: “The mass settling flux of estuarine sediments: measurement and prediction”</p>	
<p>Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project:</p> <p>KD. Paper submitted to ECSS. This was circulated to certain partners for comment.</p> <p>AM. Four Papers were submitted to the Journal of Coastal Research, Special Edition on Sediment Transport in European Estuaries, the first of which has been returned after peer review and requires minor modifications. JCR Title: “<i>Observation of the properties of flocculated cohesive sediment in three Western European estuaries</i>”; JCR Title: “<i>Flocculation measured by video based instruments in the Gironde estuary during the European Commission SWAMIEE project</i>”; JCR Title: “<i>The effects of turbulence on estuarine flocculation</i>”; JCR Title: “<i>An experimental investigation of floc’s characteristics in a diffusive turbulent flow</i>”. Submitted copies of these manuscripts have been passed on to colleagues from HR Wallingford. A paper entitled: “<i>Floc populations observed in the lower reaches of the Gironde estuary</i>” will be submitted in a few weeks to the journal Oceanologica Acta.</p>	

Partner Organisation:	University of St Andrews, Gatty Marine Laboratory	
Completed by:	David Paterson and Emma Defew	
Date completed:	March 2003	
Work description	Identify any specific target dates or miletones	
<p>Description of work completed in last 6-months (breakdown by task):</p> <p>1. To lead a review of the relevant biological process parameters that affect the stability, erodibility and deposition of sediments Review has been collated and a bibliography produced. This has been placed on the web site (www.estproc.net). Further developments are still being made to this review and material collated for updating the work at regular intervals. Reviewed CEFAS paper “Spatial patterns of estuarine macrobenthic assemblages: relationships with hydrodynamic regime” This report is in draft form but will be placed on the website in the next couple of months.</p>	Ongoing	

<p>2. To investigate the use of multivariate statistics to reduce information to a minimum parameter set. Review of current information has shown that data is largely site specific to date. See: Defew, E.C., Tolhurst, T.J. & Paterson, D.M. (2002). Site-specific features influence sediment stability of intertidal flats. <i>Hydrology and Earth System Science</i> 6: 971-982.</p> <p>3. To develop a database able to accept transect-based biosedimentary data. Research in the period has concentrated on the variation in the behaviour of sediment in response to the relative tidal position (i.e. salt marsh, intertidal flat & sub-tidal (never exposed) systems). This work is being addressed to fill a gap in our knowledge concerning the transitional behaviour of similar sediment under different desiccation regimes, and their related ecology. Results of this work will be added to the database.</p> <p>Any problems identified:</p> <ol style="list-style-type: none"> 1. (Priority area) The EAG noted at their last meeting, having reviewed the Inception Report, that the transport of mixed sediments is currently not receiving much effort and this was identified as a key area. GML have developed an extraction procedure that allows different sized tracer particles to be retrieved from sediment samples. This R&D is in its initial phases and a small funding effort (8K) is required here to collate and strengthen this area, which would greatly enhance the EstProc deliverables and provide a new state-of the art position in the transport of mixed sediments. 2. More work is required on the application of biological information within sediment models. Initial bio-sedimentary models (eg Ruddy) have been produced but a target for the next period could be to identify and list work on biosedimentary approaches that predict the erosive behaviour of intertidal systems. This could be completed in cooperation with other partners e.g PML. 3. EPS analysis is problematic. Studies can often be difficult to compare due to the different sampling and extraction methodologies. Recent work at GML (using LTSEM and the CSM) has shown that polymer extracted from sediment samples or diatom EPS analogues such as the bacterial EPS, Xanthum gum (Black <i>et al.</i>, 2001) differ in their sediment binding capacity and contribution to sediment stability. This may be due to the type of extraction method and sample preparation used (e.g. solvent extraction/rotary evaporation/freeze-drying; Perkins, unpublished), or it may be due to the nature and conformation of the EPS produced. Previous analyses (e.g. GC-MS; Taylor <i>et al.</i>, 1999) are insufficient in providing information beyond the composition of the polymer. This has been identified as a problem and gap in our knowledge. External funding has been applied for by DMP and ECD. 	
<p>Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external): Transfer of documents via e-mail. EstProc was also discussed at European forum meeting in February in St Andrews.</p>	
<p>Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc:</p>	

<p>Continue updating review and bibliography, analysis of studies using EPS (report to be produced on the variation in techniques and protocols).</p> <p>Experimental work looking at: 1) the effect of human disturbance (field sampling) on the recovery and dynamics of an intertidal mudflat, and 2) the influence of <i>Enteromorpha</i> on sediment erodibility and deposition.</p> <p>Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful:</p> <p>Yes. We could report on site-specific, biological features that influence stability of intertidal flats, and any preliminary results from the work outlined above.</p>	
<p>Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project: to be circulated</p> <p>Underwood G.J.C.1 & Paterson D.M. (2003) The importance of extracellular carbohydrate production by marine epipelagic diatoms. <i>Advances in Botanical Research</i> (in review).</p> <p>Hauton, C. & Paterson, D.M. A novel shear vane used to determine the evolution of hydraulic dredge tracks in sub-tidal marine sediments. <i>Estuarine, Coastal and Shelf Science</i> (In press).</p> <p>Tolhurst, T.J., Jesus, B., Brotas, V. and Paterson, D.M. Diatom migration and sediment armouring- An example from the Tagus Estuary Portugal. <i>Hydrobiologia</i> (in press).</p> <p>Olafsson J. S. and Paterson D.M.. Alteration of biogenic structure and physical properties by tube building chironomid larvae in cohesive sediments (Submitted)</p> <p>Mason C. F., G. J. C. Underwood, N. R. Baker, P.A. Davey, I. Davidson, A. Hanlon, S. P. Long, K. Oxenborough, D. M. Paterson, and A. Watson. (2003). The role of herbicides in the erosion of salt marshes in eastern England. <i>Environmental Pollution</i>, 122: 41-49.</p> <p>Consalvey, M., Tolhurst, T.J and Paterson, D.M. (2002). Intertidal biofilm recovery after simulated <i>in situ</i> disturbance event. <i>Estuarine and Coastal Shelf Science</i> (In press).</p> <p>Hagerthey, S.E, Paterson, D.M. and Kromkamp, J. (2002). Monitoring Estuarine Systems: The Eden Estuary and the BIOPTIS Programme. (In press)</p> <p>Defew, E.C., Tolhurst, T.J., Paterson, D.M. and Hagerthey, S.E. (2003) Can the stability of intertidal sediments be predicted from proxy parameters? An <i>in situ</i> investigation. (In press).</p> <p>Biles, C.L., Solan M., Isaksson I., Paterson, D.M., Emes., C. and Raffaelli, D.G. Flow modifies the effect of biodiversity on ecosystem functioning: an <i>in situ</i> study of estuarine sediments. <i>Journal of Experimental Marine Biology and Ecology</i>. (In press).</p> <p>Defew, E.C., Tolhurst, T.J. & Paterson, D.M. (2003). Site-specific features influence sediment stability of intertidal mudflats. <i>Hydrology and Earth Systems Science</i>. 6(6). 971-982.</p>	

Hagerthey, S.E., Defew, E.C. & Paterson, D.M. (2002). The influence of <i>Corophium volutator</i> and <i>Hydrobia ulvae</i> on intertidal benthic diatoms assemblages under different nutrient and temperature regimes. Marine Ecology Progress Series 245: 47-59.	
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Partner Organisation:	ABP Marine Environmental Research Ltd
Completed by:	P A Norton
Date completed:	March 2003

Work description	Identify any specific target dates or miletones
<p>Description of work completed in last 6-months (breakdown by task):</p> <p><u>Hydraulics</u> Completed review of raster-based methods used in flood models. Developed simplified hydraulic algorithm (FORTRAN code) for modelling wetting/drying with high resolution bathymetric data (LiDAR). Proved model on standard test cases used by de Boer (2000). Made trial application of raster model to site within Southampton Water with comparisons against 1D network model. Prepared draft internal report on investigations to date.</p> <p>Tasks in progress include non-linear analysis of time-series datasets, focussing on the Humber Estuary. Depending on progress, this work could also be presented at the next workshop.</p> <p>Improved modelling of bed roughness/near-bed stresses is also in progress and will be reported at the next workshop.</p> <p><u>Biology</u> First phase of fieldwork in Humber Estuary (winter campaign) completed in January including benthic sampling, analysis of organic content and particle size. In-situ measurements of sediment erodability also undertaken at each sample site. Analysis of invertebrate samples to be completed by end of March when data to be available to project partners.</p> <p><u>Sediments</u> Two-day workshop arranged for 12th/13th May. Expected attendance of 15 partners with up to 5 external invitees. Workshop to comprise a combination of talks and discussion sessions. Details of programme in preparation.</p> <p>Any problems identified:</p> <p><u>Hydraulics</u> Need to improve stability and computational efficiency of raster model algorithm, particularly with high resolution data.</p> <p><u>Biology</u> Fieldwork originally planned for December delayed whilst awaiting decision on additional fieldwork with Delft Hydraulics.</p>	<p>Report available June 2003.</p>

<p><u>Sediments</u> Difficulties arranging suitable date for workshop will delay report.</p>	
<p>Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external): <u>Biology</u> Involved SOES in fieldwork to provide sediment erosion data using their cohesive strength meter (CSM). <u>Data</u> Meeting with HRW to discuss collation of meta-data making use of Project Website.</p>	
<p>Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc: <u>Hydraulics</u> Further application of model to Abbot’s Hall site (LiDAR provided by HRW). Interaction with HRW planned during sediment workshop to discuss dendritic channel and bed stress modelling. <u>Biology</u> Prepare data report for distribution with winter dataset. Second phase of fieldwork in Humber Estuary planned for week commencing 14th July (summer campaign). <u>Sediments</u> Synthesise findings of discussion groups from workshop and report current practice for model set-up and field measurement. Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful:</p> <ul style="list-style-type: none"> • Raster Modelling of Tidal Creek Systems • Preliminary Findings from Sediment Workshop • Modelling Time-varying Bed Roughness • Data Collection in the Humber Estuary 	<p>Data Report available June 2003 Report available August 2003</p>
<p>Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project: Interim report on Raster Modelling (not circulated). Final report to include further case studies.</p>	<p>Report available September 2003</p>

Partner Organisation:	Delft Hydraulics
Completed by:	Ilka Tánzos
Date completed:	March 2003
Work description	Identify any specific target dates or miletones
Description of work completed in last 6-months (breakdown by task):	
<p><u>Task 2</u></p> <ol style="list-style-type: none"> 1. Inventory fine sediment processes shallow basins: tidal assymetry, lag effects, channel-shoal interactions, effect waves, effect settling flux, effects sediment-fluid interaction 2. Inventory fine-sediment processes in Humber 3. Set-up of hydro-sedimentological model Humber 4. Set-up sensitivity analysis <p><i>Any problems identified</i></p> <p><u>Task 3</u></p> <p>ESTPROC Task 3 Interactions between biological and sedimentary processes DH is developing a Delft3D model to quantify the interaction of currents, waves and sediment transport with saltmarsh vegetation. The biological processes influencing the sediment stability on intertidal areas in front of the saltmarsh will be included as well.</p> <p><u>Work completed:</u></p> <p>Contribution to ESTPROC workshop</p> <p>On December 20, 2002, Delft Hydraulics organised a workshop in order to exchange our ideas on modelling of bio-geomorphological interactions, data analysis and improvement of data availability within the framework of the ESTPROC project.</p> <p>Between February 24 and March 5, Delft Hydraulics organised a session on the modelling of vegetation interaction with the SWAN wave model. For this available field data of Delft Hydraulics and CCRU have been combined. CCRU has been provided with a SWAN case for the Dengie saltmarsh.</p> <p>Between September 2002 and July 2003 WL delft hydraulics will setup and calibrate a Delft3D model for the Paulina saltmarsh, especially including the impact of vegetation on waves and currents. This model is now in the calibration phase.</p> <p>Between January 2003 and July 2003 WL delft hydraulics will setup and calibrate a Delft3D model for the analysis of the impact of zoobenthos and algae on sediment stability and transport. This will mainly be based on the work of J. Widdows of PML. With this model large scale effects of biology on morphodynamics will be studied.</p> <p>Any problems identified:</p> <p>Availability of field data on sediment related effects of biology. Insufficient vegetation data for Dengie and Blackwater wave-modelling cases.</p>	

<p>Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external):</p> <p><u>Task 2</u> -Workshop in autumn 2002</p> <p><u>Task 3</u> Two workshops. Many discussions with ESTPROC colleagues</p>	<p>Minutes of the workshop</p>
<p>Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc:</p> <p><u>Task 2</u> Sensitivity analysis has started</p> <p><u>Task 3</u> Further progress in modelling, sensitivity analysis of impact of biota to sediment characteristics. Hopefully some additional monitoring. This will depend on the availability of additional budgets.</p> <p>Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful:</p> <p>Yes (both tasks)</p>	
<p>Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project:</p> <p><u>Task 2</u> Draft report on fine sediment processes, comments by K. Dyer are implemented</p> <p><u>Task 3</u> Wave attenuation by vegetation, March 2003. A report on Swan application to the Paulinaschor data (not circulated yet, see abstract).</p>	

Abstract

Wave attenuation by vegetation, March 2003. A report on Swan application to the Paulinaschor data

Measurements have been carried out at the Paulinaschor, a salt marsh in the Westerschelde, to obtain information of the effect of vegetation on wave attenuation. The data have been analyzed and it appears that wave height is strongly reduced by the vegetation, especially with low water depths. Further analysis of the data is done, to achieve wave energy dissipation. An attempt has been made to formulate a theoretical approach, which is suitable for calculating wave energy dissipation due to vegetation on the basis of certain vegetation characteristics such as stem diameter, plant height and plant density. This theory has been tested by a comparison that is made between the theoretical dissipations and the – so called – observed dissipations. This resulted in quite satisfying correlations; correlation coefficients of about 0.6 – 0.8 were calculated. By means of this analysis a friction coefficient is determined, describing the friction exerted by the vegetation. This coefficient depends on the various vegetation characteristics as mentioned before, but also on a second friction factor, that is more plant specific.

Subsequently, the wave model SWAN has been suited for modeling waves over vegetation areas. The Collins friction factor is used for calibration. Values for this factor turned out to be 2 orders of magnitude bigger than the default value, for bare bottoms. A further study to this Collins coefficient showed that this coefficient is, except for a constant factor, the same as the friction coefficient that was calculated on the basis of the various characteristics. With these calculated friction coefficients, converted to Collins coefficients, the SWAN model has been validated. The model results showed a good approach to reality. Only the wave attenuation at the edge of the salt marsh did not correspond very well with the observed attenuation. The cause for this was the fact that vegetation is modelled in SWAN through an enlarged bottom friction, instead of 3D obstacles. Also due to the fact that the development of the orbital velocity in the vegetation is not known exactly, deviances between model outcome and observed attenuation may occur.

Partner Organisation:	CCRU
Completed by:	T Spencer / I Moller
Date completed:	March 2003
Work description	
	Identify any specific target dates or miletones
<p>Description of work completed in last 6-months (breakdown by task): Modelling of wave attenuation using the SWAN model (setting up data files, calibration with CCRU datasets on wave attenuation, Essex coast, UK, sensitivity analyses) following appointment of project RA (Ms R Turner) in October 2002.</p> <p>Any problems identified:</p>	
<p>Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external):</p> <p>Internal: 19 - 20 December 2002: Modelling of bio-geomorphological interactions, WL Delft Hydraulics, Delft, NL; 23 February - 7 March 2003: SWAN Modelling workshop, WL Delft Hydraulics, Delft, NL</p>	
<p>Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc:</p> <p>Further collaboration with WL Delft Hydraulics (De Vries / Mol / Luijendijk), TU Delft (Booij), NIOO-CEMO (Bouma), HR Wallingford (Spearman / Tozer)</p> <p>Further modelling with a) SWAN and Delft 3D, with particular application to cliffed saltmarsh margins and incorporation of vegetation roughness (and its seasonal variability) and b) wave energy dissipation over unvegetated mudflats</p> <p>Data inputs: further analysis of CCRU wave dissipation datasets; acquisition of LiDAR for Essex coast if funds available from EstProc; investigating possible use of EA beach profile dataset for Essex coast.</p> <p>Data collection: additional field campaign in Essex UK if funds available from EstProc.</p>	

<p>Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful:</p> <p>Yes. Modelling wave attenuation at saltmarsh - mudflat boundaries</p>	
<p>Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project:</p> <p>Moller I and Spencer T 2002 Wave dissipation over macro-tidal saltmarshes: Effects of marsh edge typology and vegetation change. Journal of Coastal Research, Special Issue 36: 506-521. Not circulated</p>	

Partner Organisation:	School of Ocean and Earth Science, University of Southampton
Completed by:	Doros Paphitis
Date completed:	14 March 2003
Work description	
	Identify any specific target dates or miletones
<p>Description of work completed in last 6-months (breakdown by task):</p> <p><i>Hydrodynamic</i> Long term data sets, collected at Hythe (Southampton Water), have been analysed and a paper is currently being prepared.</p> <p><i>Sediments</i> The data on sediment threshold under sustained flow exposure were analysed and the manuscript was submitted to <i>Sedimentology</i>; waiting for the reviews.</p> <p><i>Biology Interactions</i> Data on the day-night variation of intertidal sediment stability are written up and following internal review the manuscript will be submitted. Data on the erosion threshold of fine-grained intertidal sandy sediments and their chl <i>a</i> / Extracellular Polymeric Substances (EPS) content, defined using <i>in-situ</i> temperature and salinity measurements are currently reanalysed towards a publication.</p> <p>Any problems identified: No</p>	
<p>Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external):</p> <p>The UoS participated in a field survey, with ABPmer, for the determination of the critical erosion threshold of intertidal sediments in the Humber Estuary.</p>	
<p>Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc:</p>	

<p>An in house data set relating to the influence of sediment sorting on bed erosion and subsequent sediment transport will be analysed.</p> <p>A short time-series deployment at Hythe (May 2003) will be carried out at a high frequency (4Hz) to examine the effect of boat generated waves on cliff retreat.</p> <p>Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful:</p> <p>Report on the “Day-Night Variation in Intertidal Sediment Erodability”.</p>	
<p>Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project:</p> <p>Paphitis, D. and Collins, M.B. The Threshold of Motion of Sands, subjected to Different Pre-threshold Velocities and Flow Durations: An Experimental Study into ‘Stress History’. <i>Sedimentology</i> (Submitted).</p> <p>Pérez, D.E., Perillo, G.M.E. and Paphitis, D. Initial instability and selective transport of sand-sized mixtures: a laboratory investigation. <i>Sedimentology</i> (Submitted).</p> <p>Paphitis, D. and Collins, M.B. Settling Velocities, Pivoting Angles and Entrainment Thresholds of Fluvial and Marine Gravels: An Experimental Study. Water Resource Research (To be submitted in March)</p> <p>Friend, P.L., Collins, M.B., and Holligan, P.M. Semi-diurnal variation of intertidal flat sediment properties related to sediment stability. <i>Estuarine, Coastal and Shelf Science</i> (To be submitted in March).</p> <p>These have not yet been circulated within the Project.</p>	

Partner Organisation:	Digital Hydraulics Holland BV	
Completed by:	N. Booij	
Date completed:	March 2003	
Work description	Identify any specific target dates or miletones	
<p>Description of work completed in last 6-months (breakdown by task):</p> <p>Assist colleagues within EstProc in wave modelling, in particular the use of the SWAN model. Assist in developing formulations suitable for wave modelling in estuaries, in particular in areas with vegetation.</p> <p>Any problems identified:</p> <p>Present dissipation formulations in SWAN are unsuitable for flexible vegetation, and for vegetation height of the order of magnitude of the depth.</p>		

<p>Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external):</p> <p>Participation in a meeting at Delft Hydraulics in December 2002, and in a number of meetings at Delft Hydraulics in February and March 2003 aimed at modelling waves on the Dengie Flat (UK) and the Paulinaschor (the Netherlands).</p>	
<p>Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc:</p> <p>Verification of a preliminary formulation of wave dissipation with data from Dengie, Paulinaschor and lab. experiments</p> <p>Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful:</p> <p>Wave attenuation in areas with flexible vegetation</p>	
<p>Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project:</p> <p>Draft report on a model of wave dissipation in areas with vegetation; circulated among researchers present at the above meetings at Delft Hydraulics.</p>	

Partner Organisation:	CEFAS
Completed by:	Stefan G. Bolam
Date completed:	March 2003
Work description	Identify any specific target dates or milestones
<p>Description of work completed in last 6-months (breakdown by task):</p> <p>A report has been written entitled “Spatial patterns of estuarine macrobenthic assemblages : relationships with hydrodynamic regime”. This report reviews the current understanding of the relationships between estuarine macrofaunal community structure and hydrodynamic regime. The review uses case studies from 3 estuaries from within the UK. In summary, information has been concentrated on the relationships between the spatial variability of communities with static sediment variables and relatively poor correlations have been established. Consequently, our predictive capability of estuarine macrofaunal community structure/ species distributions is poor.</p> <p>Any problems identified:</p> <p>No specific problems.</p>	

<p>Interactions with other partners in last 6-months, relevant meetings attended (internal to project and external):</p> <p>Contact with John Widdows concerning references. The draft report has been sent to J. Widdows and D. Paterson for comments.</p>	
<p>Outline of work planned for next 6-months including requirements for collaboration, modelling results, data inputs etc:</p> <p>CEFAS is to produce another report for Year 2 on the effects of anthropogenic disturbances (dredging, dredged material disposal) on estuarine macrofaunal community structure. In particular, the effect on key macrofaunal species (bio-stabilisers/ destabilisers) will be highlighted.</p> <p>Will you be ready to report results at the workshop scheduled for week of 9 June 2003 in St Andrews, if so an indication of topic would be helpful:</p> <p>I could present an overview of the Year 1 report findings (above), but I am at sea for the first 2 weeks of June so I doubt I can attend.</p>	
<p>Reports/papers produced in last 6-months; please indicate whether these have been circulated within the project:</p> <p>Report = “Spatial patterns of estuarine macrobenthic assemblages : relationships with hydrodynamic regime”, this has been circulated to R. Whitehouse, J. Widdows, D. Paterson.</p>	