Historically, estuaries have been the focal point of extensive industrial activity for maritime nations. Similarly, it is well established that such marginal marine environments are particularly sensitive to both long- and shortterm external factors. In particular, estuaries are subject to diverse anthropogenic influences, such as: maritime transport (port construction, navigational dredging and dumping, maritime traffic congestion), industrial development (both onshore and offshore), mineral and aggregate extraction, changes in hinterland agricultural practices, residential development and increased water- and sediment-based pollution. In future, these areas will be placed under enhanced environmental pressure.

All of the activities outlined will place this inherently unstable environment under excessive strain in terms of coastline evolution, intertidal saltmarsh development, and sediment contamination. In addition, superimposed upon these anthropogenic factors are the systems response to more globally-driven changes i.e. sea level rise. As the need for a coordinated and responsible approach to the effective management of these morphological systems becomes apparent, as seen by the development of national and international legislation for estuarine management plans, an improved understanding of the physical dynamics of these systems becomes imperative. Within this context, modern sediment processes require investigation whilst, at the same time, the development of the adjacent coastline should be established. Investigation of these data sets, representing different timescales, will provide the essential scientific background to management decisions.

The research described in this Special Issue address these problems, through the application of a wide range of approaches (sedimentological, geological, physical and engineering-based); these, in turn, lead to an overall interdisciplinary investigation of estuaries. The research undertaken has involved the deployment of instrumentation at a number of differing localities within various estuaries, measuring processes using both established and newly-developed (state-of-the-art) techniques. Such measurements have been extended, within an historical and recent geological time-scale, to develop a conceptual understanding of the evolution of the estuarine systems. At the same time, interpretation of the interdisciplinary data sets has been placed within the context of coastal engineering and management.

Estuarine environments form a significant part of the tidally-influenced coastlines of Europe. Sedimentological research undertaken in such environments has been either specialised and/or not in any great detail – in terms of processes. An interdisciplinary approach is required, based upon established and innovative research methods.

The specific research objectives of the SWAMIEE (Sediment and Water Movement in Industrialised Estuarine Environments) TMR Network (EU Contract No ERBFMRX-CT97-0111) were as follows:

i. to further the scientific understanding, at specific industrialised and non-industrialised locations, of the movement of water and sediment, at a variety of time scales, through an integrated programme of established and innovative field and laboratory work;

ii. to integrate the various data sets (geological, geomorphological, physicochemical and sedimentological) into predictive (forecasting-hindcasting) numerical models, for use in the establishment of regional patterns of water and sediment movement and their sensitivity to changes in the controlling mechanisms;

iii. to transfer experience and expertise between European research groups working in different research disciplines and to foster the development of an applied approach to those concerned with environmental problems;

iv. to disseminate the results of the research to various end-users of estuarine environments.

The participants in SWAMIEE included: University of Southampton, U.K. (Co-ordinator); Université de Bordeaux I, France; Centre National de la Recherche Scientifique (ER 109 – Laboratoire de Géologie, Rouen), France; Universidade do Algarve, Portugal; Universitá di Ferrara, Italy; University College Dublin, Ireland; University of Plymouth, U.K.; University of Oxford, U.K.; and Danish Hydraulic Institute, Denmark.

Within the context of a Work Plan, various research themes were established (including Key and Associated Participants): long-term estuarine evolution, incorporating the analysis of historical and existing data sets, together with the sedimentological and geochemical analysis of cores from marginal environments, to establish the long-term (10-100 year time-scale) evolution and impact of industrialisation; medium-term estuarine evolution, incorporating analysis of high-resolution morphological data sets (annual to decadal time-scales) and *in situ* measurements of patterns of sediment movement – with emphasis placed on the development of estuary mouth mud/sand banks; estuary bed process studies, incorporating dynamic processes at the sediment-water interface and the quantification of material exchange through an estuary, using high-frequency *in-situ* measurements and laboratory-based flume experiments (with emphasis placed upon fine-grained sediments); and the development of 3D models for fine-grained sediment transport in estuarine environments – similarly, the use of predictive models for medium and coarse-grained sedimentary environments, under variable boundary conditions. Within the context of the research themes, different emphasis was placed upon the fieldwork measurements (water column, water column – sea bed interface, and sea bed) for non-cohesive and cohesive sediments.

A series of European estuaries were selected for investigation, including: the Loire, Seine and Gironde, France; Teignmouth, U.K.; Venice Lagoon, Italy; and Guadiana, Portugal. Interdisciplinary research cruises (SWAMGIR1 and SWAMGIR2) were organised to investigate upstream and downstream hydrodynamics and sediment dynamics in the Gironde estuary.

Water/sediment interface studies required detailed information on nearbed flow structure and its effect on the entrainment and subsequent movement of sedimentary material. Taking into account the nature of turbulent flow in the benthic boundary layer, high frequency measurements of both the velocity structure and SPM concentration have been performed in-situ by the SWAMIEE partners in the Gironde Estuary. Specialised insitu devices such as INSEV (In Situ SEttling Velocity instrument), were also used to obtain an improved understanding of the influence of particular environmental parameters (such as biological stabilisation/destabilisation, formation of aggregates, etc.) on the resuspension mechanisms. Finally, The SWAMIEE project has integrated field observation into numerical modelling, using a standard commercial 2-d model (Mike 21-DHI).

The ultimate objective of estuarine researchers is to identify the processes and predict the evolution of these environments at different temporal scales. In industrialised estuaries, the anthropogenic impact is such that the natural processes have been contaminated by considerable “noise”. Therefore, there is a need for establishing a “base-line” which is the natural evolution of these environments. Certain stratigraphic and geochemical methods can provide valuable information on sedimentary patterns. In SWAMIEE, radionuclide dating was used to identify

horizons related to specific exceptional events in Venice and to study sedimentation patterns in the Gironde.

The STRAEE workshop was born as the final product of the SWAMIEE Project and took place in Ferrara during September 2002. The STRAEE workshop has provided an overview on aspects of estuarine research, taking advantage of the participation of young scientists from several parts of Europe and Australia. The enlargement of the audience outside of the SWAMIEE group has offered the possibility to debate the results, strengthen existing research links and create new ones. Last but not least, some attention was given to the management of estuarine areas, with the contribution of coastal managers charged with the management of the Lagoon of Venice. This site is peculiar for the Mediterranean area because of its tidal regime, but it concentrates a whole range of issues (historical monuments, conservation interests, navigation, industrial sites, tourism) which are common to many parts of the world. A fieldtrip was run in the lagoon to address the main environmental aspects of this site and the measures undertaken by local authorities to counteract pollution, saltmarsh erosion and Relative Sea Level Rise.

This special issue includes a series of publications which represent the research activities outlined above and similar investigations throughout the world. As one may expect, the main contribution comes from the Gironde Estuary, with four papers describing studies on flocculation through laboratory and field measurements (Manning; Gratiot and Manning; Manning *et al.*) and two papers on large scale sediment dynamics (Kapsimalis *et al.*). Of specialist's interest is the application of radionuclides as a tracer of water movement (Smith *et al.*) and the study of estuarine beaches (Gonzales *et al.*). A consistent contribution is presented by Lobo *et al.* on bedload transport at the second field site, the Guadiana Estuary at the border between Portugal and Spain. The flocculation issue is also examined by Mikes *et al.* after their field experiments in the Seine Estuary, in France.

The contributions from the other estuaries were varied. Large-scale and long-term perspectives are provided by the papers of Burningham and Cooper (Ireland). Lower energy environments were studied by Mitchell *et al.* in a macrotidal context (English Channel) and by Covelli *et al.* in the microtidal northern Adriatic Sea. Malvarez *et al.* manage to apply classic beach morphodynamic theories to sandy tidal flats inside an Irish lough. Finally, modelling is used by Lumborg in the Danish Wadden Sea while Schacht and Lemckert propose a new methodology for measuring suspended sediment characteristics.

Unfortunately not all the contributions presented at the workshop in Ferrara were selected for publication. Unlike other conference Special Issues, this volume has undergone a strict selection and refereeing process, employing scientists for all over the world, with many members of the JCR Editorial Board. We hope that all the contributions that were refused may benefit from the referees' comments and be published elsewhere.

A project like SWAMIEE involves a great deal of administration and the hard work of Justin Dix is greatly acknowledged. He has gone through a huge amount of paper work and science planning trying to keep together such an heterogeneous group that would manage to use during meetings most of the languages spoken in the European Union.

Instrument deployment, sample collection and surveying requires a capable Captain and crew onboard. Operations in the Gironde were successful thanks to the Captain and crew of the Cote d'Aquitaine.

A main contribution to the organisation of the STRAEE workshop in Ferrara was that of Corinne Corbau, a former project's post-doc. She helped in preparing all the divulgation material and in starting the process of paper submission. Unfortunately she was not able to complete the editorial job due to new work commitments, but she fully deserves the title of "Editorial Assistant".

Finally, we are grateful to the Consorzio Venezia Nuova for sponsoring the fieldtrip in the Lagoon of Venice at the end of the final workshop.

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Michael Collins
Ferrara, December, 2004