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THEMATIC SECTION I

Summary of Papers on Predicting Aggregated-Scale Coastal Evolution

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ABSTRACT

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Coastal evolution puts many questions, both to coastal engineers as well as to scientists. The project PACE (Predicting Aggregated-Scale Coastal Evolution) is a successful project in which they both meet. This paper puts the overview papers of the project into perspective and highlights the results. Despite the progress has been made both from modeling as well as from data-analysis point of view we still have no uniform concepts for predictions. Scales play a role in all approaches and therefore they seem a promising linking basis.

ADDITIONAL INDEX WORDS: *Coast, coastal seas, morphology, data, modelling.*

INTRODUCTION

The project PACE (Predicting Aggregated-Scale Coastal Evolution), within the EU-funded marine Science and Technology Programme, has produced many new insights into the prediction of large-scale coastal behaviour. DE VRIEND (2003) gives and overview of the PACE-project and its structure. The progress of PACE has been laid down in a significant number of in-depth scientific publications, but these were all focused on certain aspects.

The collection of papers presented in this volume takes a broader view on what has been achieved in the PACE project and what it may mean in terms of practical use. In particular, it aims at exploring whether a uniform approach can be expected, either in modeling or in data-analysis. Second aim is to find out if recent work gives a clue whether it is useful to have so many different approaches.

This paper is organized as follows. Section 2 describes data analysis techniques. Next, section 3 reviews current and new views on coastal evolution at various scales. The significance of stability models is explained by their link with rhythmic features. The final section shortly summarizes the conclusions.

DATA ANALYSIS

Field data analysis techniques, in relation with modeling, are described in two companion papers, both concerning yearly to decadal time scales. LARSON *et al.* (2003) focus on linear techniques, whereas SOUTHGATE *et al.* (2003) address non-linear techniques.

LARSON *et al.* (2003) present a nice overview of linear data-analysis techniques used in coastal research. These techniques are approached in a general way, so that their presentation also allows usage in a wide area of research. In particular, this opens the door towards interdisciplinary research within the coastal zone. They show that data-analysis in coastal areas has close links with other fields, e.g. experimental psychology.

Coastal systems, in particular morphodynamics, are non-linear. Using non-linear techniques was not common over the last decades (SOUTHGATE *et al.*, 2003), these techniques are rather fresh developed themselves. The overview gives possibilities for using them in the near future. Chronology plays a leading role. In particular, principle component analysis and data-assimilation seem very promising in making progress towards understanding the coastal system.

COASTAL EVOLUTION

Modelling coastal evolution at the moment takes a use-specific approach: there is no universal model. Herein, scales play a central role, especially the time scale. We need different models for management questions related to short, intermediate or very long time scales. An overview on modelling of coastal evolution on yearly and decadal time scales is pre-

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sented in HANSON *et al.* (2003). Herein, the authors show that equilibrium and non-equilibrium models are not contradicting: they both have their own applicability regions in terms of questions. Models on shorter time scales allow for more physical processes, longer time-scale models usually rely on parameterization or averaging techniques.

A long-term unified approach towards coastal evolution has been introduced as the coastal tract concept (COWELL *et al.*, 2003a; COWELL *et al.*, 2003b). This coastal tract concept is introduced from a conceptual point of view and propose a new way of thinking about coasts. This concept is new and promising, it will open the way to further discussions and new research.

RHYTHMIC FEATURES

Understanding rhythmic features in marine morphology as free behavior underlies the review paper of DODD *et al.* (2003). This paper explains linear and non-linear stability analysis for a broad audience. Rhythmic features are no exceptions, they are commonplace in coastal morphodynamics. Examples vary from small wave-induced ripples to large offshore tidal sand banks. Many of these features are successfully explained as self organization in stability models. This shows that free behaviour cannot be neglected in morphodynamics, both offshore as well as in coastal areas. This implies that predicting morphological evolution after interfering in such areas should include these self-organisation processes.

CONCLUSIONS

We conclude that over the last 10 years much progress has been made. Temporal and spatial scales turn out to play a crucial role in all types of research: data-analysis, numerical modelling and idealized modelling. Furthermore, we conclude that in coastal regions both modelling as well as data-analysis doesn't follow a general line or generic approach. Specific questions or research aim mainly determines which techniques are most appropriate.

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