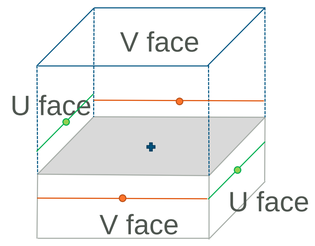
# Utilisation of Sub-Grid-Sampling of Bed Elevation Data in Gridded 2D SWE Schemes

Phillip Ryan, Shuang Gao, Bill Syme

## Why?

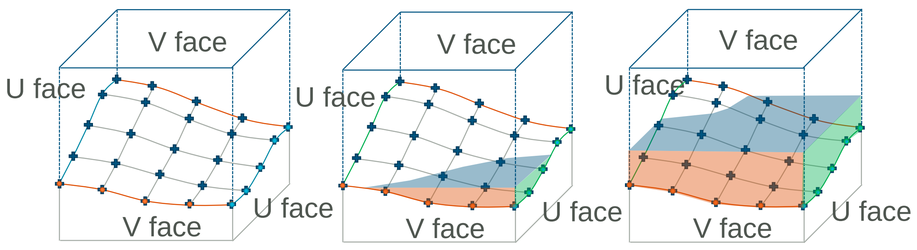
- Traditional hydraulic modelling approach of one elevation per 2D cell or cell face can be a coarse representation of topography/bathymetry.
- Sediment transport modelling using traditional approach is less accurate.
- Utilising sub-grid-scale data potentially enhances hydraulic and sediment transport modelling accuracy.




***Traditional Approach (Without Sub-Grid-Sampling)***

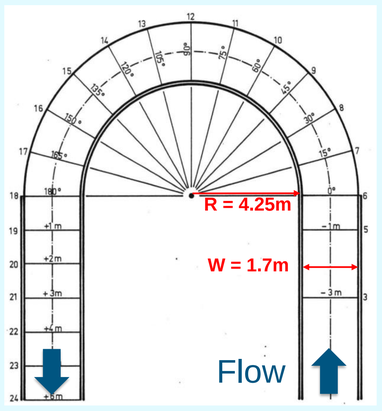
## How?

- Bathymetry is sampled across the cell at the same resolution of the DEM or TIN source data to generate volume vs depth curves for each cell.
- Bathymetry is also sampled across the 2D cell faces to generate flow area and flow width vs depth curves.

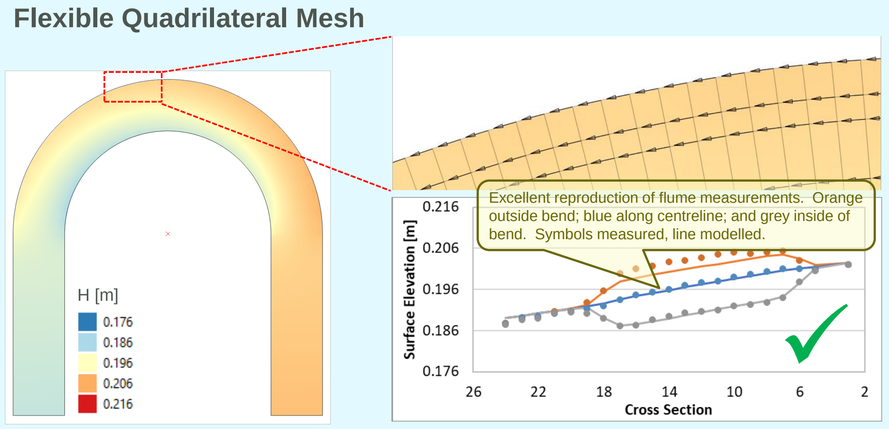



***Sub-Grid-Sampling Approach***

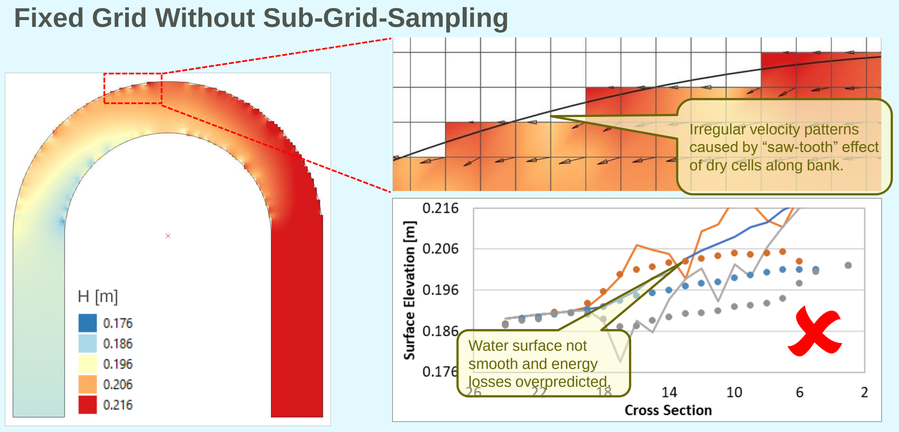
## U-Bend Flume Test (De Vriend,1978)



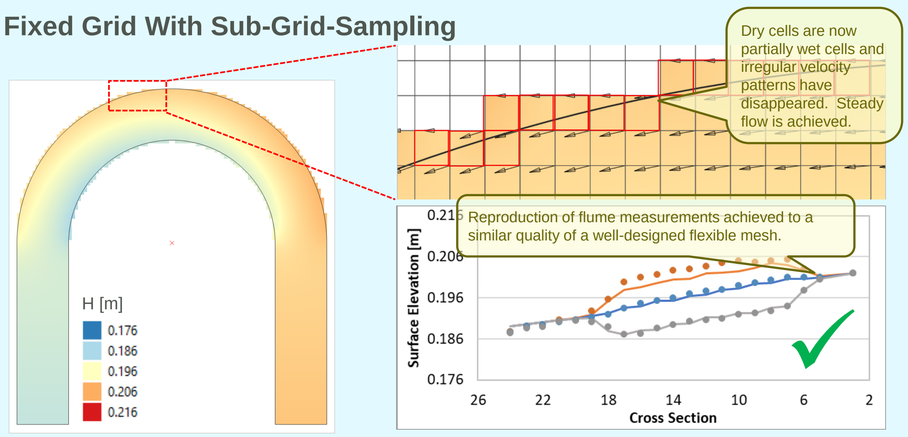

### Flexible Quadrilateral Mesh



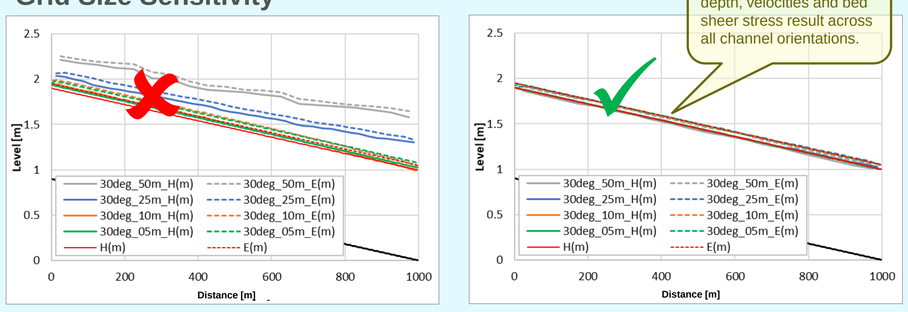

### Fixed Grid Without Sub-Grid-Sampling




### Fixed Grid With Sub-Grid-Sampling



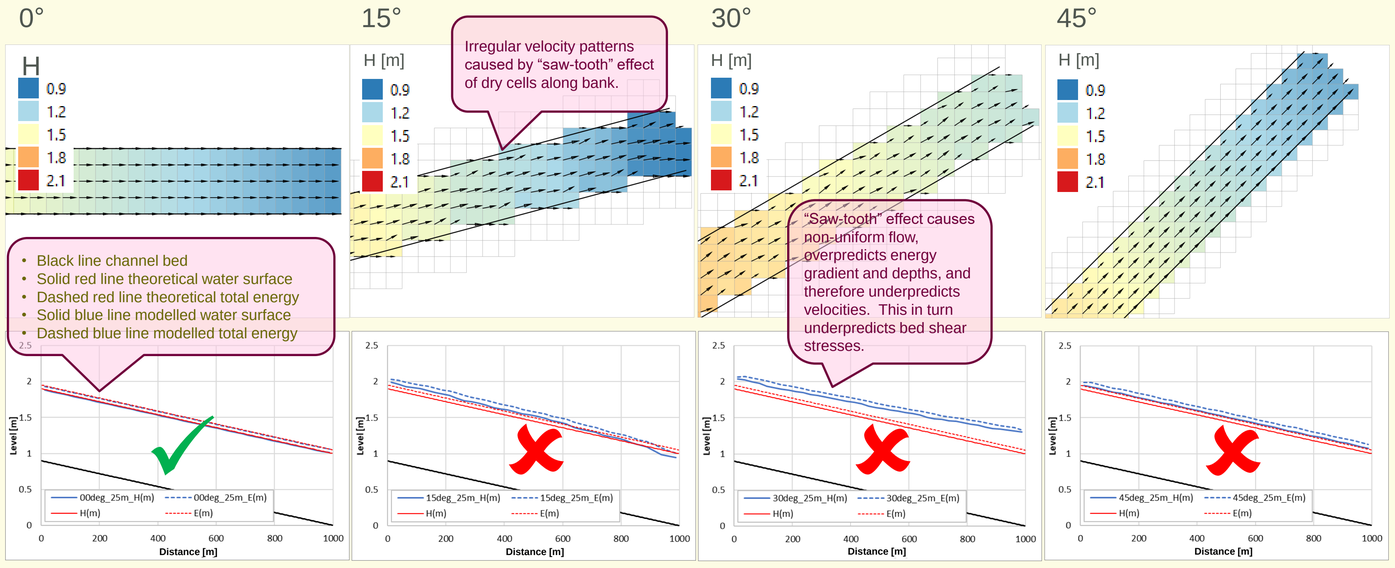

### Grid Size Sensitivity



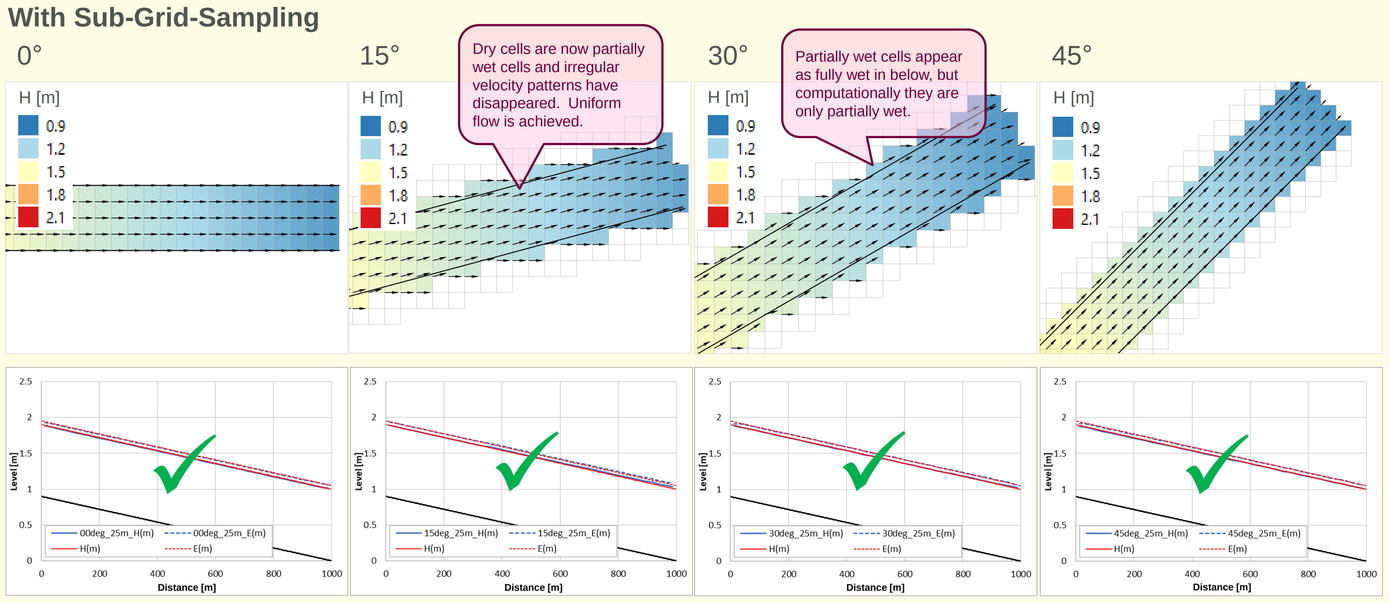

Without Sub-Grid-Sampling | With Sub-Grid-Sampling

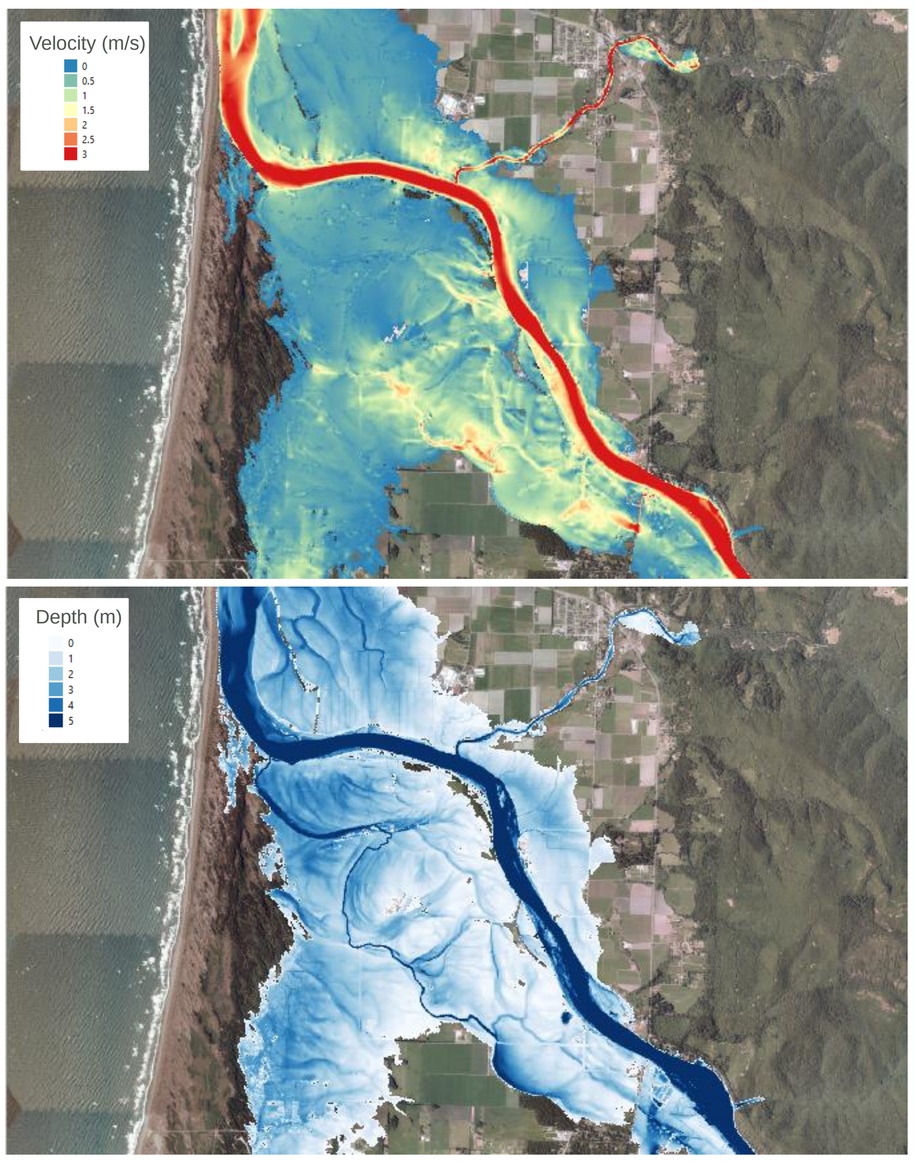
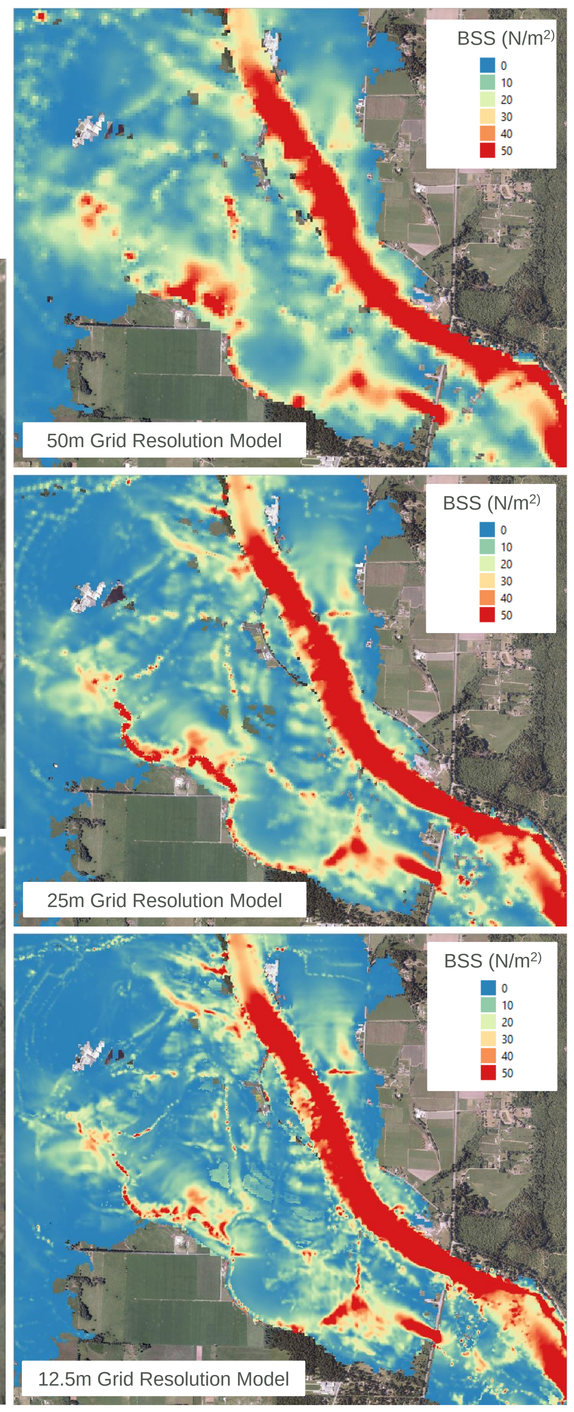
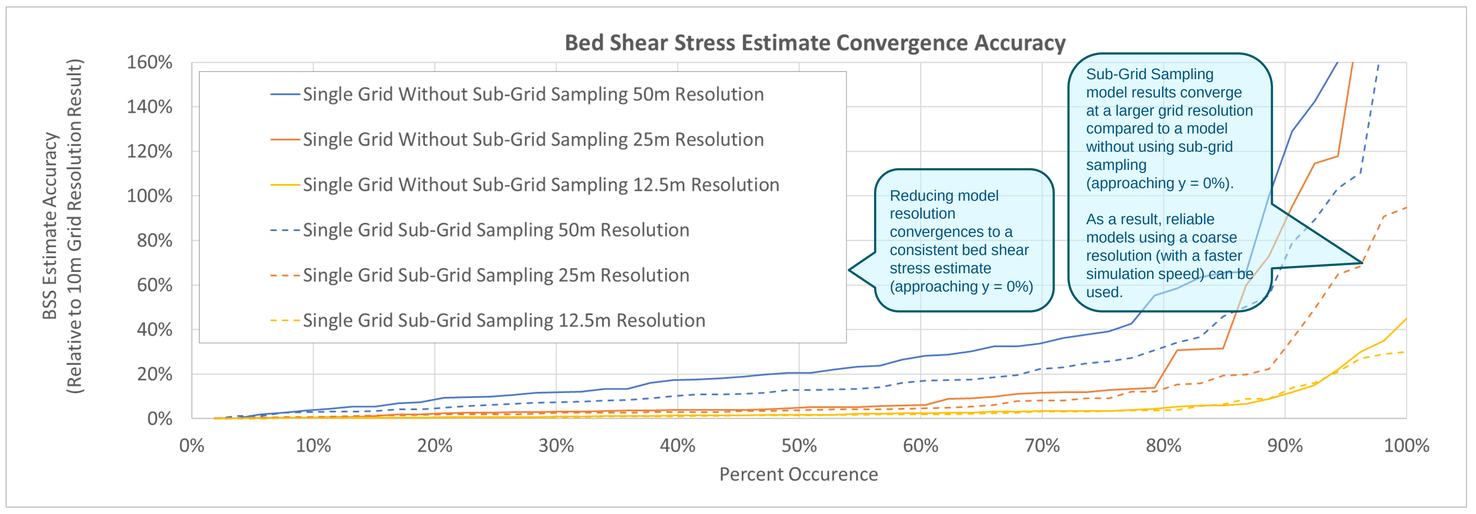
## Rectangular Channel Test – Conformance with Uniform Flow

### Without Sub-Grid-Sampling




### With Sub-Grid-Sampling




## Real-World Bed Shear Stress Estimation

- Sediment mobility for a given particle size occurs when the bed shear stress (BSS) exceeds the critical sheer stress. BSS can be used to estimate if a sediment is mobile.