





### SciNetNatHaz Project Progress Meeting - 23-26 Oct 2014, Burgas, Bulgaria SciNetNatHaz Project Progress Meeting - 7-9 May 2015, Thessaloniki, Hellas

# Using Morphometric models and Open Source Software to locate Flood prone areas A guide to pilot Implementation

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TEI of Kentriki Makedonia, LB







### Contents

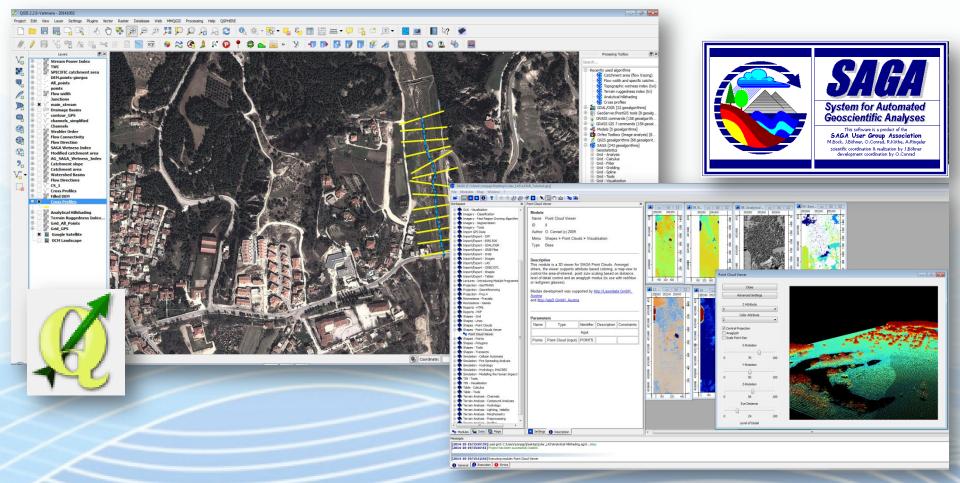
- Data Requirements
- Procedures
- Outputs
- Evaluation







### **The Tools**









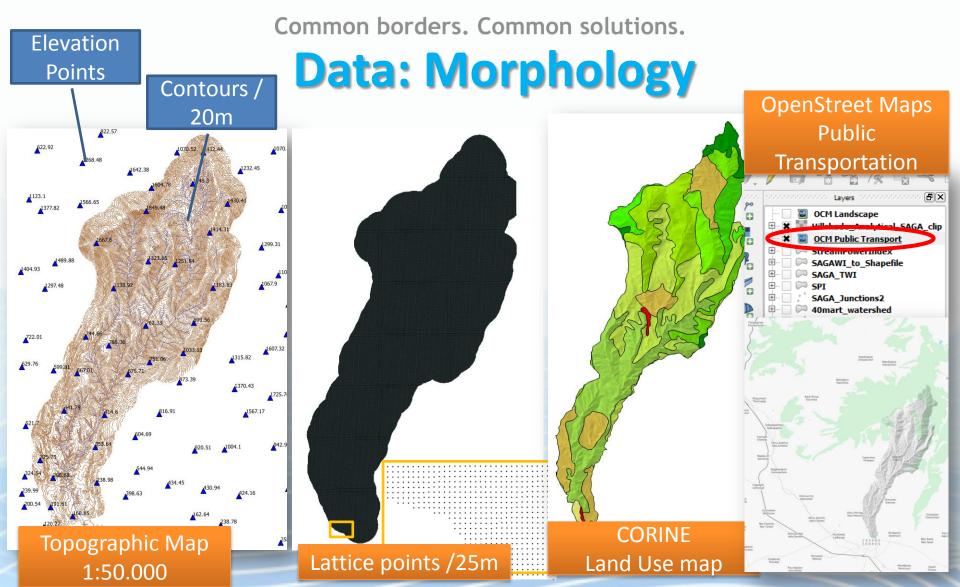
# **Data: Morphology**

- Topographic Maps, scale 1:50.000
- Elevation Points
- Land Use maps (Corine 2000 / 2006)
  - Road and Railroad Network















#### Meteorological Data: Rainfall & Hydrology atershed Stations lillshade Analytic... OCM Public Transp. StreamPowerIndex SAGAWI to Shap ... SAGA\_TWI SPT SAGA\_Junctions2 40mart watershed teteo STATIONS tectonic FAULTS 40mart Geology gn.ab.sch an,mr an-sch Is.c,st Ng.l1 Ng.s Ng.tv-mk Pl.c,st Pt.I,s Pt.t2 Pt.t3 40mart corine 40mart\_trigonom 40mart\_contours 40mart\_DEMpoints hydrol\_net SoilEROSION\_ QGIS\_DEM SAGA\_grid Soil Erosion voronoi precip ChannelNetwork&Dra OCM Landscape low Direction Flow Connectiv Strahler Order SAGA Drainage

Meteo – Stations on an OpenStreet Map Landscape layer

Hydrology Network (digitized from topo maps)

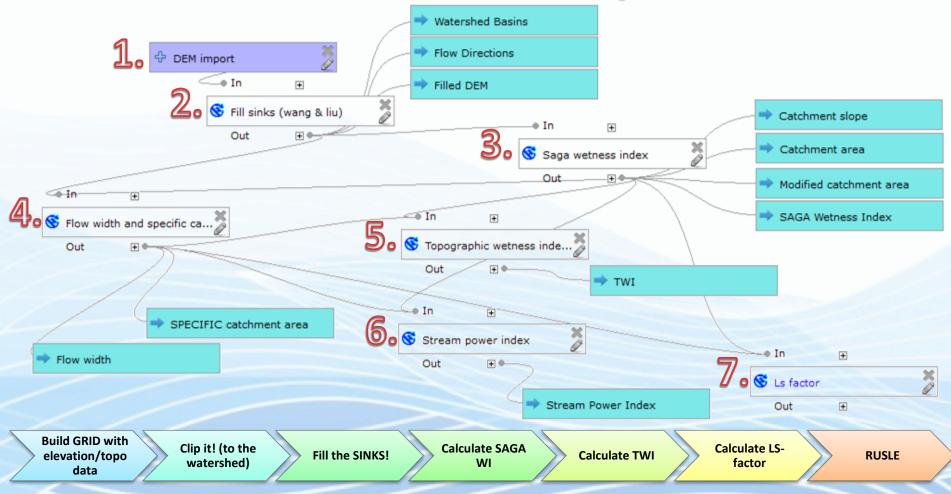
Geologic map







### **Procedural steps**

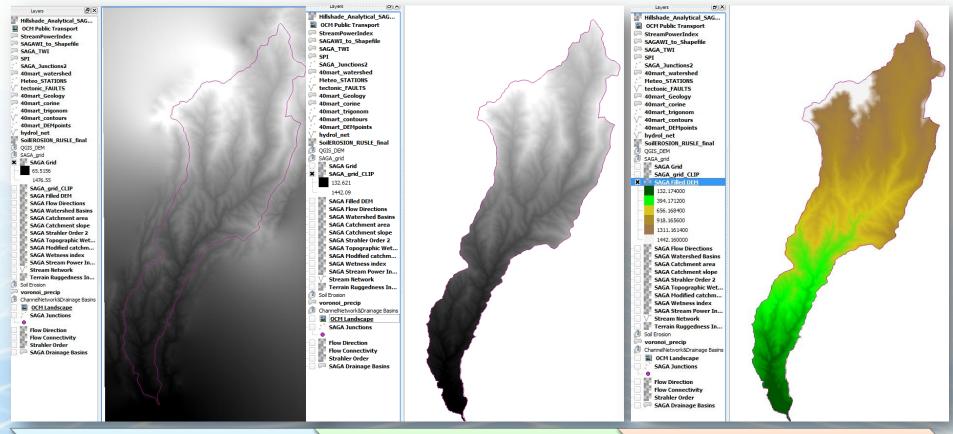








# **GRID Related Processes**



Build GRID with elevation/topo data

#### Clip it! (to the watershed)

#### Fill the SINKS!







# **GRID Related Processes – Fill Sinks**

### Description

This module uses an algorithm (Wang & Liu, 2006) to identify and fill surface depressions in digital elevation models. The method was enhanced to allow the creation of hydrologic sound elevation models, i.e. not only to fill the depression(s) but also to preserve a downward slope along the flow path. This is accomplished by preserving a minimum slope gradient between cells. This is the fully featured version of the module creating a depressionless DEM, a flow path grid and a grid with watershed basins.

#### References

Wang, L. & H. Liu (2006): An efficient method for identifying and filling surface depressions in digital elevation models for hydrologic analysis and modeling. International Journal of Geographical Information Science, Vol. 20, No. 2: 193-213.

H- Terrain Analysis - Channels Burn stream network into d... Catchment area (flow traci... Catchment area (mass-flux... Catchment area (parallel) Catchment area (recursive) Cell balance Edge contamination Fill Sinks Fill sinks (wang & liu) Fill sinks xxl (wang & liu) Flat detection Flow path length Flow width and specific cat... Lake flood Ls factor Saga wetness index Sink drainage route detection Sink removal Slope length Stream power index Topographic wetness index... Upslope Area







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**REFERENCES** 

#### Common borders. Common solutions.

### **SAGA Wetness Index**

#### SAGA Wetness Index

#### Module

Name	SAGA Wetness Index
ID	15

Author (c) 2001 by J.Boehner, O.Conrad

Menu Terrain Analysis > Hydrology > Topographic Indices

Type Grid

#### Description

The 'SAGA Wetness Index' is, as the name says, similar to the 'Topographic Wetness Index' (TWI), but it is based on a modified catchment area calculation ('Modified Catchment Area'), which does not think of the flow as very thin film. As result it predicts for cells situated in valley floors with a small vertical distance to a channel a more realistic, higher potential soil moisture compared to the standard TWI calculation.

#### References

- Boehner, J., Koethe, R. Conrad, O., Gross, J., Ringeler, A., Selige, T. (2002): Soil Regionalisation by Means of Terrain Analysis and Process Parameterisation. In: Micheli, E., Nachtergaele, F., Montanarella, L. [Ed.]: Soil Classification 2001. European Soil Bureau, Research Report No. 7, EUR 20398 EN, Luxembourg. pp.213-222.

#### Parameters Identifier Name Type Description Constraints Input Grid (input) DEM Elevation Output Grid (output) С Catchment area Catchment slope Grid (output) GN Modified catchment area Grid (output) CS SB Wetness index Grid (output) Options l t Floating point Т Minimum: 0.000000

#### SAGA GIS







# **SAGA Wetness Index**

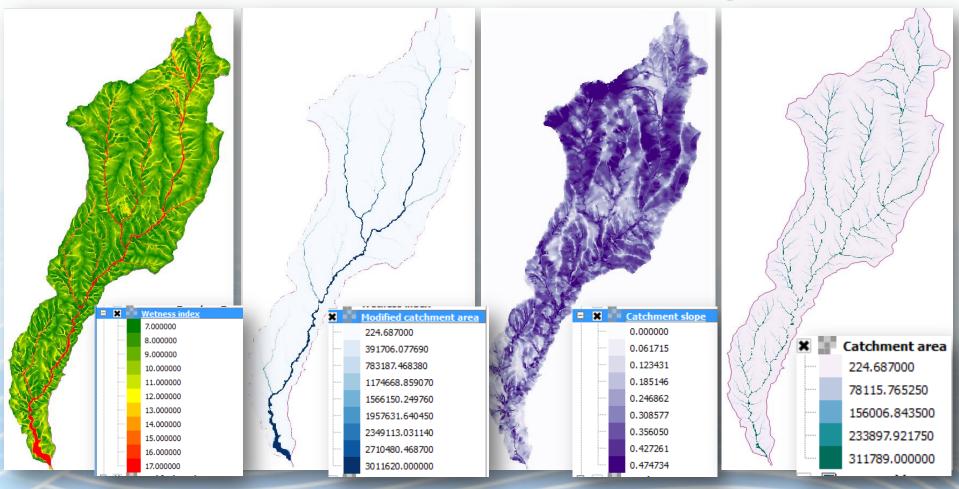
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### **SAGA Wetness Index - Outputs**









### Flow Width & Specific Catchment Area

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Flow Width and Specific Catchment Area

REFERENCES

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Author O.Conrad (c) 2003	-lana Tananahia kadiasa				- V Terrain Analysis - Hydrology
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### TWI vs SAGA WI



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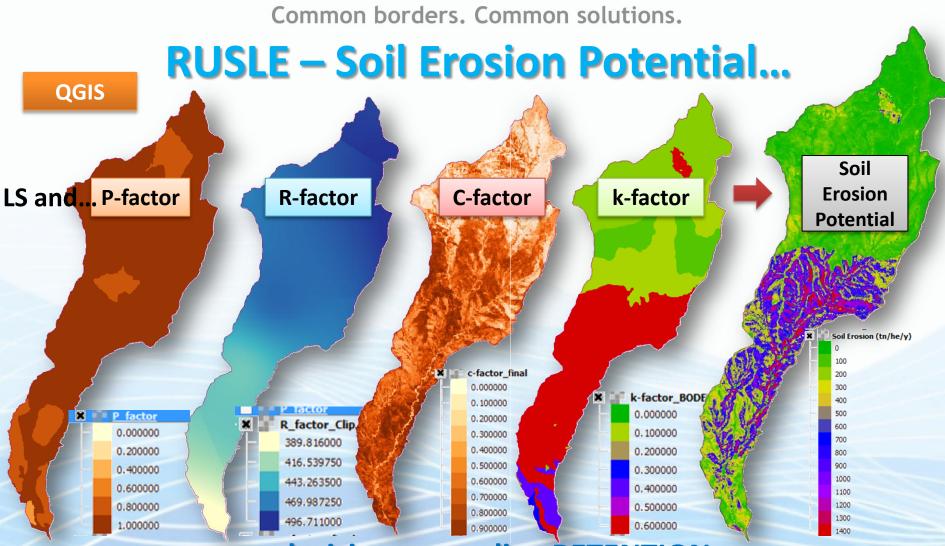
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Saga wetness index Sink drainage route de Sink removal Slope length Stream power index Topographic wetness i Upslope Area Terrain Analysis - Lighting Terrain Analysis - Porfiles Component of the after running algorithm Component o		Pill/Interrill Fracivity		
Sink drainage route de         Sink removal         Slope length         Stream power index         Topographic wetness i         Upslope Area         Terrain Analysis - Lighting         Terrain Analysis - Profiles             Volume             Solution             Solution <th><u> </u></th> <th>Rin/Lineernin Erosivity</th> <th></th> <th></th>	<u> </u>	Rin/Lineernin Erosivity		
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Slope length Stream power index Topographic wetness i Upslope Area Terrain Analysis - Lighting Terrain Analysis - Profiles CGGIS Stability [0] stable LS Factor [Save to temporary file] Concol Conc Concol Con				
Stream power index         Topographic wetness i         Upstope Area         E Terrain Analysis - Lighting         Terrain Analysis - Stroffles         Image: Construction of the stream power of the s	<u> </u>	Stability		
Contract of the contract of th		[0] stable		X LS Factor clip
LS Factor Save to temporary file] Construction	· · · · · · · · · · · · · · · · · · ·			
Image: Sevent to temporary file       Image: Sevent temporary file <td></td> <td>LS Factor</td> <td></td> <td></td>		LS Factor		
Image: Contrain Analysis - Morphometry       Image: Contrain Analysis - Profiles       Image: Contrain Analysi		[Save to temporary file]		
QGIS         0%         4.00000           Run         Close         Cancel         6.00000           9,00000         8.00000         9.00000	Terrain Analysis - Morphometry			
QGIS         0%         5.00000           Run         Close         Cancel         6.00000           9.00000         9.00000         9.00000	Terrain Analysis - Profiles	Open output file after running algorithm		
QGIS         0%         6.00000           Run         Close         Cancel         7.00000           9.00000         9.00000         9.00000				
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				10.000000









... to support decisions regarding RETENTION measures







**RUSLE – Soil Erosion Potential...** 

...Can be used to plan Sediment Retention structures (assess location) upstream in order to effectively control sediment transport towards the flood prone area.

**Soil Erosion Potential** 

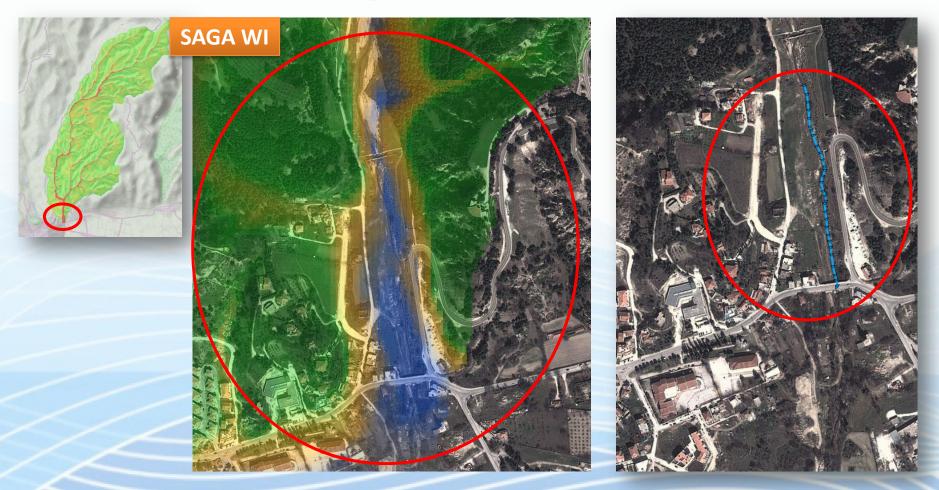
Soil Erosion (tn/he/y)







### **From Regional to Local Scale**

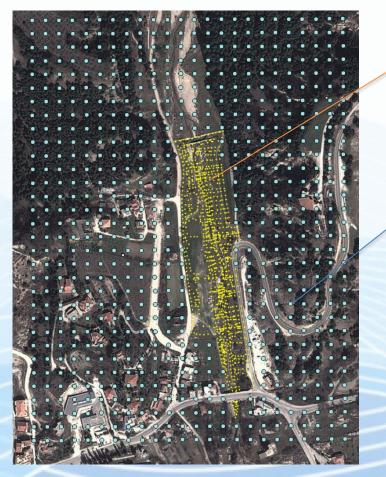








# **Detailed Topographic Data**



Measured in situ with GPS (differential GPS & RTK)

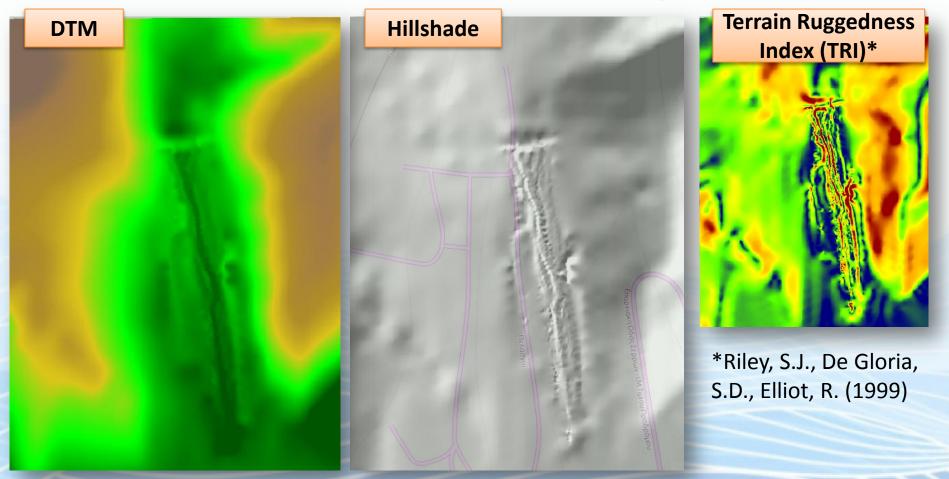
Lattice /25m or Produced by topographic maps 1:2.000 - 1 : 5.000







### **DTM & Products – additional parameters**



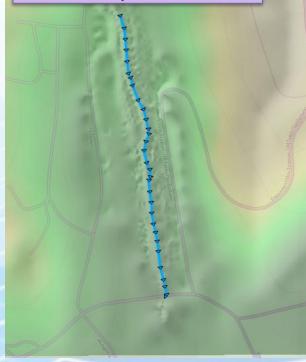






## **Cross Sections**

Requirements 1. DTM 2. STREAM (digitized towards downstream)

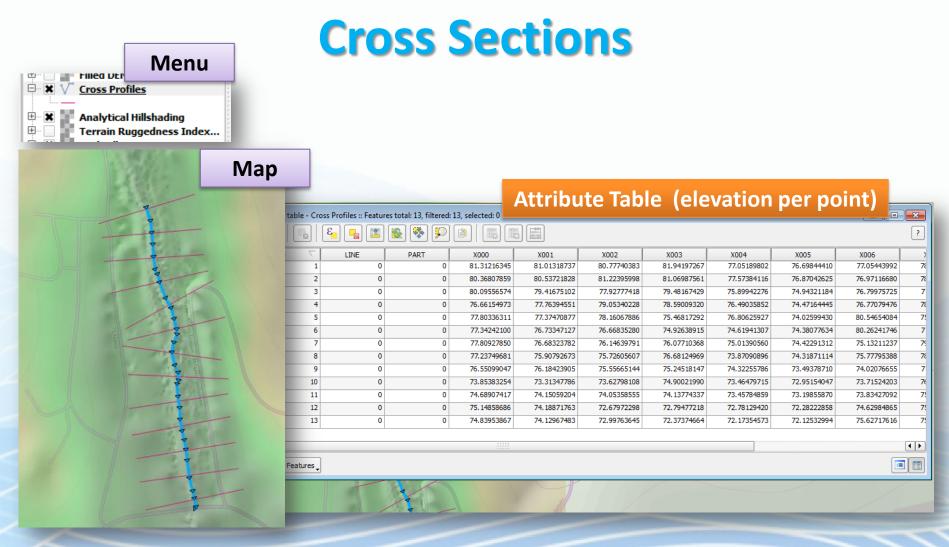


			da eta 7 commanas [100 geoal dels [5 geoalgorithms] unieo Toolbox (Image analysis) [8 QGIS geoalgorithms [68 geoalgorit SAGA [243 geoalgorithms] ⊡ Geostatistics ⊕ Grid - Analysis
Cross profiles Parameters Log Help DEM Grid_All_Points [EPSG:2100] Lines main_stream [EPSG:2100] Profile Distance 25.00000 Profile Length 50.00000 Profile Samples	DTM Stream DTM Stream Distance between pro Profile Length Points per Profile	····	Grid - Calculus     Grid - Filter     Grid - Filter     Grid - Filter     Grid - Spline     Grid - Spline     Grid - Visualization     Grid - Visualization     Grid - Visualization     Imagery - Classification     Imagery - RSA     Imagery - RSA     Imagery - Tools     Kriging     Recreations     Shapes - Grid     Shapes - Grid     Shapes - Points     Shapes - Points     Shapes - Tools     Shapes - Tools     Shapes - Tools     Simulation - Fire Spreading     Table - Cols     Taraie - Tools     Terrain Analysis - Channels     Terrain Analysis - Lighting
10,00000         Cross Profiles         [Save to temporary file]         Image: Comparison of the stress of the stres	File Name of Cross Sect	····	Terrain Analysis - Morphometry     Terrain Analysis - Profiles     Cross profiles     Profiles from lines     Profiles from lines     Scripts [14 geoalgorithms]     Tools for LiDAR data [42 geoalgorit.











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### Common borders. Common solutions.

## **Cross Sections to ....HEC-RAS**

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Т	ID 🗸	LINE	PART	X000	X001	X002	X003	X004	X005	X006	;
	1	0	0	81.31216345	81.01318737	80.77740383	81.94197267	77.05189802	76.69844410	77.05443992	78
	2	0	0	80.36807859	80.53721828	81.22395998	81.06987561	77.57384116	76.87042625	76.97116680	78
	3	0	0	80.09556574	79.41675102	77.92777418	79.48167429	75.89942276	74.94321184	76.79975725	7
	4	0	0	76.66154973	77.76394551	79.05340228	78.59009320	76.49035852	74.47164445	76.77079476	78
ŧ.	5	0	0	77.80336311	77.37470877	78.16067886	75.46817292	76.80625927	74.02599430	80.54654084	7
	6	0	0	77.34242100	76.73347127	76.66835280	74.92638915	74.61941307	74.38077634	80.26241746	7
	7	0	0	77.80927850	76.68323782	76.14639791	76.07710368	75.01390560	74.42291312	75.13211237	79
1	8	0	0	77.23749681	75.90792673	75.72605607	76.68124969	73.87090896	74.31871114	75.77795388	78
	9	0	0	76.55099047	76.18423905	75.55665144	75.24518147	74.32255786	73.49378710	74.02076655	7
,	10	0	0	73.85383254	73.31347786	73.62798108	74.90021990	73.46479715	72.95154047	73.71524203	76
.0	11	0	0	74.68907417	74.15059204	74.05358555	74.13774337	73.45784859	73.19855870	73.83427092	7
1	12	0	0	75.14858686	74.18871763	72.67972298	72.79477218	72.78129420	72.28222858	74.62984865	7
2	13	0	0	74.83953867	74.12967483	72.99763645	72.37374664	72.17354573	72.12532994	75.62717616	7
Ľ				**** ***** *****							••
	Show All Features	1								=	

and we copy those data and paste them into HEC-RAS cross section creation module



**SciNet NatHaz** 





Common borders. Common solutions.

SciNetNatHaz Project Progress Meeting - 23-26 Oct 2014, Burgas, Bulgaria

# Using Man Fic models and Open Source Software to Incate Flood prone areas

**Flood prone areas** of Implementation

> Konstantinos Papatheodorou Helena Tzanou

TEI of Kentriki Makedonia, LP/ENPI Beneficiary