UNIFORM SEDIMENT FLUX OR SEDIMENT BALANCE

One of the earliest models to use the balance of net transport was a zero-dimensional model of a tidal lagoon by di Silvio (1989). The lagoon was schematised into just three components, tidal flat, littoral and tidal channel and the model was based on the idea that although locally and at any instant sediment transport is not in equilibrium, averaged over the system as a whole and a long enough period a relationship exists between the hydrodynamic quantities and the sediment concentrations. A slightly more detailed representation (see schematisation in Figure 1a) is used by van Dongeren and de Vriend (1994) for a 1-D model of an estuary, where the balance of sediment supply and demand is based on regime definitions for the channel and tidal flats.

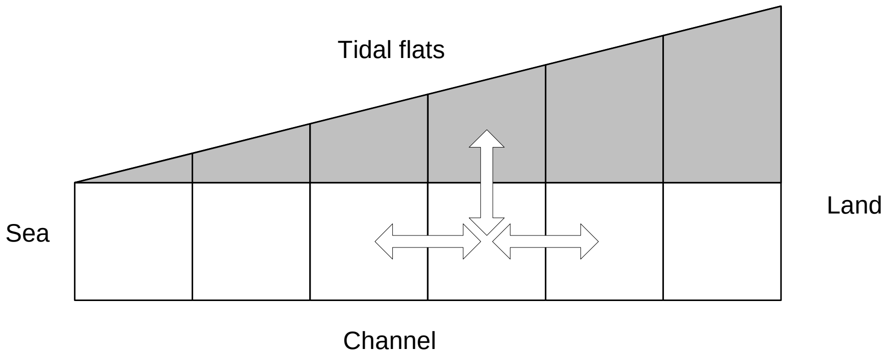
Using a similar concept but with a more complete representation of the estuary cross-sectional form Wang *et al* (1998; 1999) proposed the ESTMORF model. This follows a similar approach to di Silvio in adopting a characteristic sediment concentration in each element of the model. At equilibrium it is assumed that there is no deposition or erosion any where in the model domain. If the sediment is mainly transported in suspension, the sediment flux is likely to be proportional to the flow field, so that the ratio between sediment flux and flow rate can be treated as a local equilibrium sediment concentration. Changes occur when the local sediment concentration is not equal to its local equilibrium value (see computational procedure in Figure 1c). The equilibrium concentration is determined from the equilibrium morphological state, rather than the hydrodynamic parameters, where the equilibrium state is defined using regime relationships for the channel and height of the tidal flats (see schematisation in Figure 1c). This model has now been widely applied to the study of long-term change in estuaries, as illustrated in Paper 22 of the EMPHASYS Report (see also Jeuken *et al*. 2003).

Aggregation of the component parts of the tidal basin and adjacent coast, to a simple box model, (Figure 1b) has been developed as the ASMITA model by Stive *et al* (1998; and Kragtwijk *et al*. 2002). As with di Silvio's approach the model assumes that for each component there is a morphological equilibrium that depends on the hydrodynamic conditions. This allows the model to describe the evolution of the tidal inlet system towards equilibrium as a function of:

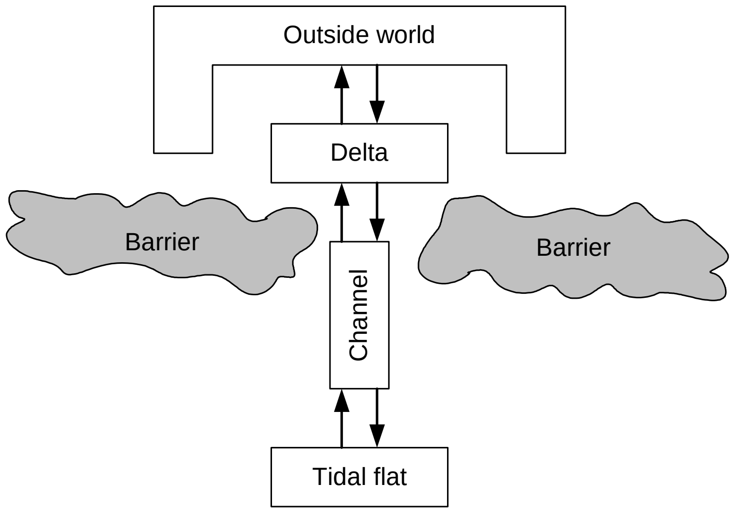
- the surplus or deficit of sediment,
- the capacity for exchange between the component parts, and
- the potential for sediment to be imported or exported across the model boundary.

This model has been applied to study the study of sea level rise on tidal basins (van Goor *et al*. 2001) and the development of shorelines and tidal inlets over millennial time scales (Niedoroda *et al*. 2003).

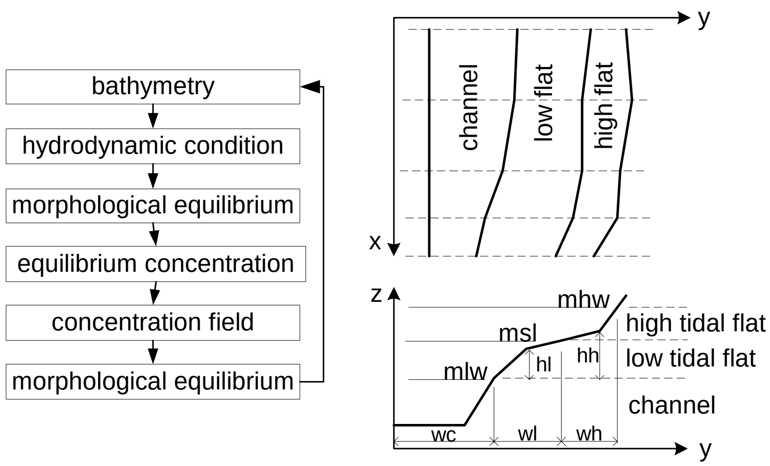
Figure 1 - Types of schematisation used in aggregated models



a) Tidal basin schematisation used by van Dongeren and de Vriend (1994)



b) Schematisation of elements and exchanges within the ASMITA model



c) Procedure and schematisation used in ESTMORF (Wang et al, 1998)

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