NATIONAL OBSERVATORY OF ATHENS

Institute for Space Applications and Remote Sensing

INTERREG IIIC South
MedWet/CODDE project
Wetland Inventory and Assessment in the Mediterranean region: Advanced Tools

Athens, 17-18 March 2008
DIVANI PALACE ACROPOLIS HOTEL
19-25 Parthenonos Street, Athens, Greece

RISK-EOS

A EUROPEAN NATURAL
DISASTER SERVICE
GMES/GSE ESA

C. C. KONTOES
ISARS/NOA PRINCIPAL RESEARCHER
PROJECT SCIENTIFIC RESPONSIBLE

RISK-EOS Product

Fire Products and Flood Products

- **Real time and near real time mapping at MR & HR and VHR of the disastrous phenomenon (site/regional/country level)**
- **Damage assessment (site/regional/national level)**

Product	Updating Frequency	Location Accuracy	Resolution	Format
Burn Scar Maps BSM 1	Yearly	60 meters	30 meters (compatible with a scale 1:50.000/1:25.000)	Vector
Burnt Area Maps BSM 2	Yearly	60 meters	30 meters (compatible with a scale 1:50.000/1:25.000)	Vector
Cloud & water/urban mask BSM 3	Yearly	60 meters	30 meters (compatible with a scale 1:50.000/1:25.000)	Raster
Post Fire Images BSM 4	Yearly	60 meters	30 meters (compatible with a scale 1:50.000/1:25.000)	Raster
GIS File integrated product	Yearly	60 meters	30 meters (compatible with a scale 1:50.000/1:25.000)	Raster & Vector

RISK-EOS Product

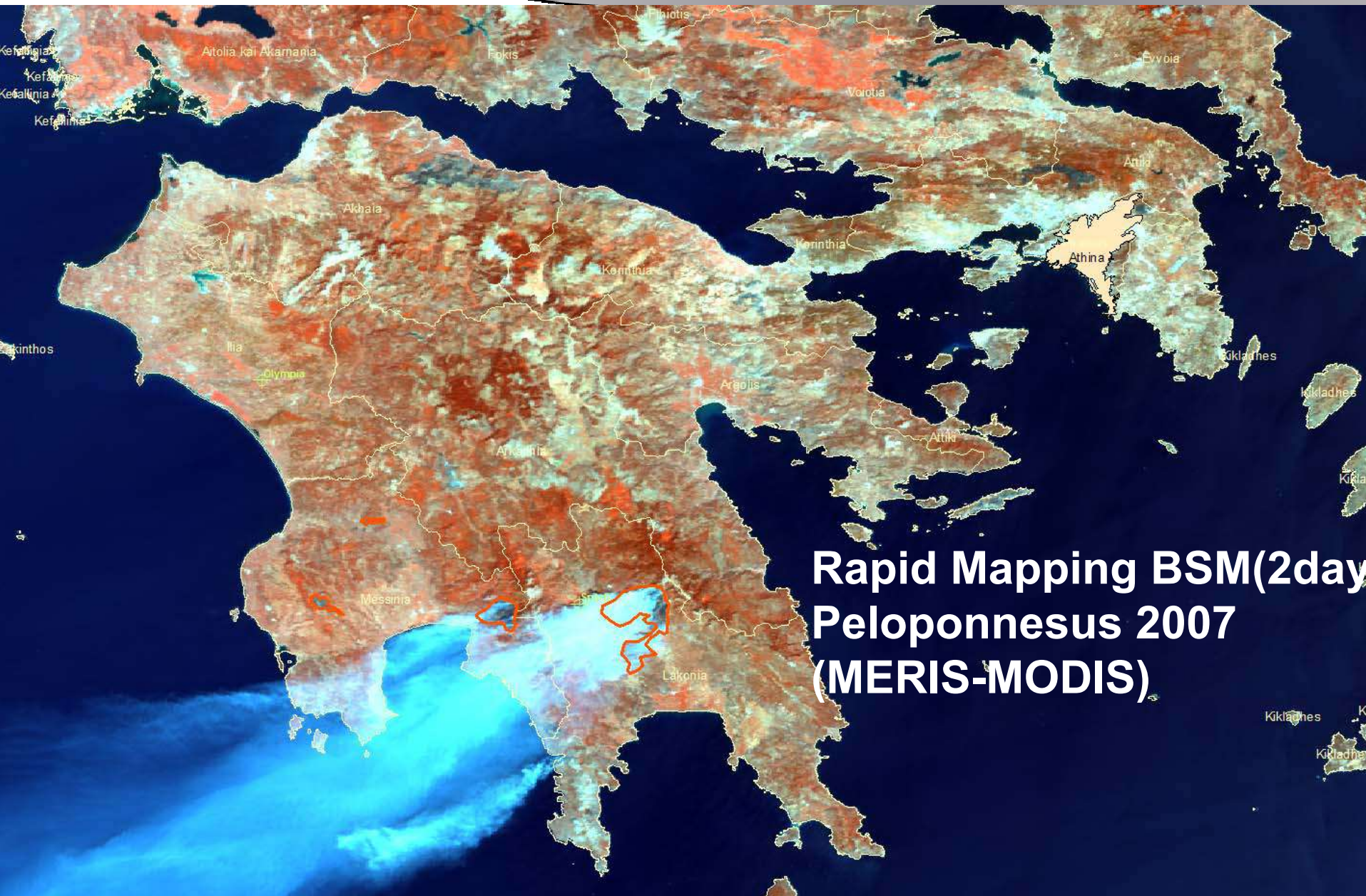
Fire Products and Flood Products

- **Real time and near real time mapping at MR & HR and VHR of the disastrous phenomenon (site/regional/country level)**
- **Damage assessment (site/regional/national level)**

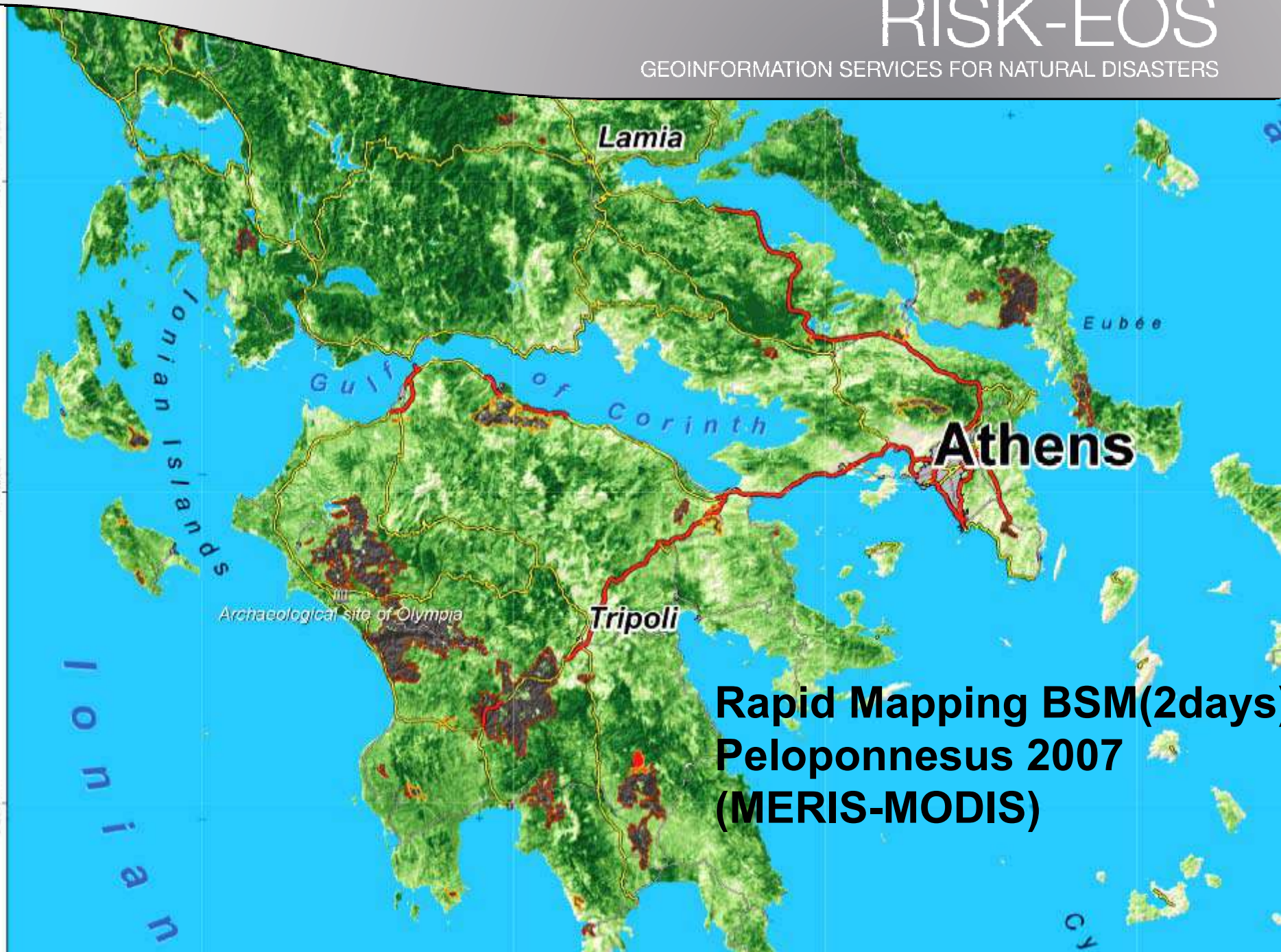
Product	Updating Frequency	Localisation Accuracy	Resolution	Format
Near Real Time Fire Extent rapid mapping FRM1	8 to 12h after image acquisition	Depends on EO data	30 meters	Raster
Non Real Time Fire Extent rapid mapping FRM2	2 weeks after image acquisition	Depends on EO data	30 meters	Raster & Vector
Non Real Time Fire damage assessment FRM3	2 weeks after image acquisition	Depends on EO data	30 meters	Vector

RISK-EOS

GEOINFORMATION SERVICES FOR NATURAL DISASTERS



Rapid Mapping BSM(2day
Peloponnesus 2007
(MERIS-MODIS)



Rapid Mapping BSM(2days)
Peloponnesus 2007
(MERIS-MODIS)

RISK-EOS Product

Fire Products and Flood Products

- **Real time and near real time mapping of the disastrous phenomenon (site/regional/country level)**
- **Damage assessment (site/regional/national level)**

Product	Updating Frequency	Localisation Accuracy	Resolution	Format
Near Real Time Flood Rapid Mapping FLRM1	12h after image acquisition (2 to 3 days)	10 to 60 meters Depends on EO data	5 to 30 meters	Raster
Non Real Time Flood Rapid Mapping FLRM2	2 weeks	10 to 60 meters Depends on EO data	5 to 30 meters	Raster & Vector
Non Real Time Maximum Flood Extent Mapping - FLRM3	2 weeks	10 to 60 meters Depends on EO data	5 to 30 meters	Raster & Vector
Non Real Time Flood Damage assess-ment - FLRM4	2 weeks	10 to 60 meters Depends on EO data	5 to 30 meters	Raster & Vector
Non Real Time Flood Duration per area - FLRM5	2 weeks	10 to 60 meters Depends on EO data	5 to 30 meters	Vector

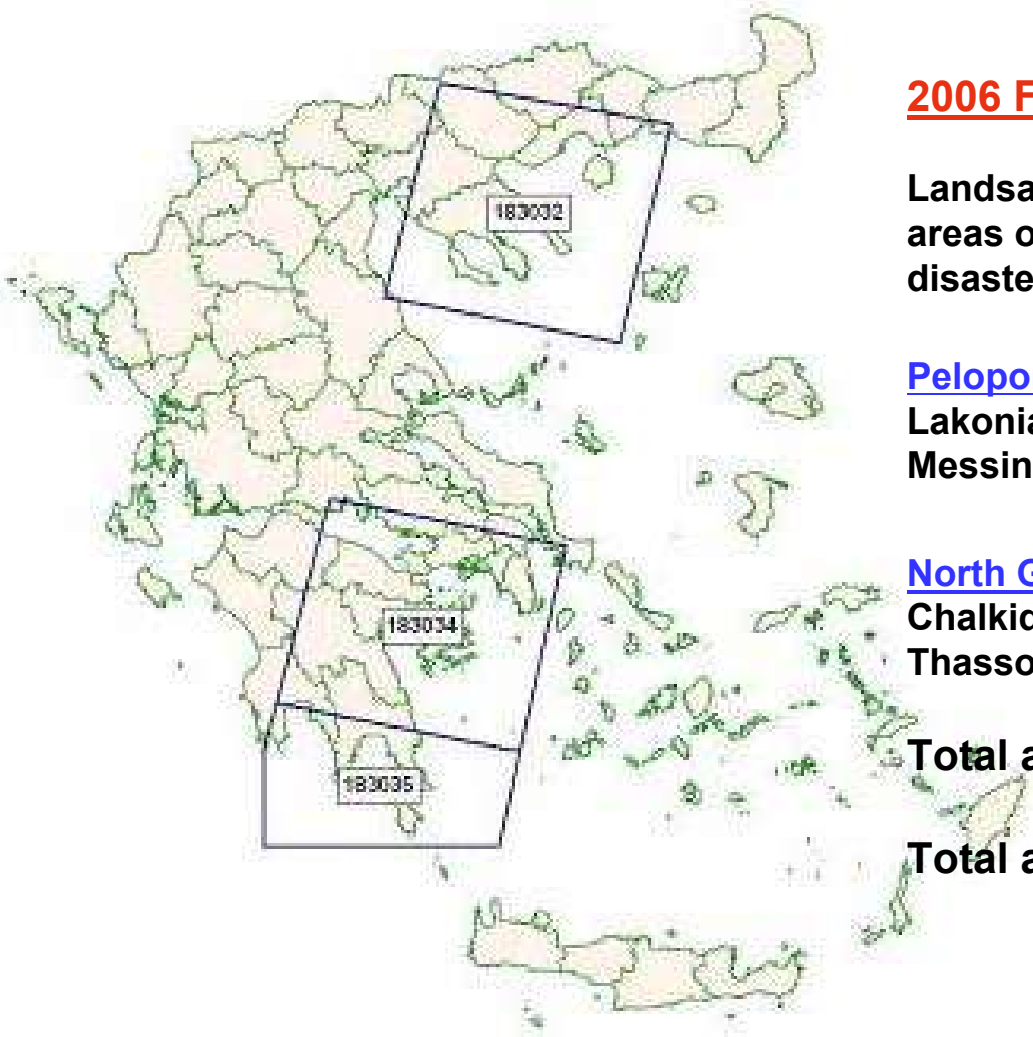
RISK-EOS Product

Flash Flood Map Products

SLAs reminder

Service	User(s)	Area
BSM_NOA	**HELLENIC MINISTRY OF AGRICULTURAL DEVELOPMENT AND FOODS**	**2006 Fire Season: 20.000 km^2** **Peloponnesus:** Prefectures (NUTS III) of Lakonia, east Messinia, Arkadia, Argolida, Korinthia **North Greece:** Prefectures (NUTS III) of Chalkidiki, Thessaloniki, Serres, Kavala and Thassos
BSM_NOA	**NATIONAL AGRICULTURAL RESEARCH FOUNDATION**	

SLAs reminder



2006 Fire Season:

Landsat TM coverage for the Greek project areas over Macedonia (including the Chalkidiki disaster) and Peloponnesus

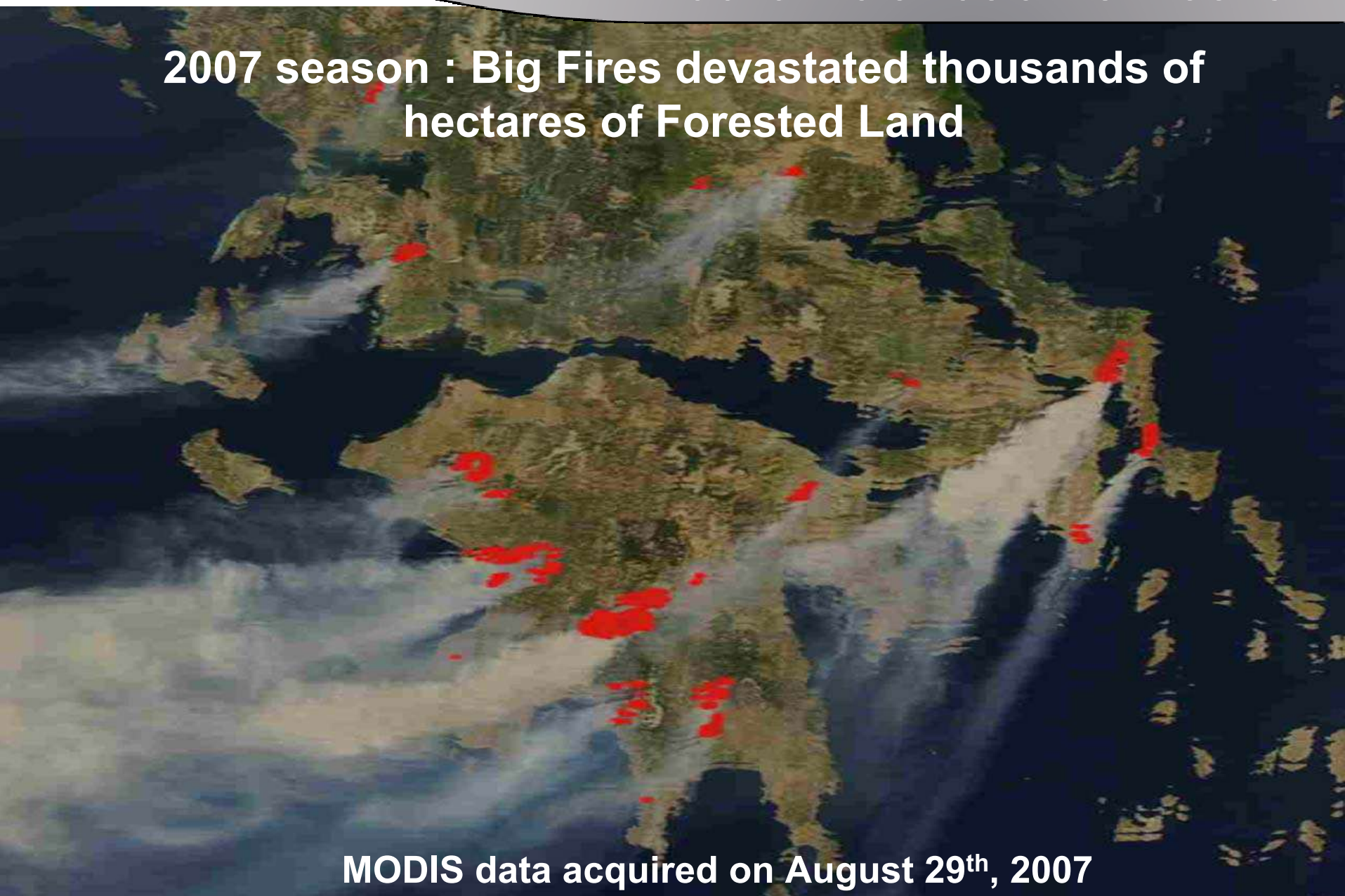
Peloponnesus: 18.350 km² (prefectures of Lakonia-(including Mani disaster), east Messinia, Arkadia, Argolida, Korinthia)

North Greece: 12.000 km² (prefectures of Chalkidiki, Thessaloniki, Serres, Kavala and Thassos)

Total area covered: 30.350 km²

Total area foreseen in SLAs: 20.000 km²

2007 season : Big Fires devastated thousands of hectares of Forested Land



MODIS data acquired on August 29th, 2007

2007 season : Big Fires devastated thousands of hectares of Land

MESSINIA Prefecture of Peloponnesus
(Associated Press)

2007 season : Big Fires devastated thousands of hectares of Land

ARKADIA Prefecture of Peloponnesus
(Associated Press)

RISK-EOS

GEOINFORMATION SERVICES FOR NATURAL DISASTERS

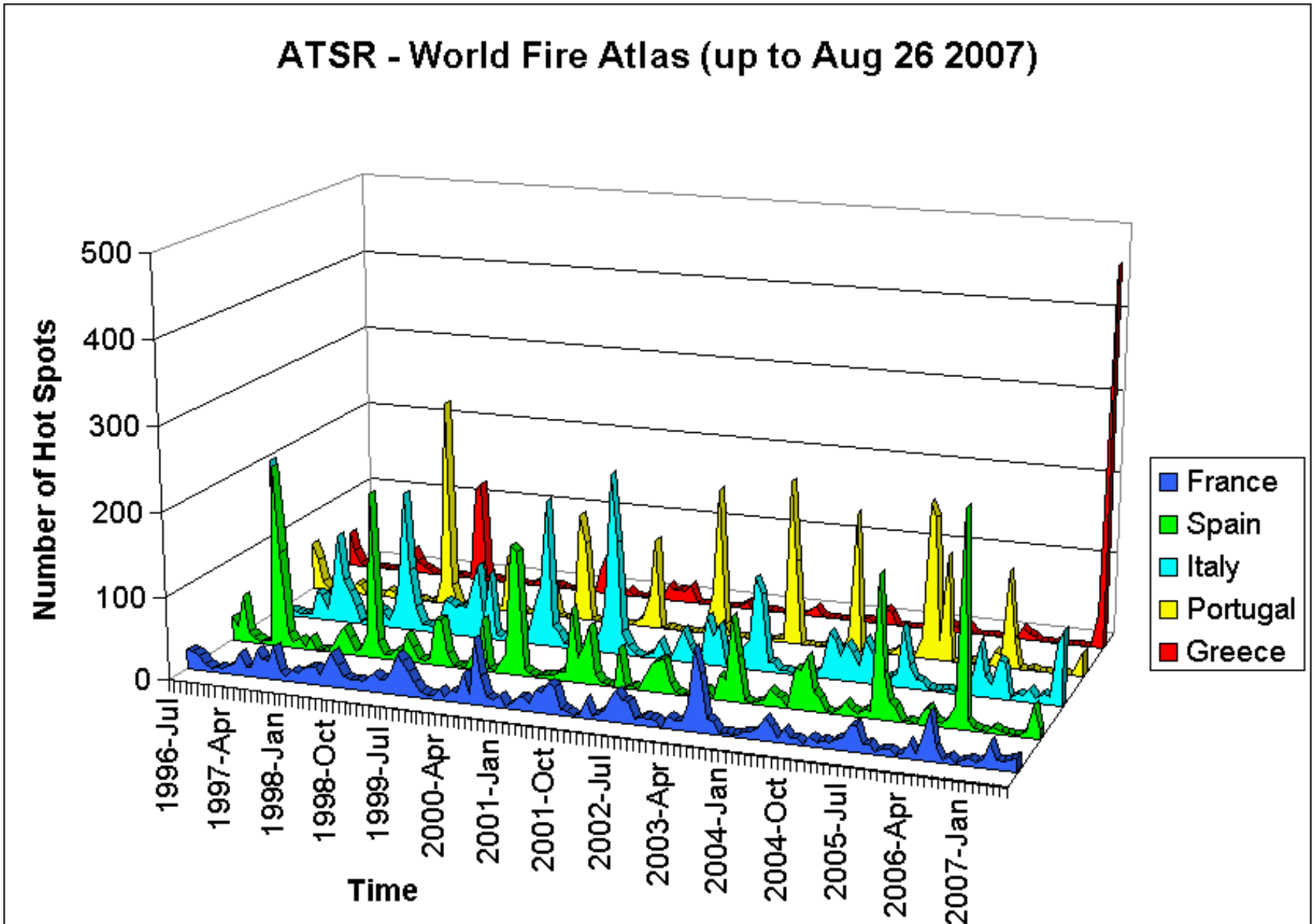
2007 season : Big Fires devastated thousands of hectares of Land

Archeological site of Olympia

HELIA (Zacharo) Prefecture of Peloponnesus

2007 season : Big Fires devastated thousands of hectares of Land

City of Zacharo (Prefecture of Peloponnesus)


ATSR - World Fire Atlas (up to Aug 26 2007)
Number of Hot Spots
0
100
200
300
400
500
1996-Jul
1997-Apr
1998-Jan
1998-Oct
1999-Jul
2000-Apr
2001-Jan
2001-Oct
2002-Jul
2003-Apr
2004-Jan
2004-Oct
2005-Jul
2006-Apr
2007-Jan
Time
France
Spain
Italy
Portugal
Greece

In addition to areas of SLAs Fire season 2007

In complement to the areas foreseen in the signed SLAs,

additional BSM analysis was realised in areas affected by big fires in 2007

Studied period: May 1st to July 19th, 2007

2007 Fire Season:

Landsat TM coverage over Peloponnesus and Sterea Hellas

Peloponnesus: 15.750 km² (prefectures of Lakonia-(including Mani disaster), east Messinia, Arkadia, Argolida, Korinthia)

Sterea Hellas (central Greece): 14.550 km² (prefectures nomos of Attiki, Voiotia, Euboea, Magnisia, and part of Fthiotida)

Total area covered: 30.300 km²

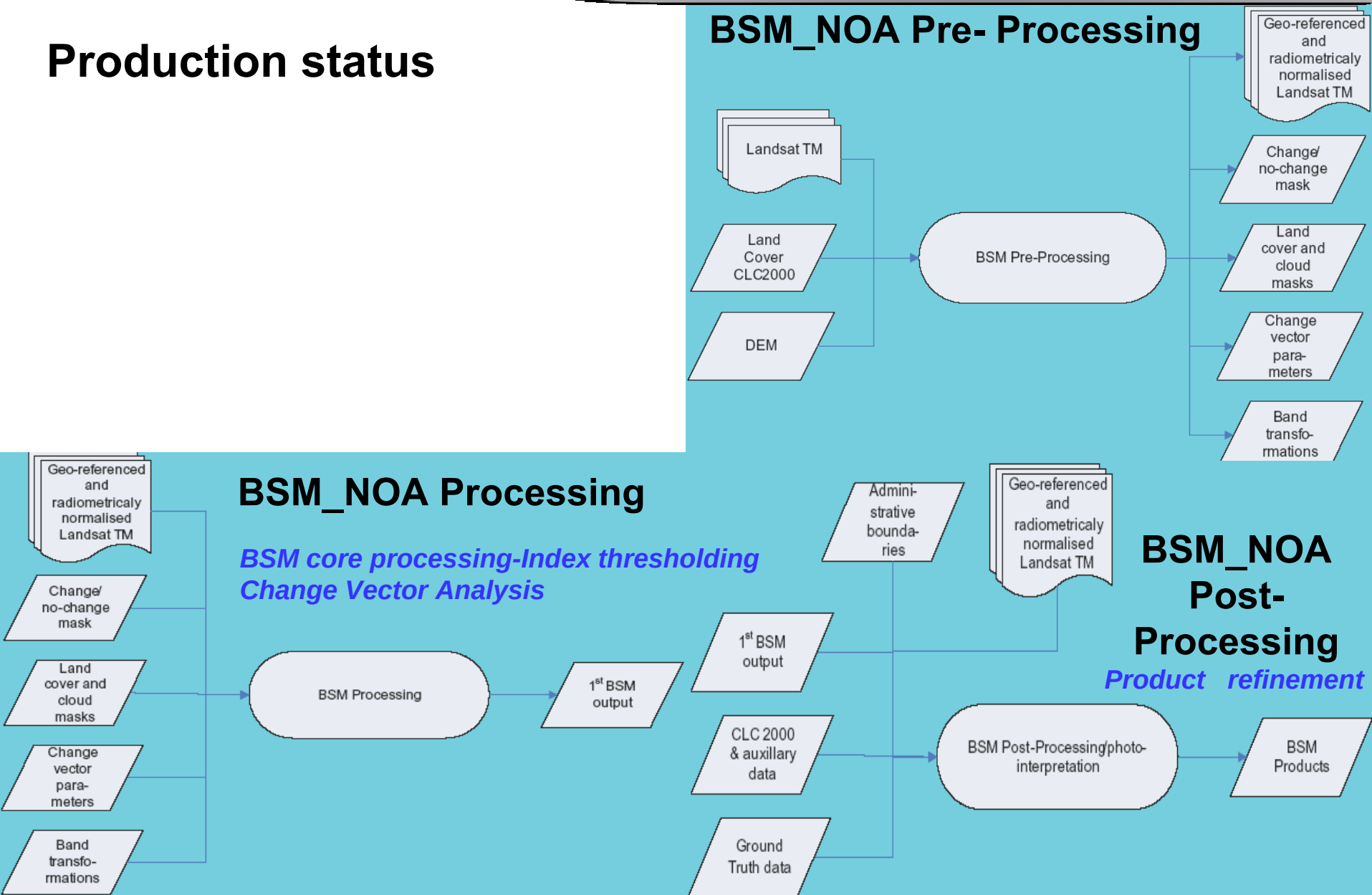
Total area foreseen in SLAs: N/A

Production status

- **Input data: Multitemporal set of Landsat TM & F2 images**
  Fire reports in the Region of Peloponnesus
  Administrative boundaries
  DTM for image data ortho-rectification
  CORINE 2000 Land Cover data

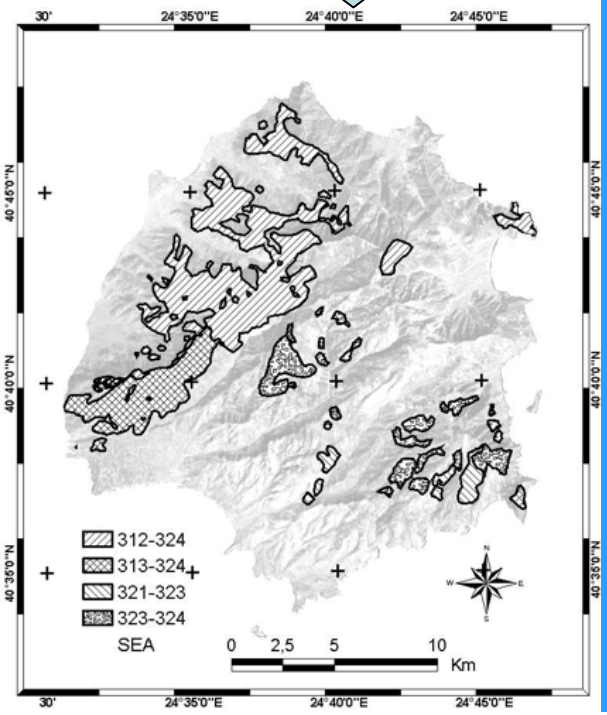
- **Generated Products: a) BSM GIS at high resolution (20-30m),**
  b) BSM GIS at very high resolution (2m)
  c) Raster georeferenced and projected satellite images at high res (20-30m)
  d) Raster georeferenced and projected satellite images at very high res (2m)
  e) Google earth-BSM dissemination

Production status



ΥΠΟΣΥΣΤΗΜΑ ΧΑΡΤΟΓΡΑΦΗΣΗΣ ΤΟΥ ΤΥΠΟΥ ΤΩΝ ΑΛΛΑΓΩΝ ΣΤΟ ΤΟΠΙΟ (CHANGE DETECTION MAPPING FROM-TO)

ΤΑΞΙΝΟΜΗΣΗ ΔΙΑΝΥΣΜΑΤΟΣ Z



- ✓ ΜΕΤΑΦΟΡΑ ΑΠΟ ΤΟ ΧΩΡΟ ΤΩΝ ΔΙΑΝΥΣΜΑΤΩΝ ΡΑΔΙΟΜΕΤΡΙΑΣ ΣΤΟ ΧΩΡΟ ΤΩΝ ΔΙΑΝΥΣΜΑΤΩΝ ΑΛΛΑΓΩΝ ΡΑΔΙΟΜΕΤΡΙΑΣ

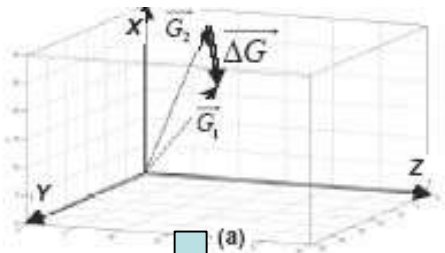
$$c_1 = \arccos\frac{\delta g_1}{|\Delta G|}, c_2 = \arccos\frac{\delta g_2}{|\Delta G|}, \ldots, c_n = \arccos\frac{\delta g_n}{|\Delta G|}$$

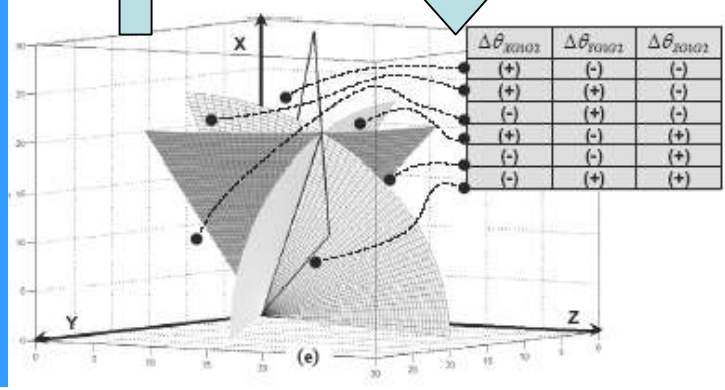
- ✓ ΔΗΜΙΟΥΡΓΙΑ ΣΥΝΘΕΤΟΥ ΔΙΑΥΣΜΑΤΟΣ «Z» ΠΟΥ ΠΕΡΙΓΡΑΦΕΙ ΤΗ ΣΥΝΘΕΤΗ ΓΕΩΜΕΤΡΙΑ ΤΟΥ ΧΩΡΟΥ ΤΩΝ ΑΛΛΑΓΩΝ
- ✓ CLUSTERING ΤΟΥ ΧΩΡΟΥ ΤΩΝ ΑΛΛΑΓΩΝ ΜΕ ΒΑΣΗ ΤΟ ΔΙΑΝΥΣΜΑ «Z»
- ✓ ΔΗΜΙΟΥΡΓΙΑ ΚΛΑΣΕΩΝ ΑΛΛΑΓΩΝ FROM-TO
- ✓ ΤΑΞΙΝΟΜΗΣΗ ΤΗΣ ΕΙΚΟΝΑΣ «Z» ΚΑΙ ΔΗΜΙΟΥΡΓΙΑ ΤΟΥ ΤΕΛΙΚΟΥ ΧΑΡΤΗ ΑΛΛΑΓΩΝ ΣΤΟ ΦΥΣΙΚΟ ΧΩΡΟ

(Kontoes 2006, IJRS)

ΔΙΑΝΥΣΜΑ Z

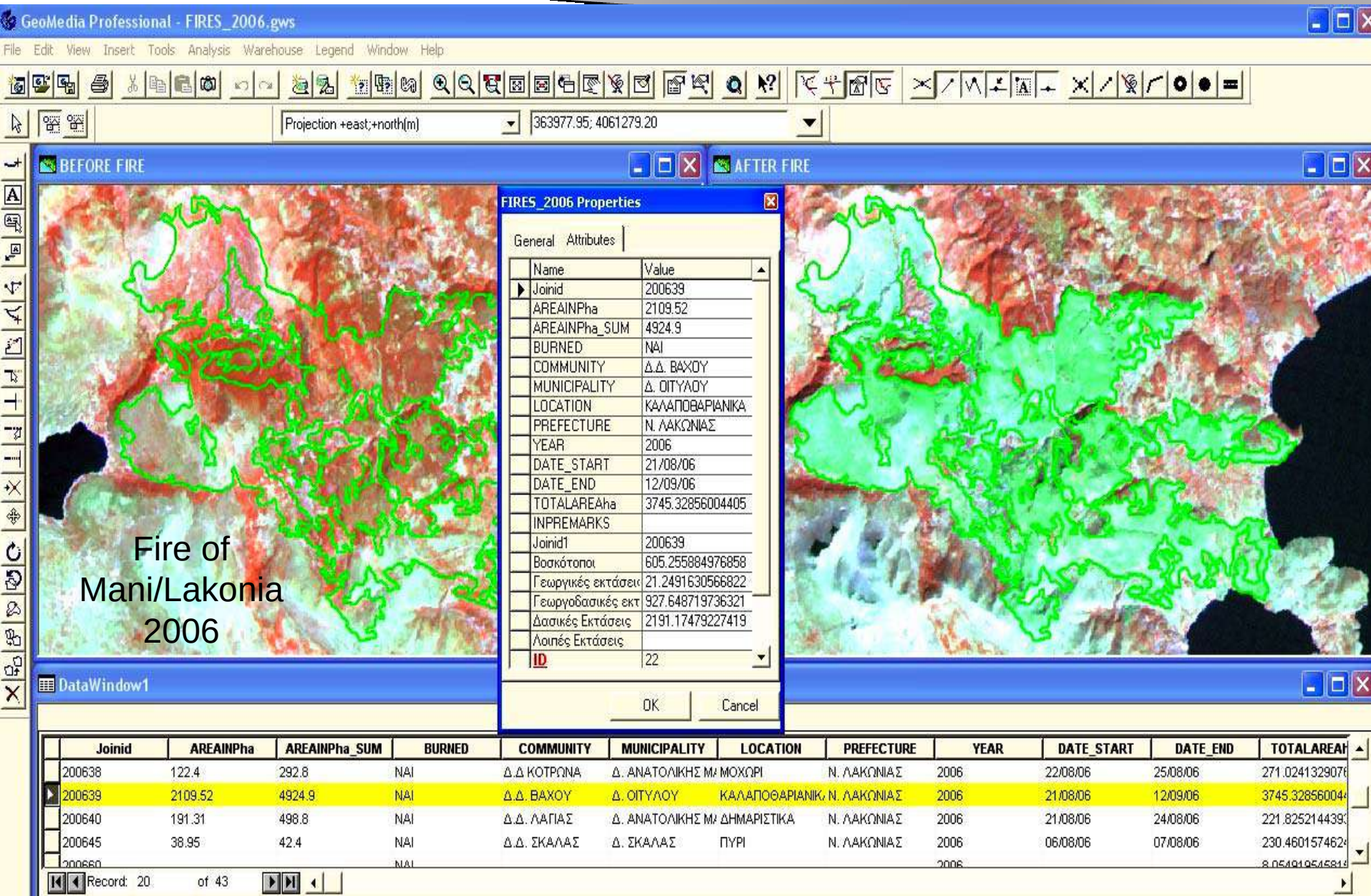
$$\vec{Z} = \begin{bmatrix} |\Delta G| \\ |\overline{G}| \\ \theta_{X0} \\ \theta_{Y0} \\ \theta_{Z0} \\ \Delta\theta_{X0} \\ \Delta\theta_{Y0} \\ \Delta\theta_{Z0} \\ c_{X0} \\ c_{Y0} \\ c_{Z0} \end{bmatrix}$$





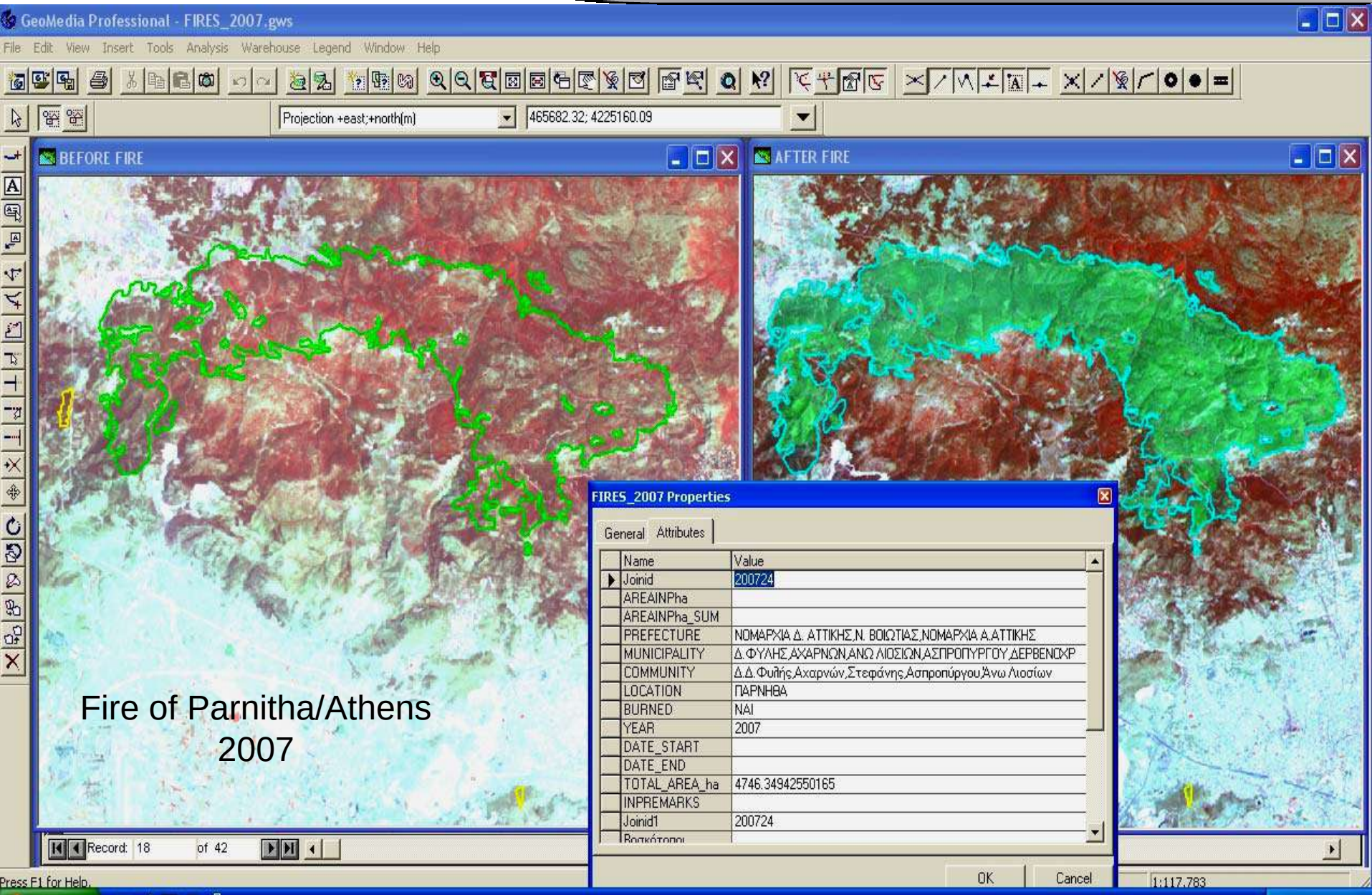
GIS BSM Product
Lakonia 2006

RISK-EOS
GEOINFORMATION SERVICES FOR NATURAL DISASTERS



GIS BSM Product
Parnitha 2007

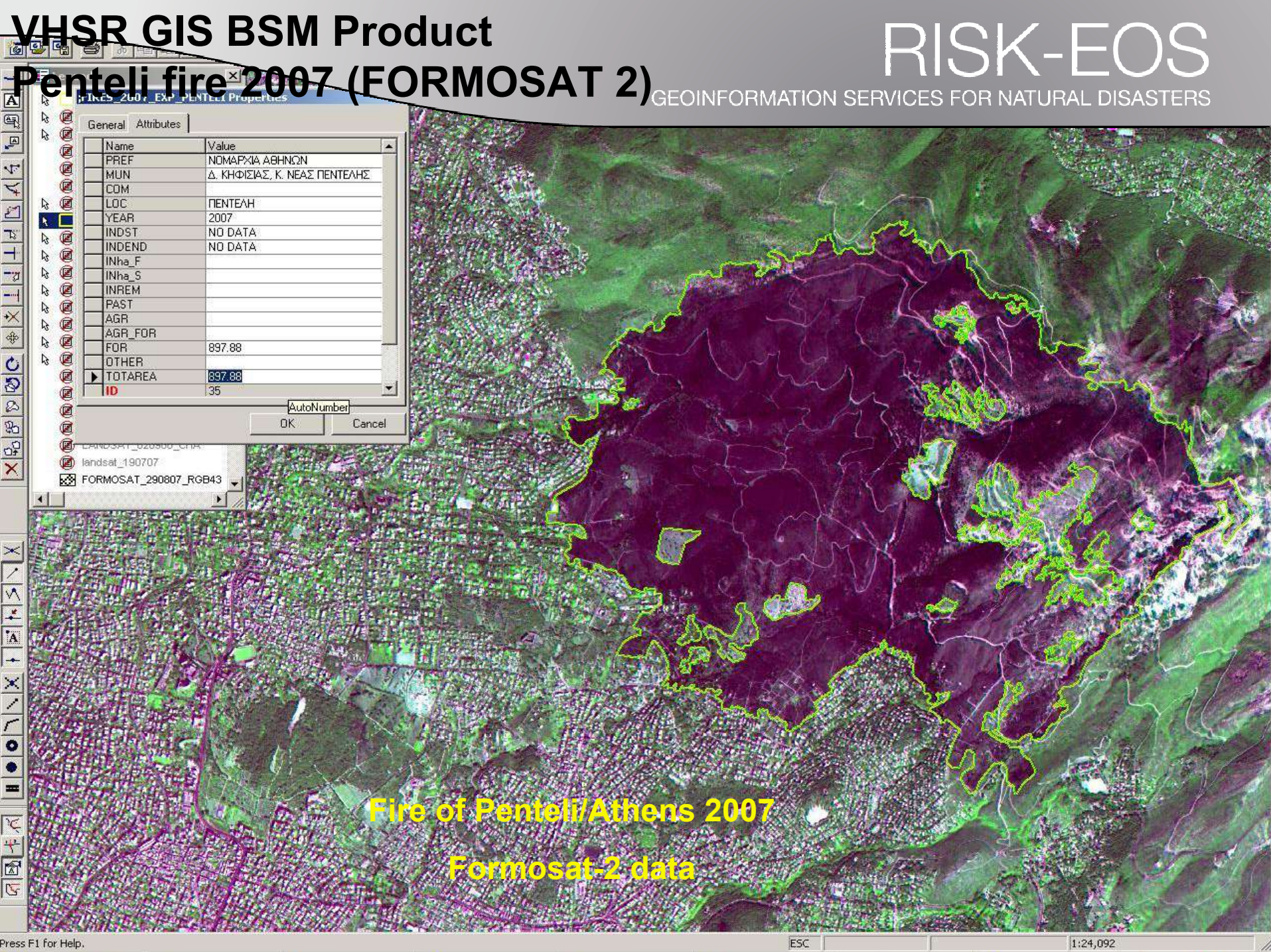
RISK-EOS
GEOINFORMATION SERVICES FOR NATURAL DISASTERS



ΧΑΡΤΟΓΡΑΦΗΣΗ ΚΑΜΕΝΩΝ ΕΚΤΑΣΕΩΝ ΕΤΟΥΣ 2007 ΜΕ ΧΡΗΣΗ ΔΟΡ

VHSR GIS BSM Product
Penteli fire 2007 (FORMOSAT 2)

RISK-EOS
GEOINFORMATION SERVICES FOR NATURAL DISASTERS

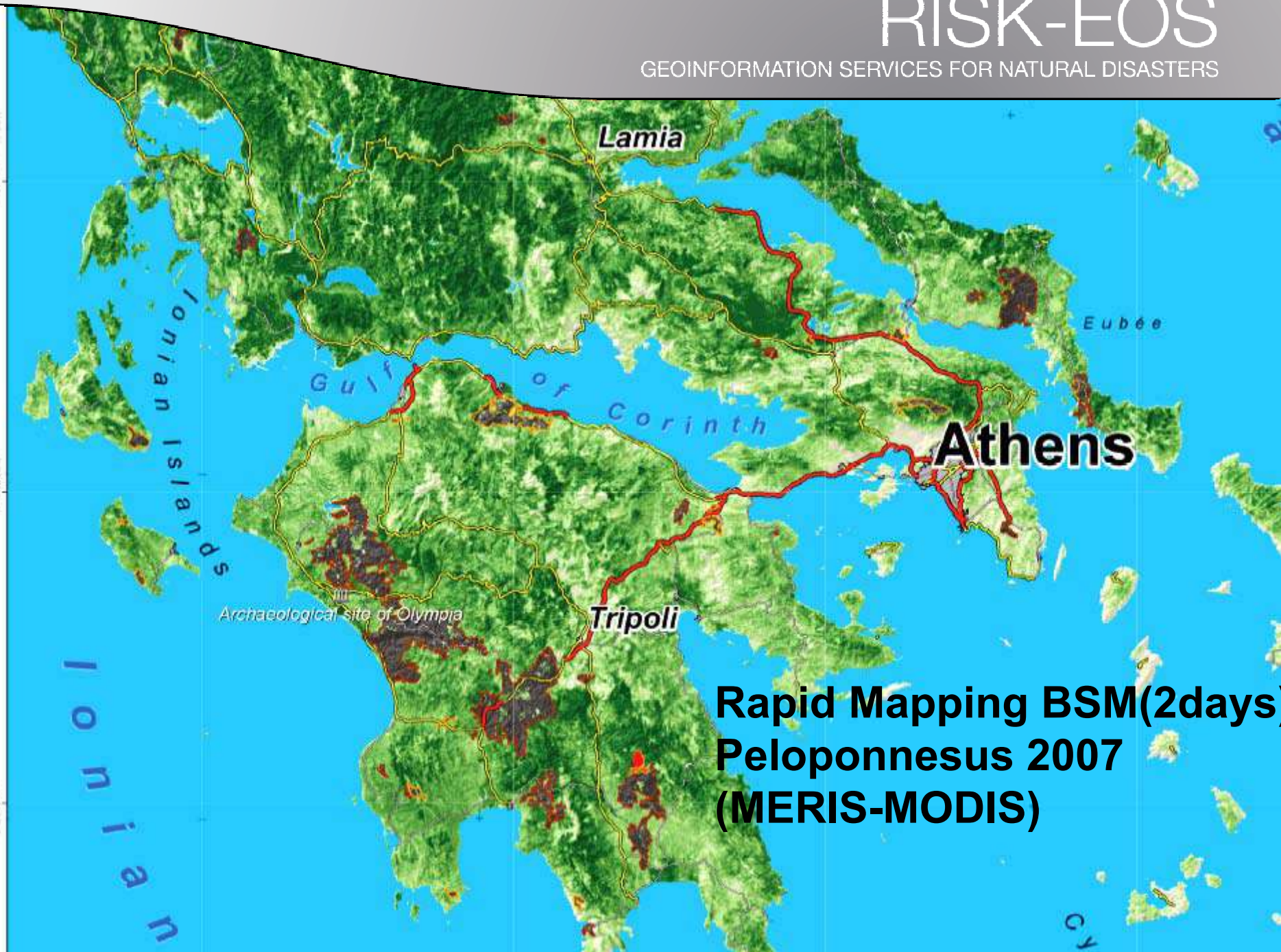



DAMAGE ASSESSMENT
BSM + LAND COVER MAPPING SPOT5 (10m) (0.1-0.25 Ha)

GIS – Google Earth BSM Product
Pilion-Skiathos 2007

RISK-EOS
GEOINFORMATION SERVICES FOR NATURAL DISASTERS

Fire of Pilion (5176 Ha**) and Skiathos (**265 Ha**) 2007**



Rapid Mapping BSM(2days)
Peloponnesus 2007
(MERIS-MODIS)

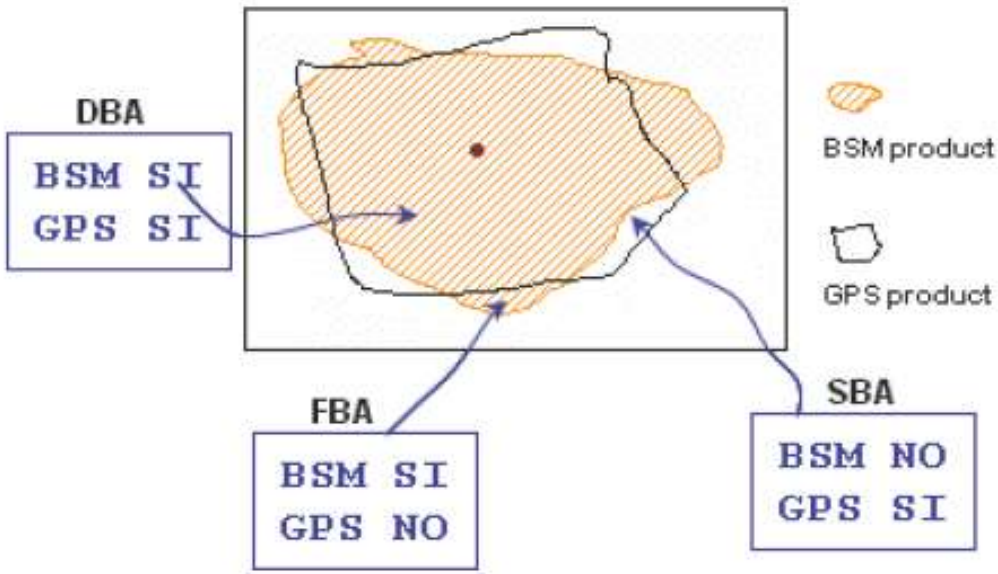
BSM Product validation

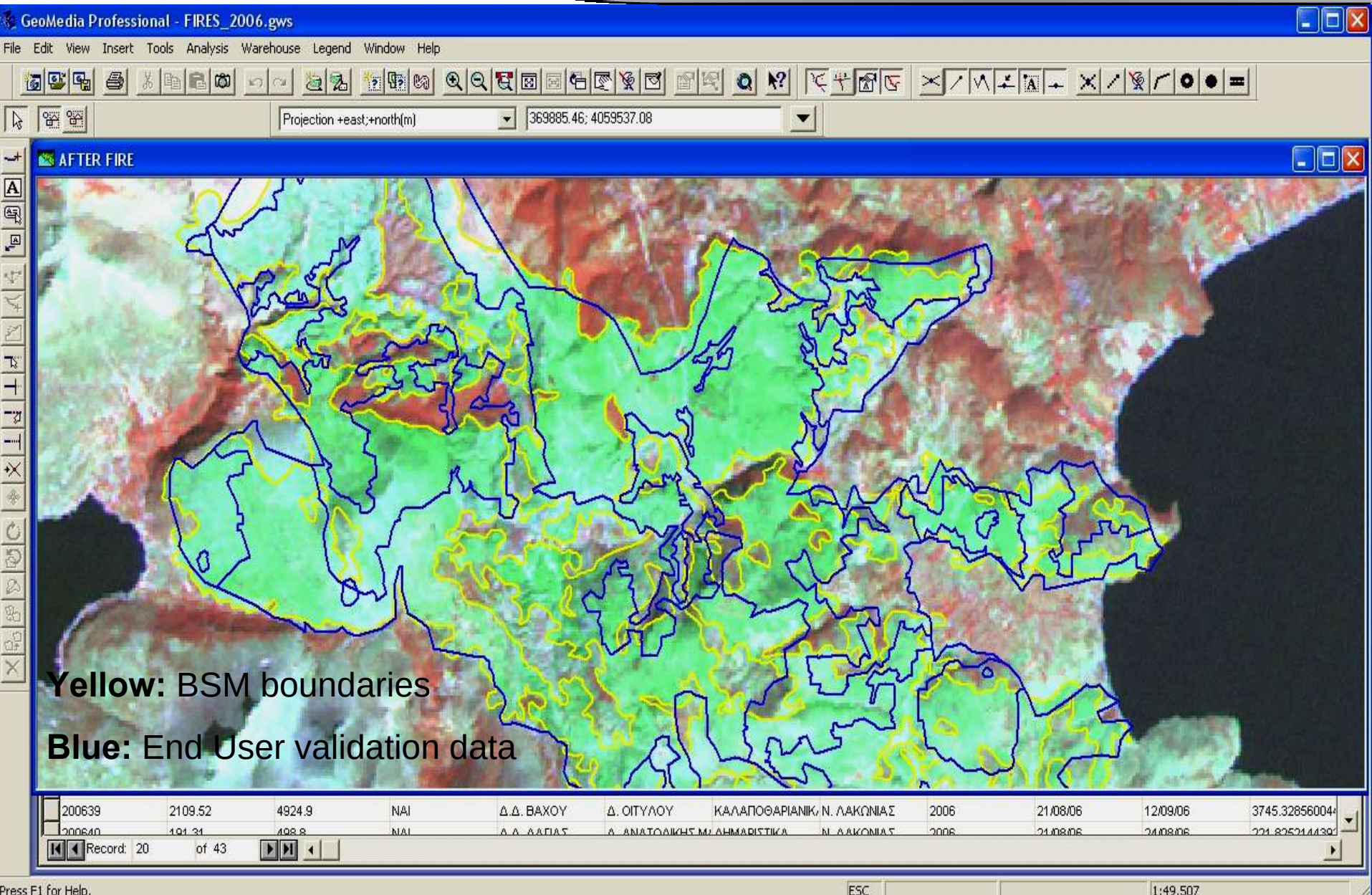
$$\text{Detection efficiency rate} = \frac{DBA}{DBA+SBA}$$

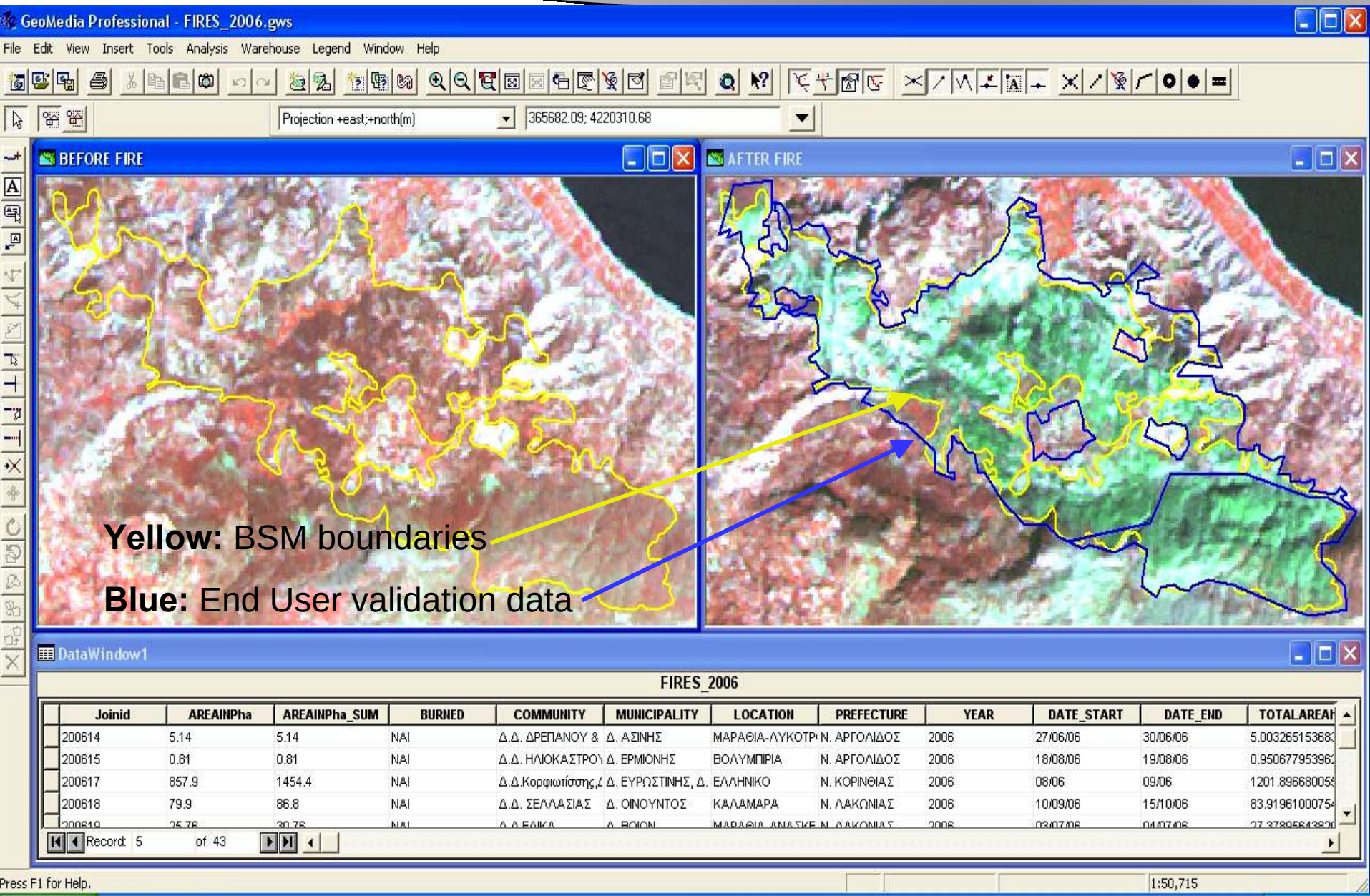
$$\text{Commission error (False Alarm rate)} = \frac{FBA}{DBA+FBA}$$

$$\text{Omission error} = \frac{SBA}{DBA+SBA}$$

- DBA: Detected burnt areas
- FBA: False burnt areas
- SBA: Skipped burnt areas

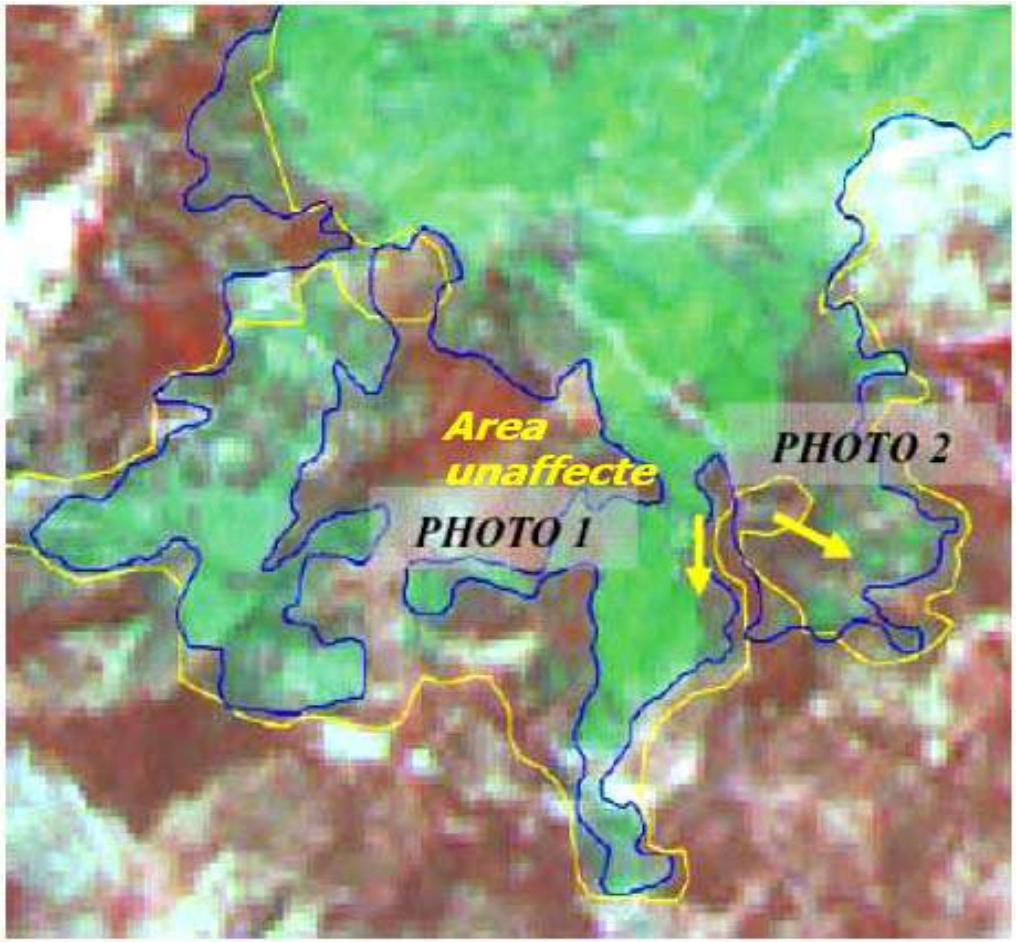



GeoMedia Professional - FIRES_2006.gws
File Edit View Insert Tools Analysis Warehouse Legend Window Help
Projection +east;+north(m)
369885.46; 4059537.08
AFTER FIRE
Yellow: BSM boundaries
Blue: End User validation data
200639 2109.52 4924.9 NAI Δ.Δ. ΒΑΧΟΥ Δ. ΟΙΤΥΛΟΥ ΚΑΛΛΑΠΟΘΑΡΙΑΝΙΚ Ν. ΛΑΚΩΝΙΑΣ 2006 21/08/06 12/09/06
Record: 20 of 43
Press F1 for Help.
ESC
1:49,507


GeoMedia Professional - FIRES_2006.gws
File Edit View Insert Tools Analysis Warehouse Legend Window Help
Projection +east;+north(m)
365682.09; 4220310.68
BEFORE FIRE
AFTER FIRE
Yellow: BSM boundaries
Blue: End User validation data
DataWindow1
FIRES_2006
Joinid AREAINPha AREAINPha_SUM BURNED COMMUNITY MUNICIPALITY LOCATION PREFECTURE YEAR DATE_START DATE_END TOTALAREAH
200614 5.14 5.14 NAI Δ.Δ. ΔΡΕΠΑΝΟΥ & Δ. ΑΣΙΝΗΣ ΜΑΡΑΘΙΑ-ΛΥΚΟΤΡ Ν. ΑΡΓΟΛΙΔΟΣ 2006 27/06/06 30/06/06
200615 0.81 0.81 NAI Δ.Δ. ΗΛΙΟΚΑΣΤΡΟ Δ. ΕΡΜΙΟΝΗΣ ΒΟΛΥΜΠΙΑ Ν. ΑΡΓΟΛΙΔΟΣ 2006 18/08/06 19/08/06
200617 857.9 1454.4 NAI Δ.Δ.Κορφιωτίσσης,Δ Δ. ΕΥΡΩΣΤΙΝΗΣ, Δ. ΕΛΛΗΝΙΚΟ Ν. ΚΟΡΙΝΘΙΑΣ 2006 08/06 09/06
200618 79.9 86.8 NAI Δ.Δ. ΣΕΛΛΑΣΙΑΣ Δ. ΟΙΝΟΥΝΤΟΣ ΚΑΛΑΜΑΡΑ Ν. ΛΑΚΩΝΙΑΣ 2006 10/09/06 15/10/06
Record: 5 of 43
Press F1 for Help.
1:50,715


DAMAGE ASSESSMENT
BSM + LAND COVER MAPPING SPOT5 (10m) (0.1-0.25 Ha)

Parnitha BSM Product vs MoA true-color ortho-photo maps



The BSM product (blue line) compared to the MMA product (yellow line).

Landscape Photo 2-Direction N-S: The example of a surface fire

Landscape Photo 1-A "false" detected burnt area due to the sole use of true-colour data

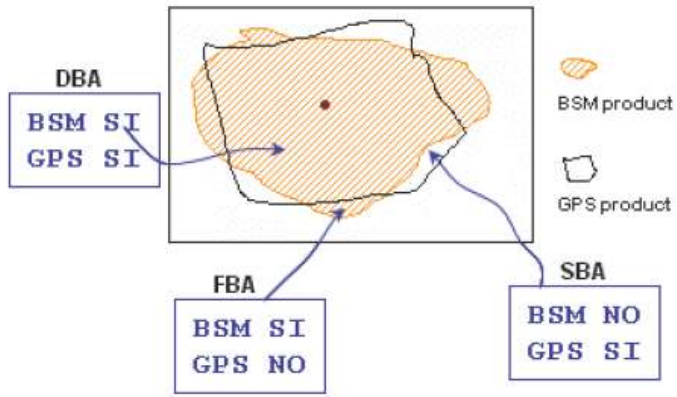
Parnitha BSM Product validation using GPS ground collected data

$$\text{Detection efficiency rate} = \frac{DBA}{DBA+SBA}$$

$$\text{Commission error (False Alarm rate)} = \frac{FBA}{DBA+FBA}$$

$$\text{Omission error} = \frac{SBA}{DBA+SBA}$$

- DBA: Detected burnt areas
- FBA: False burnt areas
- SBA: Skipped burnt areas

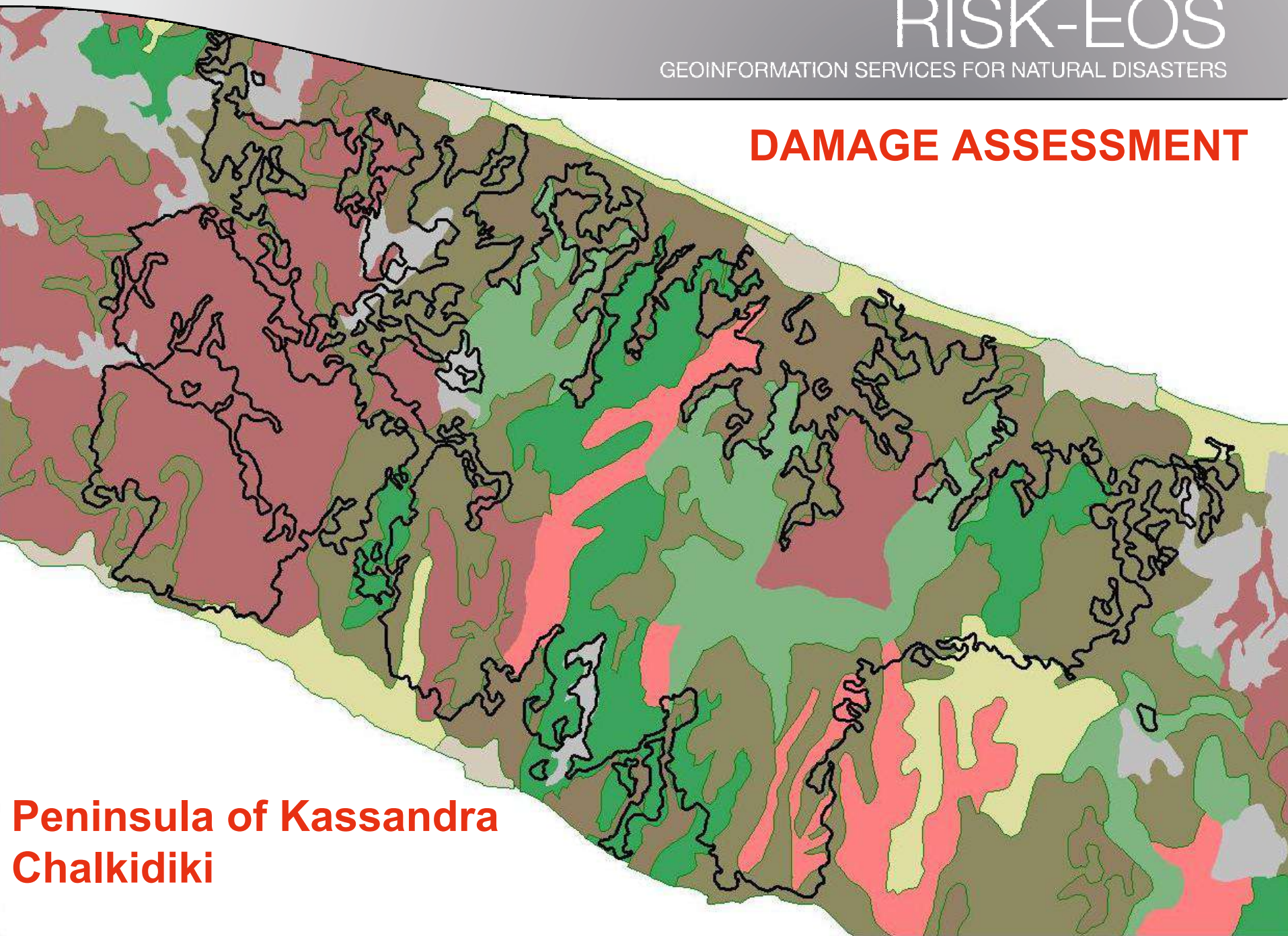


Area statistics (ha)		Accuracy statistics (percentage)	
Detected Burned Areas(DBA):	4686.56ha	Detection Efficiency Rate:	93%
Skiped Burned Areas(SBA):	105.65ha	Omission Error:	5%
False Burned Areas(FBA):	68.84ha	Commission Error:	2%

RISK-EOS

GEOINFORMATION SERVICES FOR NATURAL DISASTERS

DAMAGE ASSESSMENT

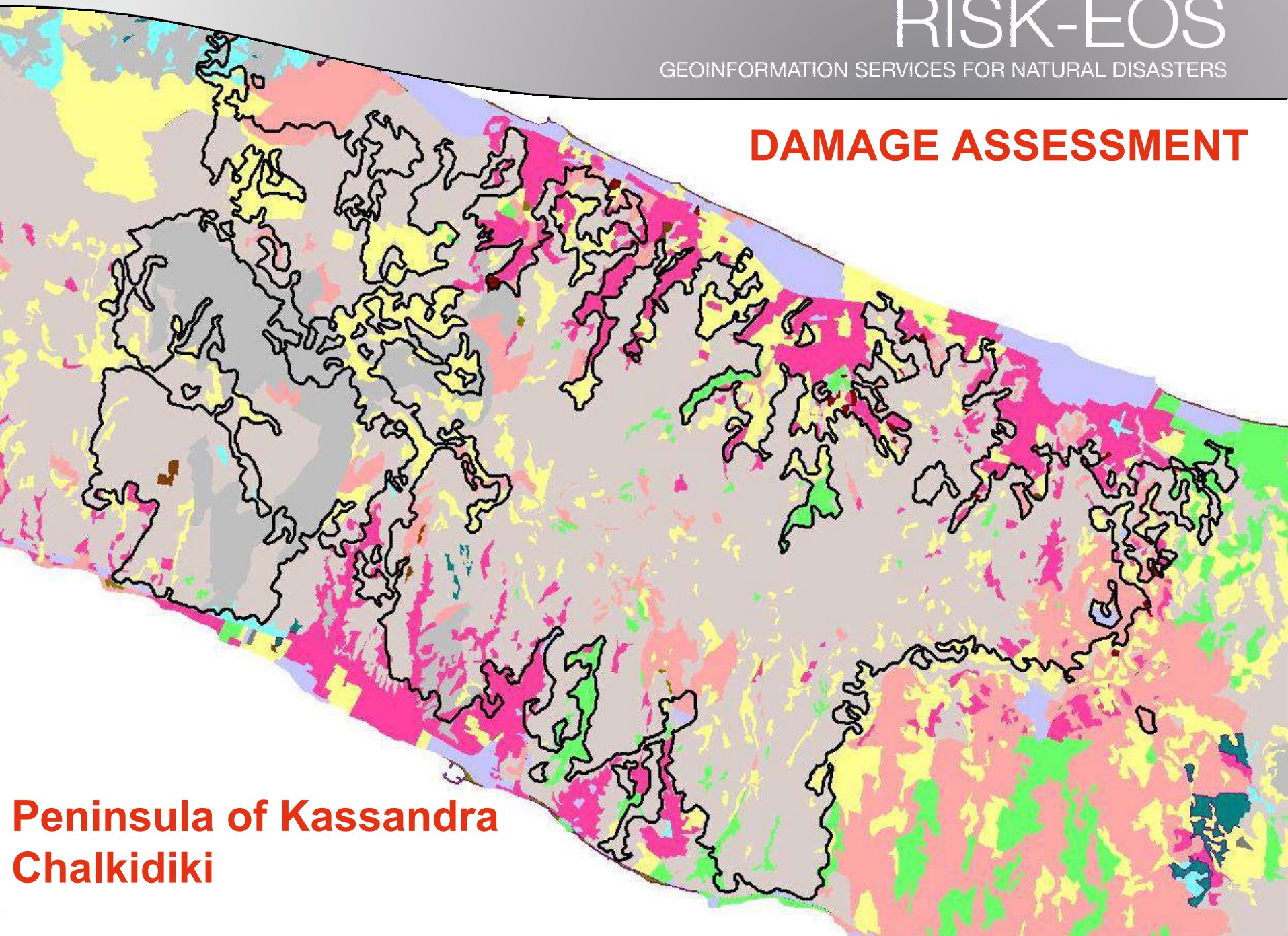


Peninsula of Kassandra Chalkidiki

RISK-EOS

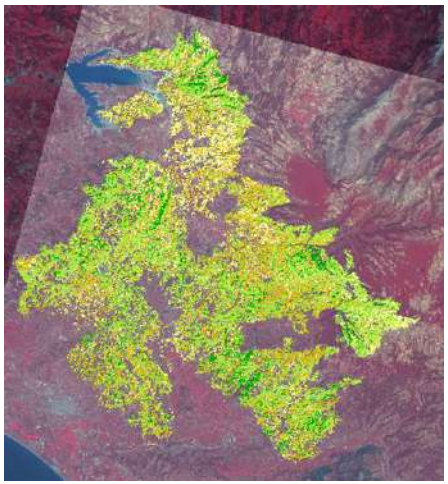
GEOINFORMATION SERVICES FOR NATURAL DISASTERS

DAMAGE ASSESSMENT



Peninsula of Kassandra
Chalkidiki

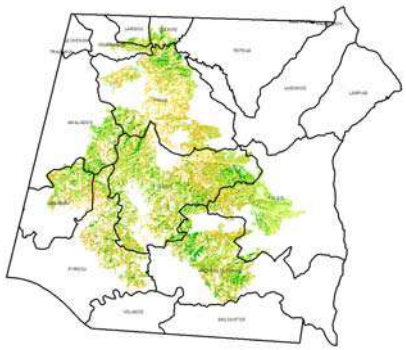
Presentation of the results: Damage assessment

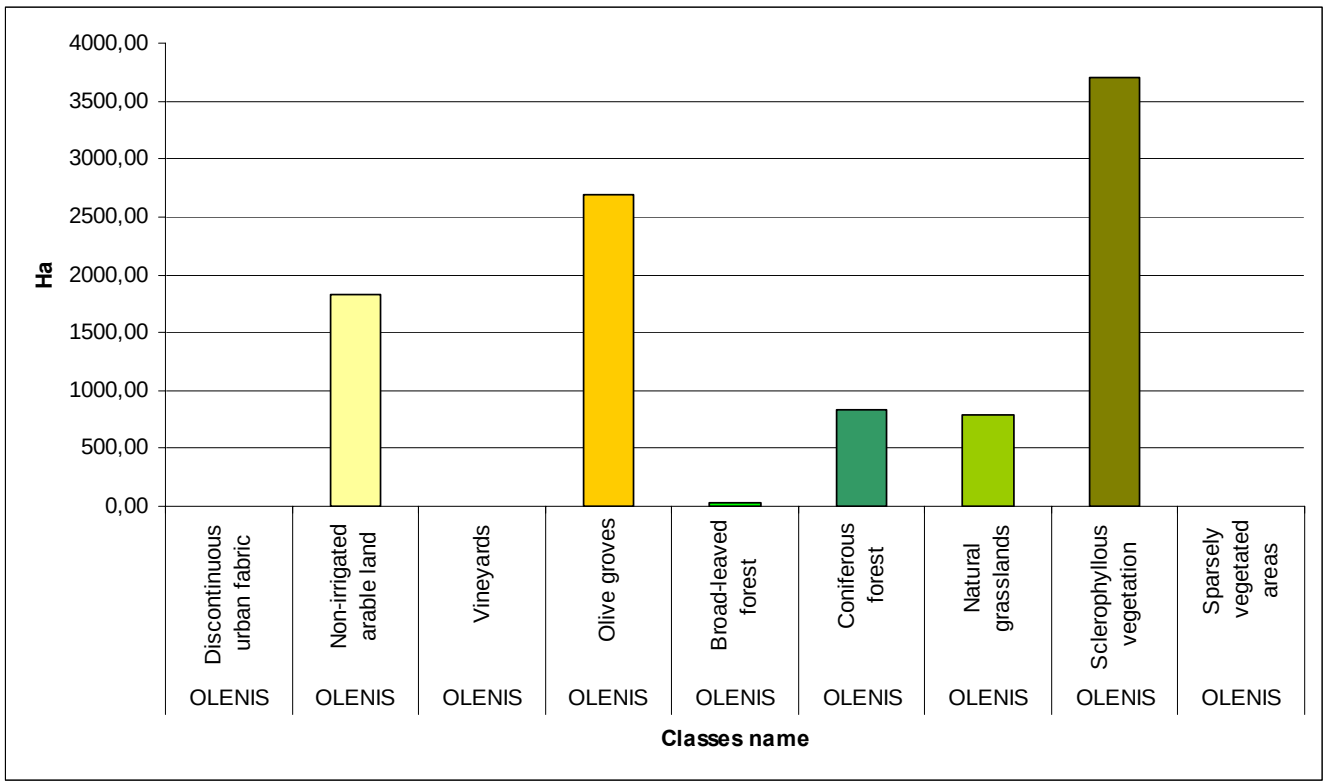


Code	Class Name	Surf_ha	%
21x	Arable land	6833.62	21.0
223	Olive groves	8445.85	26.0
311	Broad-leaved forest	131.11	0.4
312	Coniferous forest	2575.78	7.9
321	Grassland	2117.16	6.5
323	Sclerophyllous vegetation	12218.50	37.7
	Other		0.5
	Total:	**32415.20**	**100.00**

DAMAGE ASSESSMENT

Damage assessment per Municipalities





USER FEEDBACK

a) The HELLENIC MINISTRY OF RURAL DEVELOPMENT AND FOODS
b) The NATIONAL AGRICULTURAL RESEARCH FOUNDATION
c) The HELLENIC CENTER OF GREEK BIOTOPES AND WETLANDS
d) The KTIMATOLOGIO SA

The BSM products were integrated in the GIS systems of Users. The Users provided essential fedback concerning the products' utility compared to the current means

USER ASSESSMENT

A. The BSM_NOA service is useful for:
   a) Fire fighting planning and post-fire management.
   b) Timely, accurate and standardized damage assessments throughout the entire country.
   c) Monitor and control the enforcement of Greek law for maintaining the original land uses.
   d) Support the reforestation activities in respect to the Greek legislation.
   e) Update the biotope maps according to the needs of NATURA 2000.
   f) Support planning and prioritisation actions in the implementation of the National Cadastral Project

USER ASSESSMENT

The BSM_NOA service:

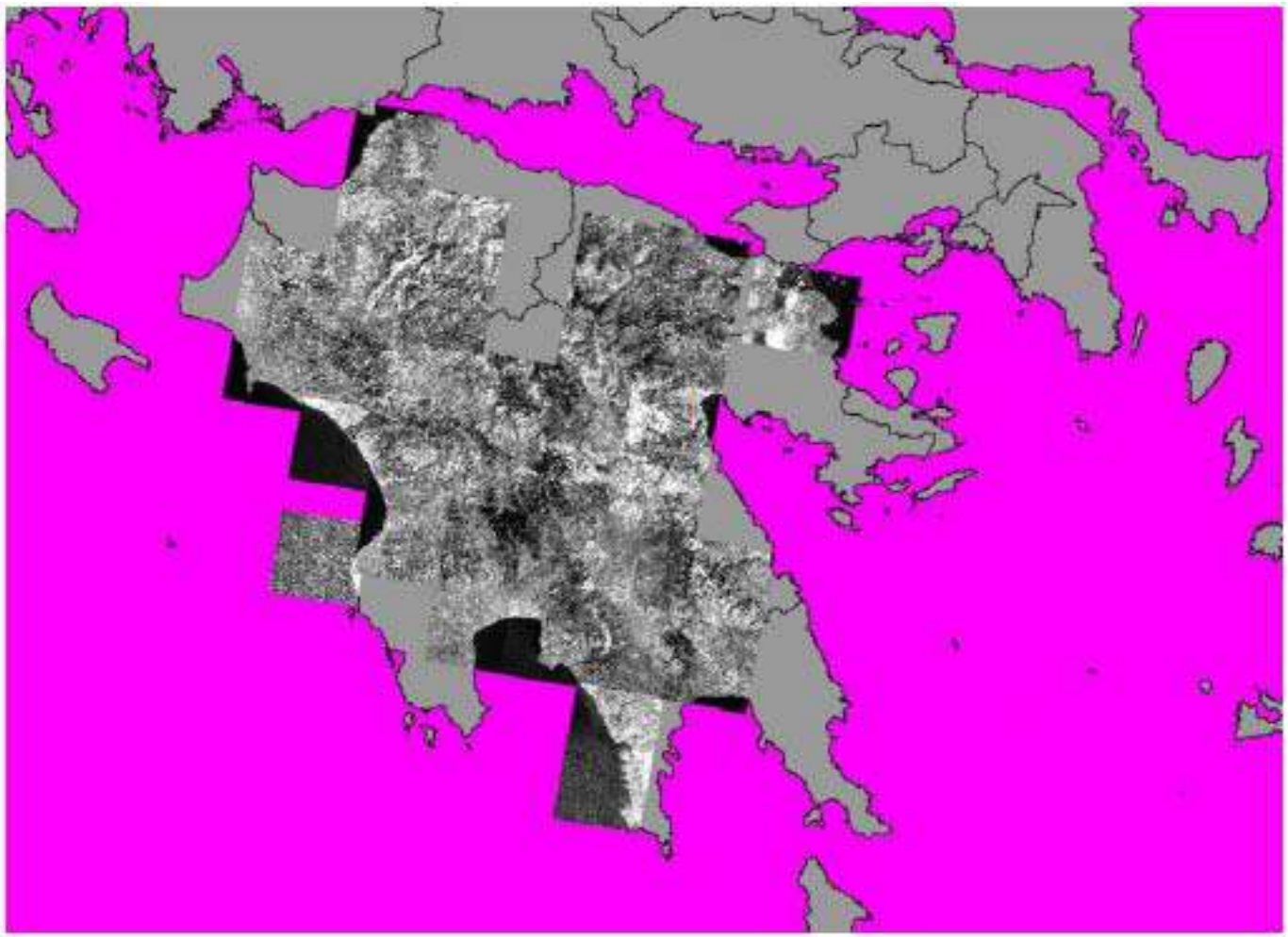
a) Delivers useful products using the same standard (accuracy and cost) throughout the entire country.
b) Consists the only alternative to the field surveys which in general are:
    a) non exhaustive and,
    b) much diversified in terms of mapping accuracy and mapping scale (depending on time and budget restrictions and the mapping method-GPS, ortho-photos).

B. Suggested Improvements:

a) For specific fire events of high economic impact or fires at the fringe of urban areas, the use of VHR satellite data is strongly suggested.

BSM Product planning for 2007 fire season

Over Peloponnesus: Use of Very High Spatial Resolution Satellite Data FORMOSAT –2 (2m/pixel). P+XS F2 Data collected in the regions below



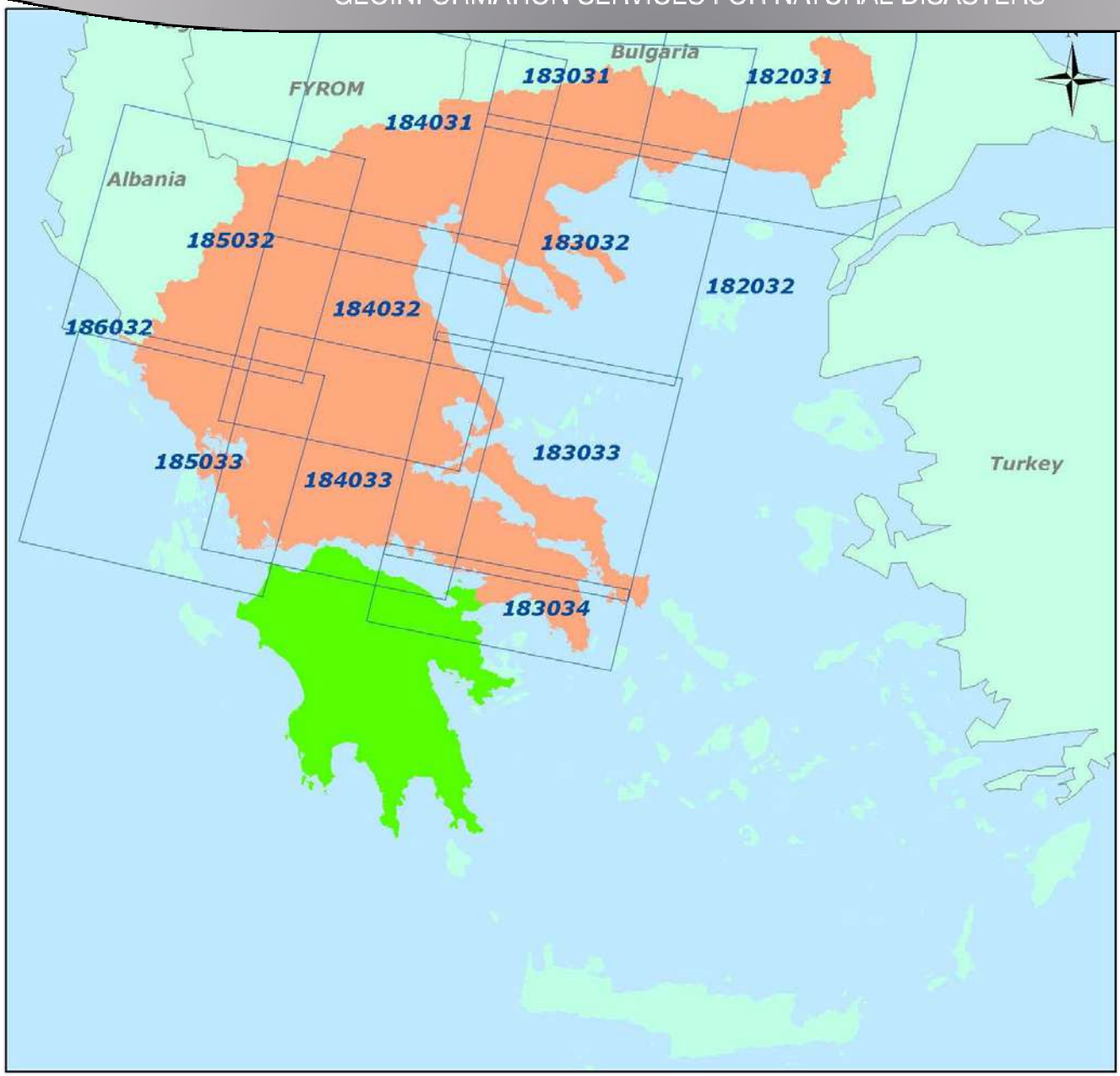
PHASE 3 SERVICE DELIVERY PLAN

Service deployment:

Continental Greece excluding islands of Aegean Sea and Peloponnesus –

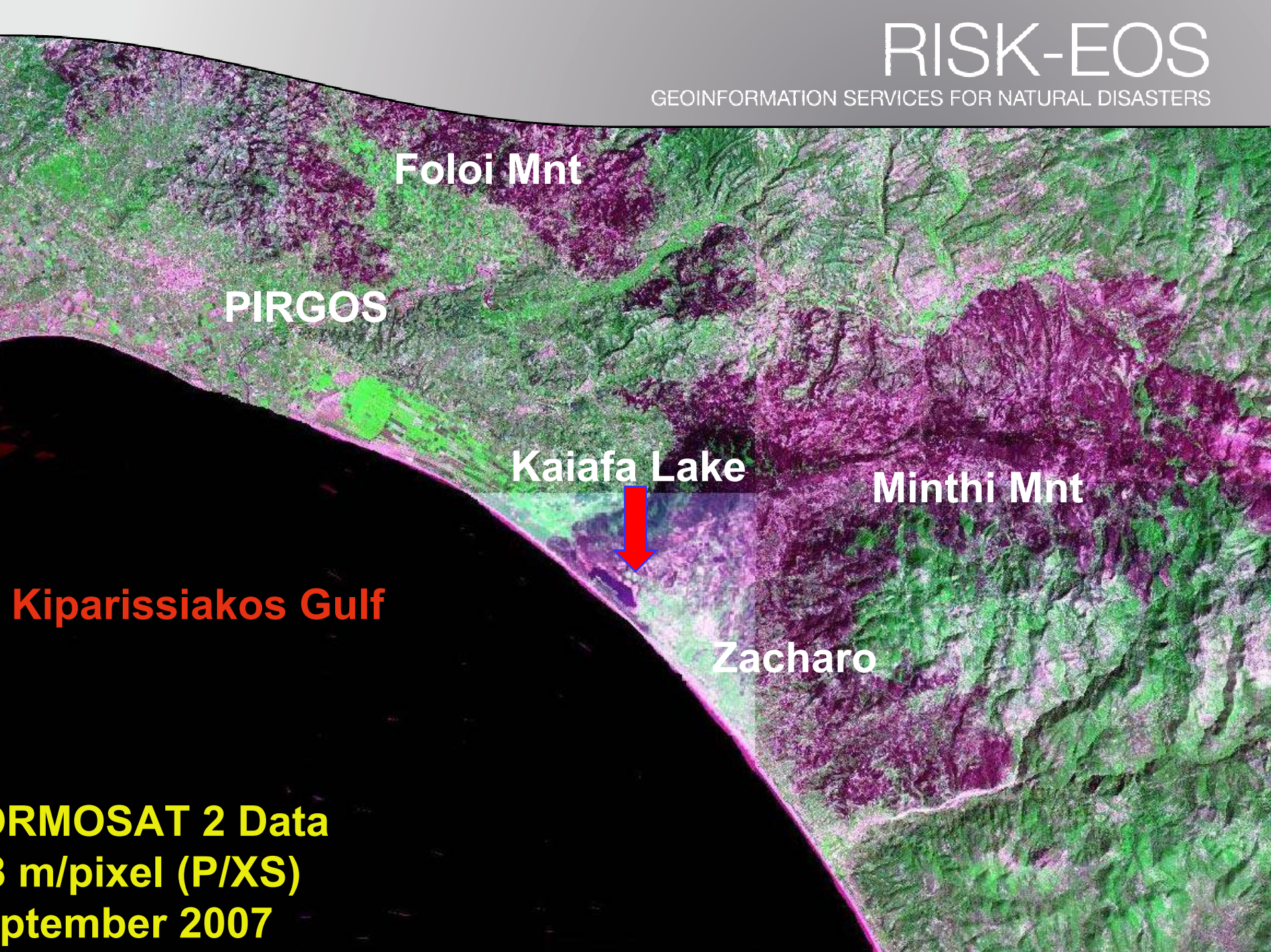
HR satellite imagery LANDSAT TM + SPOT 4 XS **(20-30m/pixel)**

Area to be covered (98.000 Km2)



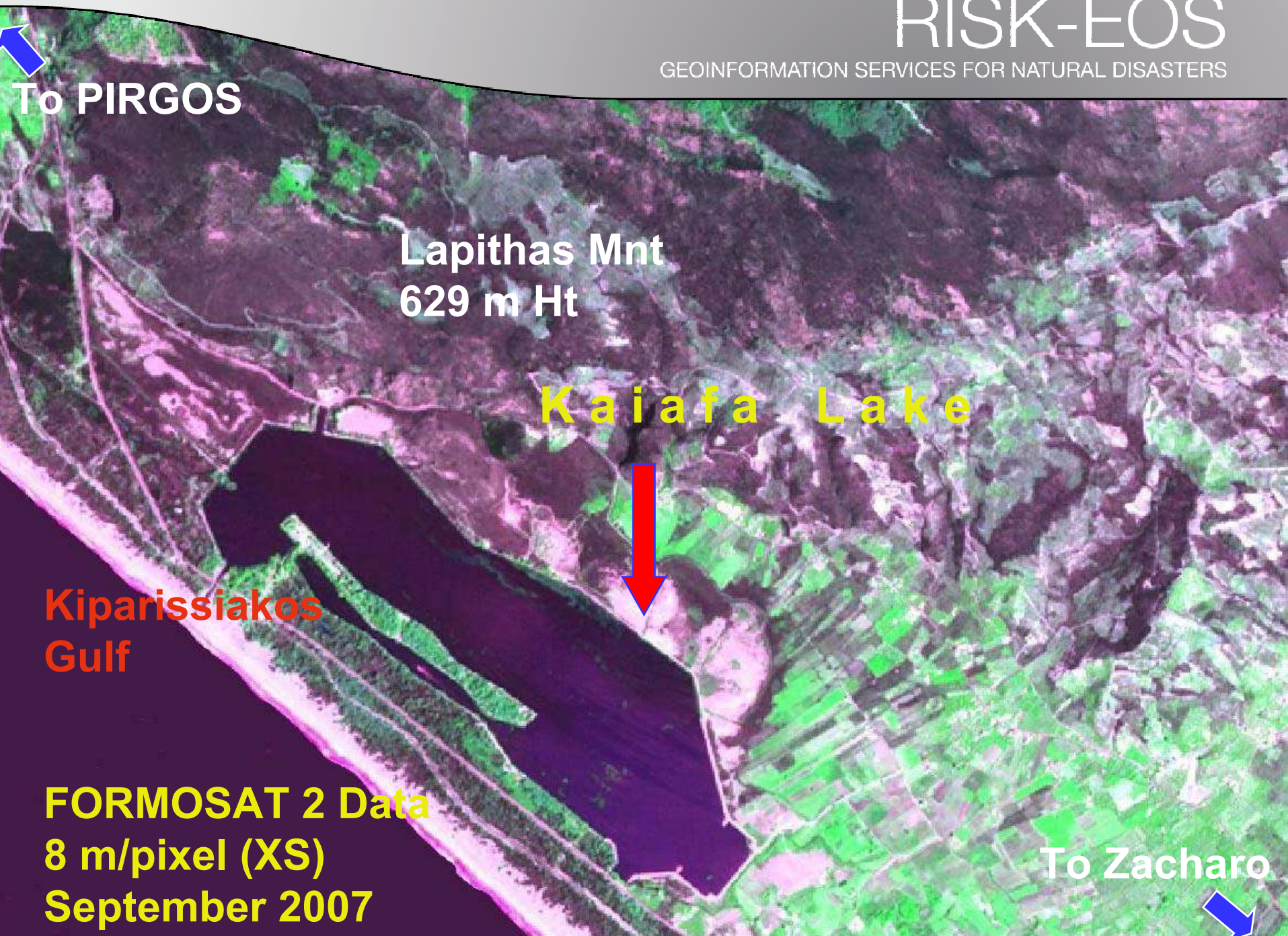
RISK-EOS

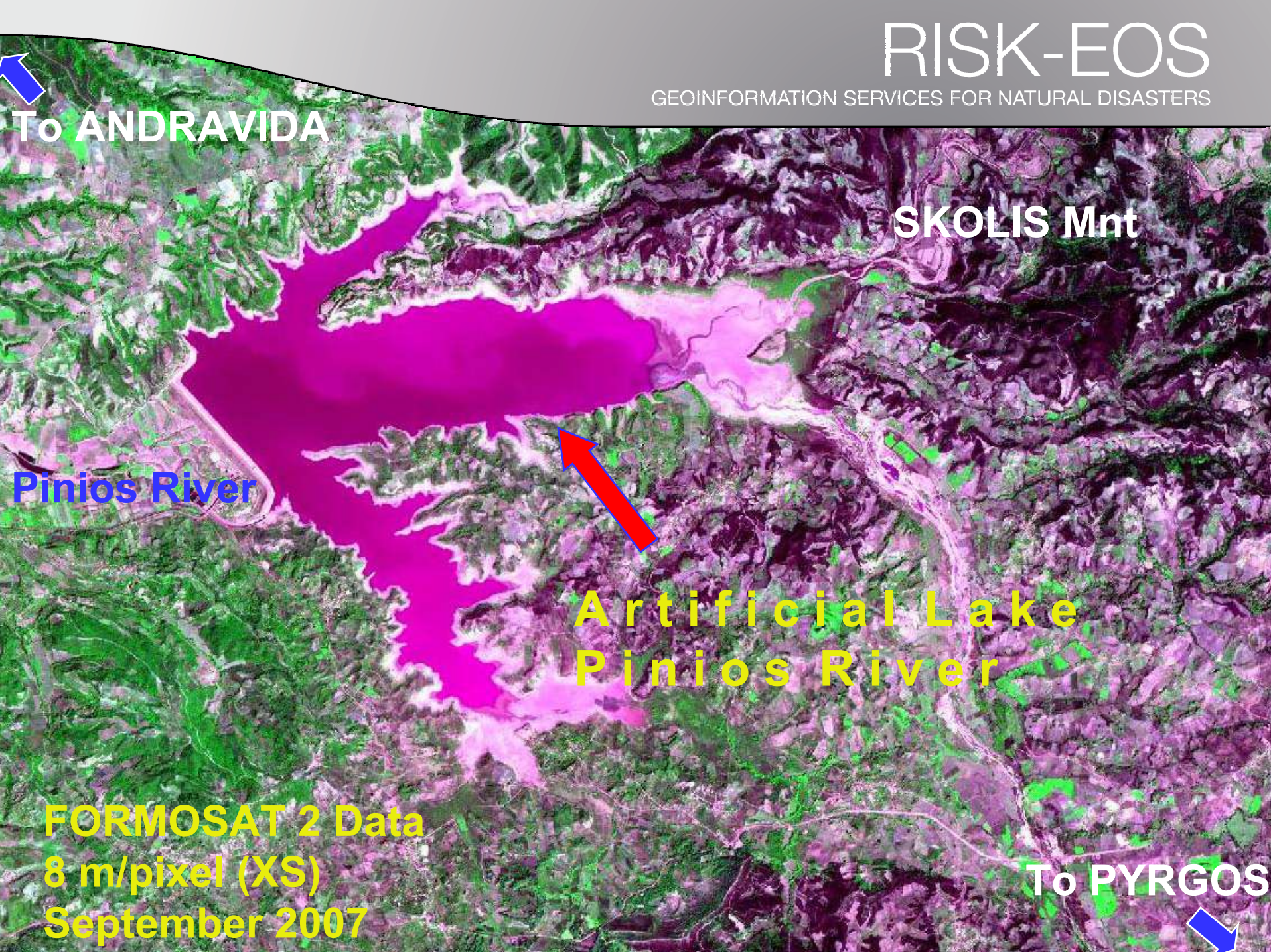
GEOINFORMATION SERVICES FOR NATURAL DISASTERS

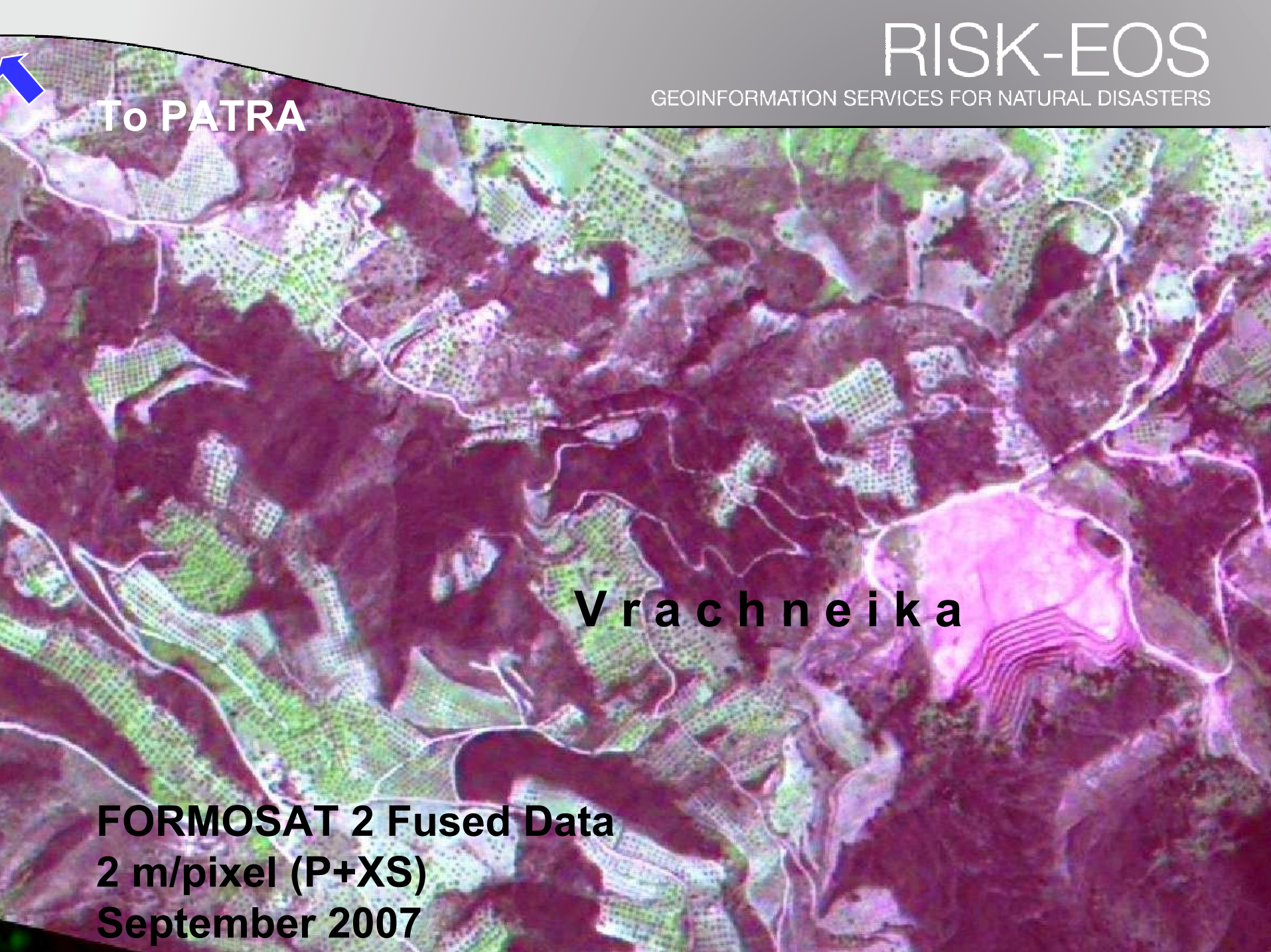


RISK-EOS

GEOINFORMATION SERVICES FOR NATURAL DISASTERS




RISK-EOS
GEOINFORMATION SERVICES FOR NATURAL DISASTERS
To ANDRAVIDA
SKOLIS Mnt
Pinios River
Artificial Lake
Pinios River
FORMOSAT 2 Data
8 m/pixel (XS)
September 2007
To PYRGOS


To PATRA
Vrachneika
FORMOSAT 2 Fused Data
2 m/pixel (P+XS)
September 2007