# BASEMENT

BASIC SIMULATION ENVIRONMENT
FOR COMPUTATION OF ENVIRONMENTAL FLOW
AND NATURAL HAZARD SIMULATION

## Software

Freely available at **www.basement.ethz.ch** including System Manuals
Windows and Linux Versions for Single or Multi Core Commodity Hardware



Department of Civil, Environmental and Geomatic Engineering
Laboratory of Hydraulics, Hydrology and Glaciology
Applied Numerics Group
Commissioned and co-financed by Swiss Federal Office for the Environment

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

VAW
Laboratory of Hydraulics,
Hydrology and Glaciology

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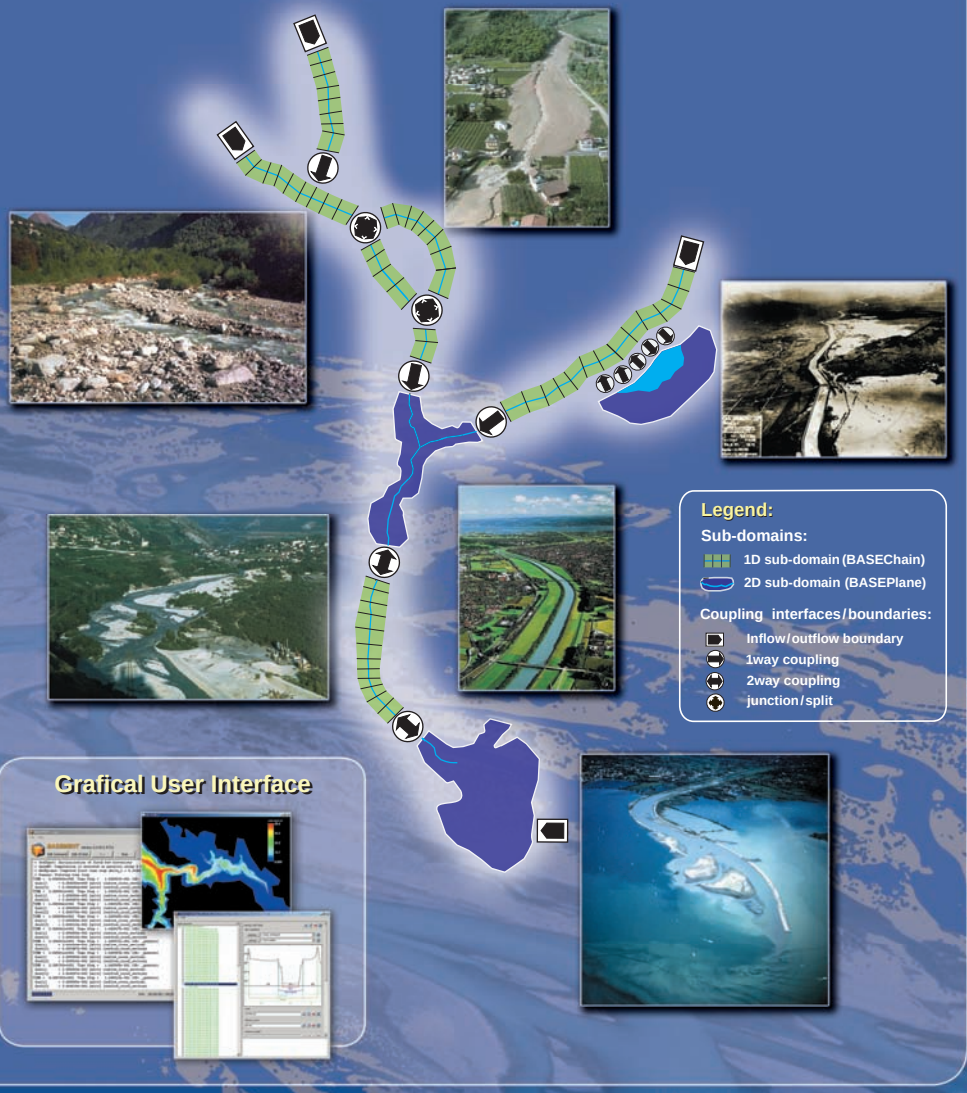
## Multi-Domain Modelling of Flow and Sediment Transport in Rivers

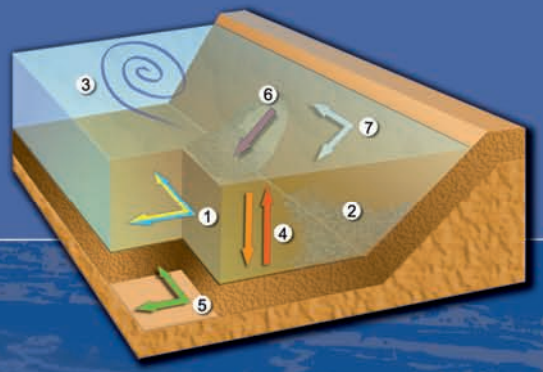



ETH

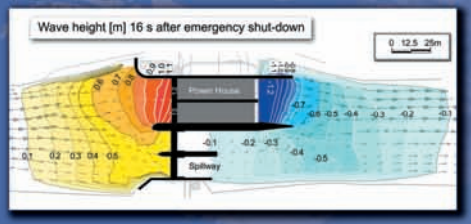
VAW

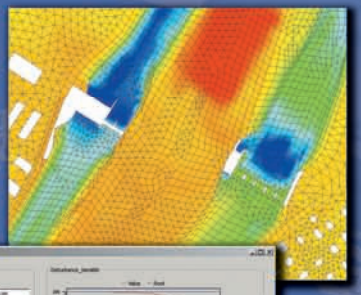
## Modelled Processes

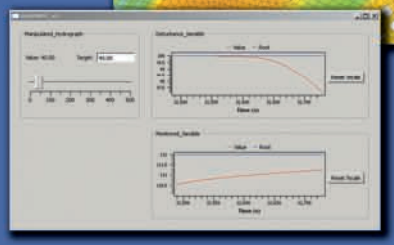
① Flow and Suspended Sediment Transport
② Channel Roughness
③ Inner Friction, Turbulence
④ Sedimentation, Resuspension
⑤ Bed Load Transport
⑥ Gravity-Induced Transport
⑦ Lateral Transport




## Hydrodynamics





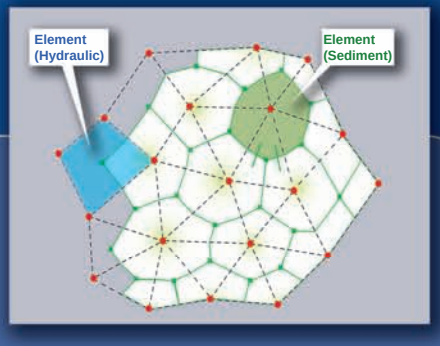
### *Basics:*

- Modelling of Unsteady Transcritical Flows
- 1D and 2D Shallow Water Equations
- Finite Volume Discretization:
  - Cross Sections for 1D River Branches
  - Unstructured Hybrid Mesh for 2D Flood Planes
- Explicit (2D, 1D) and Implicit (1D) Time Integration
- Practical Boundary Conditions for Rivers, e.g. Hydrograph, Equilibrium Flow
- Hydraulic Structures, e.g. Weir, Gate

### *Flow Control in River Systems:*

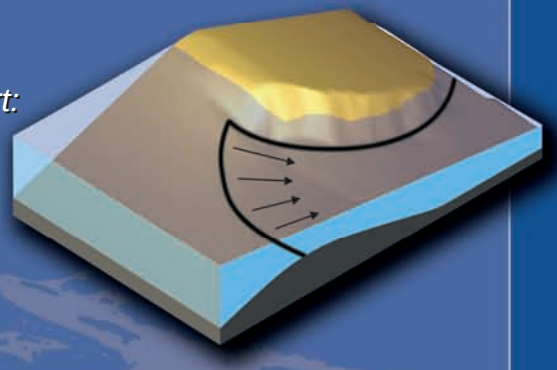
- Control of Flow Variables and Hydraulic Structures
- Local or Inter-Domain
- Controllers:
  - Automatic Regulation (PID)
  - Online Manipulation of Variables (HID)

## Sediment transport




### *Bed Load Transport:*

- 1D and 2D Bed Load Transport Model
- Single and Multi Grain Simulations
- Different Bed Load Transport Formulas Available
- Dual-Mesh Approach for 2D Simulations
- Multi Layer Soil Representation



### *Suspended Sediment Transport:*

- 1D and 2D Advection - Diffusion - Equation for Pollutant or Suspended Transport
- Exchange with the River Bed
- Different Numerical Approaches for Advective Term

### *Gravity-Induced Transport:*

- Simple Geometric Approach
- Slope Collapse Based on Critical Angles
- Distinction between Dry and Wet Material