1D morphodynamic model for mixed bedrock alluvial reaches transporting mixture of sand

Description:

This is a 1D morphodynamic model for mixed bedrock-alluvial reaches that couples St Venant shallow water equations with the conservation of mass for the total sediment mixtures and conservation of mass for each sediment grain sizes.

The input parameters are:

1) A fixed water level at the downstream (datum)
2) Bedrock surface elevation throughout the reach relative to downstream water level (etab)
3) Constant sediment supply at upstream (gbf)
4) Constant inflow discharge at upstream (qw)
5) Channel width (b)
6) Dx
7) Standard deviation of bedforms in fully alluvial reach (sigmaf)
8) Relation for standard deviation of bedforms in mixed bedrock-alluvial reach (sigma1)
9) Roughness of the bedrock surface (kbrs)
10) Bedrock slope (sbase)
11) Grain size distribution of the sediment supply
12) Number of timesteps (m)
13) Initial GSD of the active layer and the substrate. Please note that the model does not account for storing stratigraphy thus the GSD of substrate can be pre-determined and will not change over time.

The model outputs are:

1) Longitudinal flow parameters (water depth)
2) Bed surface elevation relative to downstream water level (etaa)
3) Bedrock surface elevation relative to downstream water level(etab)
4) Sediment transport rate (qbt)
5) Bed surface slope (slope)
6) Geometric mean diameter of the sediment grains in the active layer (dgf)
7) Alluvial cover fraction (pc)

*The output are for the last time step i.e., time step ‘m’. If the time step is long enough (depending on the problem of interest) the results can be a representative of equilibrium condition.