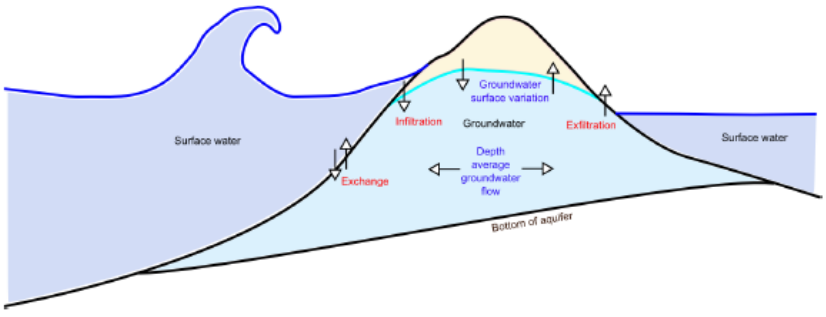
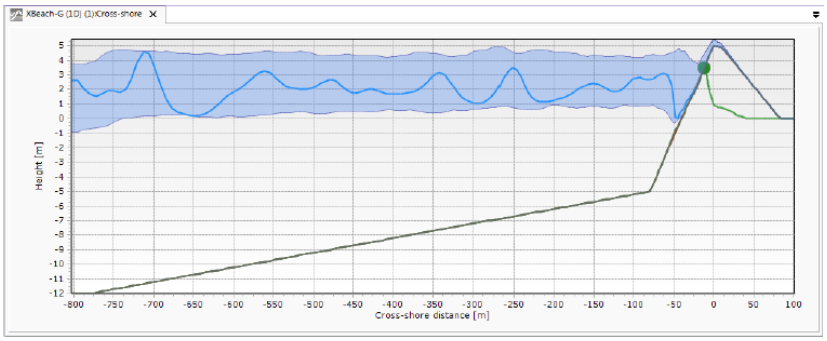
XBeach-G – an open-source model to simulate hydrodynamic and morphodynamic processes and storm impacts

General features of hydrodynamics:





- XBeach-G is a subsequent development of XBeach for gravel coasts.
- Includes: short wave transformation (refraction, shoaling and breaking), long wave (infragravity wave) transformation (generation, propagation and dissipation), wave-induced setup and runup, time-varying depth-averaged currents, wave-current interaction, roller momentum exchange, overwash, inundation and hard structures.
- Considers a 1D cross-shore profile (the longshore gradients are ignored) and can be run through a GUI.
- XBeach-G is a one-layer, depth-averaged, non-hydrostatic model, which solves each wave explicitly.
- The non-linear shallow water equations are solved as depth-averaged Generalized Lagrangian Mean formulations with a non-hydrostatic pressure term to solve short waves.
- Ground water is considered using Darcy-type flow with additional considerations for solving infiltration and exfiltration.

Sediment transport:

- Processes in XBeach-G include bed load sediment transport, steep slope collapse, bed evolution and breaching.
- XBeach-G solves a modified Meyer-Peter-Müller (1948) equation for swash zone bed load transport.
- Nielsen's (2002;2006) description of boundary layer velocity in nonstationary flows.
- Morphological evolution can run in 'real time' or with a morphological factor to simulate longer term changes.
- Gradients in bed load transport force bed level change.
- Slope collapse takes place if the angle of repose is exceeded.

Improvements to the sediment transport model: Development of XBeach-G in 2DH and validation under less energetic storm conditions.

XBeach-G use and linkages within BLUEcoast

- Applied in WP1 (Slapton) & WP4 (Dungeness) to assess sensitivity in beach response to boundary forcing from FVCOM (WP3), Delft 3D (WP1, WP4) & the Met office products (WP1, WP4).
- Applied in WP1 (Slapton) to investigate cross-shore and along-shore sediment exchange.
- Applied in WP4 (Dungeness) to investigate future resilience of the coastal system with consideration of plausible human intervention.
- Applied in WP1 & WP4 to determine changes in flood and erosion risk under future shoreline projections by COVE, developed in WP2.