BEHAVIOUR MODELS

The systems approach seeks to explain how the different elements that make up the system *interact* (Cowell & Thom, 1994; Capobianco *et al*. 1999). Hence from the outset there is a need to have a clear understanding of what the elements are and the processes that cause different elements to interact. This is the essence of the system behaviour and importantly can only be understood by considering how the elements change with time. For management purposes the morphological responses of interest will primarily be 1-100 km scale and over years to decades.

The limits of current understanding mean that we are not yet in a position to frame all of the interactions at the higher levels in a quantitative manner and we have to make use of qualitative descriptions. These can take advantage of short-term process knowledge and empirical knowledge based on observations, comparison with other systems and intuition. This has led to the application of behavioural models to describe particular aspects of a system. These take two forms in the literature. The first are those that summarise steady-state conditions, or explain transitional behaviour, in effect *functional behaviour models*. Some of these are described under Regime (or Top-Down) Methods and discussed more fully in the paper on Coast & Estuary Behaviour Systems (or see Townend, 2003; Capobianco *et al*. 1999).

The second is a class of models derived from running more detailed process models, to formulate an empirical description that summarises the behaviour in a simplified form (typically some form of parametric equation). They are therefore *empirical behaviour models,* to distinguish them from the first type of behaviour model. This was an approach developed as part of the Dutch Kustegenese programme (Stive *et al*. 1990) and subsequently developed more formally as “behaviour-oriented models” by Capobianco *et al*. (1993; 1999). The concept is to use field observations and results from process-based models (run with real input conditions) to establish simple mathematical models that exhibit the same behaviour. Quite often the resulting model does not have any direct relationship with the underlying physical processes but does reflect the net change of some characteristic form (e.g. shoreline position). Capobianco *et al* group both *functional* and *empirical* behaviour models under the heading of behaviour-oriented models. However given the emerging development of systems based approaches to studying complex geomorphic systems, such as estuaries and tidal inlets, it is considered useful to draw the distinction between the former as a more qualitative or descriptive representation of behaviour and the latter as a quasi or fully quantitative representation. There is however an inevitable overlap between the two.

References

Capobianco M, de Vriend H, Nicholls R, Stive MJE, 1993, Behaviour-oriented models applied to long term profile evolution, Large scale coastal behaviour, USGS, Report No: Open File Report 93-381, 21-24.

Capobianco M, de Vriend H, Nicholls R, Stive MJF, 1999, Coastal area impact and vulnerability assessment: the point of view of a morphodynamic modeller, Journal of Coastal Research, 15(3), 701-716.

Cowell PJ, Thom BG, 1994, Morphodynamics of coastal evolution, In: Carter RWG, Woodroffe CD (Eds.), Coastal Evolution: Late Quaternary shoreline morphodynamics, Cambridge University Press, Cambridge, UK, pp. 33-86.

Stive MJE, Roelvink JA, de Vriend H, 1990, Large-scale coastal evolution concept, In: Proceedings of the 22nd Coastal Engineering Conference, ASCE, New York, 2, pp. 1962-1974.

Townend IH, 2003, Coast and estuary behaviour systems, In: Coastal Sediments '03: Crossing Disciplinary Boundaries - Proceedings of the Fifth International Symposium on Coastal Engineering and Science of Coastal Sediment Processes, East Meets West Productions (EMW) Inc., Corpus Christi, USA, pp. 1-14.