BEACHES AT RISK PROJECT

FINAL SCIENCE REPORT FOR PHASE II

GEOMORPHOLOGY

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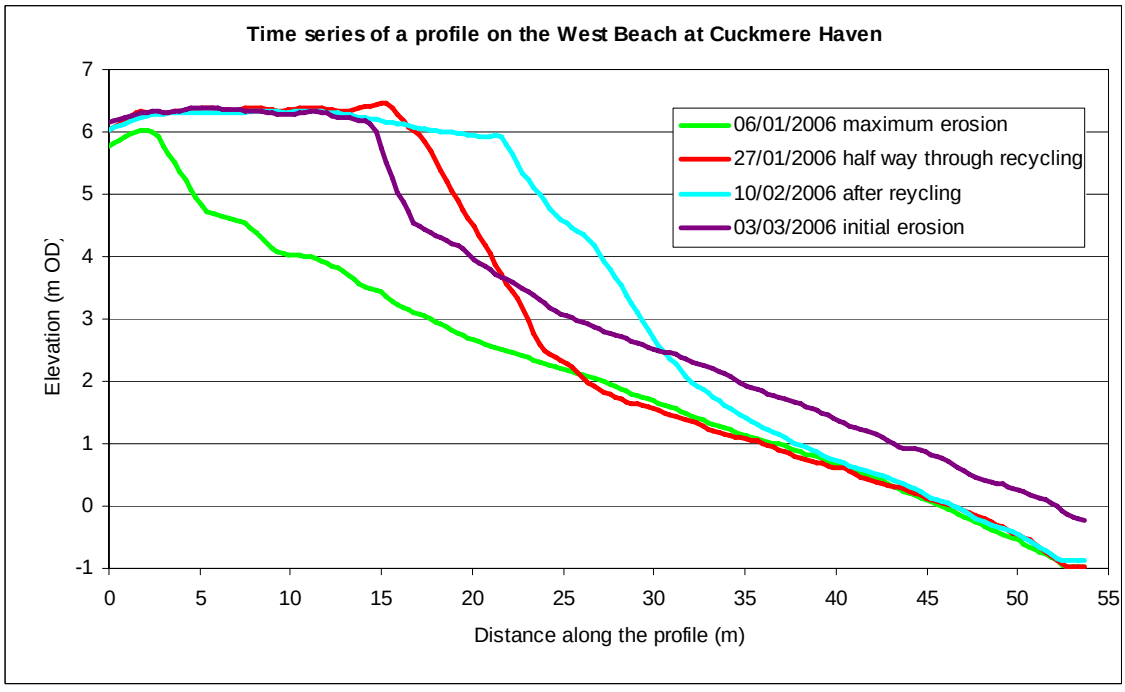

Cover illustration: Profiles covering 2 months at the beginning of 2006 illustrate the difficulties associated with beach recharging that involves adding material to the upper part of the beach profile (06 January to 10 February). The material is rapidly redistributed and the pre-recharge profile is reached only a few months after the management intervention. Profile location is ~10m west of the western groyne on Cuckmere Haven west beach.

Introduction

Phase II of the BAR project was initially designed to be a phase of intensive data collection followed by data analysis in Phase III. Due to funding constraints, Phase III has been shortened and redesigned and this has meant that data analysis has been brought forward into Phase II whilst trying not to jeopardise the unique opportunity of the BAR project to collect long data records. This has been a difficult balancing act and some analysis, especially of data collected right up to the end of Phase II will not form part of this report but it is hoped that it will be incorporated into Phase III. The depth of analysis is also more limited than was hoped in some cases due to time constraints. However, all of the primary data will be in the public domain by the end of Phase II so that further and alternative analysis can be carried out either by members of the BAR research team or other interested researchers. The data collected during Phases I and II that form the basis for the reports and manuscripts are available from the BAR website at http://www.geog.sussex.ac.uk/BAR/ .

The results of most of the ongoing analyses that have been carried out have been submitted to scientific journals. Rather than converting these into report format, they are referenced in the overview section: '1. Progress from Phase I' and added to the Appendix; they will eventually be replaced in Phase III by the final published articles. In addition, during Phase III a special volume of the scientific journal Zeitschrift fur Geomorphologie, edited jointly by Cherith Moses at the University of Sussex and Arnaud Hequette at the Université du Littoral Cote d'Opale, will be published. This will be a benchmark volume on the dynamics of the beacheds on the Eastern Channel coasts and will incorporate the results of research conducted during Phases I and II of the BAR project.

Appendix A contains the Reports, papers and abstracts from the UK team; Appendix B contains posters present by the UK and French team during Phase 2; Appendix C contains papers and abstracts from the French team. The enclosed CD contains presentations given during Phase 2.

1 Progress from Phase I

The main progress since Phase I has been made in the fields of beach behaviour and longshore transport, the temporal variation in the rate of cliff retreat, the erosion of the chalk platform, long-term changes to the width of the intertidal area and advances in understanding surges in the English Channel. Each section below provides a short summary and refers to the detailed documents in Appendix A.

1.1 Cliff retreat

The investigations into long-term cliff retreat rate for the Southeast of England that were produced during Phase I (Dornbusch et al., 2006a) have been published in a detailed map in the Journal of Maps (Dornbusch et al., 2006b). The publication in this web-based journal means that the results are freely available in the pubic domain. Following on from the long-term perspectives on cliff retreat, the investigation into variations in the rate of chalk cliff retreat has taken the tasks outlined at the end of the Phase I report further by not only providing a similar short and recent time slice (1973 to 2001) to that used by the French colleagues (1966-1995) but also by including additional periods based on historic maps. This has provided interesting results showing that the rate of cliff retreat on the UK side has declined and is now ~25% lower than the average for the preceding 100 years. The results of

this investigation have been written up in Dornbusch et al. (submitted-a) for the journal Marine Geology. Investigations into the cause of this decrease have also added to knowledge of the factors that control cliff retreat, highlighting the role of beaches and of the width of the shore platform. However, though new insights have been gained into temporal variations, the subject of controls on the spatial variability of cliff retreat requires further research.

1.2 Platform erosion

Many of the shingle beaches of the Eastern Channel coasts lie on chalk shore platforms whose erosion (downwearing) has important consequences for beach dynamics. To enhance our understanding of the erosion dynamics of these platforms, during Phase II a review of chalk shore platform downwearing was carried out, synthesising a range of platform erosion studies (Moses, 2006). The chalk shore platforms of the Eastern Channel coast are the most rapidly downwearing platforms in Northwestern Europe. Those of East Sussex are the most intensively studied in the world in terms of measuring downwearing using micro-erosion meters (MEM) and laser scanners. They represent type sites providing a unique opportunity to compare and assess the results of the different techniques that have been used to infer and quantify downwearing rates, from the earliest inferences based upon morphology to the latest innovative photogrammetric techniques. The report documents the results of existing studies and presents the results of pioneering new work using photogrammetry carried out during Phase II (see paragraph below). Different techniques yield quite different downwearing rates. For example, at Peacehaven in East Sussex MEM studies carried out over the period summer 1999-2002 yield a rate of 1.494 ± 4.066 mm/year whilst photogrammetry covering the period 1973-2001 has yielded a rate of 20-60 mm/year. It is possible that photogrammetry yields higher rates because it also incorporates meso-scale erosion of steps on the platform whilst the MEM only measures micro-scale erosion on the rock surface. The report investigates the different methods that have been used to infer and measure platform erosion and addresses relationships between platform erosion and lithology, weathering, wave action, beach material, ecology, rockfalls and engineering structures. The report is the basis for a scientific publication in Zeitschrift für Geomorphologie (Moses et al., submitted).

An understanding of shore platform erosion is also important for coastal managers concerned with the construction and maintenance of coastal defence structures. As a starting point the capabilities of photogrammetry for studying the changing nature of shore platforms have been investigated. Elevations derived from photogrammetry were compared with elevations derived from ground surveys and examples provided for differences in platform elevation between 1973 and 2001. The results of this investigation were presented at CoastGis conference in Aberdeen in 2005 and they can be found in Dornbusch et al. (2005) and will also appear in an abridged version in Dornbusch et al. (in press).

Following on from these encouraging results a comparative study of platform erosion in front of coastal defence structures of different ages was carried out (Dornbusch et al., submitted-c). Conclusions from this research have also contributed to the BAR investigations into changing rates of cliff retreat since platforms, beaches and cliffs are linked in the coastal system. Results show that erosion of the intertidal chalk platform is generally very slow with most of the erosion on the lower part of the platform being due to the incision and widening of existing runnels. In the upper part significant erosion can occur through a block-removal mechanism that affects layers of several tens of centimetres thickness by backward erosion of steps. These steps often represent individual beds within the chalk. The highest erosion of more than 1m over <30 years is found in front of seawalls or around the tip of groynes and it

is argued that the use of heavy machinery on the platform during construction has contributed significantly to this high rate. This is evidenced by enhanced erosion that has occurred along the track over which the construction vehicles traversed the platform. Information on vehicle track erosion at another site has resulted in a short report on platform erosion at Hope Gap where only weakly incised vehicle tracks can be seen in the field (Dornbusch, 2006).

1.3 Beach behaviour

Beach behaviour has been the main focus of the geomorphological investigations during Phases I and II of BAR. Investigations into beach behaviour include changes of surface sediment characteristics, longshore transport measurements using tracers, depth of the active layer using depth of disturbance columns, and beach volume changes using detailed topographic surveys. The time-scale of these investigations ranges from changes occurring over just one tide to repeat surveys that span more than 3 years. Insights into beach behaviour are significant due to the long-term monitoring that, in the case of Cuckmere Haven, has covered more than 3 years on a monthly basis. The inclusion of a variety of beaches will make an in-depth analysis possible, e.g. the surveys at Cuckmere Haven include four recycling events. The long running surveys are important because they allow inter-annual comparison. The behaviour of the beach – channel – delta system at Cuckmere Haven for example shows similarities between some years but, particularly during 2006, the system has behaved very differently from the preceding years. Despite the long time series no major storm events have occurred and the curtailment of Phase III has removed the chance to capture extreme events.

1.3.1 Beach surface sediments

Part of the complex behaviour of mixed beaches is the spatial and temporal change of the surface sediment cover that occurs from one tide to the next. Watt el at. (2006) include a first analysis of data from Pevensey collected during Tamsin Watt's DPhil research. The beach below a zone of active mixing by waves is composed of a densely packed sand and gravel mix. From this source material wave activity sorts out different grain sizes depending on the wave conditions. The patterns that can be observed are related to the high tide berm and beach face below. In contrast to studies on pure gravel beaches, the high tide berm is composed of finer material than the beach face below. High wave conditions lead to the creation of a beach face that is more homogenous, i.e. less grains size variations, than during low or moderate wave conditions. These results agree with observations made on the other beaches surveyed. Information on average conditions and the behaviour of beaches between the groynes at Saltdean can be found in Dornbusch et al. (submitted-b).

1.3.2 Longshore transport using tracers

Following on from the experiments with tracers in Phase 1 and the experiences gained at the field site in Cayeux, France, a two week experiment was carried out in November 2005 as part of Jerome Curoy's DPhil research. The experiment involved the release of tracers every second low tide and an extensive search during the following low tide. The tracer experiment was complimented by detailed topographic surveys at every low tide and measurement of the thickness of the active layer using depth of disturbance columns. The extensive data set has not yet been fully analysed but first results are documented in Curoy et al. (submitted-a; submitted-b). Two similar experiments, though of shorter duration have been carried out at Birling Gap in March 2006 and December 2006. Results of these experiments will be incorporated into Phase III.

1.3.3 Beach volume change

Volume change on beaches has been calculated from surveys on a tidal basis by Jerome Curoy at Birling Gap and Cayeux and over periods of days at Pevensey. The sites at Cayeux and Pevensey are very similar in that prior to the start of the survey period, substantial amounts of recharge material had been placed on the beaches, thus creating 'unnatural' profile shapes that were eroded quickly. Results on these studies will become available in Phase III as part of the ongoing research work of Jerome Curoy. These short term measurements are supported by measurements on a predominantly monthly basis at Birling Gap, Saltdean, Telscombe, Newhaven and Cuckmere Haven which all include information on beach surface material too.

Surveying at the field site at Saltdean began in July 2003 and finished in January 2005, although there is a follow up survey in August 2006. The results of the volume change surveys show some remarkable results, as documented in Dornbusch et al. (submitted-b). The main findings are that the survey and analysis methodology allows the detection of beach surface elevation changes of <0.03 m. This level of accuracy has made it possible to detect trends in beach volume for the beaches adjacent to rock groynes. The results show that these groynes are permeable to the beach sediment at a near constant rate. Width between the groynes determines the magnitude of volume change but does not influence the distribution pattern. The beaches between concrete groynes show a straighter arrangement of contour lines on the beach than those on beaches with rock groynes. The latter show a concave shape of the contour lines, which means that in the middle of the beach wave action reaches further landwards than on the beaches between concrete groynes, potentially increasing the risk of the sea reaching the sea wall at the back.

Analysis for Newhaven has been started only shortly before the end of Phase 2 but shows dramatic changes that involve beach elevation variations close to the harbour arm of >8m and material movements of ~16,000m³ from at ~100m long section just west to the harbour arm in one event (Dornbusch, 2007a).

The driver for beach volume change is waves which, when arriving obliquely to the beach, generate longshore transport. The exchange of beach material between the western and eastern halves of the beaches at Saltdean and their relationship to waves is investigated in the report "Additional beach behaviour analysis for Saltdean: longshore transport investigation" (Dornbusch, 2007b). Though there is a good agreement between the longshore wave power calculated from the incoming waves and the beach volume distribution within the groyne bays, no predictive quantitative relationship has been found so far. It is argued that a non-linear relationship exists and the available data would appear to make it very difficult to be more precise.

1.4 Intertidal width

Aided by the digitising carried out for the cliff retreat work, an assessment of the long-term development of the width of the intertidal area has been carried out for the whole English study area. It has provided very valuable information for assessing the use of historic maps in coastal studies and the impact of these results on coastal management. Contrary to previous research, the change of the position of the low water line seems to be small and the landward movement of the line is most likely linked to sea level rise that the region has experienced over the past century. At the same time cliffs have retreated, which in many places has counterbalanced the amount of landwards movement of the low water line leading, in effect, to a widening of the intertidal area. For those sections of the coast that are not cut in rock (the shingle barriers associated with extensive sandy foreshores), the movement of tide lines cannot in most cases be measured from maps. This is because changes in the elevation of the sandy foreshore can occur at a range of time scales and so the changes recorded on maps cannot show a reliable trend. The results of this investigation

are documented in Dornbsuch et al. (submitted-a).

1.5 Waves and tides

The analysis of tide records and identification of surges has continued in transnational co-operation lead by Paolo Pirazzoli (Pirazzoli et al., 2006). During Phase II, ABPmer have approached the issue from the modelling perspective (Swift, submitted; Swift and Harris, 2006). The collection of wave data that started in Phase I has continued and has also been expanded to include directional wave data using a MIDAS directional wave buoy that was placed in the intertidal zone at Telscombe, Birling Gap and Pevensey. Data from the latter two deployments are used in Jerome Curoy's research work and their analysis will be presented in Phase III. An overview over data available and some initial analysis can be found in Dornbusch (2007c)

1.6 Beach management

The co-operation with project partners has led to a compilation of data on past and present beach recharge and recycling activities along the Sussex and Kent coast (Moses and Williams, Submitted) that provides a regional overview of the importance and financial value of this type of coastal defence.

A wider view including the English and French BAR coast as well as the different types of coast is taken by Robinson and Costa (submitted) that also discusses the different management policies and strategies on both sides of the channel.

Clarke and McFarland (submitted) on the other hand focus on a recharge case study at Tankerton in Kent where different groyne bays have been filled with different types of sediment. Their behaviour has been studied to aid future beach management decisions.

2 References:

Clarke, J. and McFarland, S., submitted. Practical aspects of the design and execution of renourishment schemes on mixed beaches. Zeitschrift für Geomorphologie, N.F.

Curoy, J., Dornbusch, U., Moses, C., Robinson, D. and Williams, R., submitted-a. Cross-shore and longshore transport of tracer pebbles on a macrotidal mixed sediment beach, Somme Estuary, France, Coastal Sediments 2007, New Orleans.

Curoy, J., Dornbusch, U., Robinson, D. and Moses, C., submitted-b. Beach profile evolution and active layer measurements on a macrotidal mixed sediment beach, Somme Estuary, France. Zeitschrift für Geomorphologie, Supplement Band.

Dornbusch, U., 2006. Phase 2 report: Platform erosion at Hope Gap.

Dornbusch, U., 2007a. Phase 2 report (unfinished): Survey analysis for Newhaven.

Dornbusch, U., 2007b. Phase 2 report: Additional beach behaviour analysis for Saltdean: longshore transport investigation.

Dornbusch, U., 2007c. Phase 2 report: Report on wave data.

Dornbusch, U., Moses, C., Robinson, D. and Williams, R., submitted-a. Spatial and temporal variations of the chalk cliff retreat rate in East Sussex, 1873 to 2001. Marine Geology.

Dornbusch, U., Robinson, D., Moses, C. and Williams, R., submitted-b. Variation in beach behaviour in relation to groyne spacing and groyne type for mixed sand and gravel beaches, Saltdean, UK. Zeitschrift für Geomorphologie, Supplement Band.

Dornbusch, U., Robinson, D., Moses, C. and Williams, R.B.G., 2005. Soft copy photogrammetry to measure shore platform erosion on decadal time scales. In: D. Green (Editor), CoastGis, Aberdeen.

Dornbusch, U., Robinson, D., Moses, C. and Williams, R.B.G., 2006a. Chalk coast erosion and its contribution to the shingle budget in East Sussex. Zeitschrift für Geomorphologie, Supplement Volume, 144: 215-230.

Dornbusch, U., Robinson, D., Moses, C. and Williams, R.B.G., in press. Soft copy photogrammetry to measure shore platform erosion on decadal time scales. In: D. Green (Editor), Coastal and Marine Geospatial Technologies. Coastal Systems and Continental Margins. Springer.

Dornbusch, U., Robinson, D., Moses, C., Williams, R.B.G. and Costa, S., 2006b. Retreat of Chalk cliffs in the eastern English Channel during the last century. Journal of Maps, http://www.journalofmaps.com, 2006: 71-78.

Dornbusch, U., Robinson, D., Williams, R. and Moses, C., submitted-c. Chalk shore platform erosion in the vicinity of sea defence structures and the impact of construction methods. Coastal Engineering.

Moses, C., 2006. BAR Phase 2 report: Recent advances in understanding chalk shore platform downwearing: a review.

Moses, C. and Williams, R., Submitted. Artificial beach recharge: the South East England experience. Zeitschrift für Geomorphologie, N.F.

Moses, C., Williams, R., Robinson, D. and Dornbusch, U., submitted. Recent advances in chalk shore platform downwearing: implications for management of the Eastern Channel coasts. Zeitschrift für Geomorphologie, N.F.

Pirazzoli, P.A., Costa, S., Dornbusch, U. and Tomasin, A., 2006. Recent evolution of surge-related events and assessment of coastal-flooding risk on the eastern coasts of the English Channel. Ocean Dynamic, March 2006: 1-15.

Robinson, D. and Costa, S., submitted. Coastal management in relation to geomorphological form and process along the Eastern Channel coast: comparisons between England and France. Zeitschrift für Geomorphologie, N.F.

Swift, R., submitted. Secular trends in tidal parameters along and near to the BAR coastline. Zeitschrift für Geomorphologie, Supplement Band.

Swift, R. and Harris, J., 2006. BAR Phase 2 report: Storm Surge Modelling: propagation of tidal surges through the English Channel.

Watt, T., Dornbusch, U., Moses, C. and Robinson, D., 2006. Measuring cross-shore sediment transport on mixed shingle beaches using GPS survey techniques, Proceedings of the Fifth Coastal Dynamics International Conference held in Barcelona, Spain from April 4-8, 2005. American Society of Civil Engineers, Barcelona.

3 Appendix A: Reports and papers UK side

Appendix A contains detailed reports, copies of journal papers or conference proceedings and *abstracts of conference contributions and journal papers in preparation (indicated in italics)*.

They are arranged in the order of the overview of the main report with those not linked to the main report following at the end.

Cliff retreat

Dornbusch, U., Robinson, D., Moses, C. and Williams, R.B.G., 2006. Chalk coast erosion and its contribution to the shingle budget in East Sussex. Zeitschrift für Geomorphologie, Supplement Volume, 144: 215-230.

Dornbusch, U., Robinson, D., Moses, C., Williams, R.B.G. and Costa, S., 2006. Retreat of Chalk cliffs in the eastern English Channel during the last century. Journal of Maps, http://www.journalofmaps.com, 2006: 71-78.

Dornbusch, U., Moses, C., Robinson, D. and Williams, R., submitted a. Spatial and temporal variations of the chalk cliff retreat rate in East Sussex, 1873 to 2001. Marine Geology.

Platform erosion

Dornbusch, U., Robinson, D., Moses, C. and Williams, R.B.G., 2005. Soft copy photogrammetry to measure shore platform erosion on decadal time scales. In: D. Green (Editor), CoastGis, Aberdeen.

Dornbusch, U., Robinson, D., Williams, R. and Moses, C., submitted-c. Chalk shore platform erosion in the vicinity of sea defence structures and the impact of construction methods. Coastal Engineering.

Dornbusch, U., 2006. Phase 2 report: Platform erosion at Hope Gap.

Moses, C., 2006: Phase 2 report: Recent advances in understanding chalk shore platform downwearing: a review.

Moses, C., Williams, R., Robinson, D. and Dornbusch, U., submitted. Recent advances in chalk shore platform downwearing: implications for management of the Eastern Channel coasts. Zeitschrift für Geomorphologie, N.F.

Beach behaviour: surface material change

Watt, T., Dornbusch, U., Moses, C. and Robinson, D., 2006. Measuring cross-shore sediment transport on mixed shingle beaches using GPS survey techniques, Proceedings of the Fifth Coastal Dynamics International Conference held in Barcelona, Spain from April 4-8, 2005. American Society of Civil Engineers, Barcelona.

Watt, T. 2006: A Quantitative Tool For Mixed Beach Dynamics. Presentation slides given at the BAR Phase II meeting March 2006

See also Dornbusch et al. in the following section

Beach behaviour: beach volume change

Dornbusch, U., Robinson, D., Moses, C. and Williams, R., submitted-b. Variation in beach behaviour in relation to groyne spacing and groyne type for mixed sand and gravel beaches, Saltdean, UK. Zeitschrift für Geomorphologie, Supplement Band.

Dornbusch, U., 2007a. Phase 2 report (unfinished): Survey analysis for Newhaven.

Dornbusch, U., 2007b. Phase 2 report: Additional beach behaviour analysis for Saltdean: longshore transport investigation.

Curoy, J., Dornbusch, U., Moses, C., Robinson, D. and Williams, R., submitted-a. Cross-shore and longshore transport of tracer pebbles on a macrotidal mixed sediment beach, Somme Estuary, France, Coastal Sediments 2007, New Orleans.

Curoy, J., Dornbusch, U., Robinson, D. and Moses, C., submitted-b. Beach profile evolution and active layer measurements on a macrotidal mixed sediment beach, Somme Estuary, France. Zeitschrift für Geomorphologie, Supplement Band.

Intertidal width

Dornbusch, U., Moses, C., Robinson, D. and Williams, R., submitted-a. Temporal and spatial variations of the chalk cliff retreat rate in East Sussex, 1873 to 2001. Marine Geology.

Waves and tides

Dornbusch, U., 2007c. Phase 2 report: Report on wave data.

Pirazzoli, P.A., Costa, S., Dornbusch, U. and Tomasin, A., 2006. Recent evolution of surge-related events and assessment of coastal-flooding risk on the eastern coasts of the English Channel. Ocean Dynamic, March 2006: 1-15.

Swift, R. and Harris, J., 2006. BAR Phase 2 report: Storm Surge Modelling: propagation of tidal surges through the English Channel.

Swift, R., submitted. Secular trends in tidal parameters along and near to the BAR coastline. Zeitschrift für Geomorphologie, Supplement Band.

Beach management

Moses, C. and Williams, R., Submitted. Artificial beach recharge: the South East England experience. Zeitschrift für Geomorphologie, N.F.

Robinson, D. and Costa, S., submitted. Coastal management in relation to geomorphological form and process along the Eastern Channel coast: comparisons between England and France. Zeitschrift für Geomorphologie, N.F.

Clarke, J. and McFarland, S., submitted. Practical aspects of the design and execution of renourishment schemes on mixed beaches. Zeitschrift für Geomorphologie, N.F.

4 Appendix B: Posters UK and French side

Appendix B contains copies of posters that were produced during Phase 2.

Anthony, E. J. and M. Sedrati 2006: Morphodynmics of intertidal bars on wave-tide-dominated beaches: examples from northern France. *British Geomorphological Research Group, 28-30 June 2006*, Loughborough

Curoy, J et al, 2005: Longshore drift on the Sussex and Kent coasts: natural tracer experiments. BAR meeting January 2005, Dunkerque

Dornbusch, U. et al, 2005: Calculating longshore transport rates from topographic beach surveys using GPS and GIS. BAR meeting January 2005, Dunkerque

Dornbusch, U. et al, 2005: Chalk cliff retreat along the Eastern Channel coasts and possible controls. BAR meeting January 2005, Dunkerque

Dornbusch, U. et al, 2005: Laboratory abrasion of grey flints, recharge material, shingle-sand and shingle-gravel mixtures. BAR meeting January 2005, Dunkerque

Dornbusch, U. et al, 2005: Longshore transport on the Cayeux Spit. BAR meeting January 2005, Dunkerque

Gillespie, F. 2005: Management problems of dune systems on the East Sussex and Kent coastlines. BAR meeting January 2005, Dunkerque

Low, E. et al, 2005: Response of shingle beach plants to predicted climate change. BAR meeting January 2005, Dunkerque

Sedrati, M. and E. J. Anthony 2006: Morphodynmics of intertidal bars on wave-tide-dominated beaches: examples from northern France. *British Geomorphological Research Group, 28-30 June 2006*, Loughborough

5 Appendix C: Papers and abstracts French side

Sand dunes and beach dune sediment exchange

Anthony, E.J., Vanhee, S. and Ruz, M.-H., 2006. Short-term beach-dune sand budgets on the north sea coast of France: Sand supply from shoreface to dunes, and the role of wind and fetch. Geomorphology, 81(3-4): 316-329.

Ruz, M.-H., Anthony, E.J. and Faucon, L., 2005. Coastal dune evolution on a shoreline subject to strong human pressure : The Dunkirk area, Northern France., Dunes & Estuaries 2005, International Conference on Nature restoration practices in European coastal habitats, Koksijde, Belgium, 19-23 September 2005,, pp. 441-449.

Ruz, M.-H., 2005. Influence of high water levels on the evolution of an upper beach/dune system, Wissant Bay, Northern France, 5th International Conference on Coastal Dynamics, April 2005, Barcelona, Spain, pp. Book of Abstracts, p. 400-401.

Sand beach morphodynamics

Aernouts, D. and Héquette, A., 2006. L'évolution du rivage et des petits fonds en Baie de Wissant pendant le XXè siècle, Pas-de-Calais, France. Géomorphologie : relief, processus et environnement(1): 49-64.

Chaverot, S., Héquette, A. and Cohen, O., 2005. Evolution of climatic forcings and potentially eroding events on the coast of Northern France. 5th International Conference on Coastal Dynamics. In: A. Sanchez-Arcilla (Editor), 5th International Conference on Coastal Dynamics, April 2005. American Society of Civil Engineers, Barcelona, Spain, pp. 11p.

Héquette, A., Hemdane, Y. and Anthony, E.J., 2005. Determination of sediment transport paths on a macrotidal shoreface: comparison of the "Gao and Collins" method with near-bed current measurements. In: A. Sanchez-Arcilla (Editor), 5th International Conference on Coastal Dynamics, April 2005. American Society of Civil Engineers, Barcelona, Spain, pp. 11p.

Héquette, A., Chaverot, S., Aernouts, D., Cohen, O. and Ruz, M.-H., 2005. Recent evolution of the coastline of Nord-Pas-de-Calais, France : An assessment of natural and human induced changes. In: C. Baeteman (Editor), Late Quaternary Coastal Changes: Sea Level, Sedimentary Forcing and Anthropogenic Impacts, INQUA-IGCP 495 Meeting, 28 June - 2 July 2005. Belgian Geological Survey, Royal Belgian Institute of Natural Sciences, Dunkerque, France, pp. Abstract Book, p. 28.

Reichmüth, B. and Anthony, E.J., 2005. Morphodynamic mobility of intertidal bars on a macrotidal 'ridge and runnel' beach, Dunkerque-Est, Côte d'Opale, Northern France. In: A. Sanchez-Arcilla (Editor), 5th International Conference on Coastal Dynamics, April 2005. American Society of Civil Engineers, Barcelona, Spain, pp. 13p.

Sedrati, M. and Anthony, E.J., 2005. The role of longshore currents in intertidalbar mobility on a macrotidal beach under high-energy wave conditions, Dune d'Amont, Wissant Bay, Northern France. In: A. Sanchez-Arcilla (Editor), 5th International Conference on Coastal Dynamics, April 2005. American Society of Civil Engineers, Barcelona, Spain, pp. 14p.

Chalk cliff retreat

Costa, S., Laignel, B., Hauchard, E. and Delahaye, D., 2006. Facteurs de répartition des entonnoirs de dissolution dans les craies du littoral du Nord-Ouest du Bassin de Paris. Zeitschrift für Geomorphologie, N.F., 50(1): 95-116.

Gravel beach dynamic

Costa, S., Hénaff, A. and Lageat, Y., 2006. The gravel beaches of north-west France and their contribution to the dynamic of the coastal cliff-shore platform system. Zeitschrift für Geomorphologie, Supplement Volume, 144: 199-214.

Costa, S., Levoy, F., Monfort, O., De Saint Leger, E. and Delahaye, D., submitted. Le rôle de la fraction sableuse sur le fonctionnement morpho-sédimentaire des plages de galets (Haute-Normandie, Manche orientale). Zeitschrift für Geomorphologie, Supplement Band.

River inputs into the coastal zone

Laignel, B., 2006. Characterization and erosive dynamics of geosystems on chalk substratum. Examples of the Western Paris Basin and North Western Europe., USGS 1 February 2006, Austin, Texas.

Laignel, B., 2006. Bilan d'érosion et fonctionnement hydrologique des bassins versants à partir des enregistrements haute fréquence dans les eaux de surface. Exemple du système Ouest Bassin de Paris - Manche, Conférence, Université de Béjaia (Algérie), 6-7 November 2006.

Laignel, B. and Massei, N., 2006. Hydro-sedimentary transfers in the karstified chalky watersheds in the Western Paris Basin - Channel system., Fifth FRIEND World Conference, UNESCO Program. Water Resource Variability: Processes, Analyses and Impacts., Havana (Cuba), 27/11 to 1/12 2006.

Lequien, A., Durand, A. and Dupont, J.P., 2005. Continuous water monitoring on three coastal watersheds in Haute Normandie: an approach to integrated river basin management., EWRA 6th international conference: "sharing a common vision for our water resources", 7-10 September 2005, Menton, France.

Lequien, A. et al., 2006. High frequency monitoring to identify factors controlling sediment yields in small river basins (Western Paris Basin, France), RST du 4-8 décembre 2006, Dijon.

Lequien, A. et al., submitted. High temporal resolution monitoring for a better understanding of factors that control sediment yields within small-sized river basins of the Western Paris Basin, France. Earth Surface Processes and Landforms.