FD2107 ‘Shell’ Hybrid Model Interface

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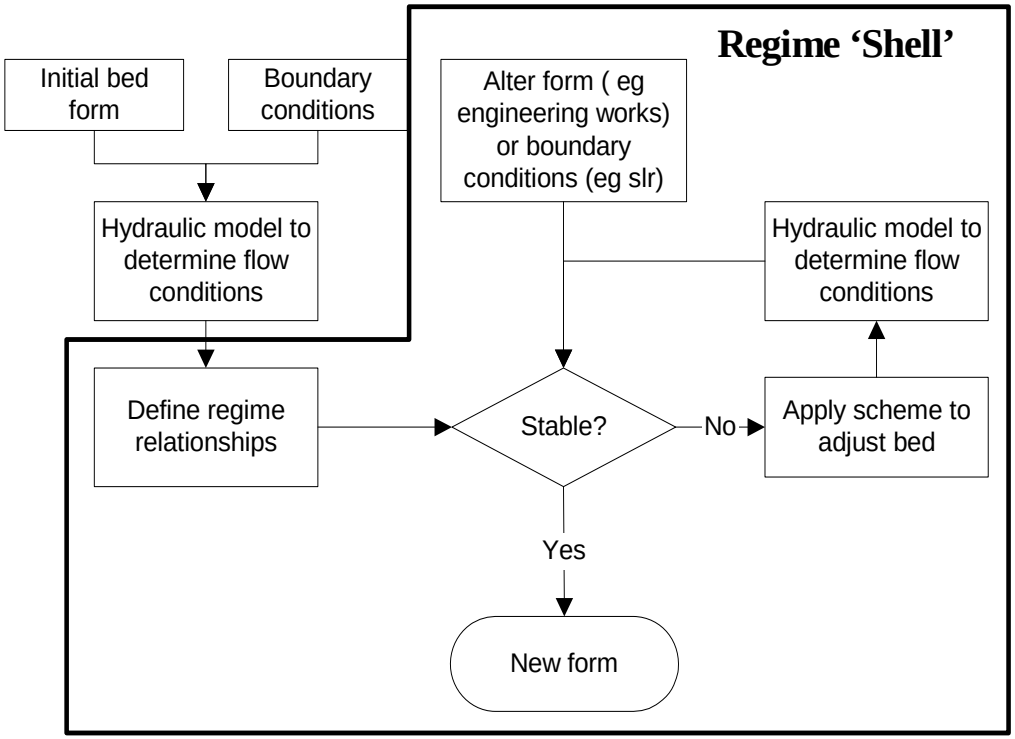
Aims – Regime Shell

- Develop an application framework for hybrid models (interface bottom-up (B-U) + top-down (T-D) models
- Close collaboration Between ABP/POL/ HR Wallingford
- Development with VB and MATLAB software
- Open source code
- Trial on the Humber Estuary

What is it?

- The Shell Interface links a 1D model with regime algorithms

Initial Condition Defined Outside the Shell



Regime Hybrid Simulation

What is regime?

- Regime Q^n
  - Width Coefficient, q (r = p + q)
  - Depth Coefficient, p
  - Discharge, Q
  - Equilibrium Discharge, Qe

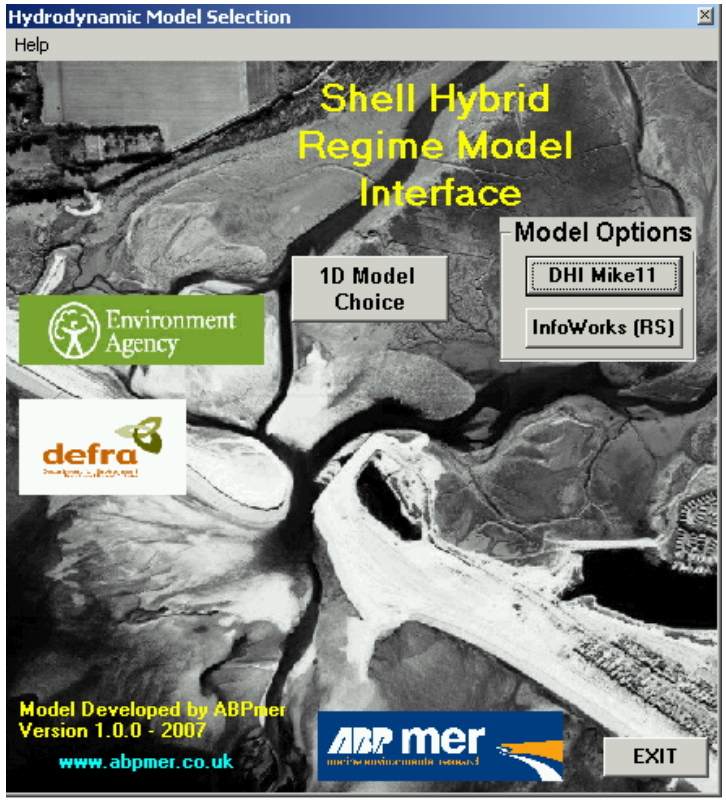
$$\frac{A}{A_e} = \left(\frac{Q}{Q_e}\right)^r; \quad \frac{B}{B_e} = \left(\frac{Q}{Q_e}\right)^q$$

Assumptions

- The existing estuary form can be characterized by some function that describes the equilibrium relationship.
- The estuary will achieve some form of equilibrium state
- Sediment supply is not limited

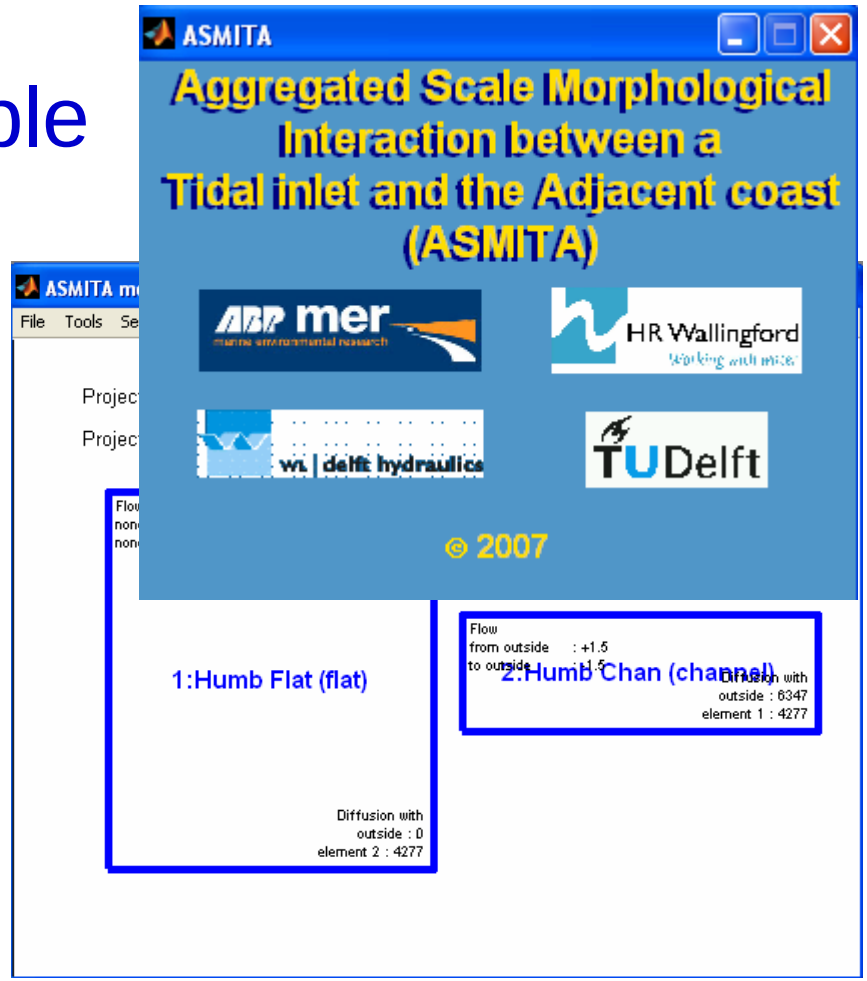
The Shell Interface

- Fully windows based tool.
- Option to include both Mike11 and ISIS (InfoWorks)
- Full documentation (user manual)
- ASMITA (extra)



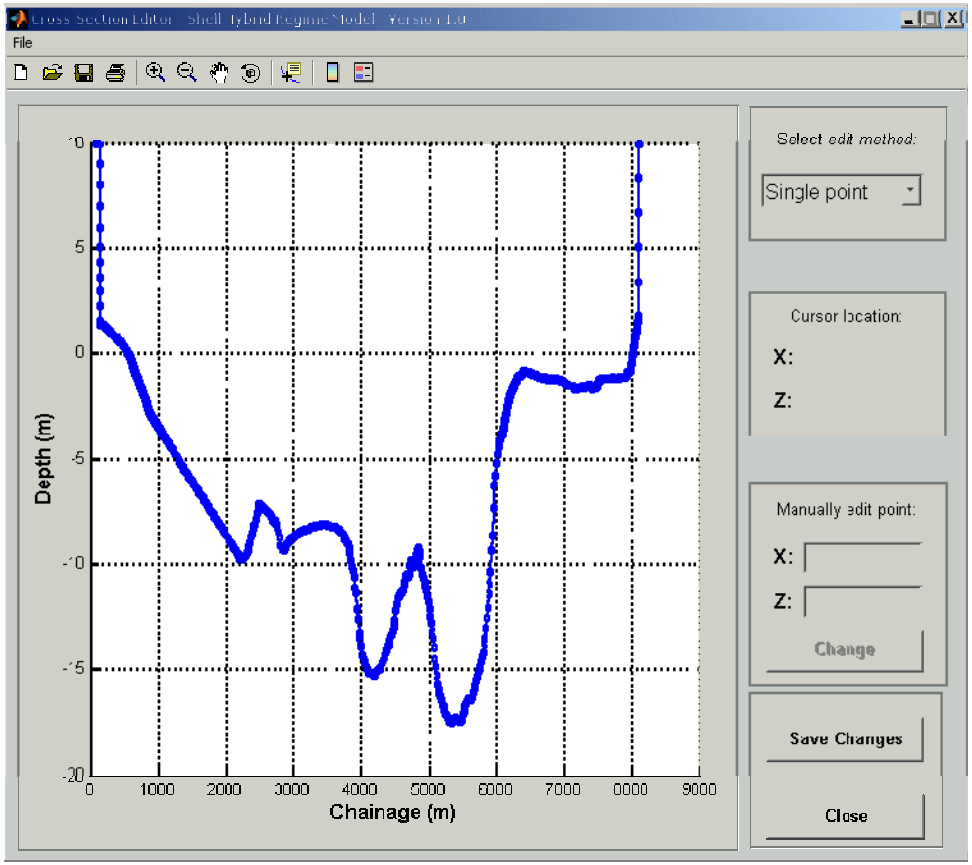
ASMITA

- Code fully available
- Matlab
- GUI environment
- Full Interactive
- Documentation



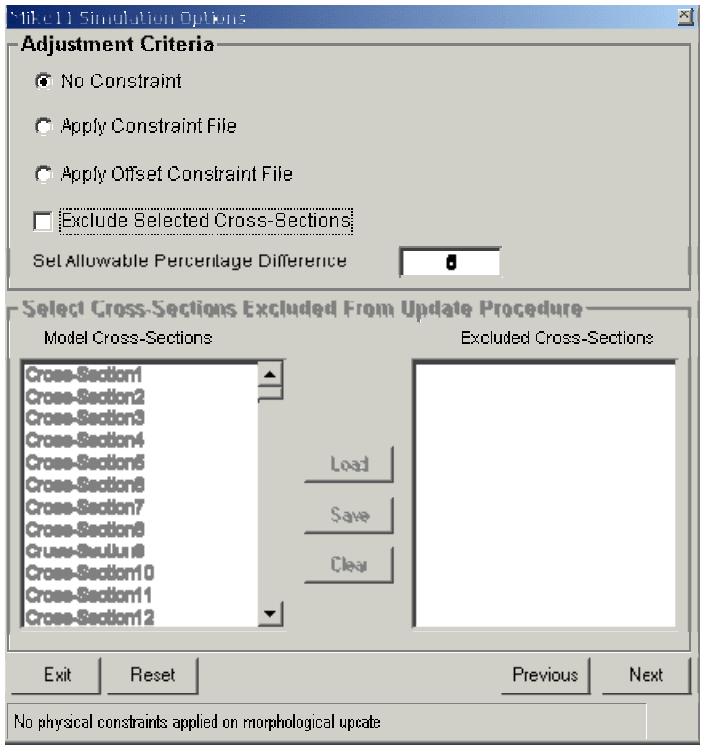
Shell Utilities

- Graphical user interfaces built into the Shell Interface.



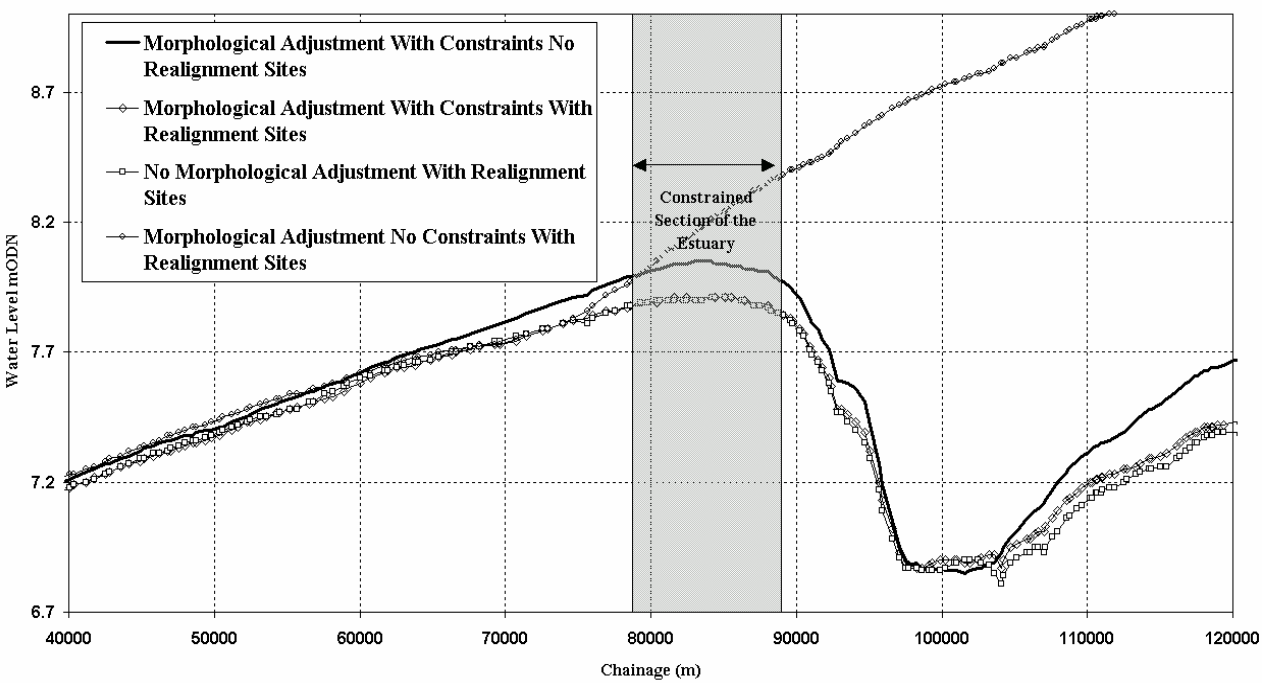
Morphological Update Options

- Critical to the update of estuary morphology is the identification of physical constraints.
  - Update Options
  - Exclude sections



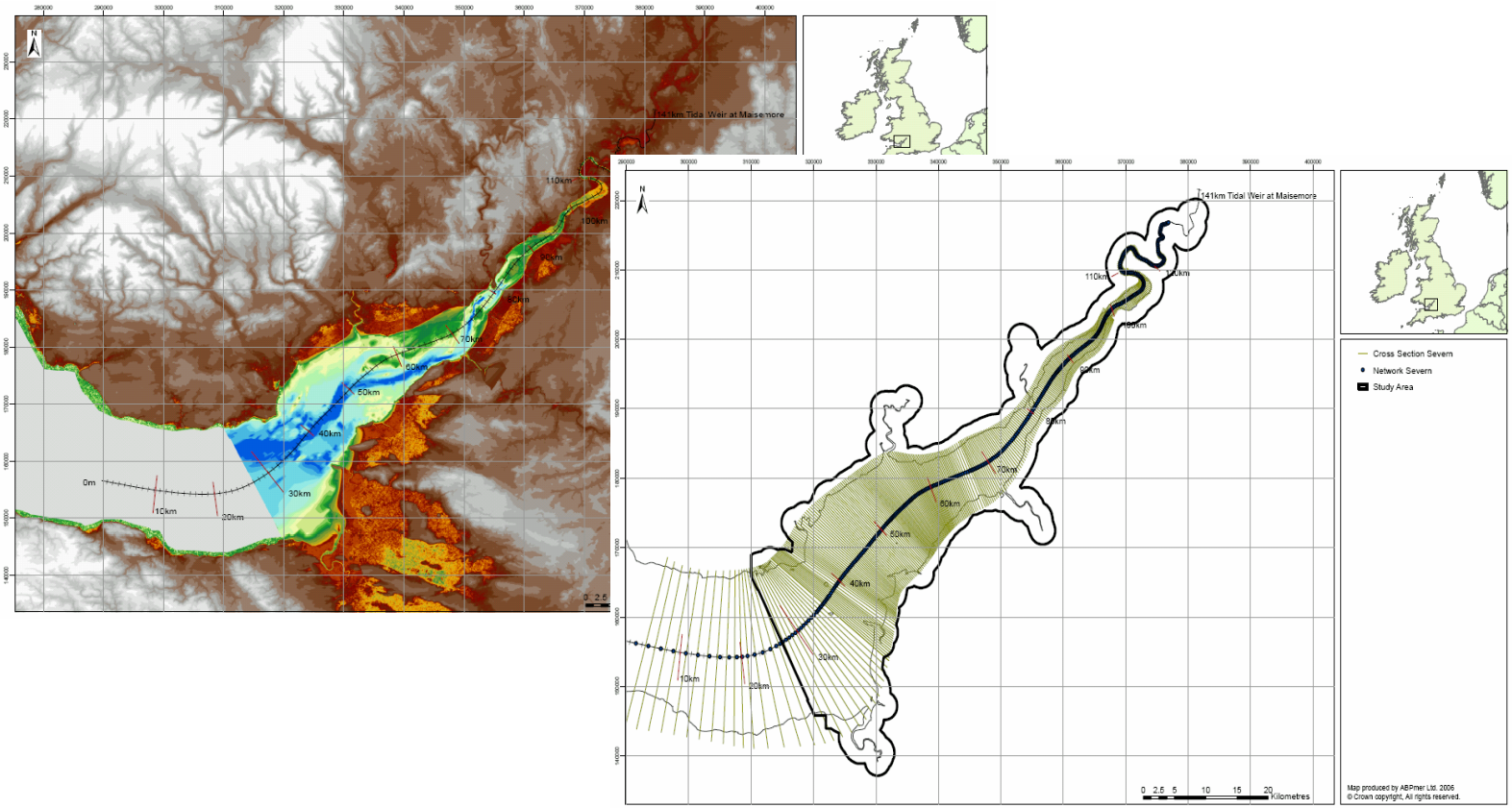
Importance of Constraints

- Severn Estuary – Response with and without constraints



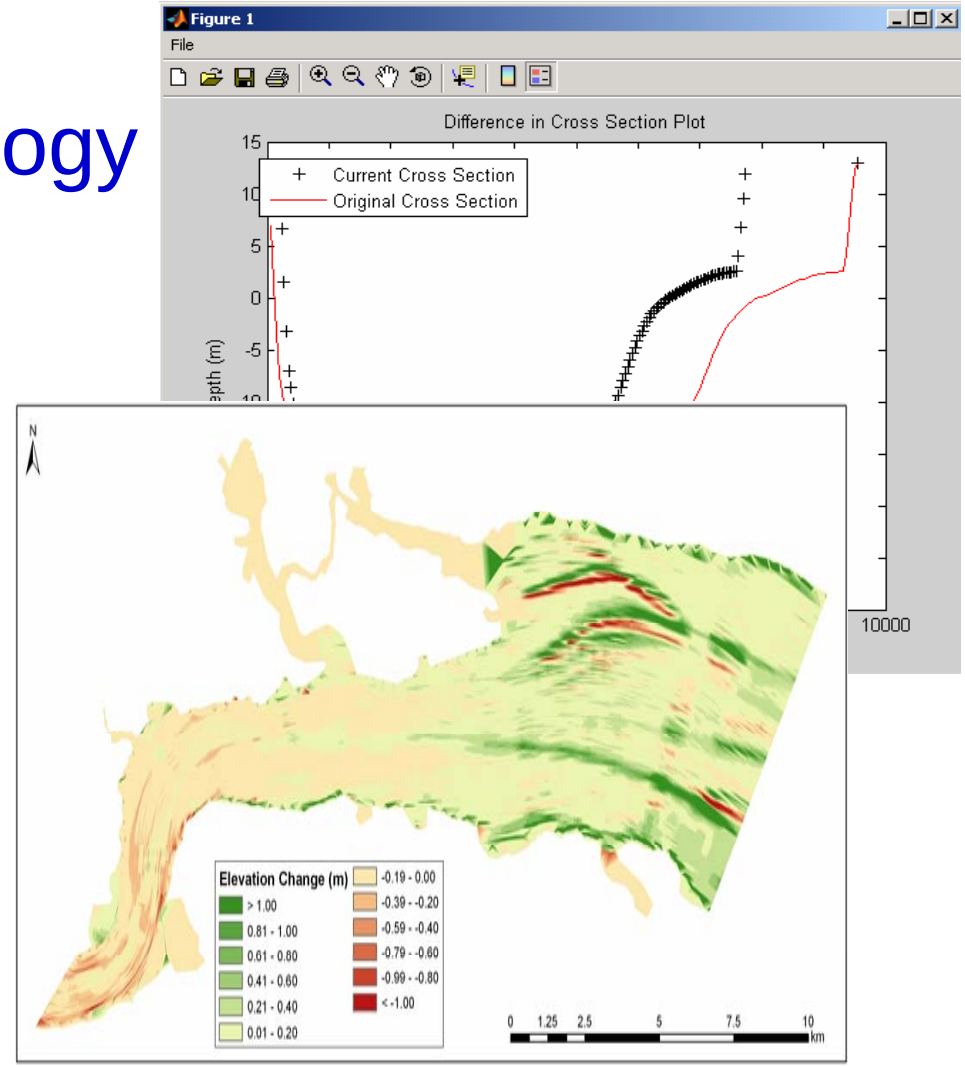
1D Model Setup

- Cross-section setup - critical step



Regime Results

- New morphology
- Areas
- Volumes
- **Water levels**
- Velocities
- Discharges
- Habitats



Limitations

- Unknown time frame
- Not suitable in estuaries that are not in an equilibrium or stable state.
- Cannot be applied to estuaries that are sediment limited

Advantages

- Simple to use
- Proven approach (Seven and Thames CHaMP)
- Comprehensive results that can inform morphological change, flood alleviation, habitat change etc.
- Open source code
- Framework that can be adopted by other consultancies/agencies
- Full documentation (user manual)

Application

- Model successfully applied to the following estuaries:
  - Blackwater
  - Humber
  - Mersey
  - Southampton Water
  - Thames

  Results presented in detail (Norton et al, Defra 2007, paper 03.5)

What can we do next?

- Implement in a .net environment
- Improve bed updating algorithms
- Add time element via alternative regime algorithms
- Continued testing