UNIVERSITY OF ARCHITECTURE CIVIL ENGINEERING AND GEODESY

REPUBLIC OF BULGARIA Ministry of Economy

Flood Monitoring

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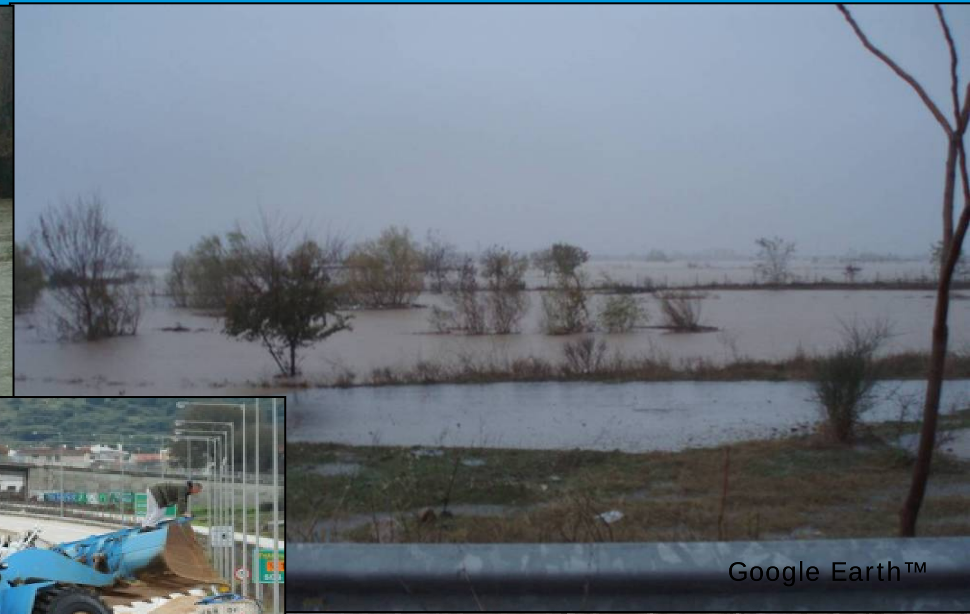
ARISTOTLE UNIVERSITY OF THESSALONIKI

...a common impression about Greece, but also...

...an impression not as uncommon, as you might think...


http://www.realpolitics.gr


Google Earth™


http://www.inews.gr


http://www.softwhere.gr/

http://www.shutterstock.com

Indicative catastrophes caused by a severe flash-flood of October 2006, in the prefectures of Thessaloniki and Halkidiki in North Greece.

The cost of reconstructing this 80m bridge along with several other smaller-scale damages in the area was more than 2 million €.

Water level traces in the village of Melissourgos

(Vouvalidis et al., 2006, Nikolaidou 2009)

Water maximum level traces

(Vouvalidis et al., 2006)

Flood-related phenomena: Landslides
January 2004, Thessaly



Flood-related phenomena: Subsidence
March 2011, Peloponnese

Introduction

- “Floods are considered as one of the most important catastrophes, in that, on global scale, they affect more population compared to any other natural hazard’’ *(Bell, 1999)*
- Escalating frequency of flood events around the world (e.g. Milly et al., 2002)
- EU flood risk assessment and management Directive *(EU, 2007)*

Introduction: Definitions

"**Floods** are overflows of water onto normally dry land that may last days or weeks and are caused by rising water in an existing waterway, such as a river, stream, or drainage ditch, with the ponding of water occurring at or near the point where the rain fell''.

"A **flash-flood** is caused by heavy or excessive rainfall within a short period of time, generally less than 6 hours. Flash-floods are usually characterized by raging torrents after heavy rains that rip through river beds, urban streets or mountain canyons, sweeping everything before them…''

(NOAA)

Introduction:
Floods and Earth Observation

Public/International services:

✓The International Charter "Space and Major Disasters"

✓The Services and Applications For Emergency Response (Safer/GMES)

National Institutions:

✓e.g.: Centre for Satellite Based Crisis Information (ZKI), Service Régional de Traitement d'Image et de Télédétection (SERTIT) etc...

...yet, there are still hundreds of important floods on local and regional level that remain to be addressed using EO data...

Charter Activations

RSS | XML

- Cyclones
- Earthquakes
- Fires
- Floods
- Ice
- Landslide
- Ocean Wave
- Oilspills
- Other
- Volcanoes

Browse by Location

2016

31 May	Flood in the United States
17 May	Flood in Sri Lanka
15 April	Flood in Iran
07 April	Flood in Argentina
12 March	Flood in the United States
04 January	Flood in the United States

2015

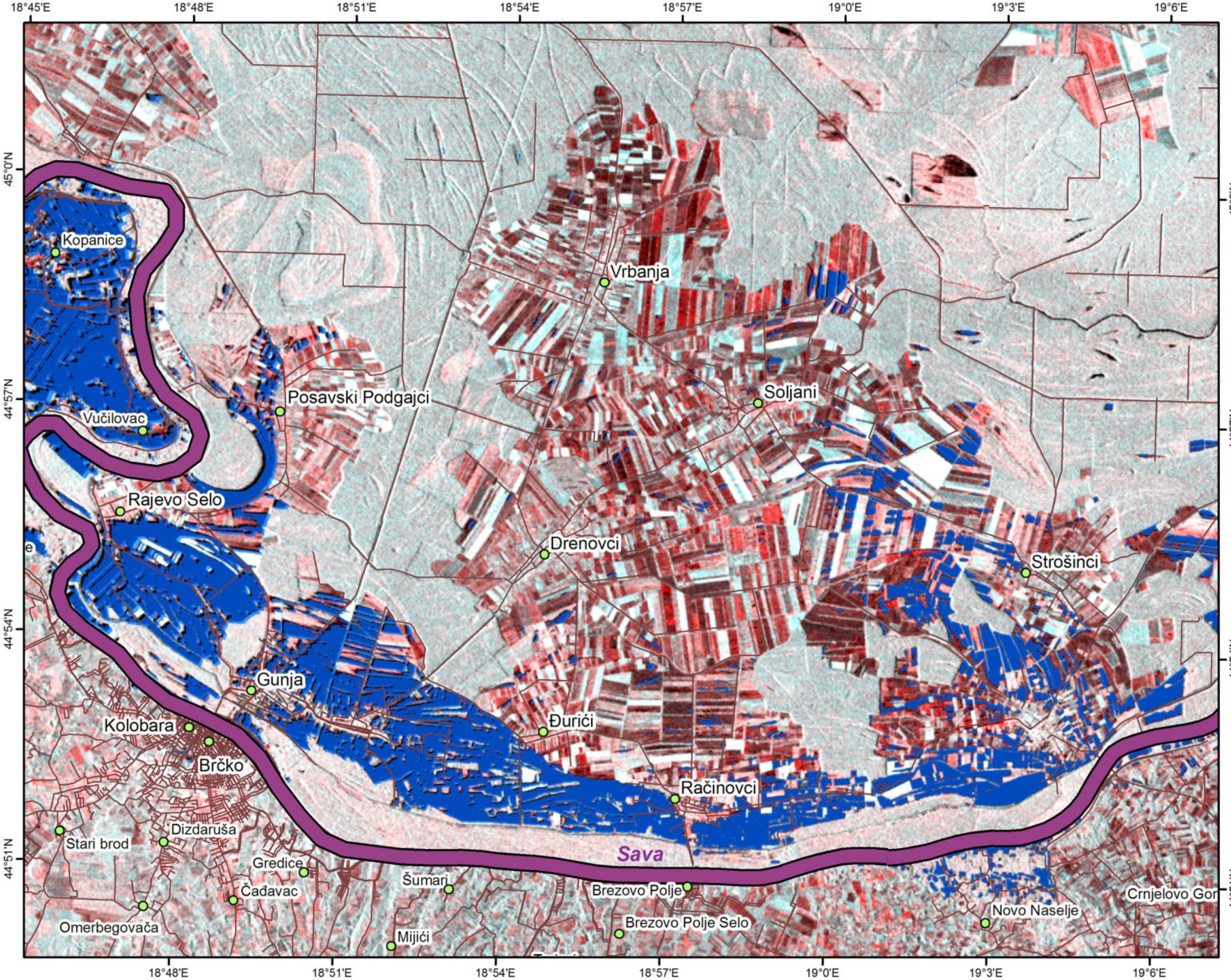
28 December	Flood in Argentina
03 December	Other in INDIA
02 December	Flood in India
06 November	Flood in Iraq

Activations

- Activations Home
- Charter Activations
- PM Portfolio Form
- Data Product Report
- Archive Activation
- Charter Archive
- Activations Map via GeoBrowser

Flooding situation in the Balkans on May 24, 2014

Flooded inhabited areas along the Sava river



Area location

Cartographic information

Projection: WGS 1984 UTM Zone 34N

Scale: 1:100 000

Legend

- Flooded area mask
- Locations
- Sava river mask
- Roads

N W E S

0 1 2 4 6 8 Km

Description

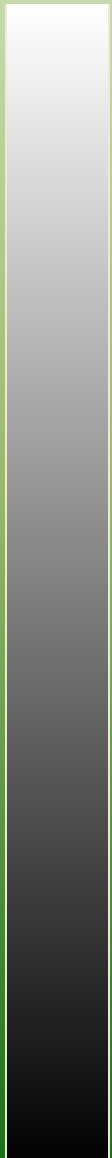
Torrential rain in the Balkans caused the worst flooding that the area had experienced in over a century. The rain caused rise of water level which resulted in inundation of all nearby inhabited areas. In Serbia it was estimated that 51 people died and more than 36 000 people were evacuated.

Data source

Sentinel image (HH,HV polarisation) acquired on 24.05.2014, resolution - 15 x 10 m

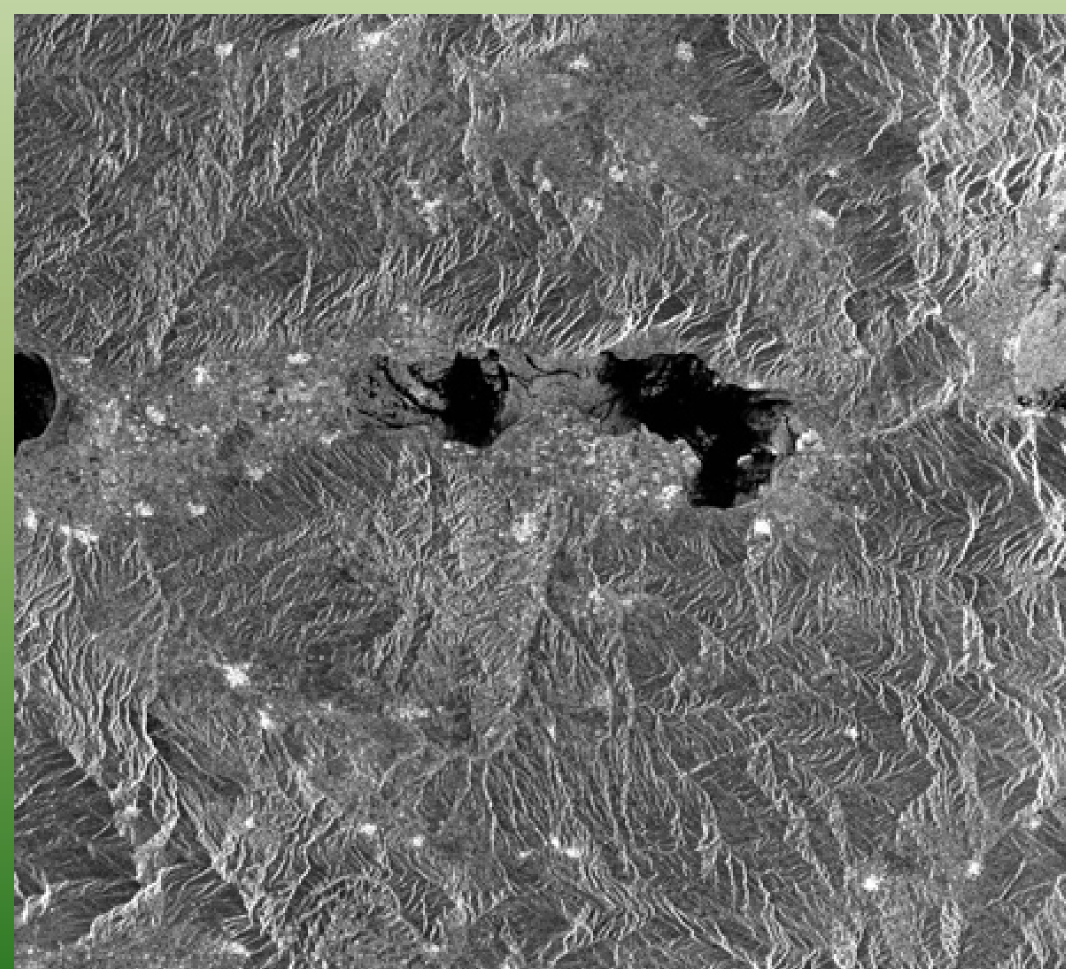
Data processed by Research Center for Earth Operative Monitoring (NTs OMZ)
JSC "Russian Space Systems "

SAR



Surface roughness

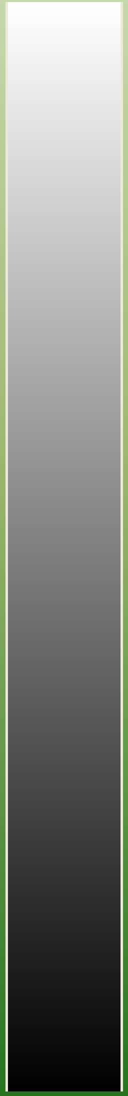
backscattering



Surface roughness

backscattering

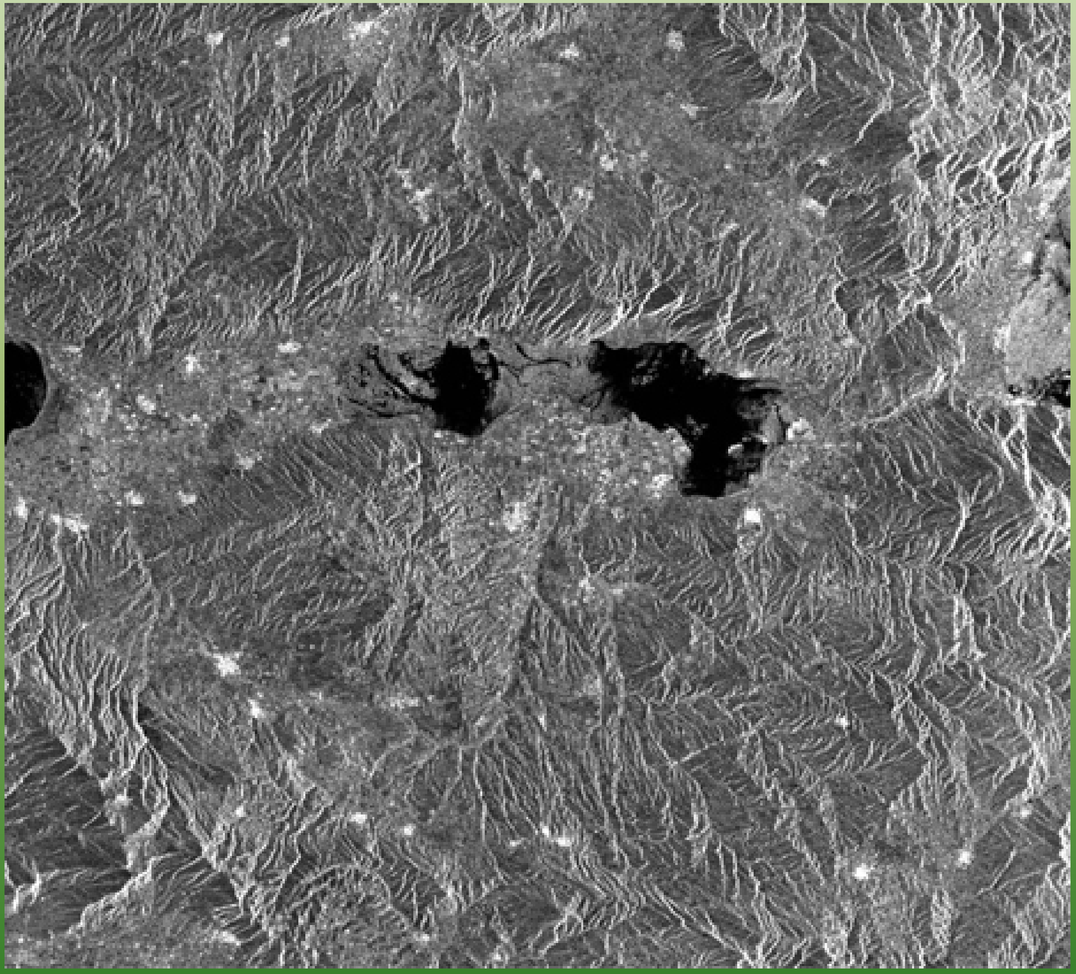
SAR



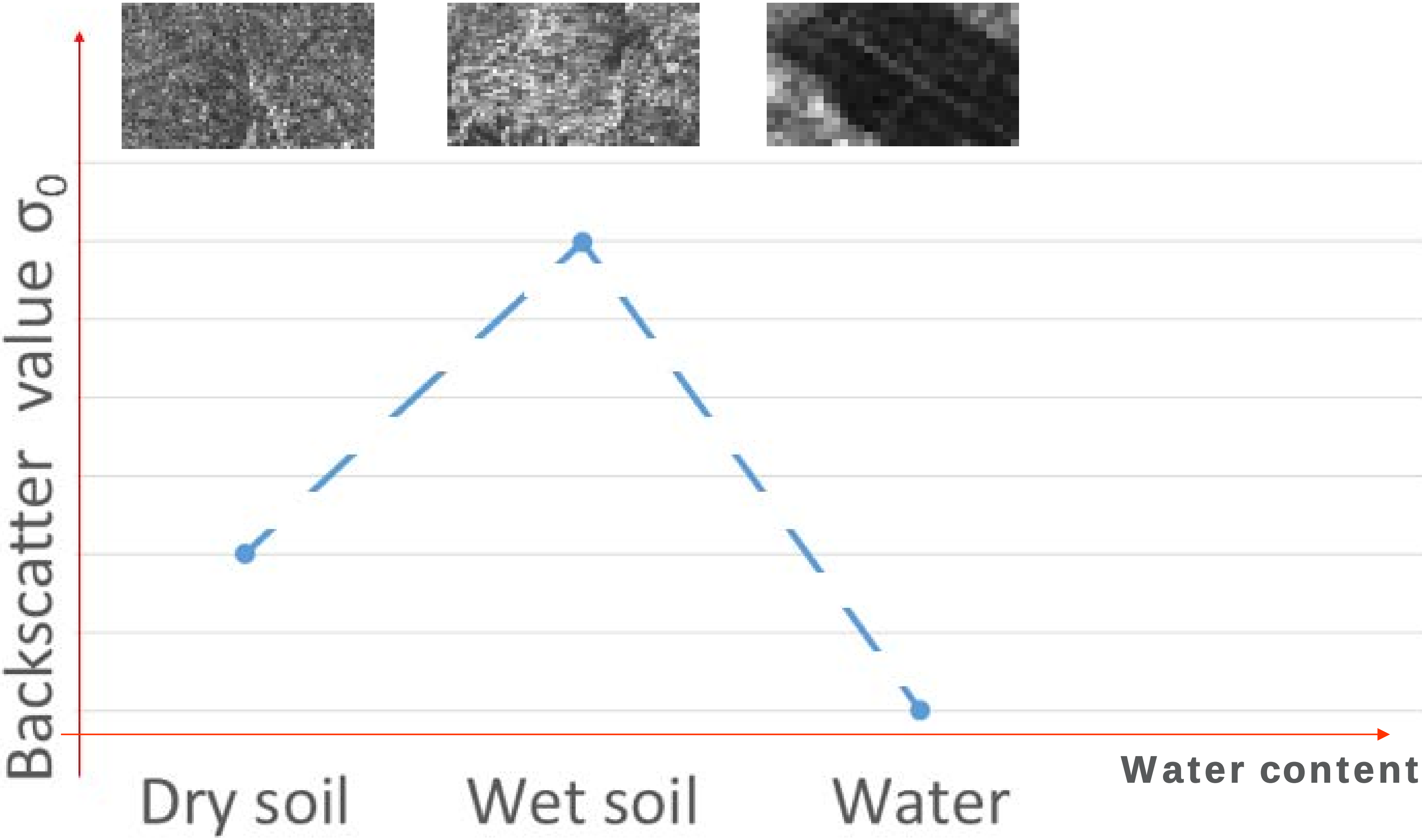
Wet soil

Dry soil

Water



The...strange σ_0 - water relationship



SAR image analysis

Implementation of change detection analysis (CDA) - False Colour Composition (FCC)

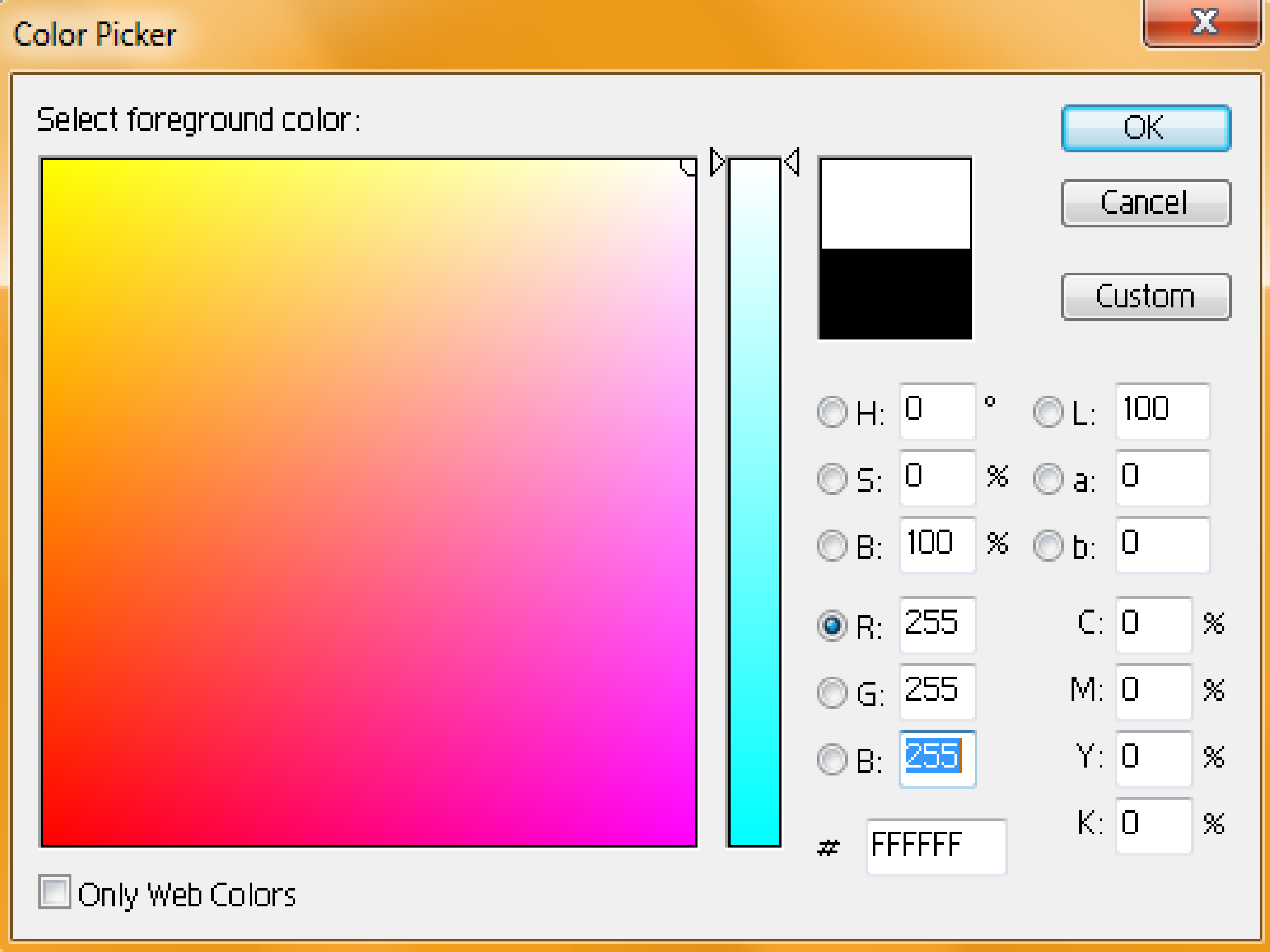
R: Flood image

G: Flood image

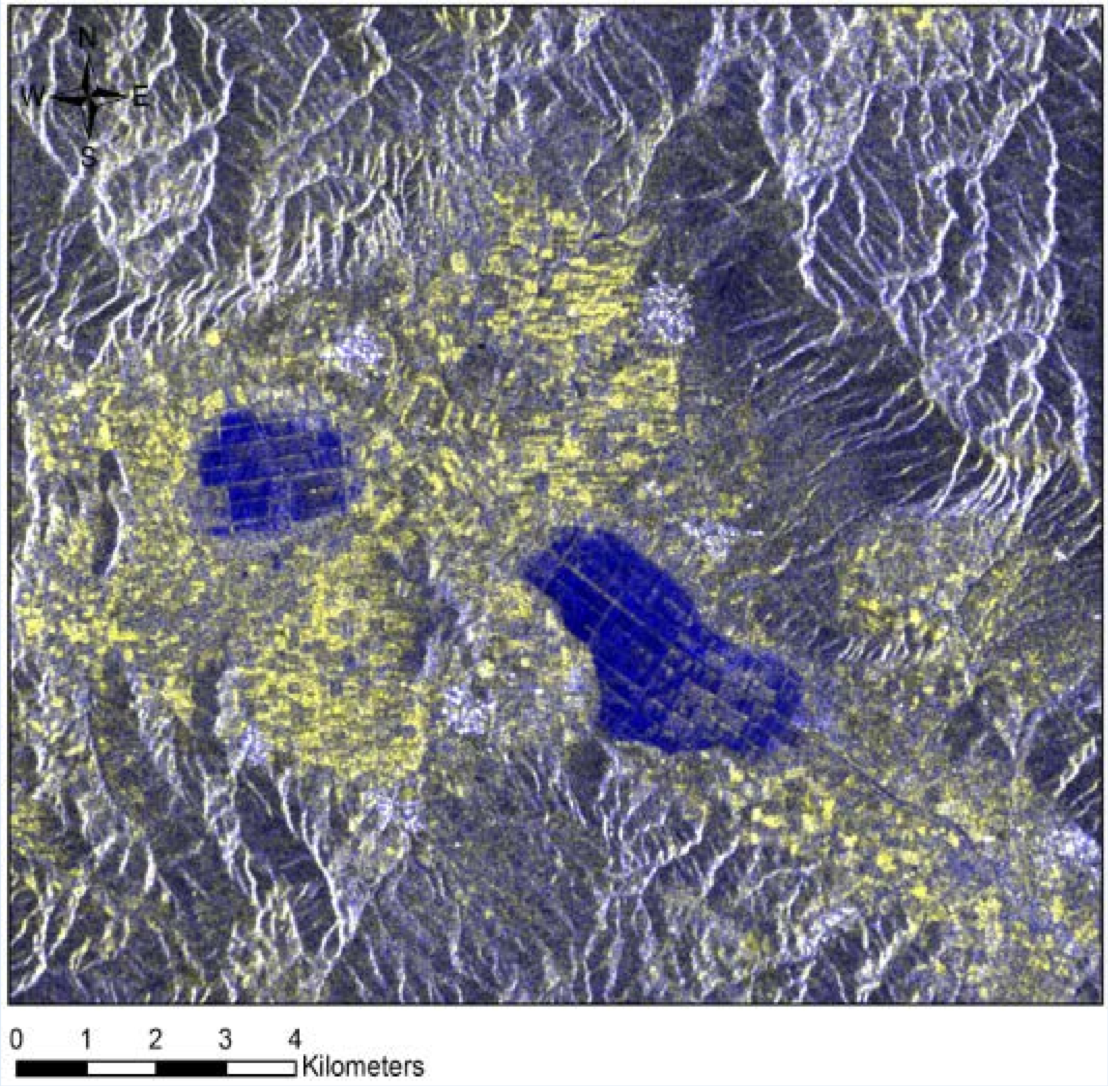
B: Dry image (mean of available dry images)

so that:

- flooded areas appear in blue
- Soil moisture appears in yellow
- No change appears in shadings of the greyscale


Color Picker
Select foreground color:
OK
Cancel
Custom
H: 0 °
S: 0 %
B: 100 %
L: 100
a: 0
b: 0
R: 255
G: 255
B: 255
C: 0 %
M: 0 %
Y: 0 %
K: 0 %
FFFFFF
Only Web Colors

SAR image analysis



Case study: Thessaloniki

Delineation of flooded areas two days after the flash-flood using an ENVISAT/ASAR IMG mode false colour composite:

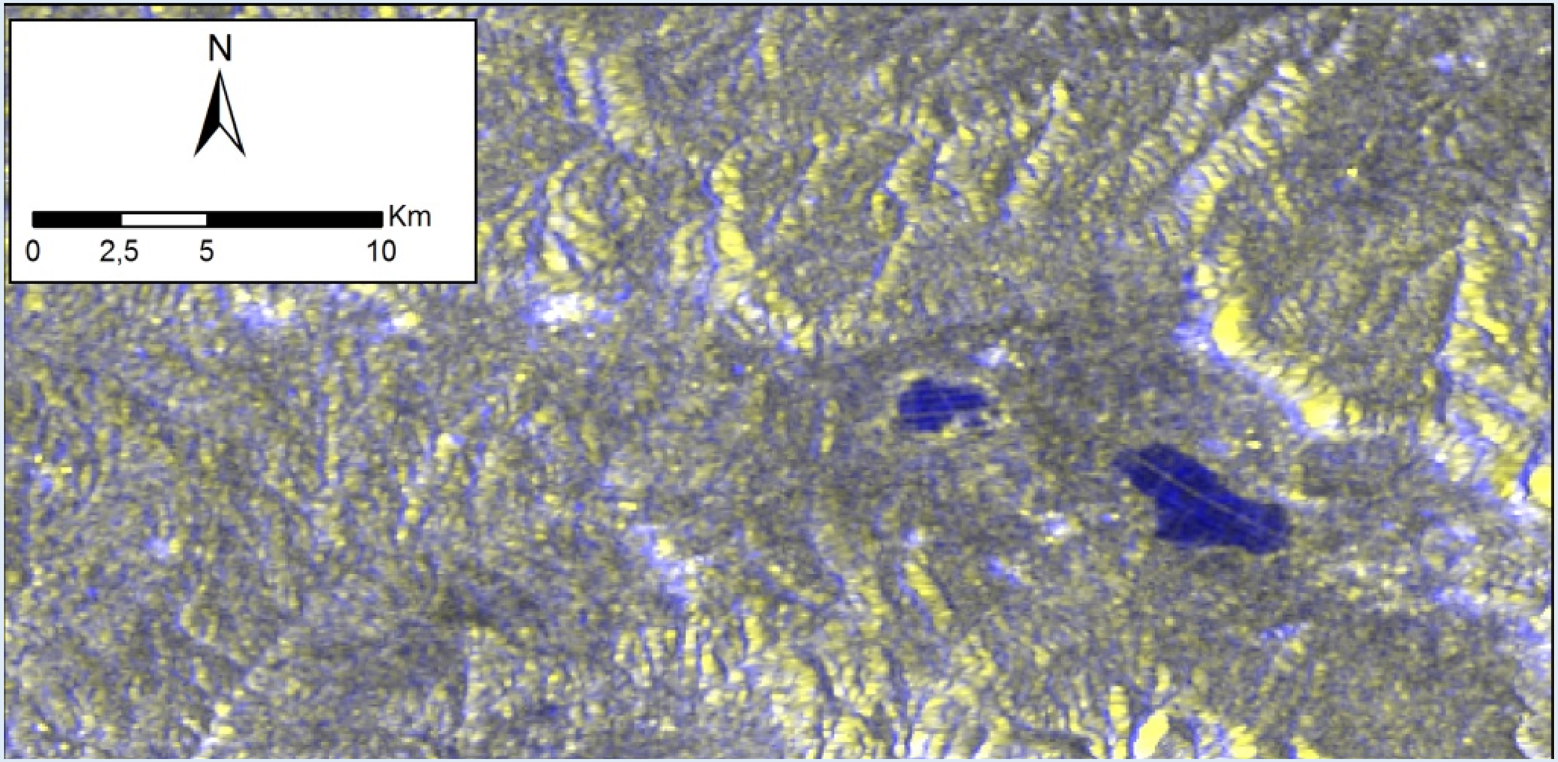
R=G=10/10/2006 (flood image),

B=(5/10/2004 + 25/10/2005)/2 (average of two images during the same season, but under dry conditions).

Blue = flooded regions

Yellow = wet soil.

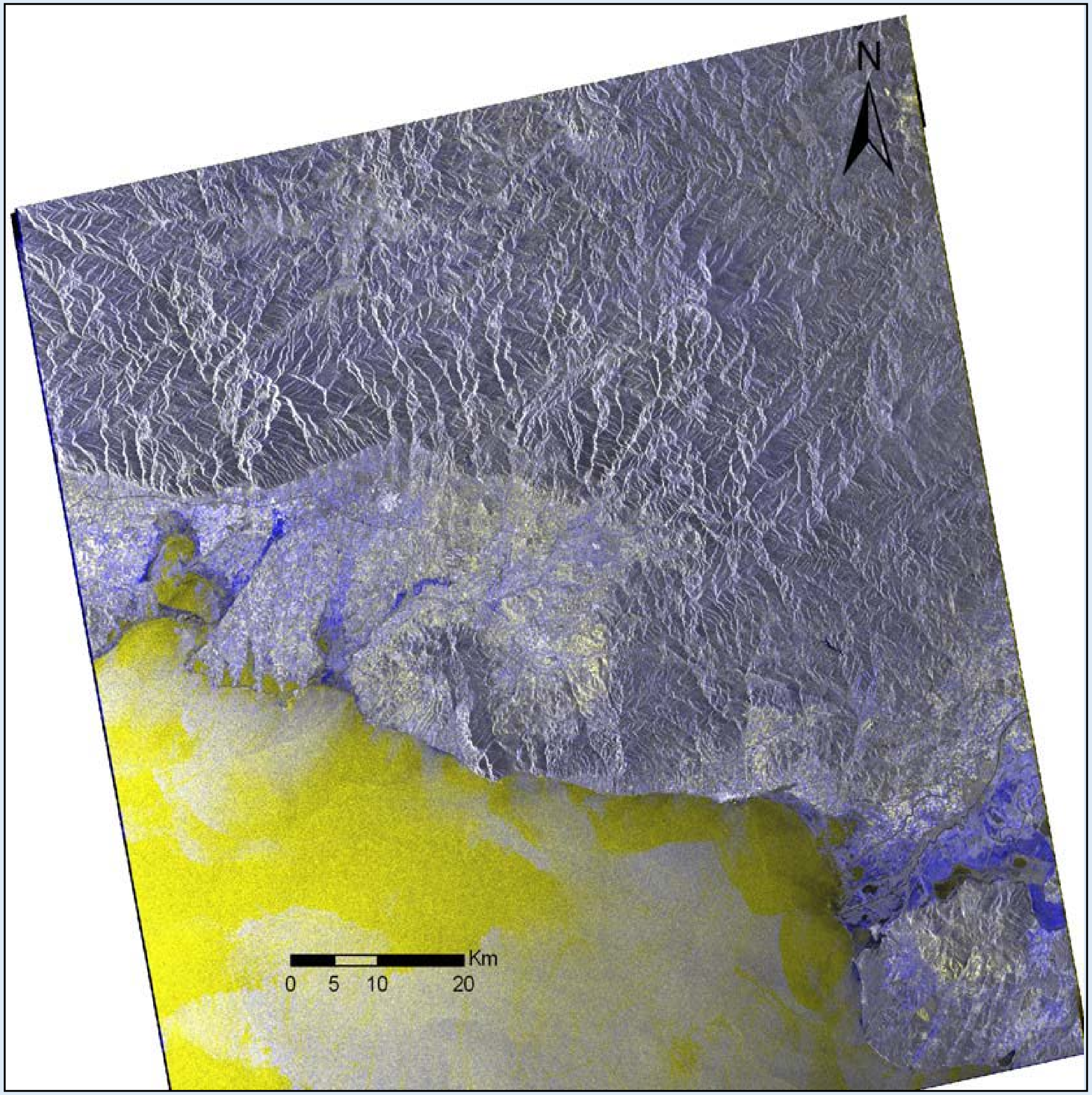
SAR image analysis



Case study: Thessaloniki

Delineation of flooded areas four days after the flash-flood, using an RGB false colour composite of ASAR Wide Swath Mode data. R=G=25/09/2011 (flood image), B=25/09/2011 (dry conditions). Blue = flooded regions, Yellow = wet soil.

SAR image analysis



Case study: Thrace

Overview of flooded areas during the crisis period, using an ENVISAT/ASAR false colour composite:

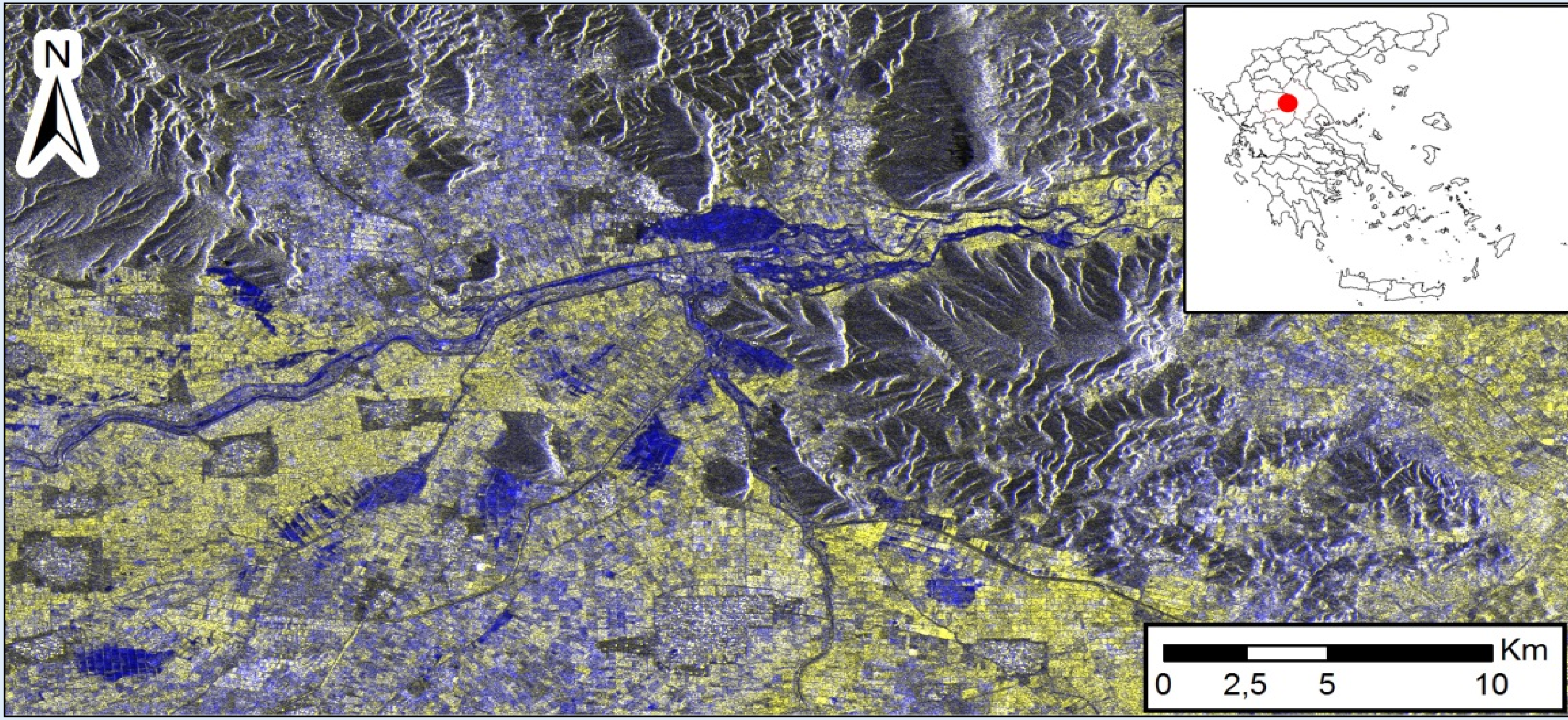
R=G=18/11/2007 (flood image),

B= average of seven images taken under dry conditions.

Blue = flooded regions

Yellow = wet soil.

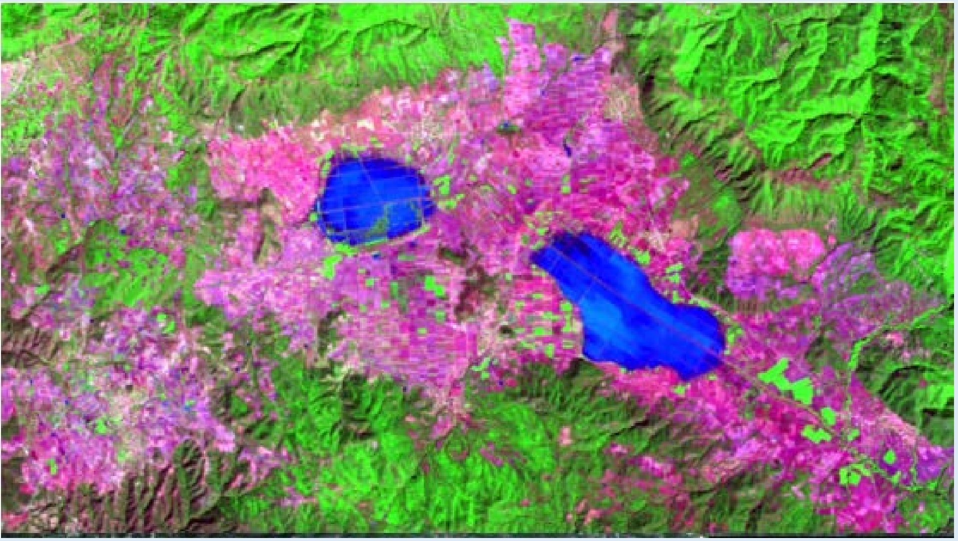
SAR image analysis

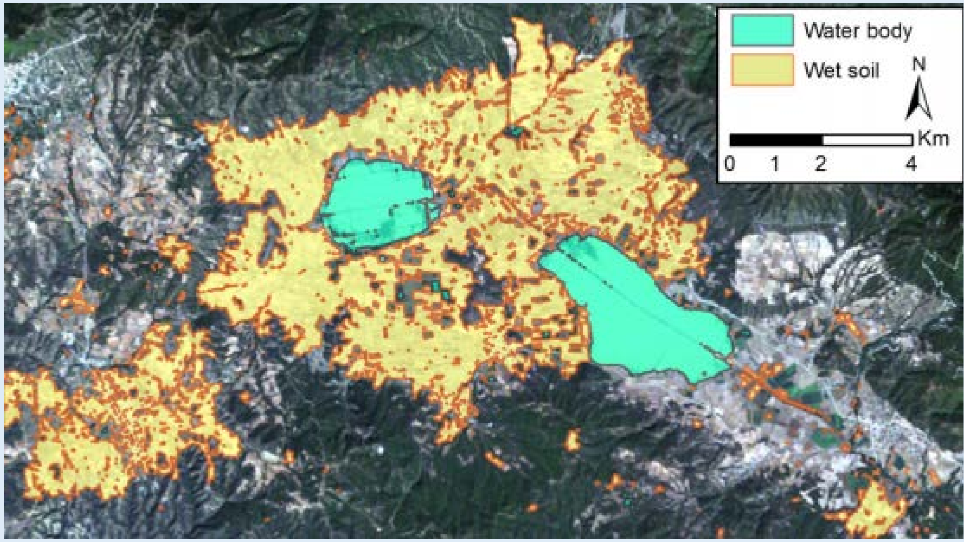


Case study: Thessaly

Floods along Pinios river, near Piniada, Farkadona and surrounding areas captured by ERS-2 during the crisis phase. SAR RGB false colour composite: R=G=02/02/2003 (flood image), B= 06/02/2005 (dry conditions). Blue = flooded regions, Yellow = wet soil.

Optical images





Case study 2: Thessaloniki

Results from the 2011 floods in Thessaloniki; Left: Landsat- 5/TM image, R/G/B: 7/4/3, depicting the flooded areas in blue colours. Right: Classified Landsat-5/TM image depicting water and wet soil classes.

	ERS-1/2	Envisat/ASAR (IM)	Envisat/ASAR (WSM)	Sum	Probability*
1991	22	-	-	22	6,0%
1992	11	-	-	11	3,0%
1993	12	-	-	12	3,3%
1994	17	-	-	17	4,7%
1995	17	-	-	17	4,7%
1996	20	-	-	20	5,5%
1997	15	-	-	15	4,1%
1998	8	-	-	8	2,2%
1999	17	-	-	17	4,7%
2000	10	-	-	10	2,7%
2001	8	-	-	8	2,2%
2002	11	1	3	15	4,1%
2003	21	13	30	64	17,5%
2004	23	17	41	81	22,2%
2005	21	17	40	78	21,4%
2006	20	12	72	104	28,5%
2007	14	8	85	107	29,3%
2008	18	7	66	91	24,9%
2009	14	10	82	106	29,0%
2010	14	11	69	94	25,8%
Sum	313	96	488	897	Center Lat/Lon (dd:mm:ss)
Acquisitions/yr	16	10,7	54,2	Area (Height x Width)	40:42:50/23:18:16
Probability*	4,3%	2,9%	14,9%	10km x 10km	

Indicative statistics of available SAR data (source: EOLI Catalogue/ESA).

Considerations: size of the area of interest, acquisition strategy.

Probability* = Probability of having 1 image within the day of the flood.

C-band SAR comparison

PARAMETERS	ERS 1/2	ENVISAT	Radarsat 1/2	Sentinel 1A/B
Centre frequency (GHz)	5,300	5,331	5,3 / 5,405	5,405
Polarization	VV	HH/VV, HH/VH, VV/HH	HH / HH, HV, VV, VH	HH+HV, VV+VH
Incidence angles (°)	23	15 - 45	20 - 49	20 - 45
Orbit (km)	800	800 → 783 (2010+mission)	793-821 / 798	693
Inclination (°)	98,5	98,5	98,6	98,18
Repeat cycle (day)	35	35	24	12
Launch date	17 Jul. 1991 / 21 Apr. 1995	1 March 2002	4 Nov. 1995 / 14 Dec. 2007	May 2013 / 2014
Spatial resolution (m)	25	25	30	25


➔ SNAP | Sentinels Application Platform 2
esa
seom
scientific exploitation
of operational missions