

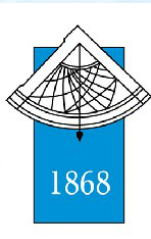


Common borders. Common solutions.

# Regional and Local Scale Flood Hazard Assessment in Tekirdağ and Samsun



Istanbul Technical University  
Department of Civil Engineering  
Division of Hydraulics (ITU)



In collaboration with  
Bogazici University  
Kandilli Observatory and Earthquake Research Institute  
(KOERI)

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Isitan Selin ERMIS



Common borders. Common solutions.

## Contents

- Introduction
- Regional Scale Applications
- Local Scale Applications
- Conclusion





## Ayamama Creek Flood, Istanbul, 2009



SciNetNatHazPrev: “...to achieve a strong cooperation, to setup common strategies...”



(Particularly in Turkey's Black Sea Region)

## Causes of Floods



- Topographic factors
- Meteorological factors
- Other factors ( Inappropriate land use, insufficient flood control structures and lack of channel improvements)
- ...

## Consequences of Floods

- Loss of human life
- Damage to property
- Destruction of crops and loss of livestock
- ...

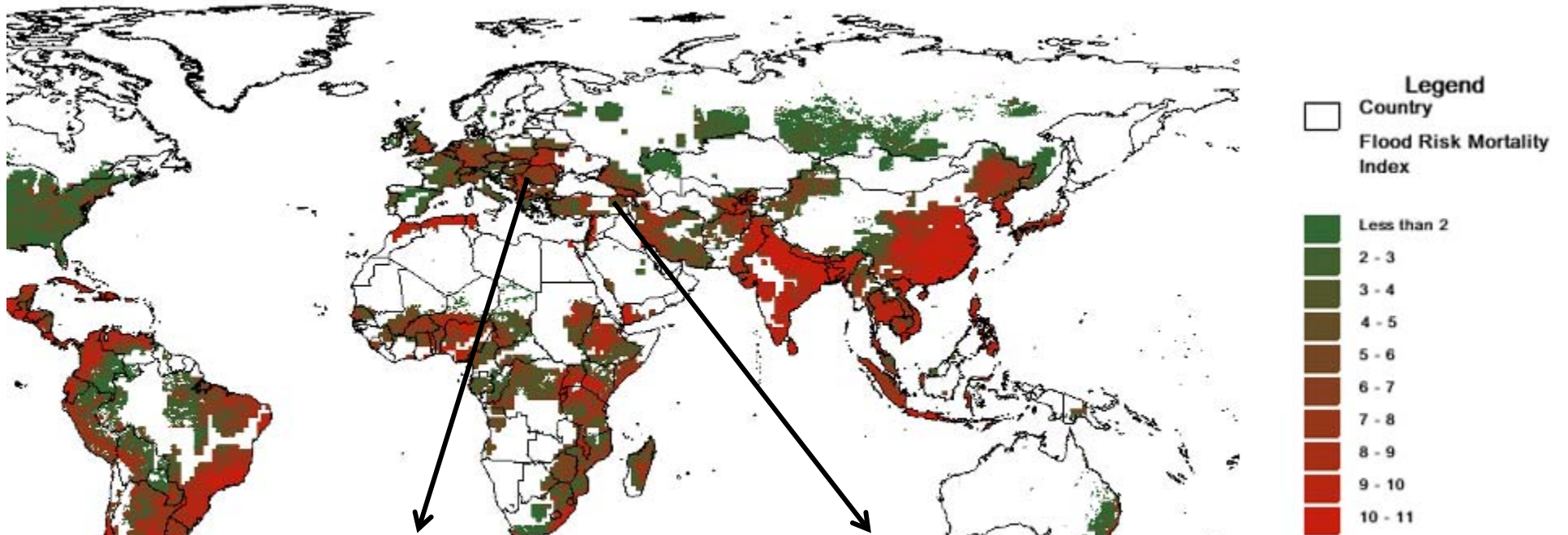


Karen A. Lemke  
(klemke@uwsp.edu)





# World Flood Risk Mortality Index





# Hazard Map of Turkey (1950 – 2008, earthquake excluded)



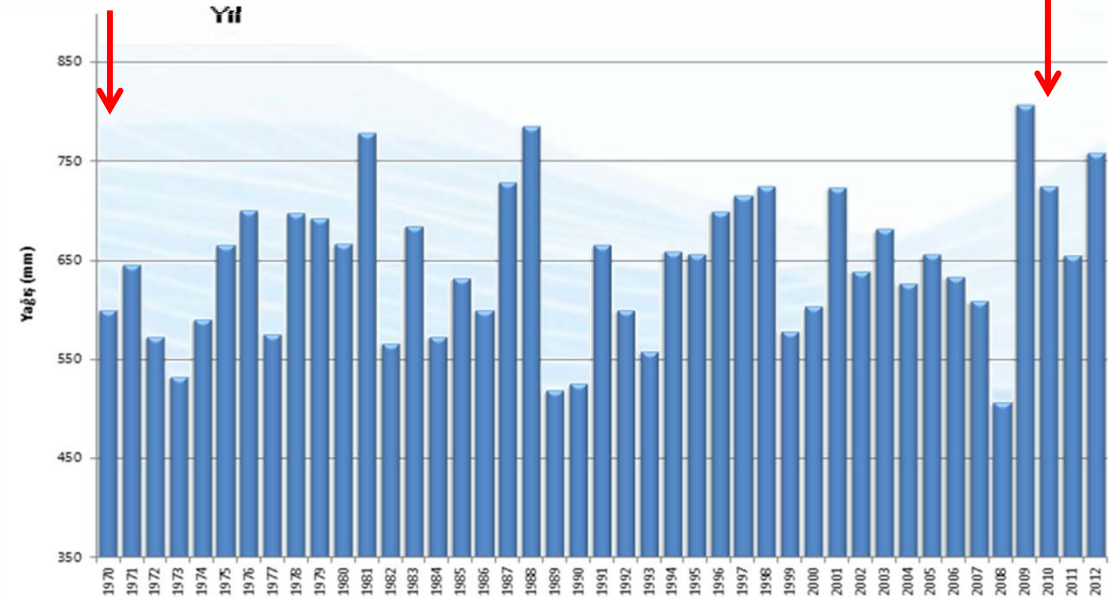
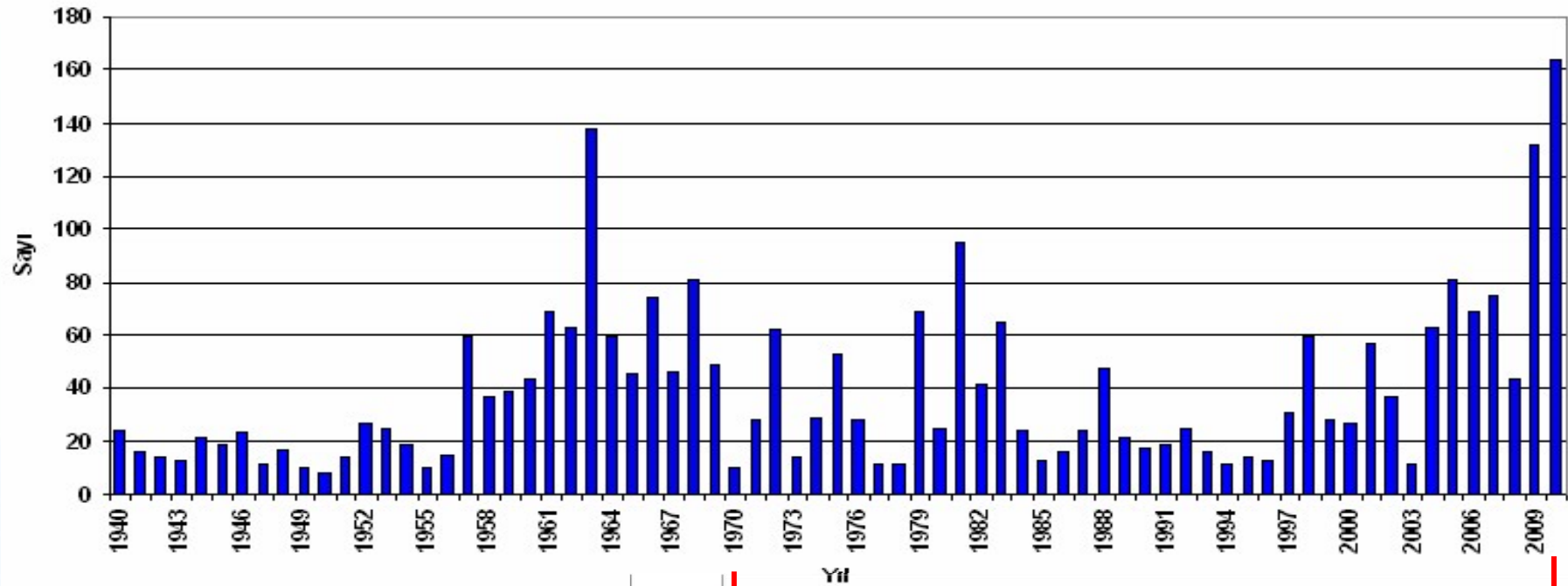
- Landslide events
- Rock-fall events
- Flood events
- Avalanche events



- In the last 20 years total 369 recorded flood events with **448 life losses**
- Only between 2000-2009 **over 250 million USD loss** in 18 recorded flood events.



# Number of Floods (1940 -2010)



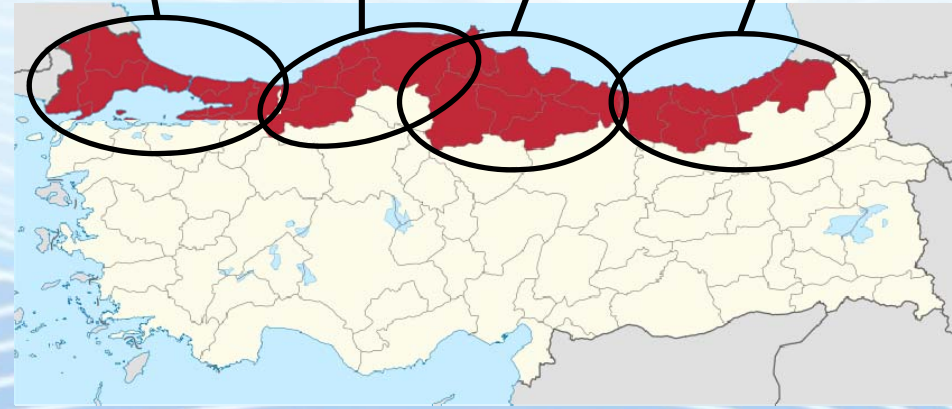




# Loss due to Floods in Turkey's Black Sea Region (1956 -1998)



Flood Importance Level	Human Life Loss	Damage Cost (\$)	Floodplain (1000 m <sup>2</sup> )	Εβρος/ Maritza/ Meriç and Ergene	Western Black Sea	Central Black Sea	Eastern Black Sea
Low		< 50000	< 2000	25	41	11	28
Medium		50000 – 200000	2000 – 5000	11	3	4	10
High		200000 – 500000	5000 – 10000	3	1	4	8
Very High	>= 1	> 500000	> 10000	23	8	13	40





# Legislative Framework on Flood in Turkey

LAW	<ol style="list-style-type: none"> <li>1. ORGANIZATION AND DUTIES OF THE GENERAL DIRECTORATE OF STATE HYDRAULIC WORKS</li> <li>2. PROTECTION AGAINST FLOOD</li> <li>3. METROPOLITAN MUNICIPALITIES</li> <li>4. PRECAUTIONS FOR DISASTERS AFFECTING EVERYDAY LIFE</li> <li>5. MUNICIPALITY LAW</li> <li>6. ORGANIZATION AND DUTIES OF THE PRESIDENCY FOR DISASTER AND EMERGENCY MANAGEMENT (AFAD)</li> <li>7. ORGANIZATION AND DUTIES OF TURKISH STATE METEOROLOGICAL SERVICE</li> <li>8. ESTABLISHMENT AND DUTIES OF GENERAL DIRECTORATE OF ISTANBUL WATER AND SEWAGE ADMINISTRATION (ISKI)</li> <li>9. TURKISH CRIMINAL CODE</li> </ol>
DECREE	<ol style="list-style-type: none"> <li>1. ESTABLISHMENT AND DUTIES OF THE MINISTRY OF FORESTRY AND WATER MANAGEMENT</li> </ol>
CIRCULAR	<ol style="list-style-type: none"> <li>1. STREAM BEDS AND FLOODS (No. 2006/27)</li> <li>2. RIVER AND STREAMBED REGULATION (No. 2010/5)</li> </ol>

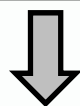
## Common borders. Common solutions.

Hazard Type	What is lacking	Reasons/Drawbacks	SciNetNatHaz
Floods	<b>Cross Border cooperation.</b>	Lack of Political will, lack of public awareness.	Raising public awareness, provide assistance to Decision Makers
	<b>Systematic Flash Flood Hazard</b> assessment on a local scale in order to design preventive measures.	Multitude of methodologies, lack of reliable, accurate and harmonized data.	Harmonization of Methodologies, freely accessible GIS platform with PRODUCED by the Project Data & Results, Metadata according to INSPIRE provisions.

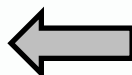


REGIONAL

Meteorological Data  
Input



Topographical Data  
Input



Regional /  
Hydrological  
(Basin) Model



Hydraulic (Flow)  
Model:

- 1D-2D Flow
- Flow velocities
- Water levels



Inundation Output

- Flood-prone area

LOCAL



Common borders. Common solutions.

# Regional Scale Flood Hazard Assessment in Samsun and Tekirdağ





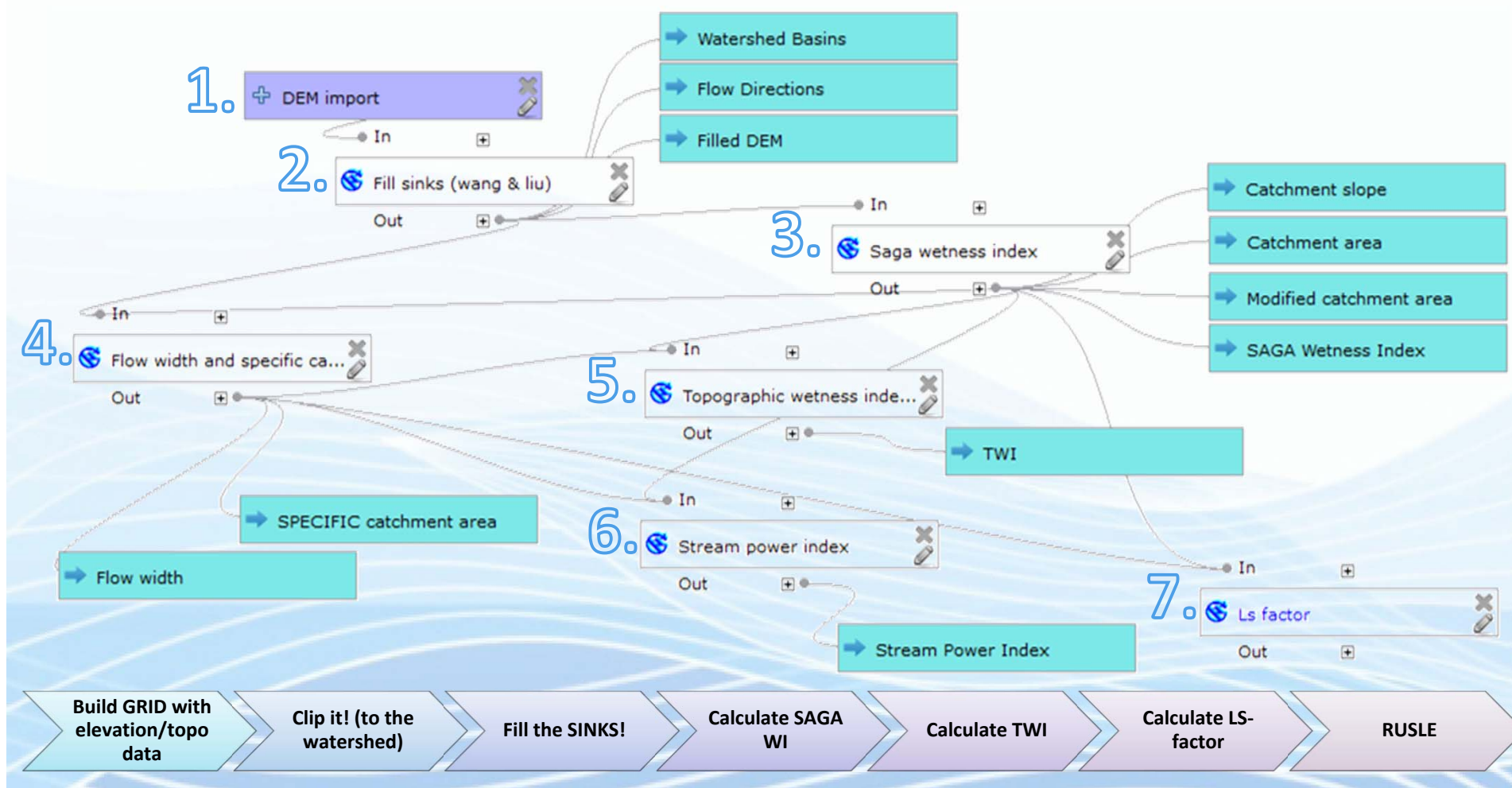
Common borders. Common solutions.

## Data and Software

- Data (Topographic data only):
  - Maps of Samsun and Tekirdağ with 1/25000 scale (Turkish Army, General Command of Maps)
  - Basin Borders – (Turkish Ministry of Forestry and Water)  
<http://geodata.ormansu.gov.tr>
- Software:
  - QGIS
  - SAGA GIS

Common borders. Common solutions.

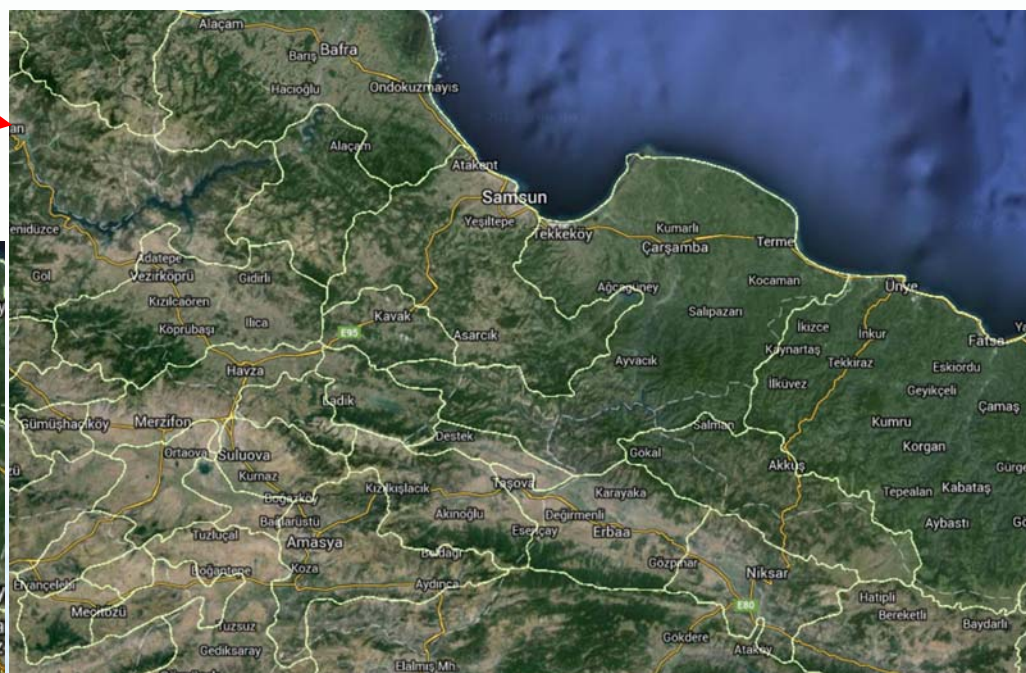
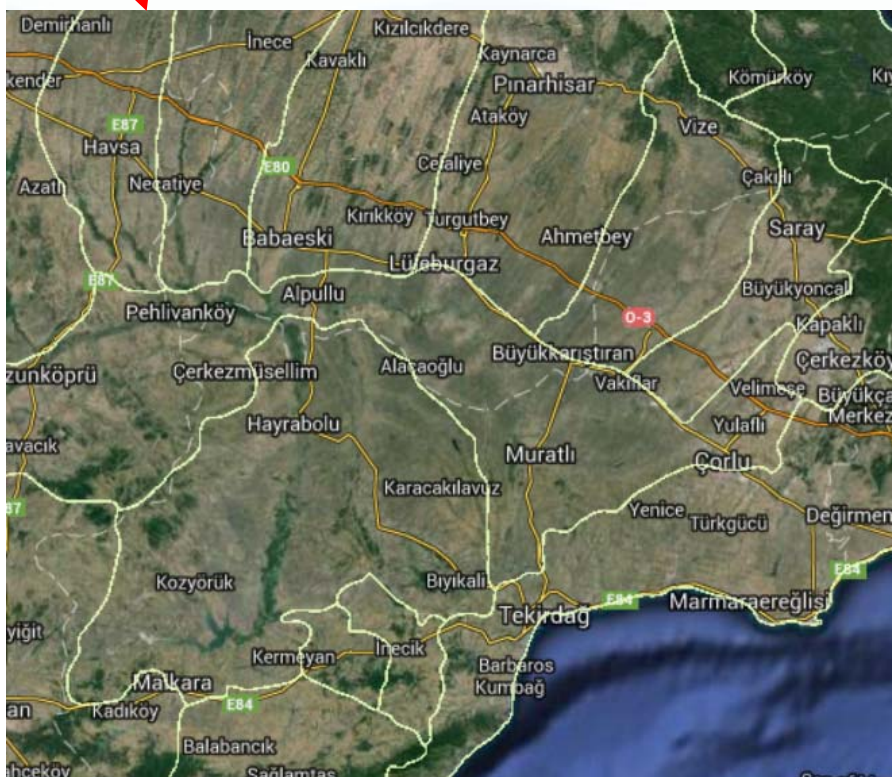
# Steps for Wetness Index Calculation in QGIS







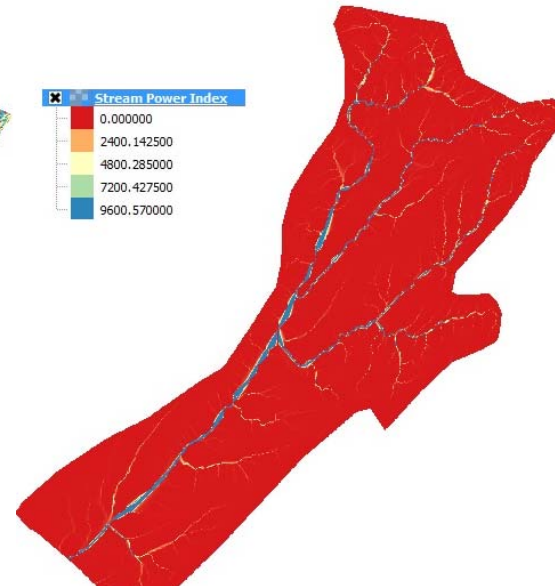
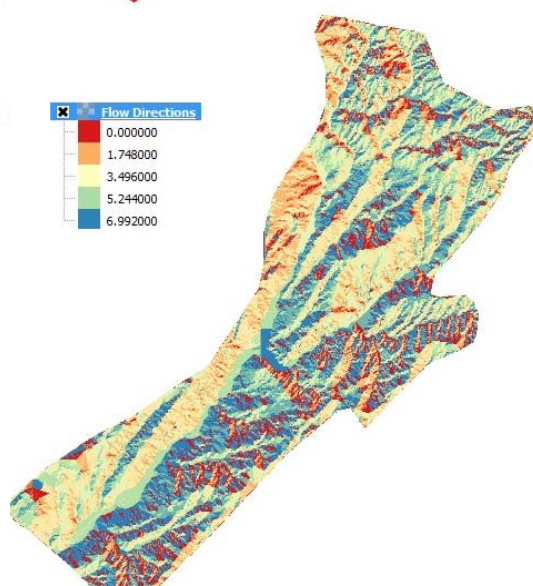
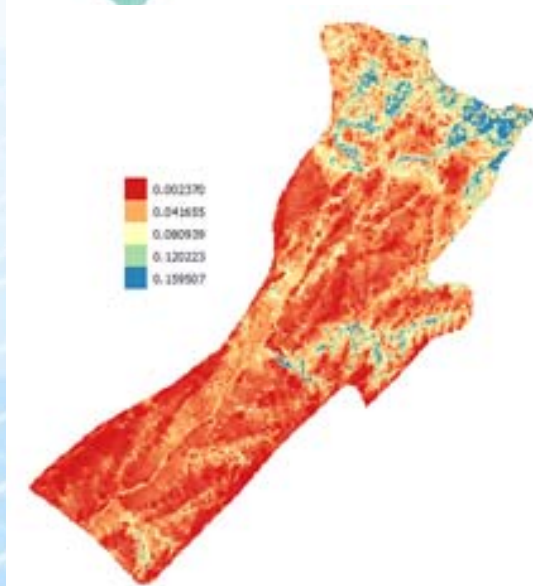
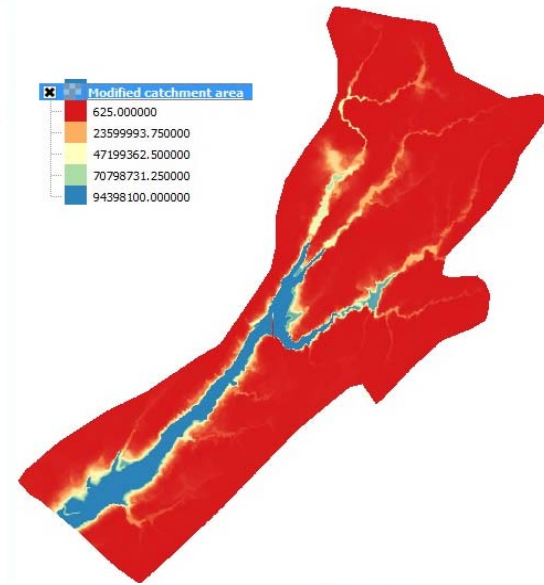
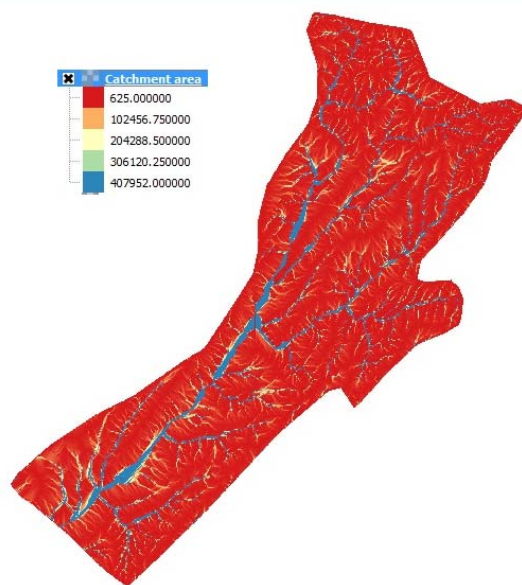
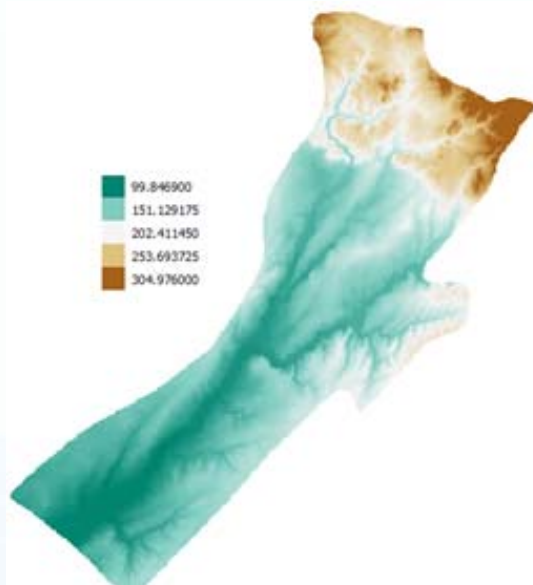
## TEKIRDAG and SAMSUN







Project funded by the  
EUROPEAN UNION



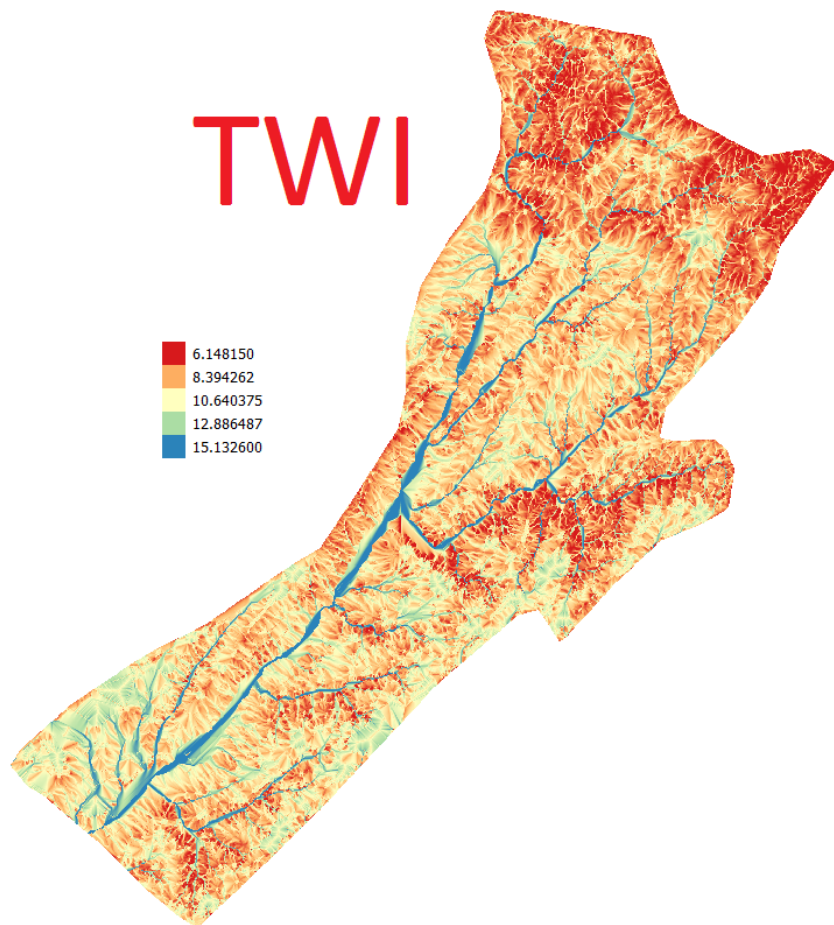
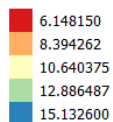


## RESULTS OF REGIONAL SCALE MODELS

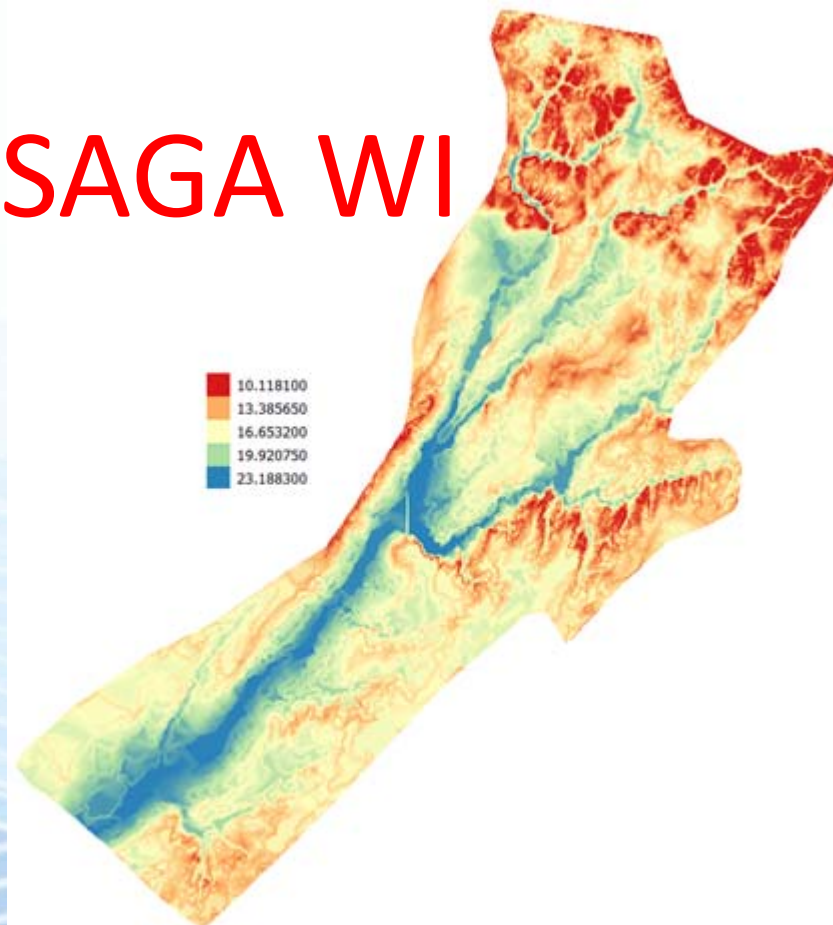
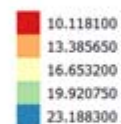
### TEKIRDAG SARAY SUBBASIN

Area 454 km<sup>2</sup>

# TWI



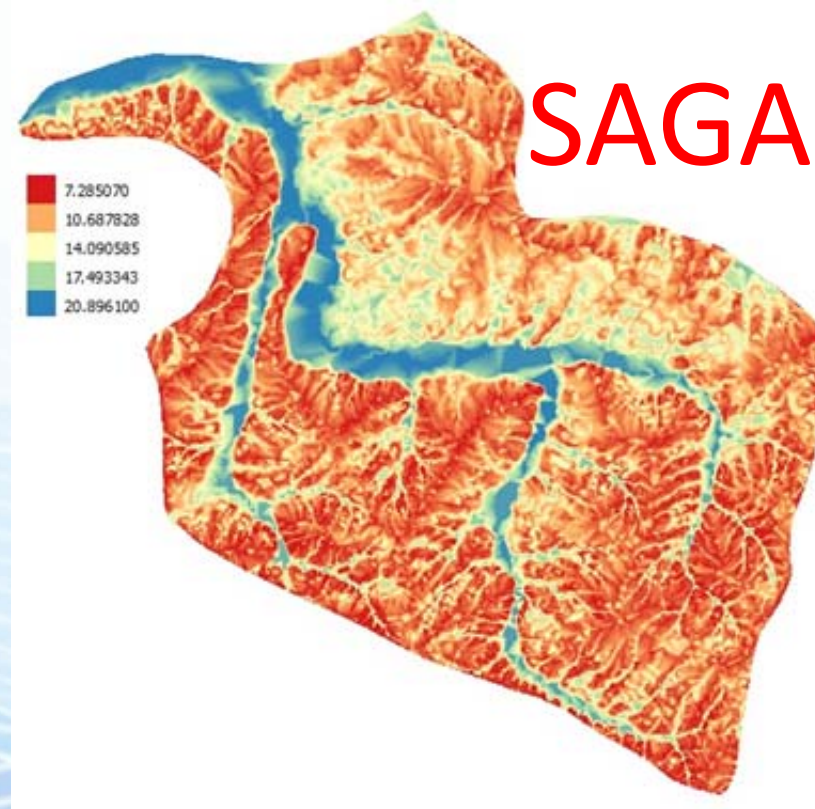
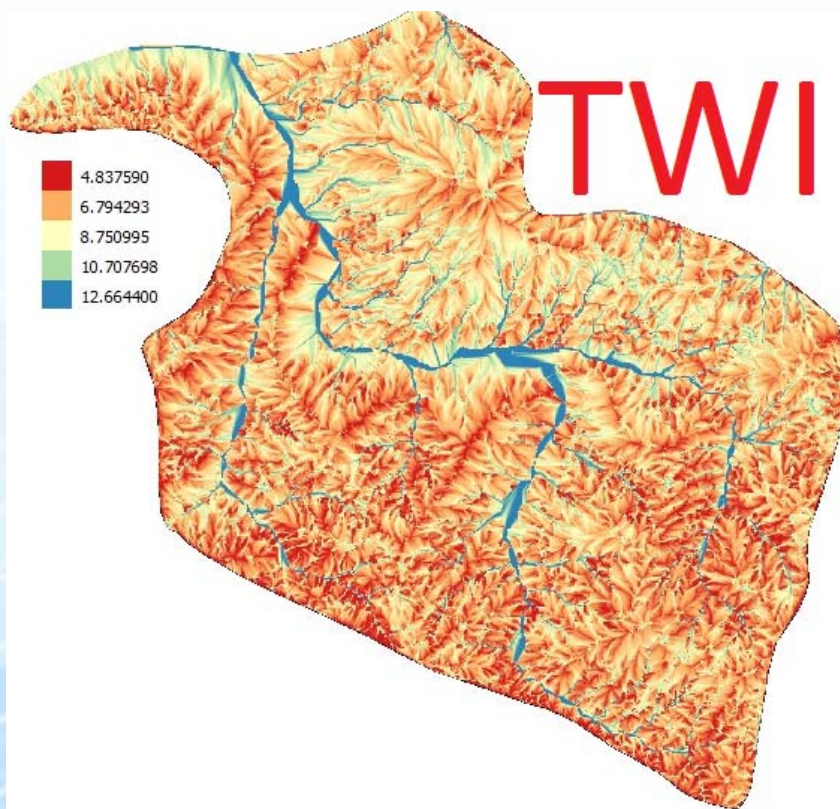
# SAGA WI



## RESULTS OF REGIONAL SCALE MODELS

TEKIRDAG YENICE SUBBASIN

Area 118 km<sup>2</sup>

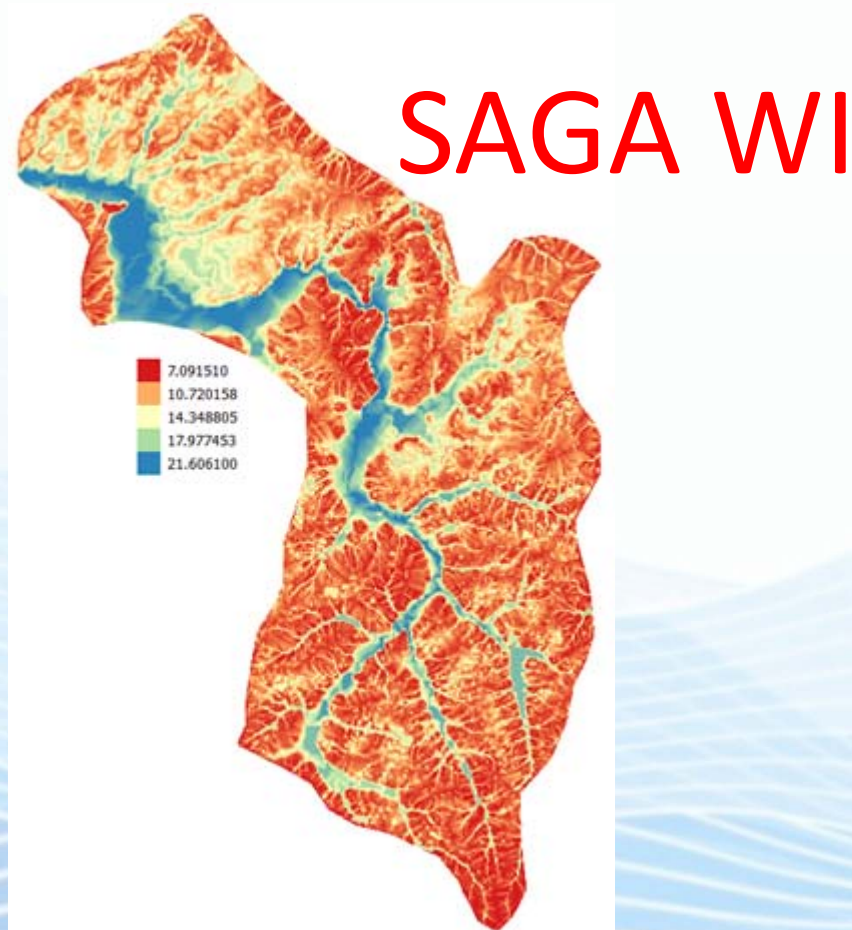
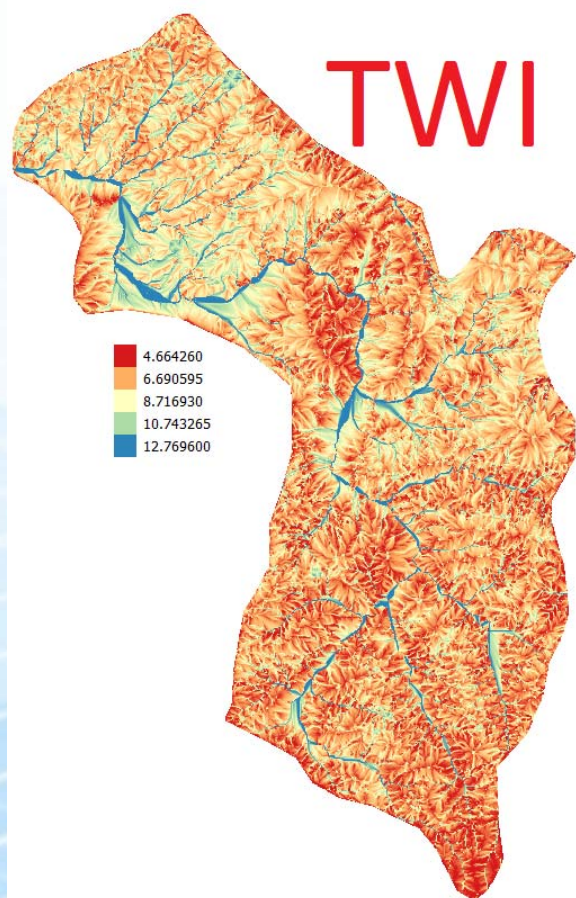




## RESULTS OF REGIONAL SCALE MODELS

### TEKIRDAG INECIK SUBBASIN

Area 165 km<sup>2</sup>

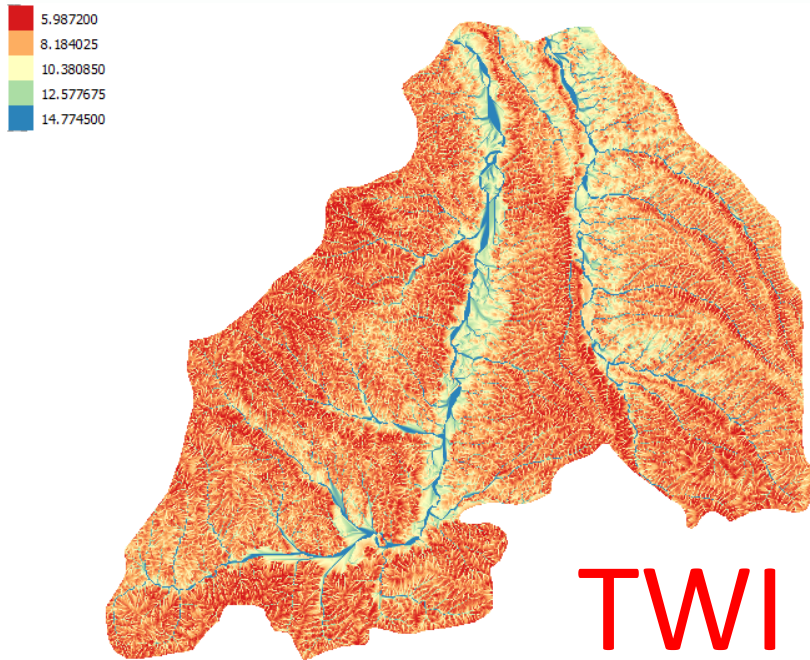




## RESULTS OF REGIONAL SCALE MODELS

### TEKIRDAG HAYRABOLU SUBBASIN

Area 1800 km<sup>2</sup>





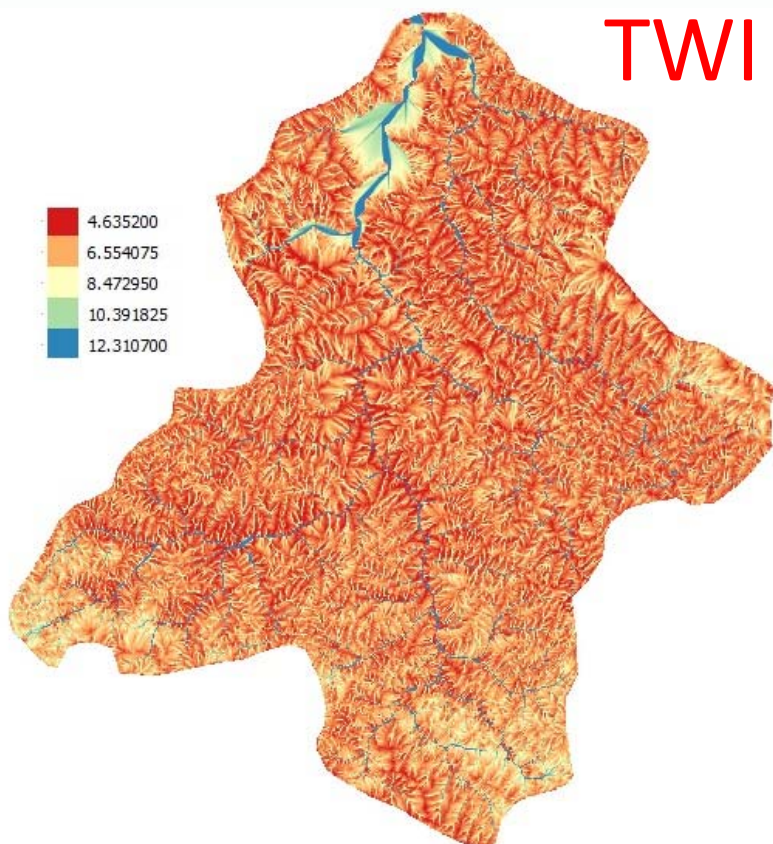


## RESULTS OF REGIONAL SCALE MODELS

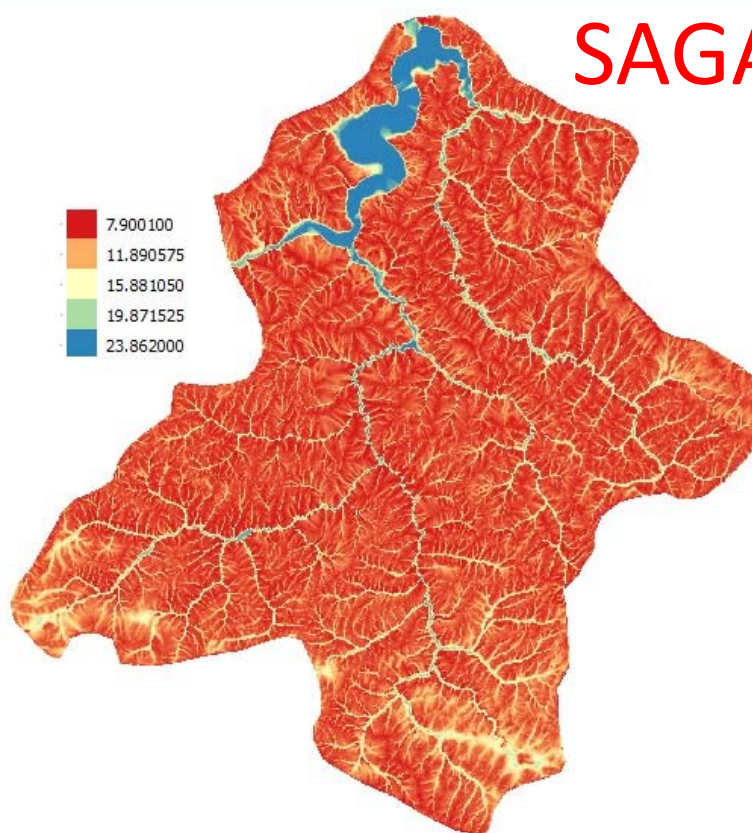
SAMSUN DERBENT SUBBASIN

Area 642 km<sup>2</sup>

TWI



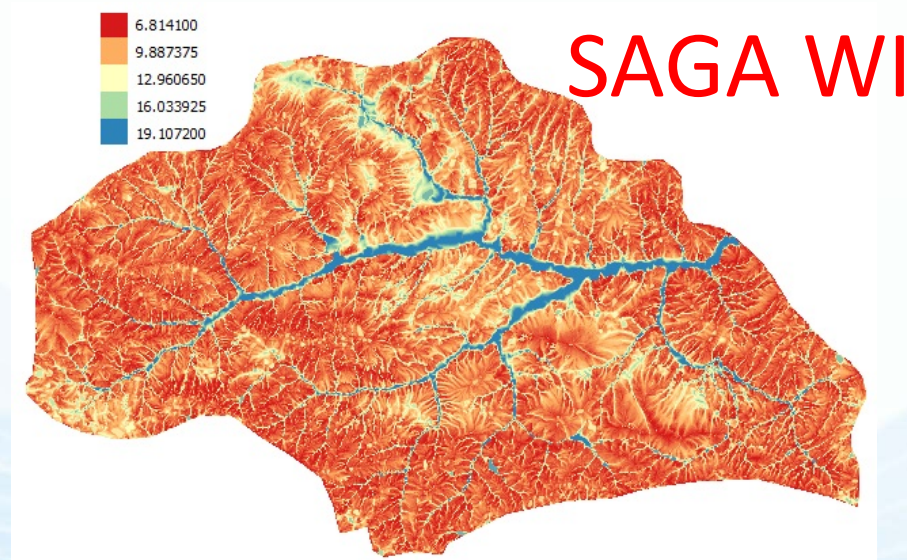
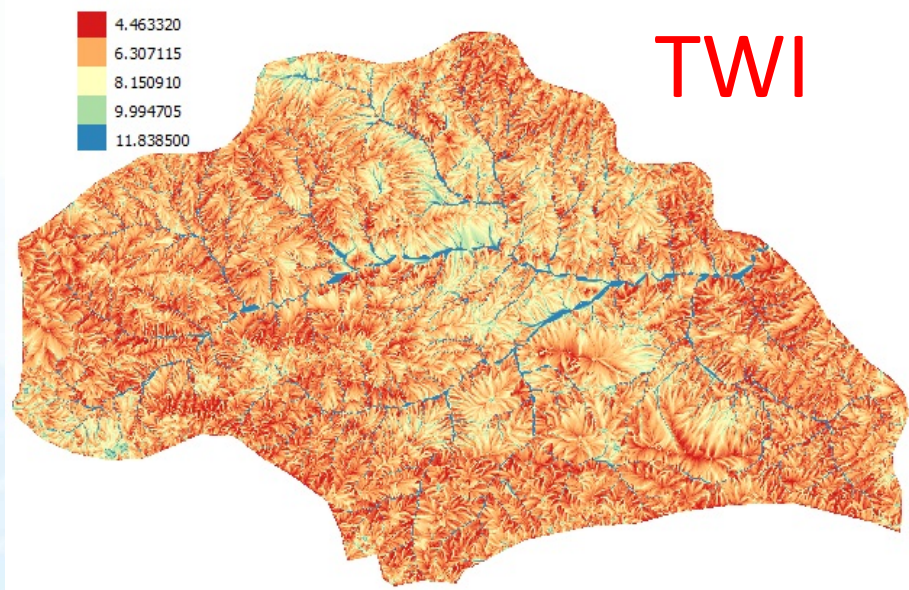
SAGA WI





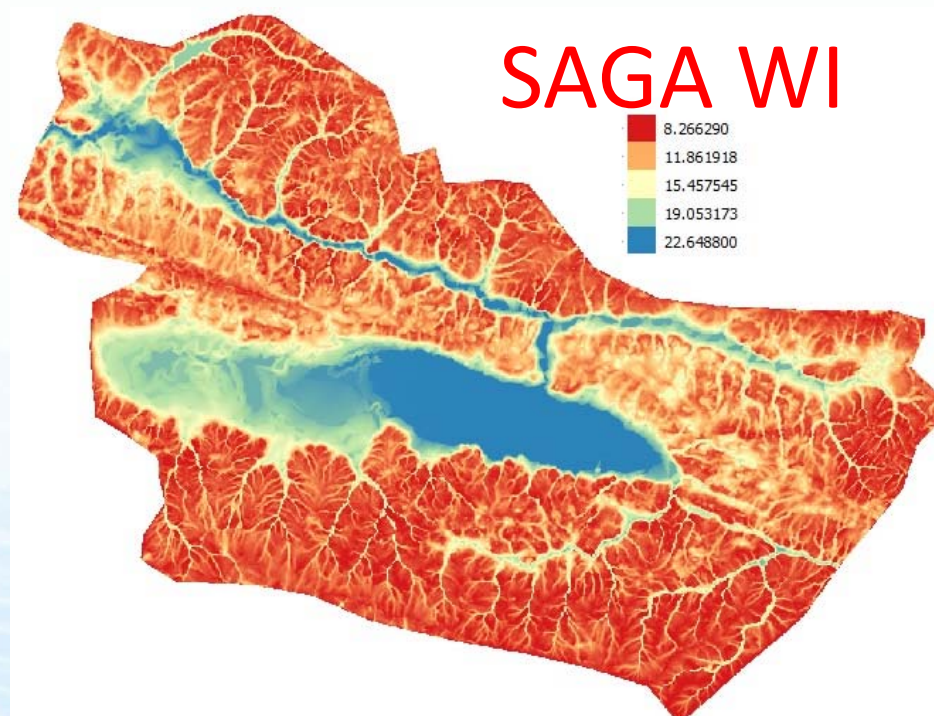
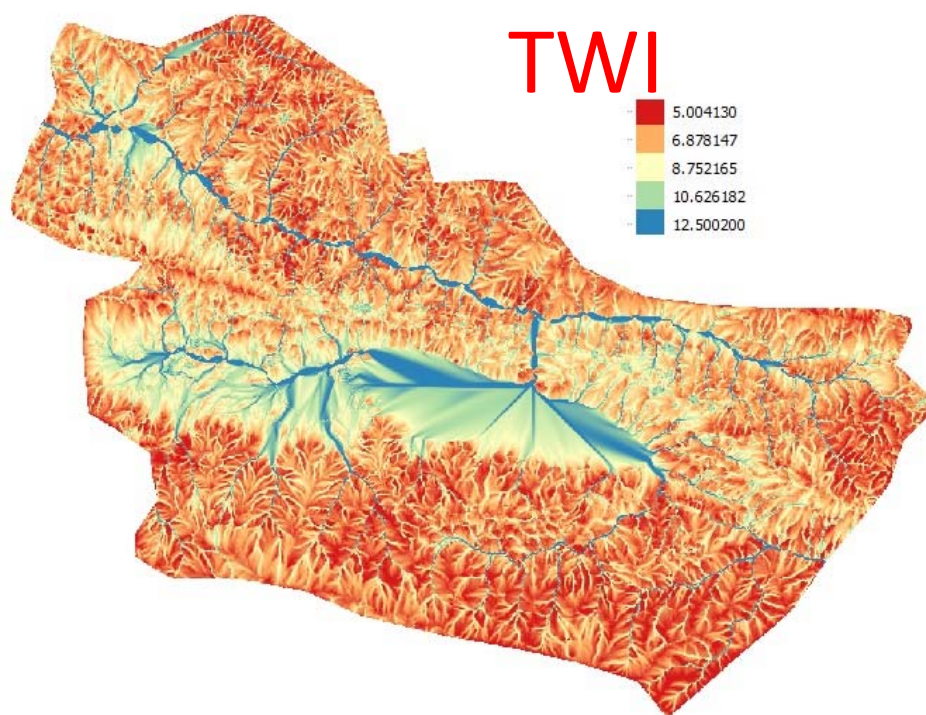
## RESULTS OF REGIONAL SCALE MODELS SAMSUN KAVAK SUBBASIN

Area 296 km<sup>2</sup>



## RESULTS OF REGIONAL SCALE MODELS SAMSUN LADIK SUBBASIN

Area 308 km<sup>2</sup>







Common borders. Common solutions.

# Local Scale Flood Modelling in Samsun, Akçay Creek (Say Creek)



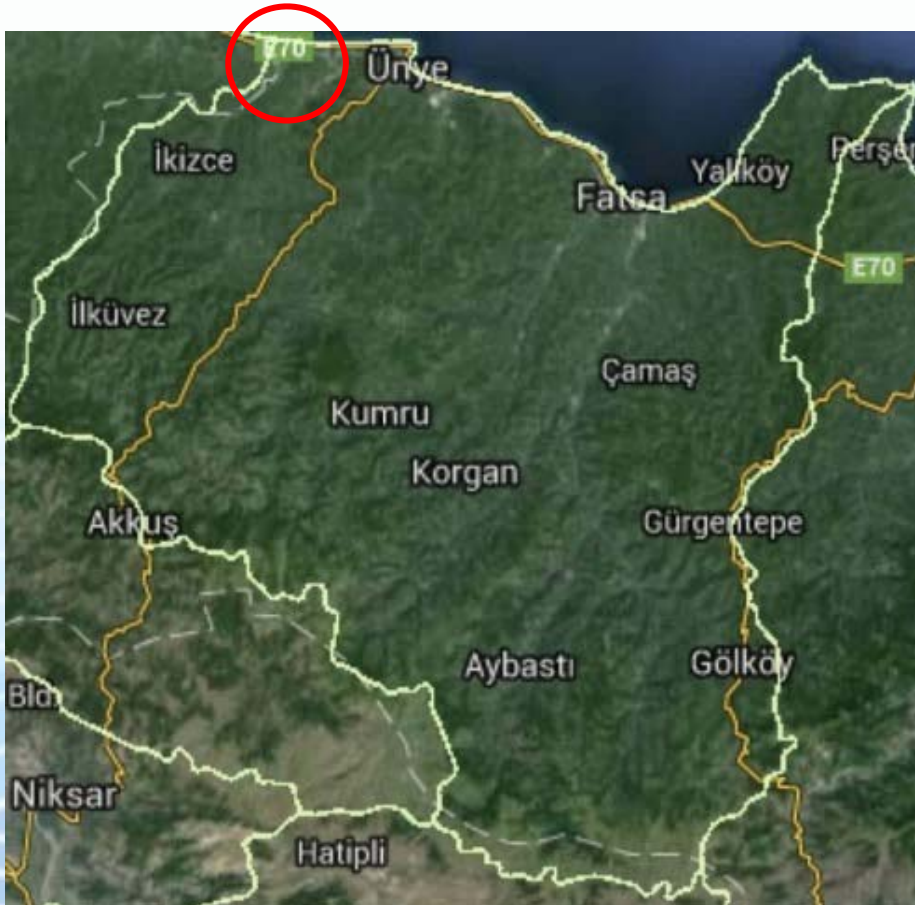


Common borders. Common solutions.

## Data and Software

- Data (Topographic):
  - Maps of Samsun and Tekirdağ with 1/25000 scale (Turkish Army, General Command of Maps)
  - Basin Borders – (Turkish Ministry of Forestry and Water) [geodata.ormansu.gov.tr](http://geodata.ormansu.gov.tr)
  - Samsun Akçay Orthophoto Map with 1/5000 Scale
  - In-Situ Bathimetric Data from Akçay Cross-Sections
- Data (Hydrologic):
  - 2,5,10,25,50,100 and 500 years flood hydrographs of Akçay produced by DSI method
- Software:
  - QGIS
  - SAGA GIS
  - HEC-RAS

## SAMSUN “FATSA-ÜNYE-İKİZCE” SUB-BASIN

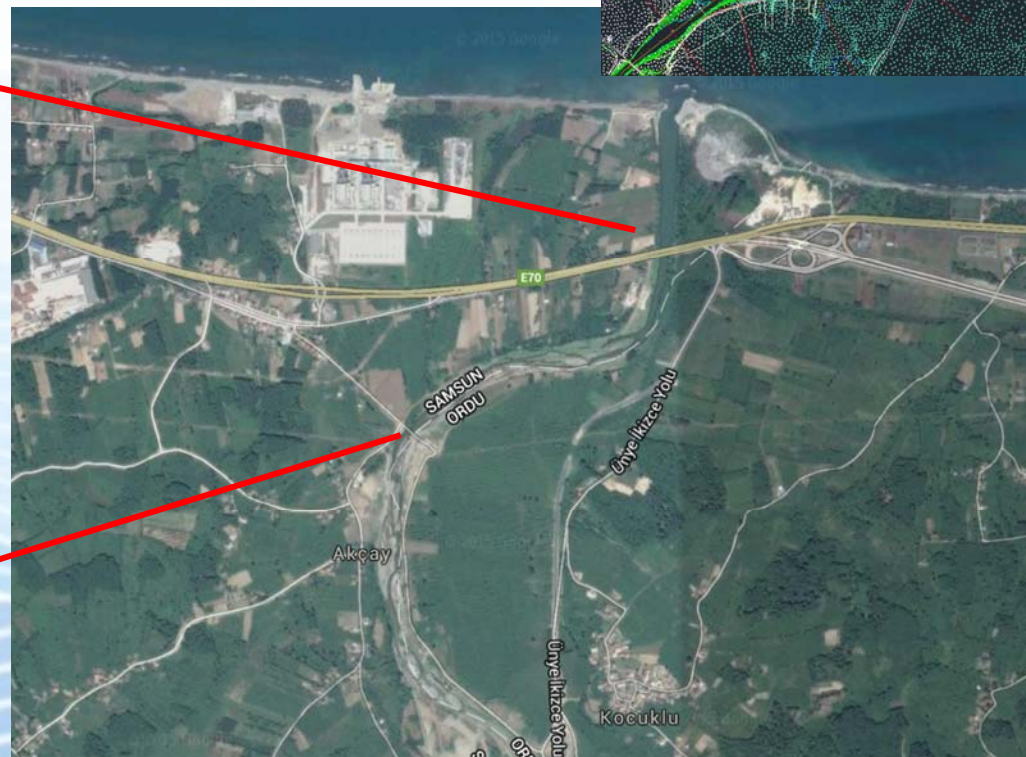


Area	3000 km <sup>2</sup>
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## AKÇAY CREEK DOWNSTREAM REGION

LNG Power Plant



The Old Bridge







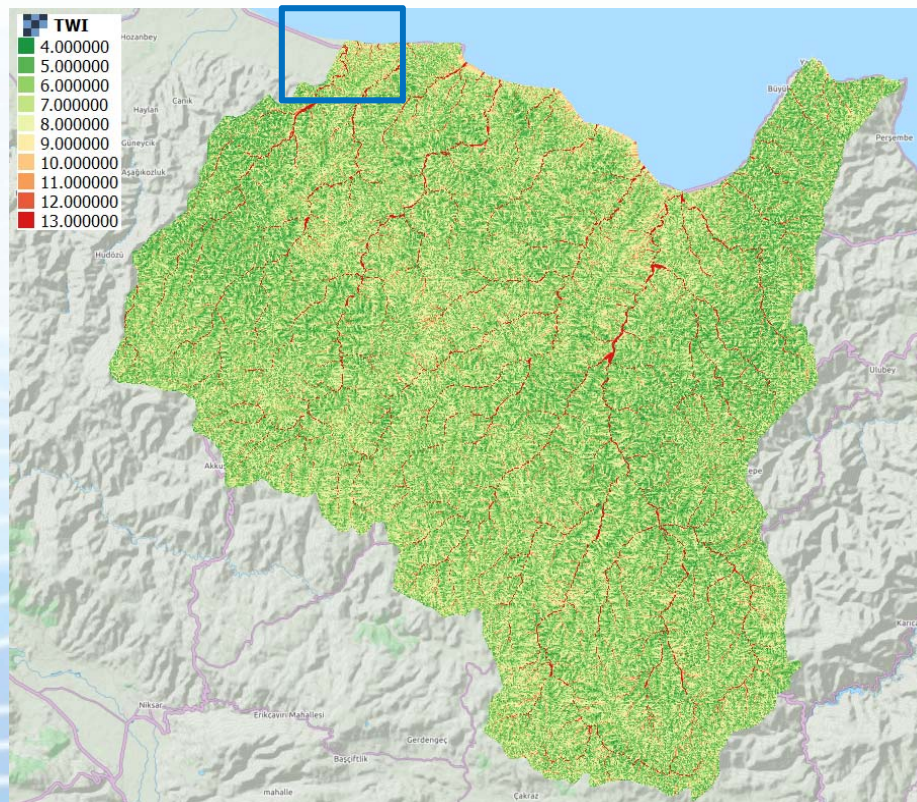
## FLOOD INCIDENCES (2012)





## REGIONAL SCALE MODEL FOR SAMSUN “FATSA-ÜNYE-İKİZCE” SUB-BASIN

Area 3000 km<sup>2</sup>



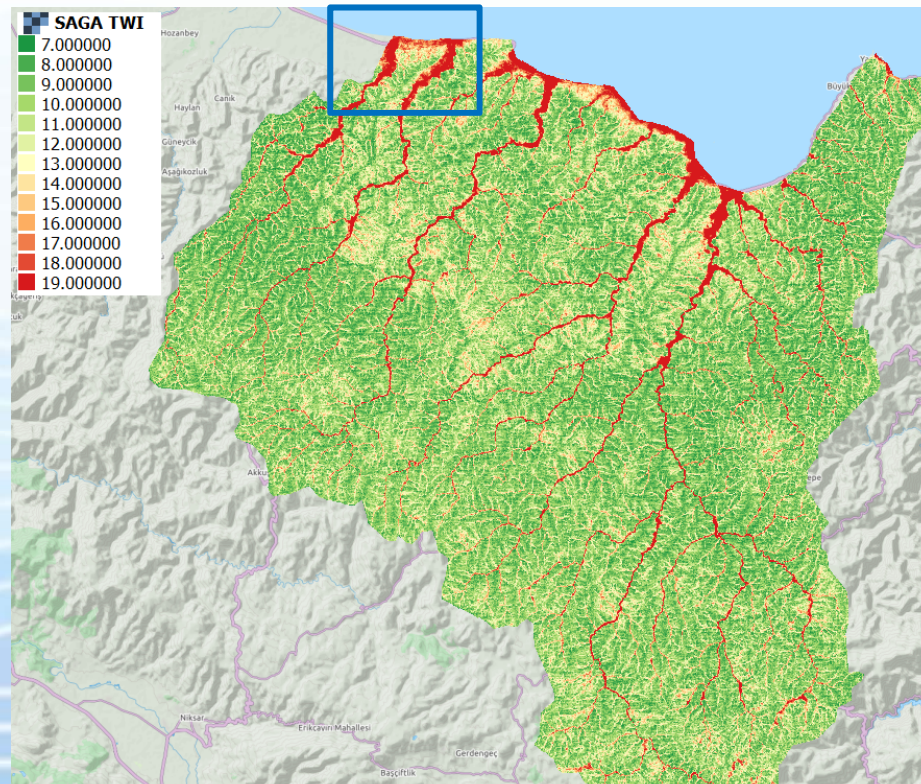
TWI





## REGIONAL SCALE MODEL FOR SAMSUN “FATSA-ÜNYE-İKİZCE” SUB-BASIN

Area 3000 km<sup>2</sup>

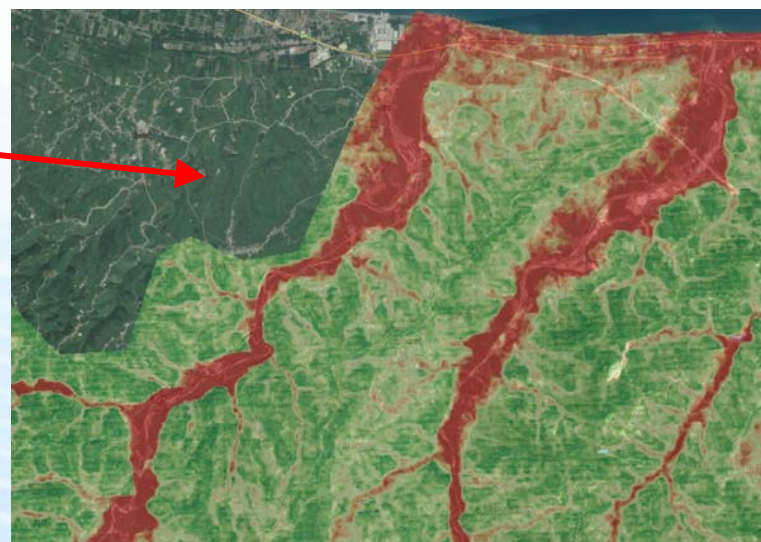


**SAGA WI**



Common borders. Common solutions.

## RESULTS OF REGIONAL SCALE ASSESSMENT ON THE MAP





## LOCAL SCALE MODELLING WITH HEC-RAS





Common borders. Common solutions.

## CONCLUSIONS

- ☐ Proposed regional scale model proved to perform well with 1/25000 scale maps.
- ☐ SAGA WI indicates a larger area of susceptibility to flood compared to TWI index. Local scale model showed that these two indices can be taken as sensitivity limits for susceptibility to flood hazard.
- ☐ Regional scale model accompanied by local scale solutions (where necessary) comprise an integrated flood hazard assessment system: **easy, free, applicable and reliable**.
- ☐ Yet, there is always room for improvement...





# Thank you

VIII. Ulusal Hidroloji Kongresi 08-10 Ekim 2015, Harran Üniversitesi, Şanlıurfa

## Akarsu Havzalarında Taşkına Meyilli Alanların Zemin Nem İndeksi ile Belirlenmesi

### Determination of Flood-Prone Areas by Soil Wetness Index in River Basins

Hafzullah AKSOY<sup>1</sup> V. Ş. Özgür KIRCA<sup>2</sup> H. İbrahim BURGAN<sup>3</sup>  
Dorukhan KELLEÇİOĞLU<sup>4</sup> I. Selin ERMİŞ<sup>5</sup>

#### ABSTRACT

*Proceedings of the Mediterranean Meeting on "Monitoring, modelling and early warning of extreme events triggered by heavy rainfalls". PON 01\_01503 - MED-FRIEND project  
University of Calabria, Cosenza (Italy), June 26<sup>th</sup>-28<sup>th</sup>, 2014*

#### FLOOD HAZARD ASSESSMENT AND MODELLING PRACTICES IN TURKEY

H. Aksoy<sup>1</sup>, V.S.O. Kirca<sup>1</sup>, K. Papatheodorou<sup>2</sup>

<sup>1</sup>Civil Engineering Department, Istanbul Technical University, Maslak, Istanbul, Turkey

<sup>2</sup>Civil, Surveying and Geomatics Engineering Department, Technological Educational Institute of Central Macedonia, Serres, Greece

#### Legislative Aspects of Flood Hazard Prevention and Resilience in Non-EU Member European Countries

V.S. Ozgur Kirca<sup>1\*</sup>, Hafzullah Aksoy<sup>1</sup>, Konstantinos Papatheodorou<sup>2</sup> & Katia Stepanova<sup>3</sup>

<sup>1</sup> Istanbul Technical University, Dept. of Civil Eng., Istanbul, Turkey

<sup>2</sup> Technological Edu. Ins. of Kentriki Makedonia, Civil Eng. & Geomatics & Surveying Eng. Dept., Serres, Greece

<sup>3</sup> Environmental Academy of Sciences, Black Sea Branch, Odessa, Ukraine

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ FEN BİLİMLERİ ENSTİTÜSÜ

AKARSU HAVZALARINDA ZEMİN NEMLİLİK İNDEKSİLERİ İLE TAŞKINA MEYİLLİ ALANLARIN BELİRLENMESİ

DETERMINATION OF FLOOD PRONE AREAS WITH SOIL WETNESS INDICES IN THE RIVER BASINS

YÜKSEK LİSANS TEZİ

İşitan Selin ERMİŞ

İnşaat Mühendisliği Anabilim Dalı

Hidrolik ve Su Kaynakları Mühendisliği Programı

MAYIS, 2015