

Meteo Romania Contribution to the Creation of an Satellite Based Service for Flood Monitoring in Romania

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Introduction

- The availability of high quality, rapidly accessible and secure geo-information is the basis of rational decision making for risk management and disaster prevention. In the last years there is a clear aim of most of European countries to promote scientific excellence and innovation to advance knowledge and understanding in the field of risk management.





Floods

- Floods are the major disaster affecting many countries in the world year after year. From Romania perspective, floods are among the most hazardous natural disasters in terms of human suffering and economic losses. Major floods occurred in 2000, 2005, 2006, 2008 and 2010, the worst ones in more than 40 years, have affected large regions of Romania: in the Timis county (April 2005) over 1 300 homes have been damaged or destroyed, 3 800 people have been evacuated and about 30 000 hectares of agricultural land flooded; in five counties situated in eastern Romania (July 2005) 11 000 homes were inundated, 8 600 people have been evacuated, 20 people were killed, 53 000 hectares farmland flooded, 379 bridges damaged or destroyed; in 12 counties along the Danube (April 2006) 3 077 homes were affected (1 049 completely destroyed), 16 000 people evacuated, 5 people killed, 144 000 hectares of land flooded; in six counties from the North-East part of Romania (July 2008) 3 985 houses were affected (over 300 totally destroyed), 15 834 people evacuated and 35 084 hectares of agricultural land inundated. At the end of June 2010, heavy rainfalls caused severe floods and flash floods in the river basins Prut and Siret (East and Northeast of Romania). More than 20 people were killed and hundreds were evacuated. Several roads and thousands of hectares of farmland were inundated.

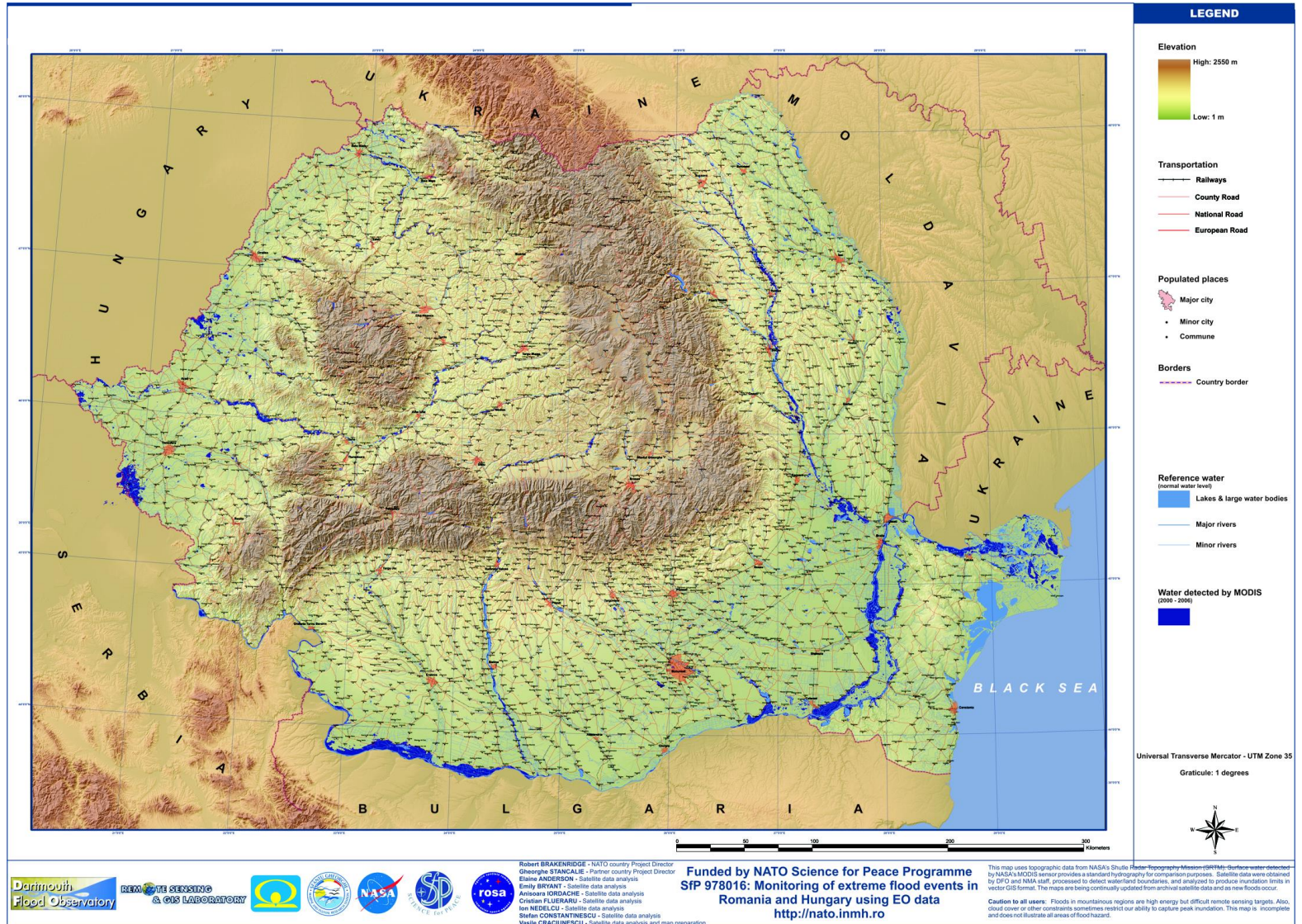


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Flood Hazard Map (2000 – 2012)





Framework

Projects:

- 2003 – 2006: NATO SfP 978016, Monitoring of extreme flood events in Romania and Hungary using EO data
- 2007 – 2010: PNCDI2 SIGUR, Satellite Based Emergency Response Service
- 2007 – 2010: PNCDI2 RISCASAT, Development of New Satellite-Derived Products Adapted to Users Requirements for Hydro-Meteorological Risk Management
- 2009 – 2012: FP7 SAFER, Services and Applications For Emergency Response
- 2012 – 2015: PNCDI2 GEODIM, Platform for GeoInformation in Support of Disaster Management

Partners:

- Romanian Space Agency
- National Meteorological Administration
- National Institute of Hydrology & Water Management
- Romanian Center for the Remote Sensing Use in Agriculture
- University Politehnica Bucharest
- Advanced Studies and Research Center

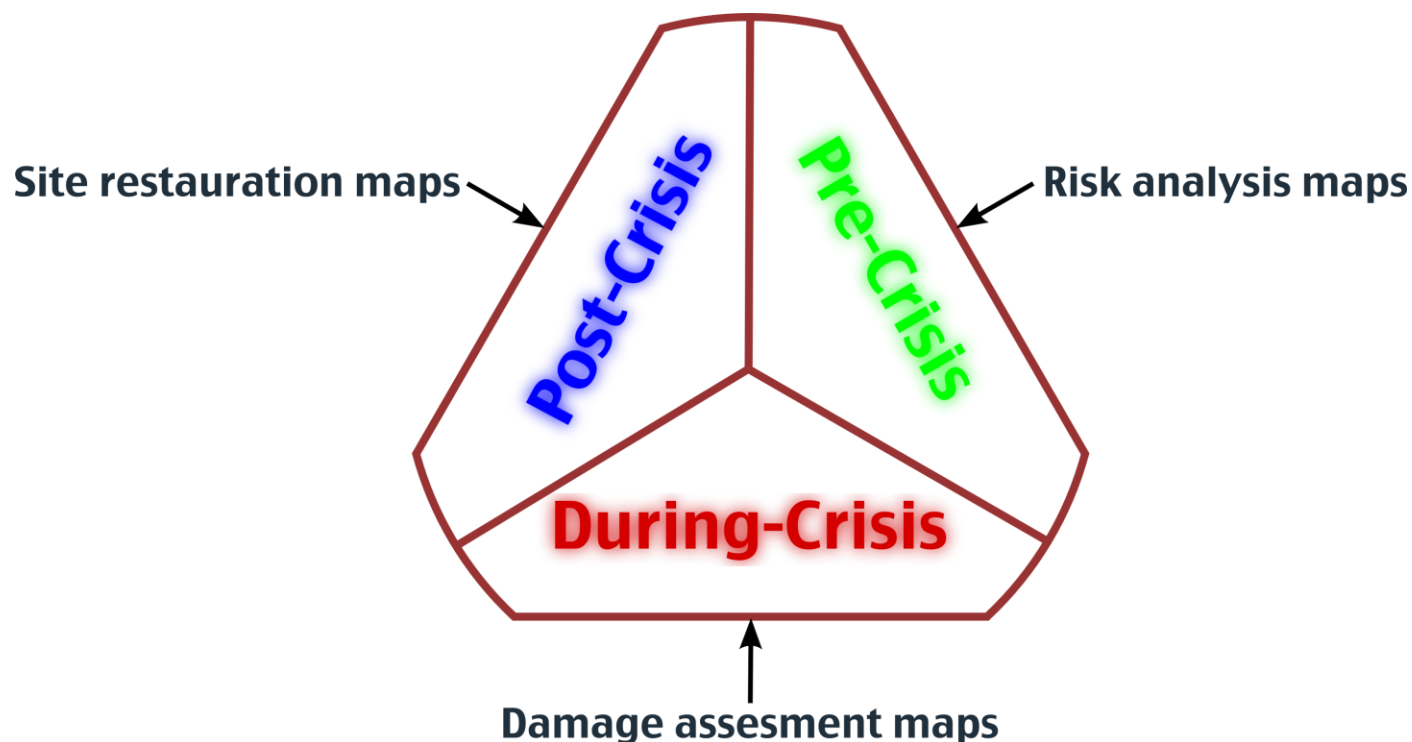
Beneficiaries:

- General Inspectorate for Emergency Situations
- Ministry of Environment and Sustainable Development
- Local county councils, prefectures, etc.



Service concept

- Various processing techniques (classification, geo-referencing, filtering, and photo-interpretation) are used to combine the optical and radar images and **map** the flooded areas.



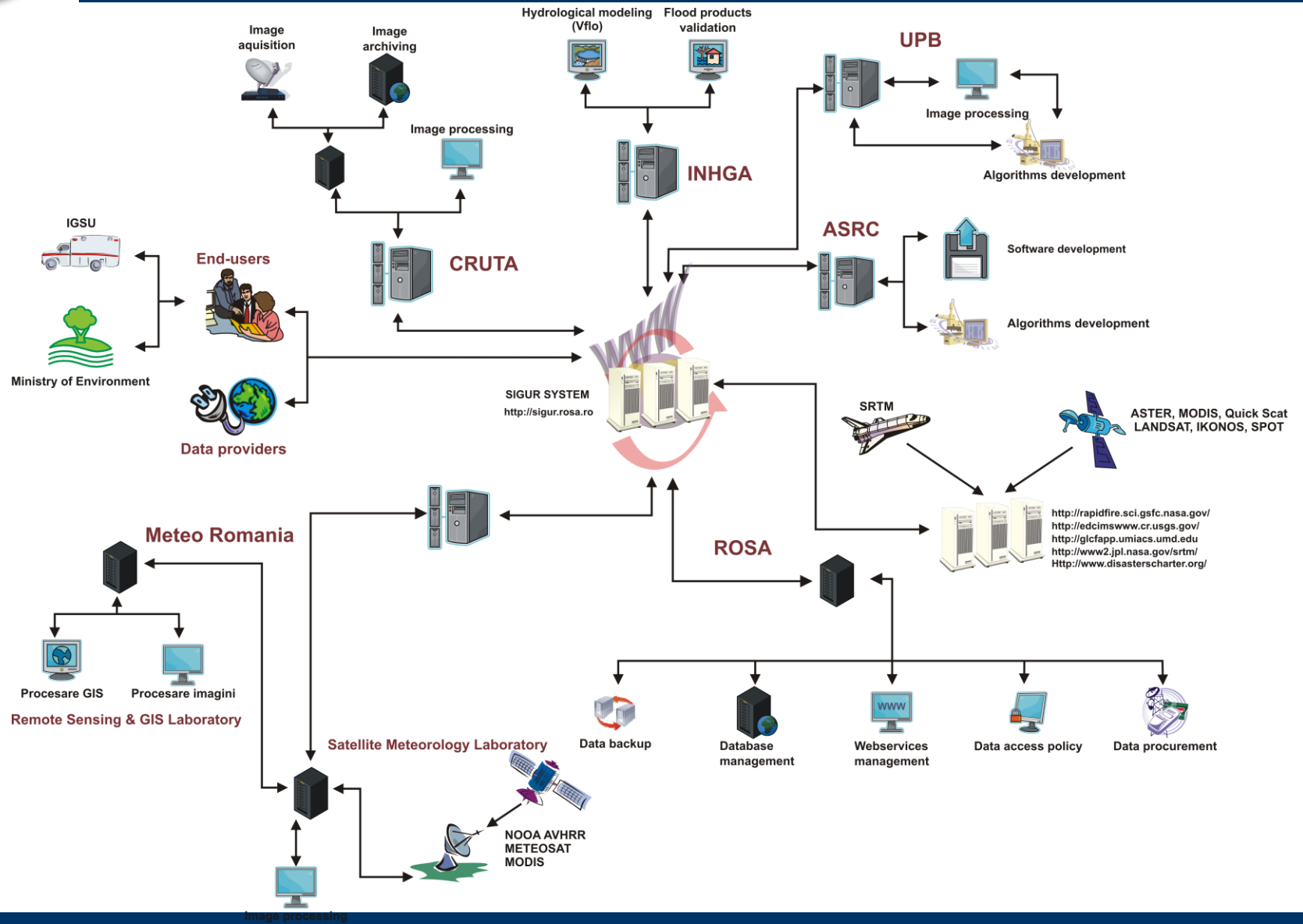


Service history

- Version 1: started in 2005
- Version 2: started in 2007
- Version 3: started in 2012

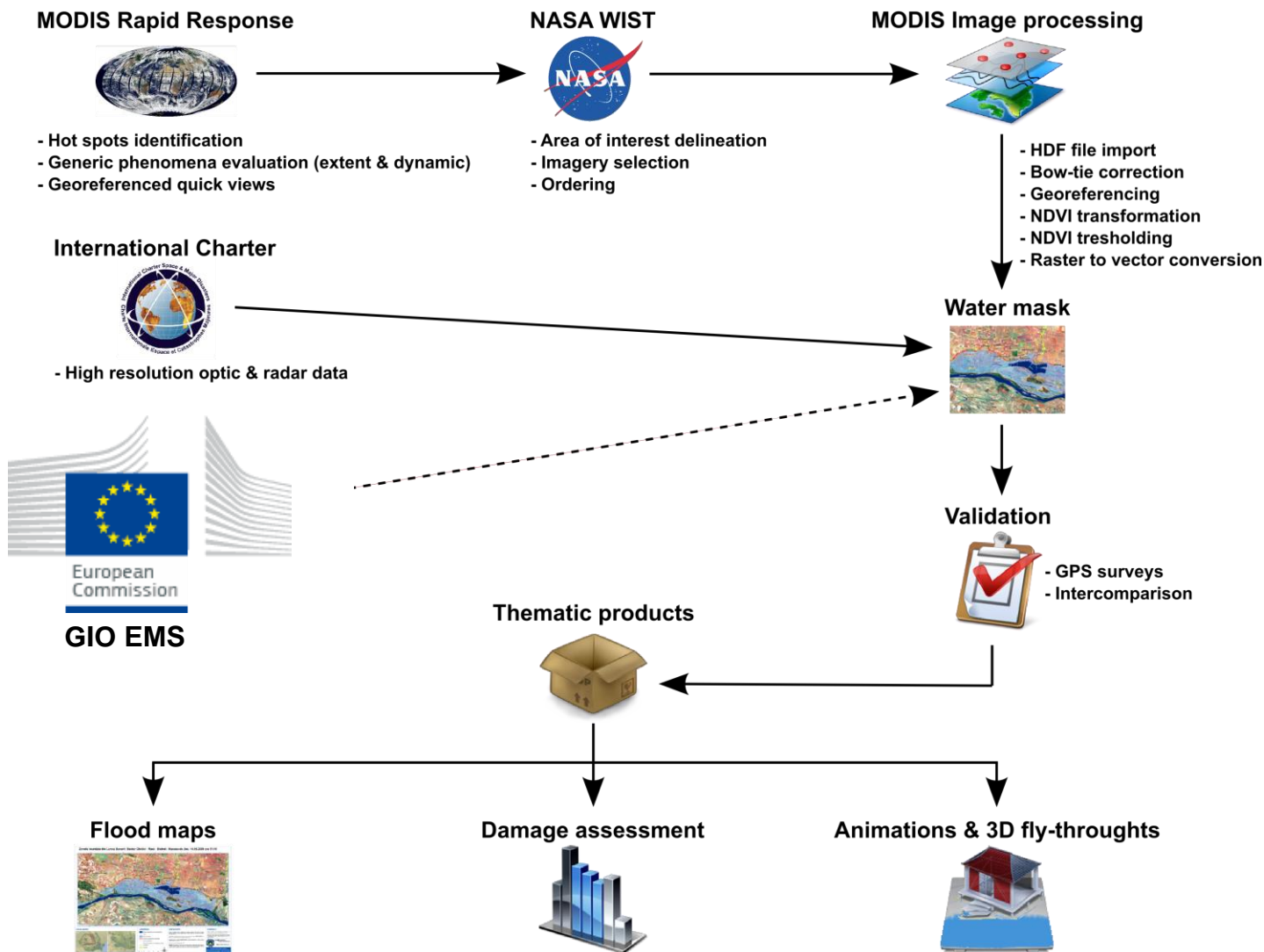


Workflow





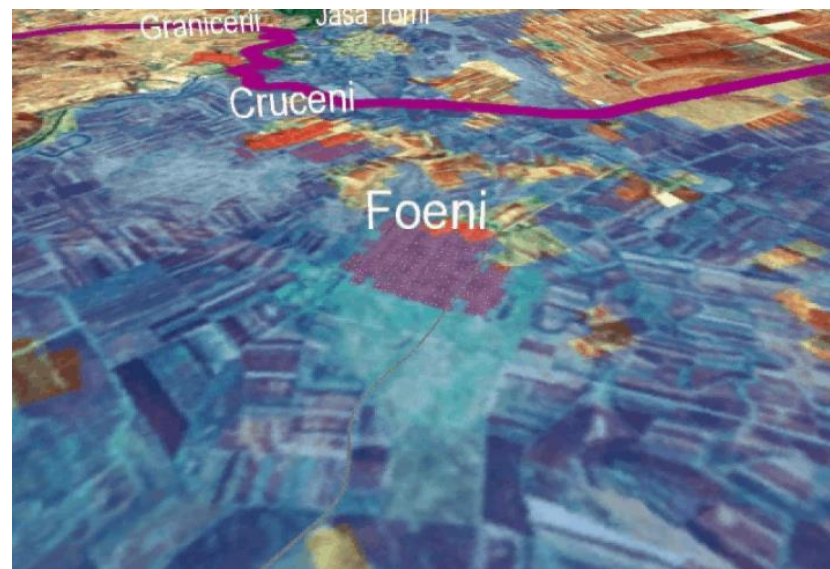
Flood image processing chain





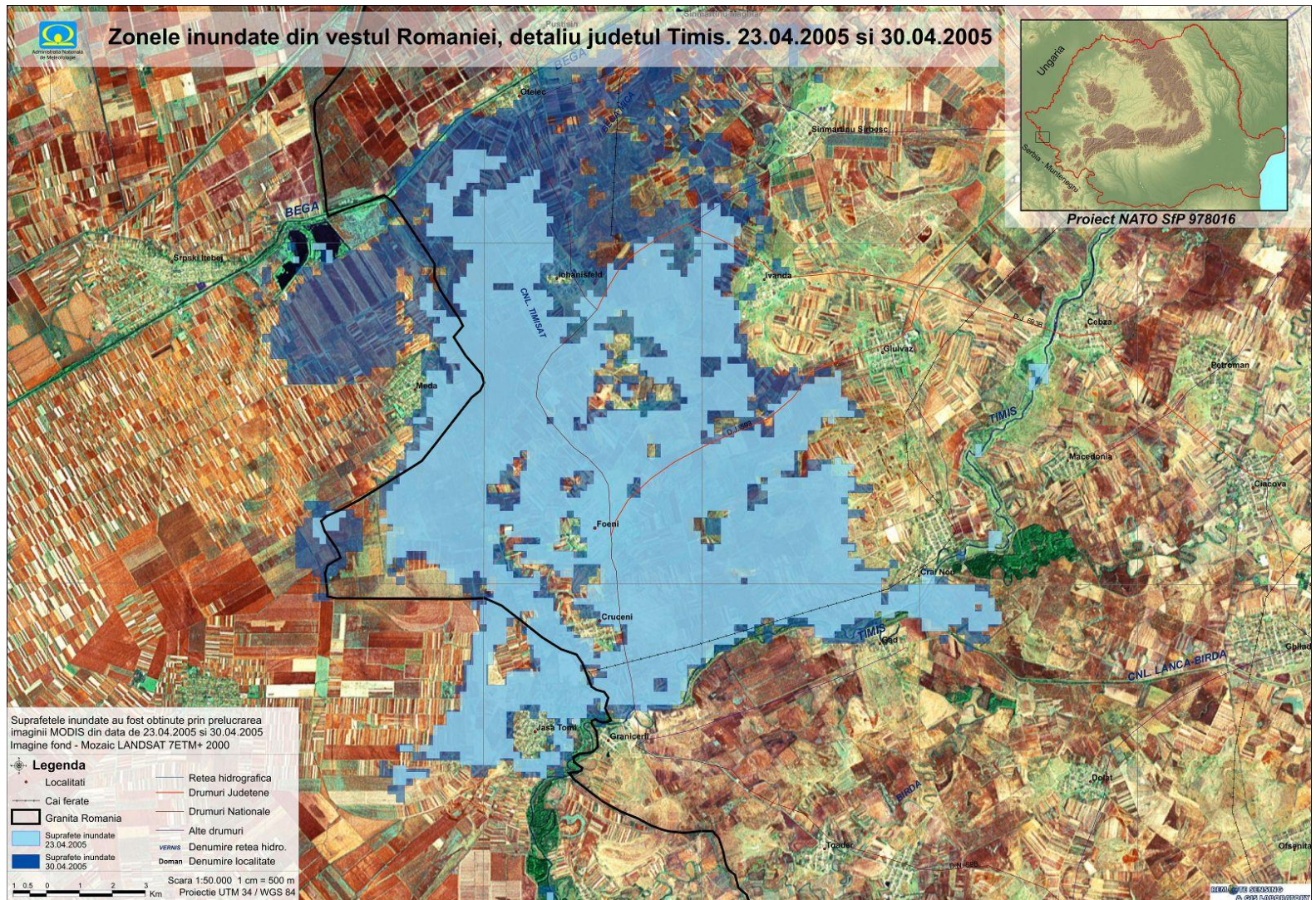
Flood related products

- Near real-time flood mapping
- Non real-time flood mapping
- Maximum flood extend mapping
- Flooded area classification
- Flood evolution mapping
- Damage assessment maps & reports
- 2D Animations
- 3D Flythrough



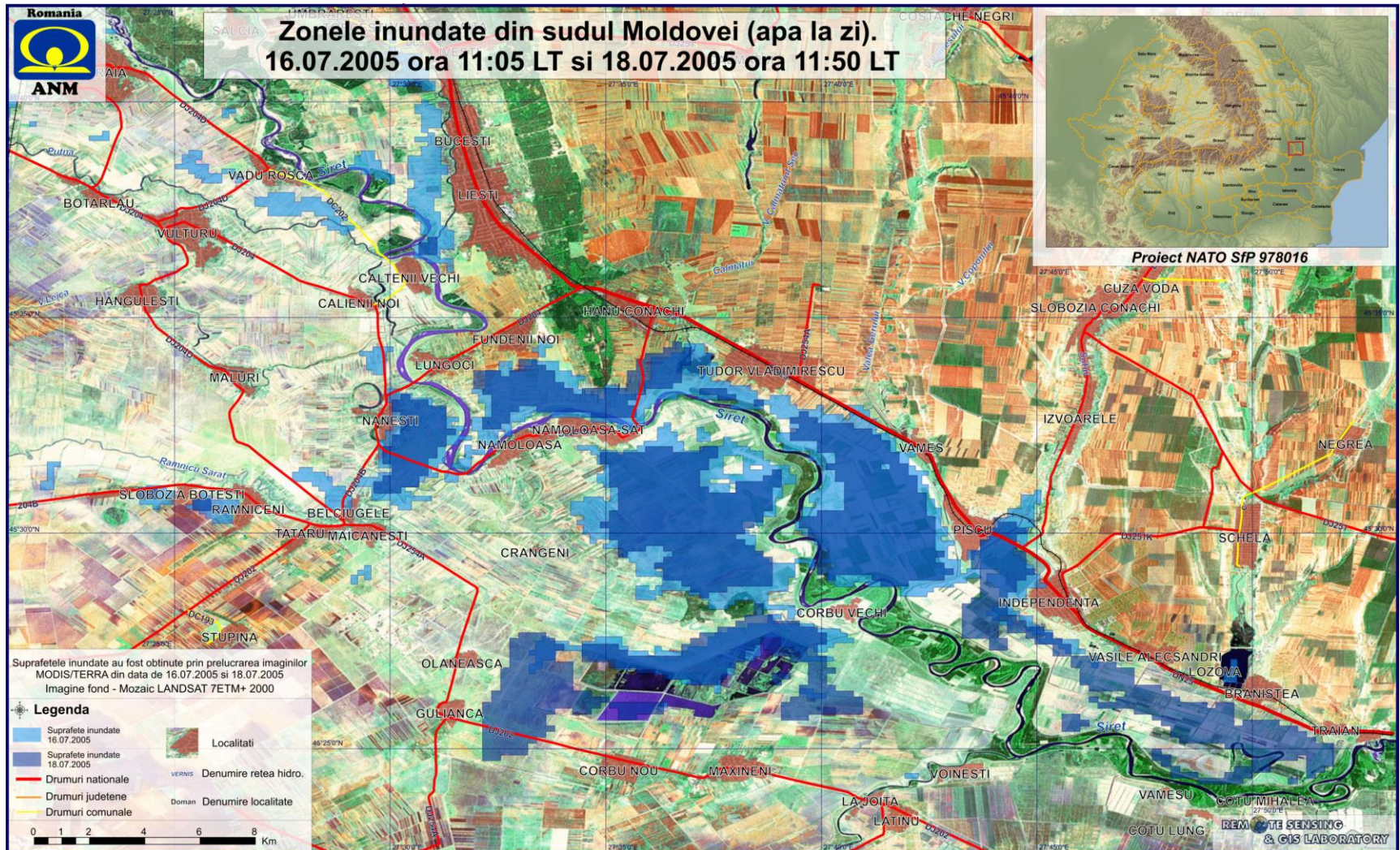


Map example: Timis river 2005





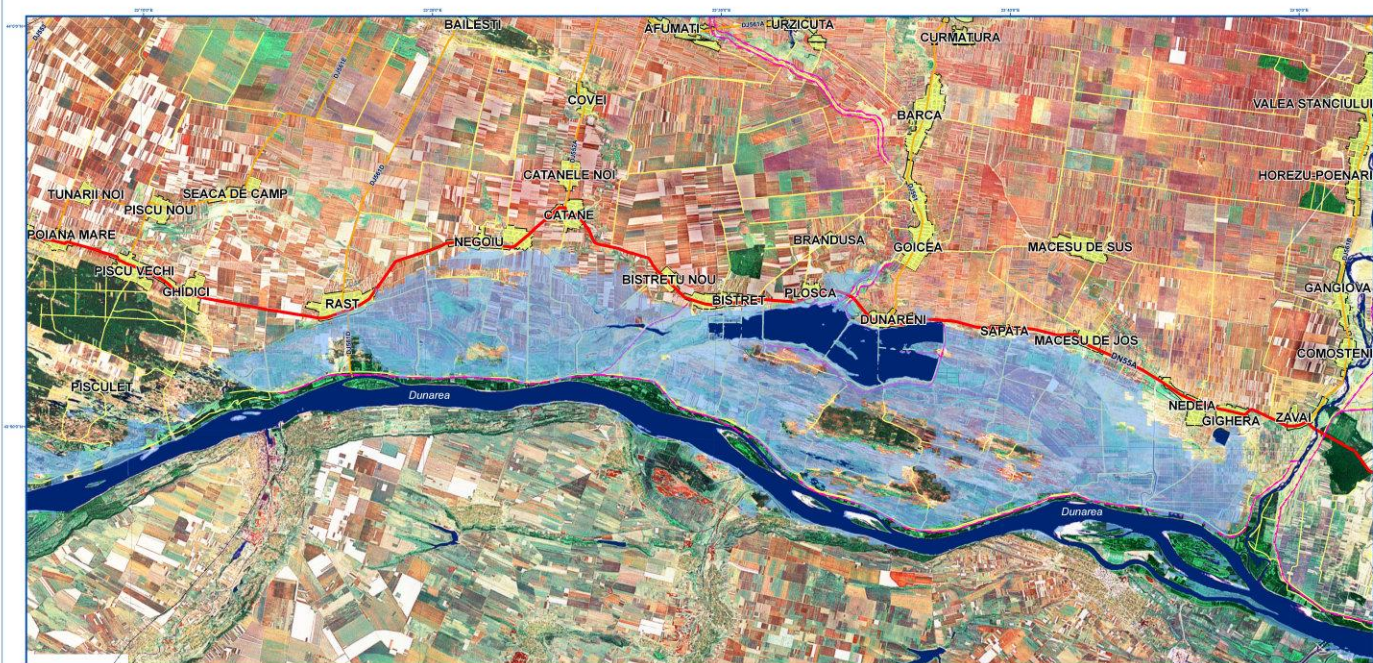
Map example: Siret river 2005



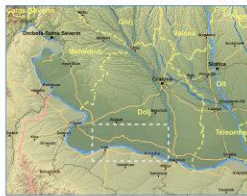


Map example: Danube river 2006

Zonele inundate din Lunca Dunarii: Sector Ghidici - Rast - Bistret - Macesu de Jos. 16.05.2006 ora 11:00



LOCALIZARE



LEGENDA

- Rețea hidrografică (nivel de referință)
- Zone inundate
- Diguri
- Drumuri europene sau naționale
- Drumuri județene
- Drumuri comunale, de exploatare, străzi
- Căi ferate
- Localități

0 1 2 4 6 8 Km



EXPLICATII

Urmare a debitului istoric înregistrat pe Dunare în Aprilie 2006, digul ce proteja terenurile agricole din sudul județului Dolj a cedat în data de 14.04.2006 pe teritoriul comunei Catane.

Suprafețele inundate au fost obținute prin prelucrarea imaginii MODIS/TERRA din data de 16.05.2006 (rezoluție spațială de 250 metri).

Imaginea de fond, mozaic LANDSAT ETM+ (rezoluție spațială de 15 metri), prezintă situația zonei în anul 2000.

Sistem de proiectie Stereografic 1970.

ATENȚIE: Acuratețea cu care au fost extrase zonele inundate este strâns legată de rezoluția spațială a datelor de intrare. Din această cauză pot exista areale acoperite cu apă, ce au o suprafață mai mică de 250², care sa nu fie reprezentate.

CONTACT

Produs realizat de Administrația Națională de Meteorologie, Laboratorul de Teledetecție și GIS.

Pentru mai multe detalii ne puteți contacta la adresa inundatii@meteo.inmh.ro sau la telefonul +40 21 318 32 40 - int. 163.



<http://www.inmh.ro>

Proiect NATO SIP 978016
Monitoring of extreme flood events in
Romania and Hungary using EO data.
<http://nato.inmh.ro>



Map example: Danube river 2006

Zonele inundate din Lunca Dunarii: Sector Ghidici - Rast - Bistret - Macesu de Jos

01.04.2006



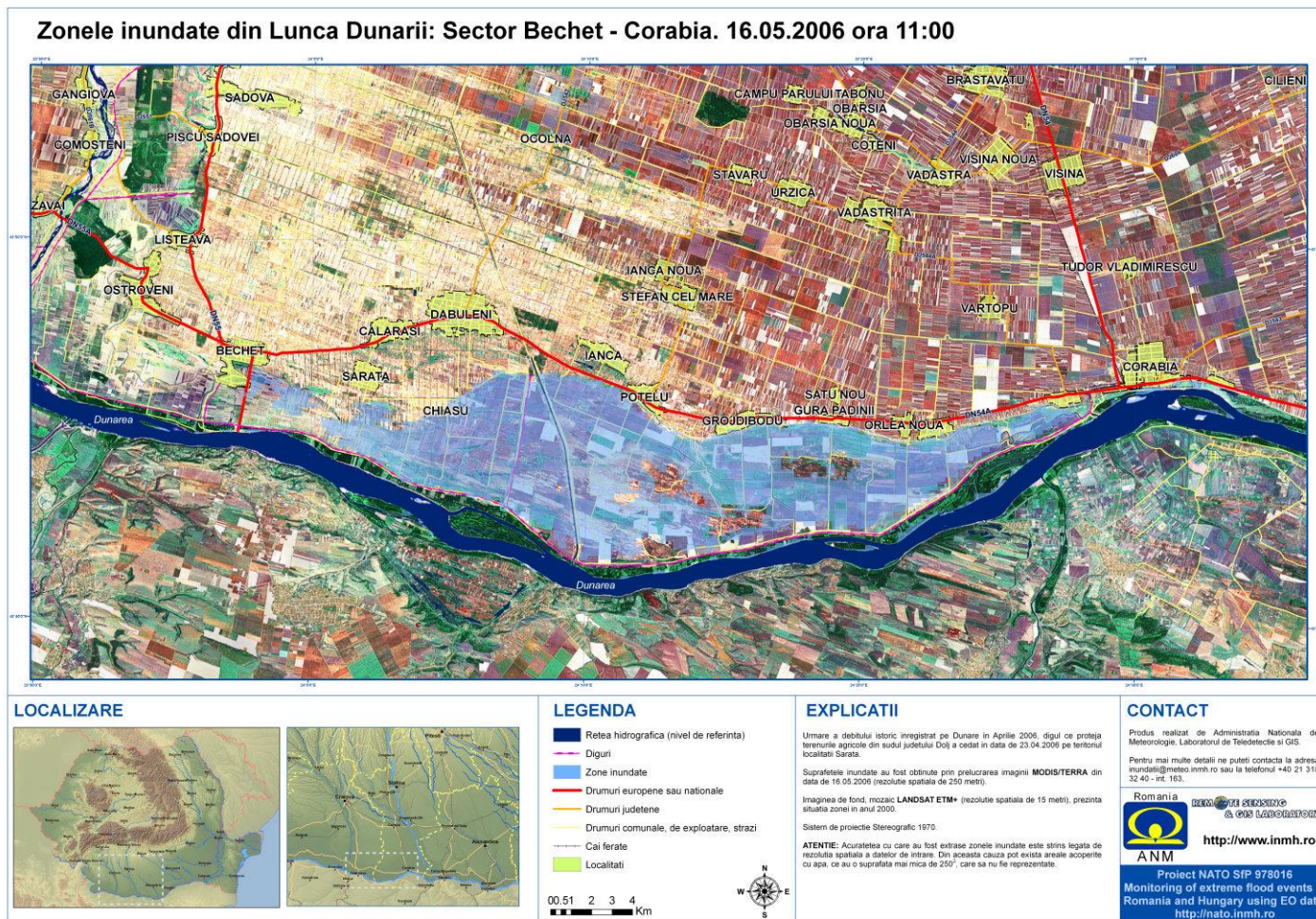
Romania



REMOTE SENSING
& GIS LABORATORY



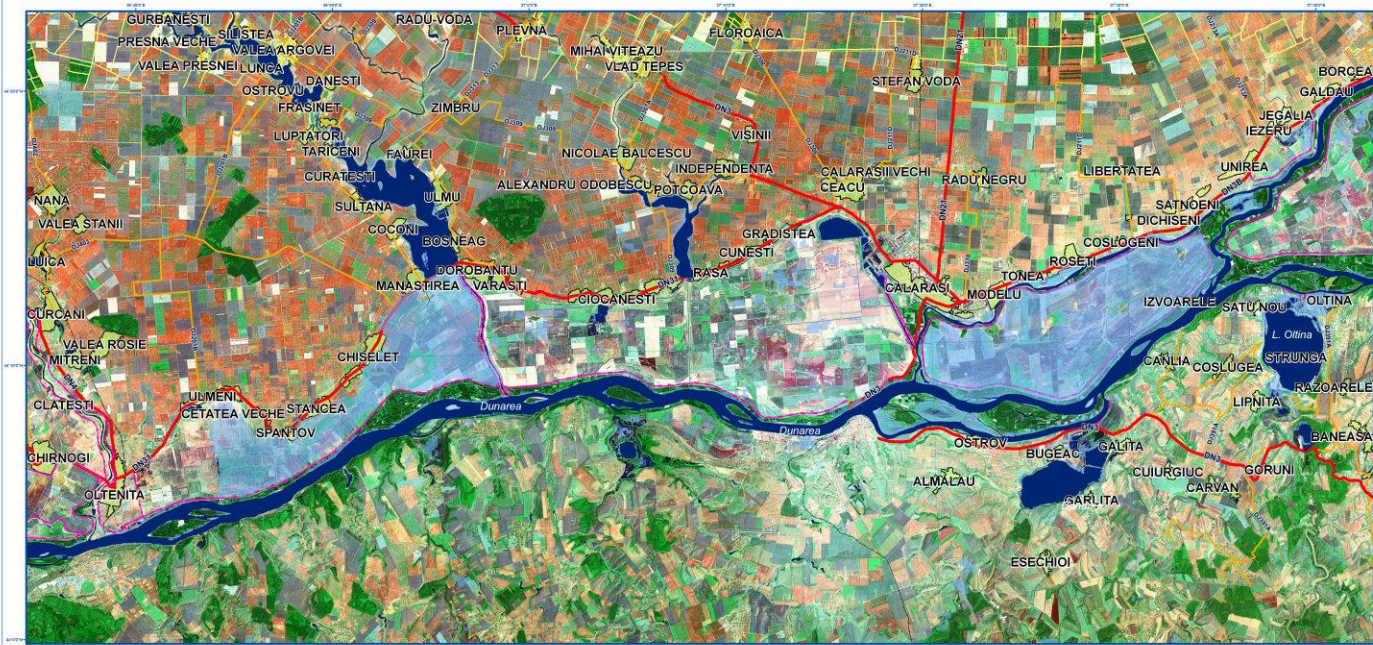
Map example: Danube river 2006



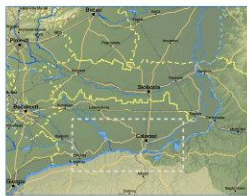


Map example: Danube river 2006

Zonele inundate din Lunca Dunarii: Sector Oltenita - Calarasi. 14.05.2006 ora 11:10



LOCALIZARE



LEGENDA

- Retea hidrografică (nivel de referință)
- Diguri
- Zone inundate
- Drumuri europene sau naționale
- Drumuri județene
- Drumuri comunale, de exploatare, străzi
- Căi ferate
- Localități

0 1.5 3 6 9 12 Km



EXPLICATII

Urmare a debluului istoric înregistrat pe Dunare în Aprilie 2006, digul ce proteja terenurile agricole din sudul județului Calarasi a cedat în data de 24.04.2006 pe teritoriul comunei Spantov. Apele revărsate s-au apropiat pericolos de mulți de corăbi Oltenita.

Anterior, în data de 23.04.2006 s-a produs o breșă în digul ce separa brațul Dunării de lacul Oltenia. Datorită creșterii nivelului în lac a fost amenințată localitatea Oltenia.

Suprafețele inundate au fost obținute prin prelucrarea imaginii MODIS/TERRA din data de 14.05.2006 (rezoluție spațială de 250 metri).

Imaginea de fond, mozaic LANDSAT ETM+ (rezoluție spațială de 15 metri), prezintă situația zonei în anul 2000.

Sistem de proiectare Stereografic 1970.

ATENȚIE: Acuratețea cu care au fost extrase zonele inundate este strâns legată de rezoluția spațială a datelor de intrare. Din această cauză pot exista arii acoperite cu apă, ce au o suprafață mai mică de 250', care nu le reprezintă.

CONTACT

Produs realizat de Administrația Națională de Meteorologie, Laboratorul de Teledetecție și GIS.

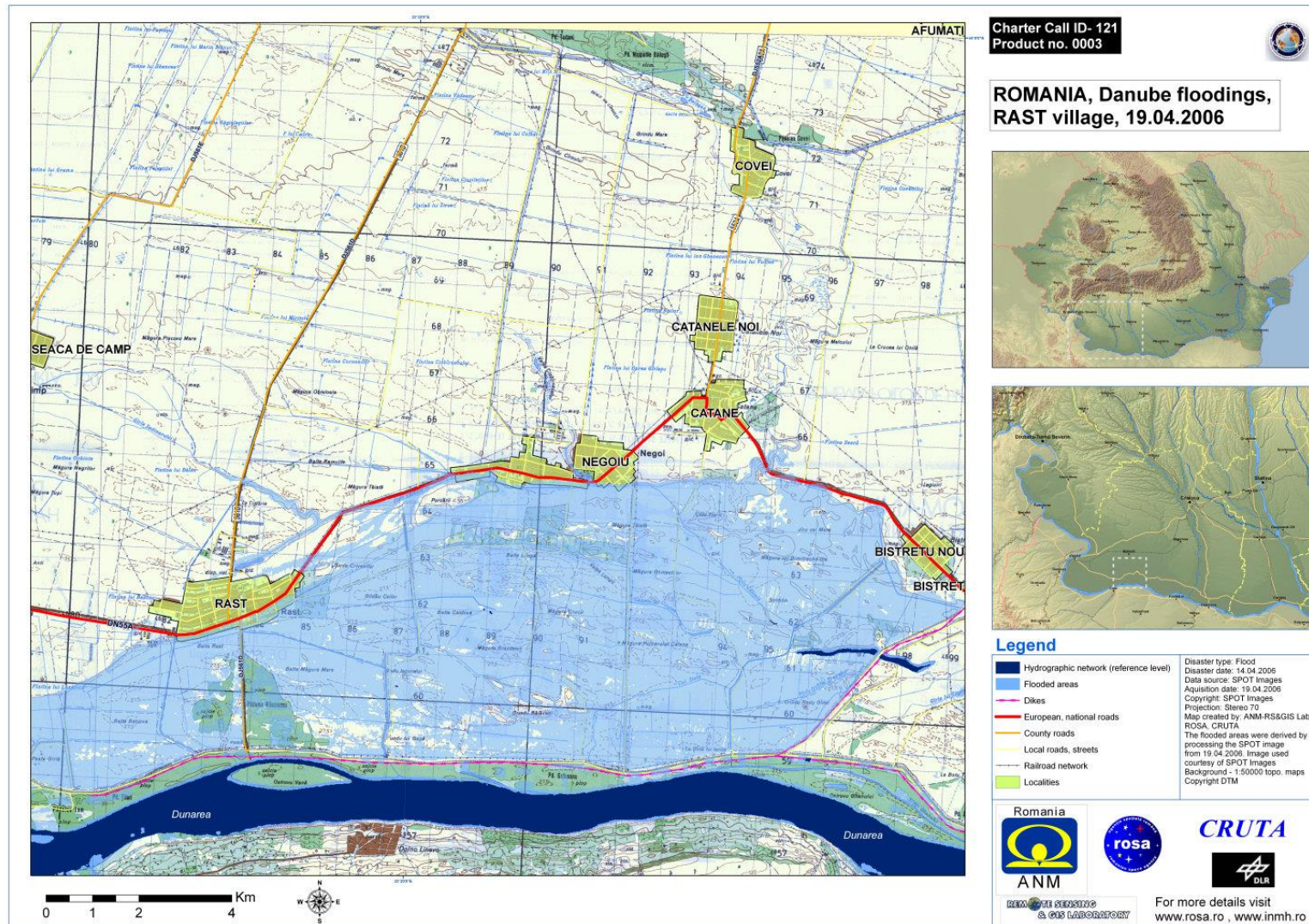
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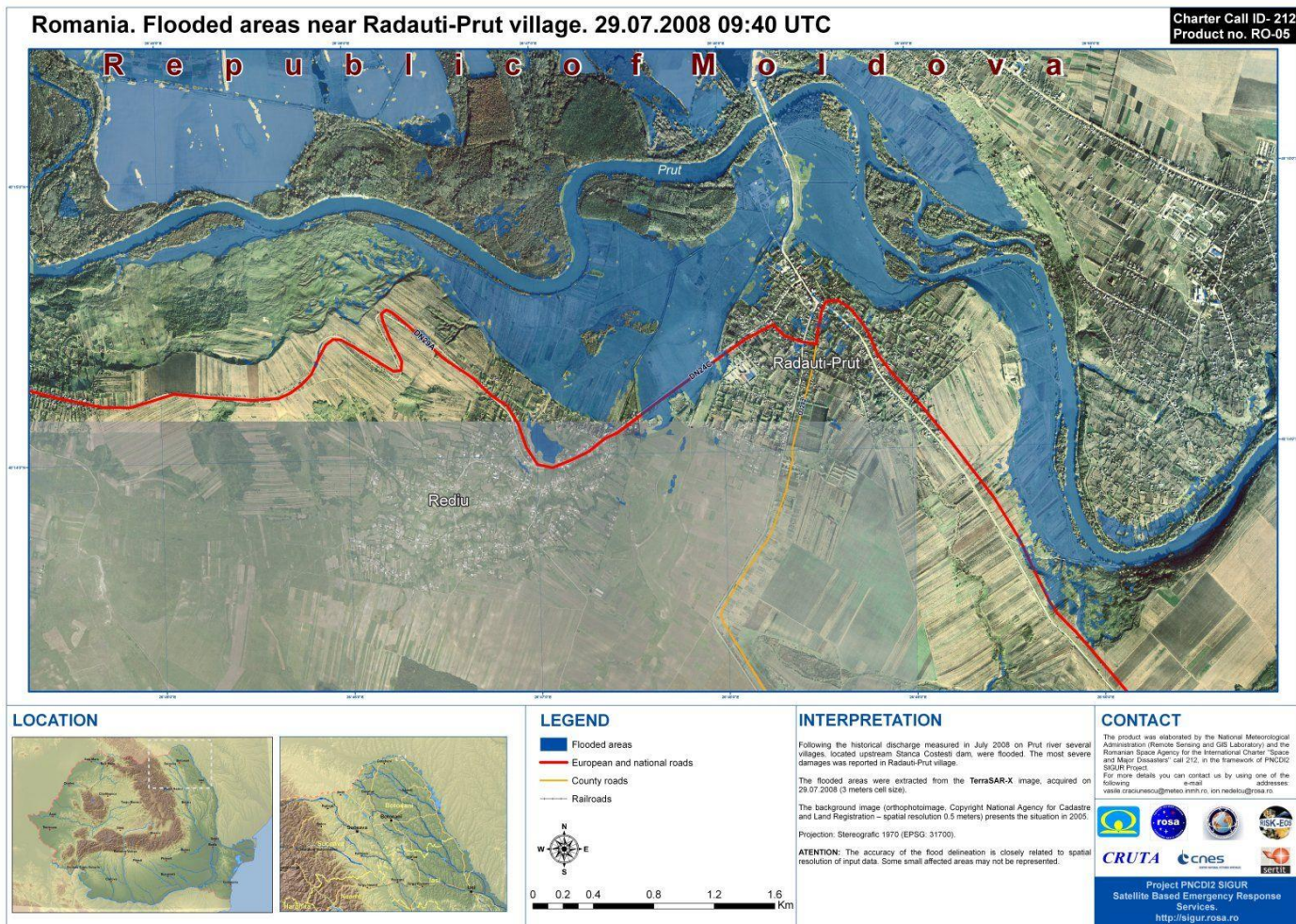
Map example: Danube river 2006







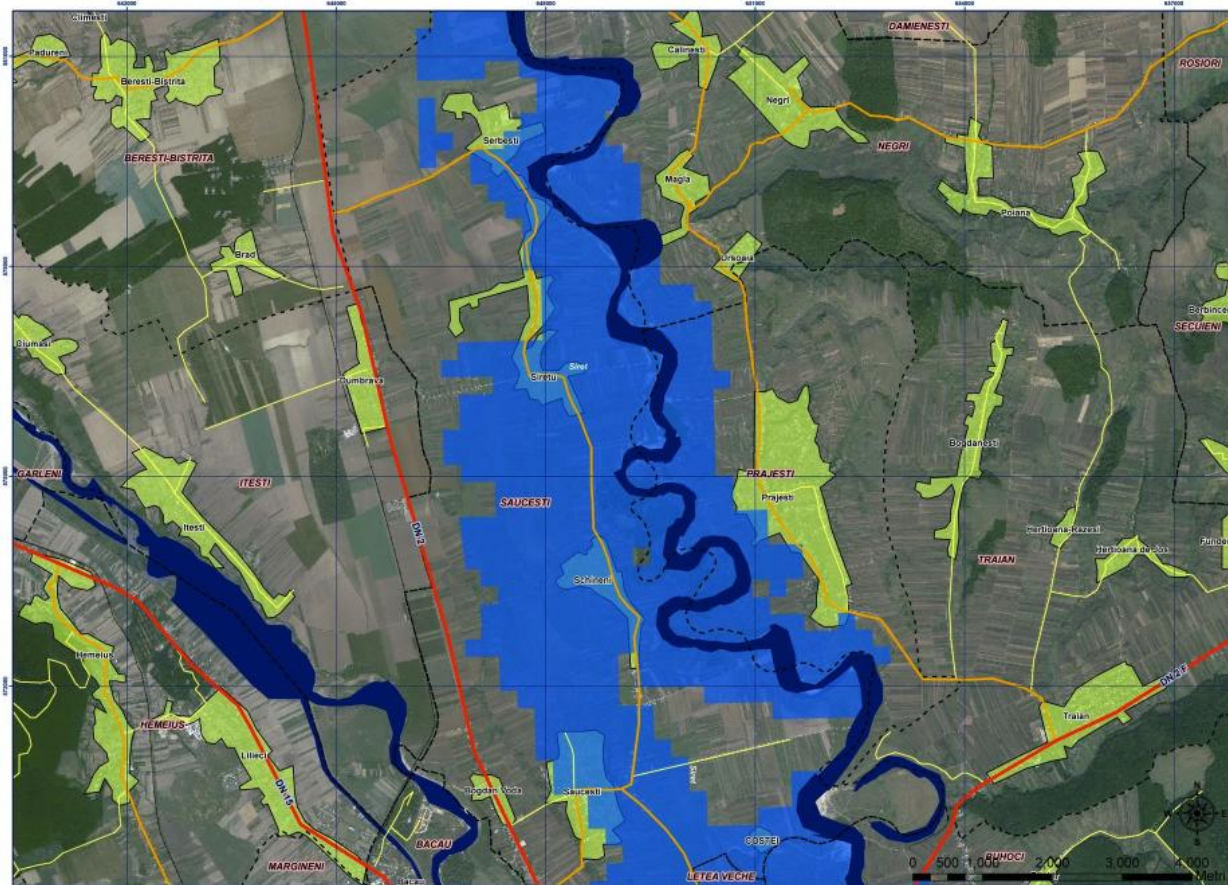
Map example: Prut river 2008





Map example: Siret river 2010

Siret. Suprafetele inundate de pe raza localitatii Saucesti. (05.07.2010 ora 12:20).



LOCALIZARE



LEGENDA

- Drumuri europene sau nationale
- Drumuri județene
- Drumuri comunale sau de exploatare
- Cai ferate
- Reteza hidrografică (nivel de referință)
- Zone inundate
- Localități
- Unități administrativ-teritoriale

BILANTUL SUPRAFETELOR INUNDATE

CATEGORIA DE FOLOSINTA A TERENULUI	SUPRAFATA (ha)
SUPRAFATA CONSTRUITA	227
TEREN ARABIL	3616
PASUNE	551
PADURE	70
TEREN NEPRODUCTIV	94
TOTAL	2558

EXPLICATII

Urmare a debitului istoric inregistrat pe Siret in lunile Iulie 2010, mai multe localitati aflate in lungul raului Siret au fost puternic afectate. Suprafetele inundate au fost obtinute prin prelucrarea imaginii MODIS/TERRA din data de 05.07.2010 (250 metri rezolutie spatiala). Nivelul de referinta al apei a fost extras din setul de date Corine Landcover 2006. Bilantul suprafetelor inundate a fost calculat pentru comuna Saucesti folosind baza de date IACS/LPIS (April 2009). Imaginile de fond, mozaic SPOT 5 (prin amabilitatea Spot Image S.A.), prezinta situatia zonei in anul 2007 (rezolutie spatiala de 2.5 metri). Sistem de proiectie Stereografic 1970.

ATENTIE: Acuratetea cu care au fost extrase zonele inundate este strinsa legata de rezolutia spatiala si calitatea datelor de intrare. Din aceasta cauza pot exista arii acoperite cu apa (suprafete foarte mici sau acoperite cu nori) care sa nu fie reprezentate.

CONTACT

Produs realizat de Administratia Nationala de Meteorologie si Agentia Spatiala Romana in cadrul proiectului PNCDI2 SIGUR.

Pentru mai multe detalii ne puteti contacta la adresa floods2010@rosa.ro.

Proiect PNCDI2 SIGUR: Serviciu bazat pe informatii satelitare pentru Gestionarea situatiilor de Urgenta.
<http://sigur.rosa.ro>



CRUTA

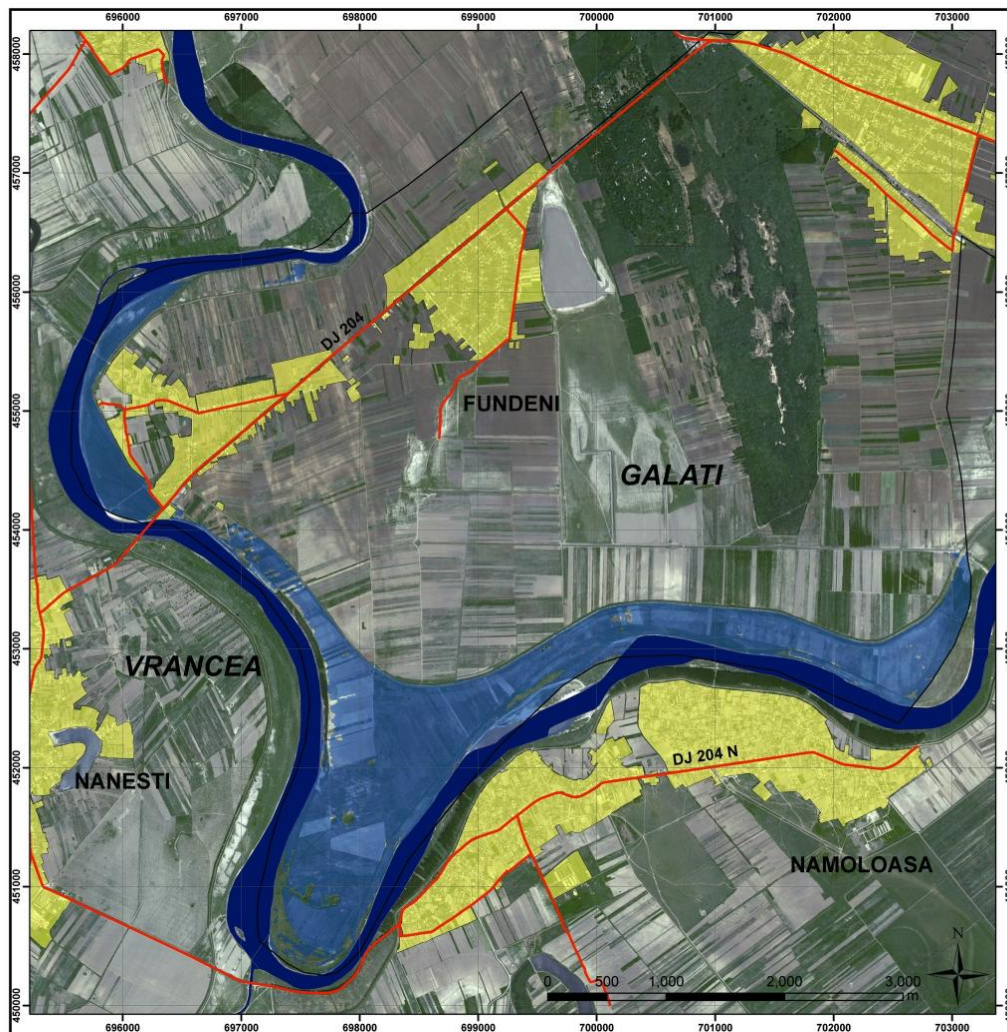


Center for Satellite Based Crisis Information
– Emergency Mapping & Disaster Monitoring –
a service of DFD

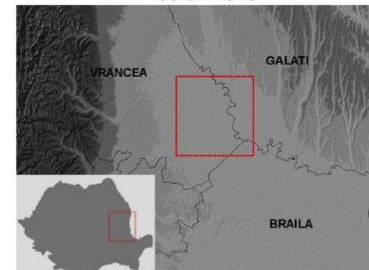




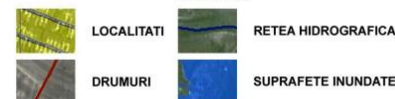
Map example: Siret 2010



Produs nr. 05 / 06.07.2010
**EVALUAREA SUPRAFETELOR INUNDATE
 DIN COMUNA FUNDENI, JUDETUL GALATI**
 03.07.2010



LEGENDA



BILANTUL SUPRAFETELOR INUNDATE

CATEGORIA DE FOLOSINTA A TERENULUI	SUPRAFATA (ha)
SUPRAFATA CONSTRUITA	19
TEREN ARABIL	322
PASUNE	117
TEREN NEPRODUCTIV	22
TOTAL	480

INFORMATII

Masca de apa a fost realizata de catre ZKI/DLR (<http://www.zki.dlr.de>) prin prelucrarea imaginii RADARSAT-2 din data de 03.07.2010. Fondul hartii este reprezentat de imagini SPOT 5 (prin bunavointa SPOT IMAGE S.A.) cu rezolutia de 2,5 m multispectral, preluate in anul 2007. Bilantul suprafetelor inundate a fost efectuat folosind baze de date LCCS Romania (ROSA-CRUTA) si IACS/LPIS (DAPIA 2009). Sistemul de proiectie folosit este Stereografic 1970. Informatiile geografice au limitari datorita scarii, rezolutiei si interpretarii datelor sursa. Producatorul hartii nu isi asuma nici o responsabilitate legata de continutul sau utilizarea acestora.

Produs realizat de Agentia Spatiala Romana (©ROSA 2010) si Administratia Nationala de Meteorologie in cadrul proiectului PNCDI2 SIGUR.

Proiect: PNCDI2 SIGUR - Serviciu bazat pe Informatii primare satelitare pentru Gestionarea situatiilor de Urgenta.
floods2010@rosa.ro www.rosa.ro



CRUTA

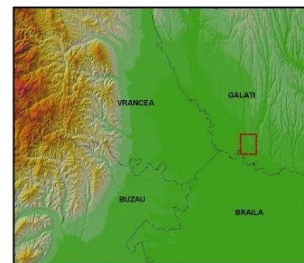




Map example: Siret 2010



EVALUAREA SUPRAFETELOR INUNDATE DIN COMUNA PISCU, JUDETUL GALATI 03.07.2010



LEGENDA



BILANTUL SUPRAFETELOR INUNDATE

CATEGORIA DE FOLOSINTA A TERENULUI	SUPRAFATA (ha)
SUPRAFATA CONSTRUITA	36
TEREN ARABIL	20
PASUNE	239
PADURE	3
TEREN NEPRODUCTIV	50
TOTAL	348

INFORMATII

Masca de apa a fost realizata de catre ZKI/DLR (<http://www.zki.dlr.de>) prin prelucrarea imaginii RADARSAT-2 din data de 03.07.2010. Fondul hartii este reprezentat de imagini SPOT 5 (prin bunavointa SPOT IMAGE S.A.) cu rezolutia de 2,5 m multispectral, preluate in anul 2007. Bilantul suprafetelor inundate a fost efectuat folosind baza de date LCCS Romania (ROSA-CRUTA). Sistemul de proiectie folosit este Stereografic 1970. Informatiile geografice au limitari datorita scarii, rezolutiei si interpretarii datelor sursa. Producatorul hartii nu isi asuma nicio responsabilitate legata de continutul sau utilizarea acesteia.

Harta produsa de Agentia Spatiala Romana (©ROSA 2010)
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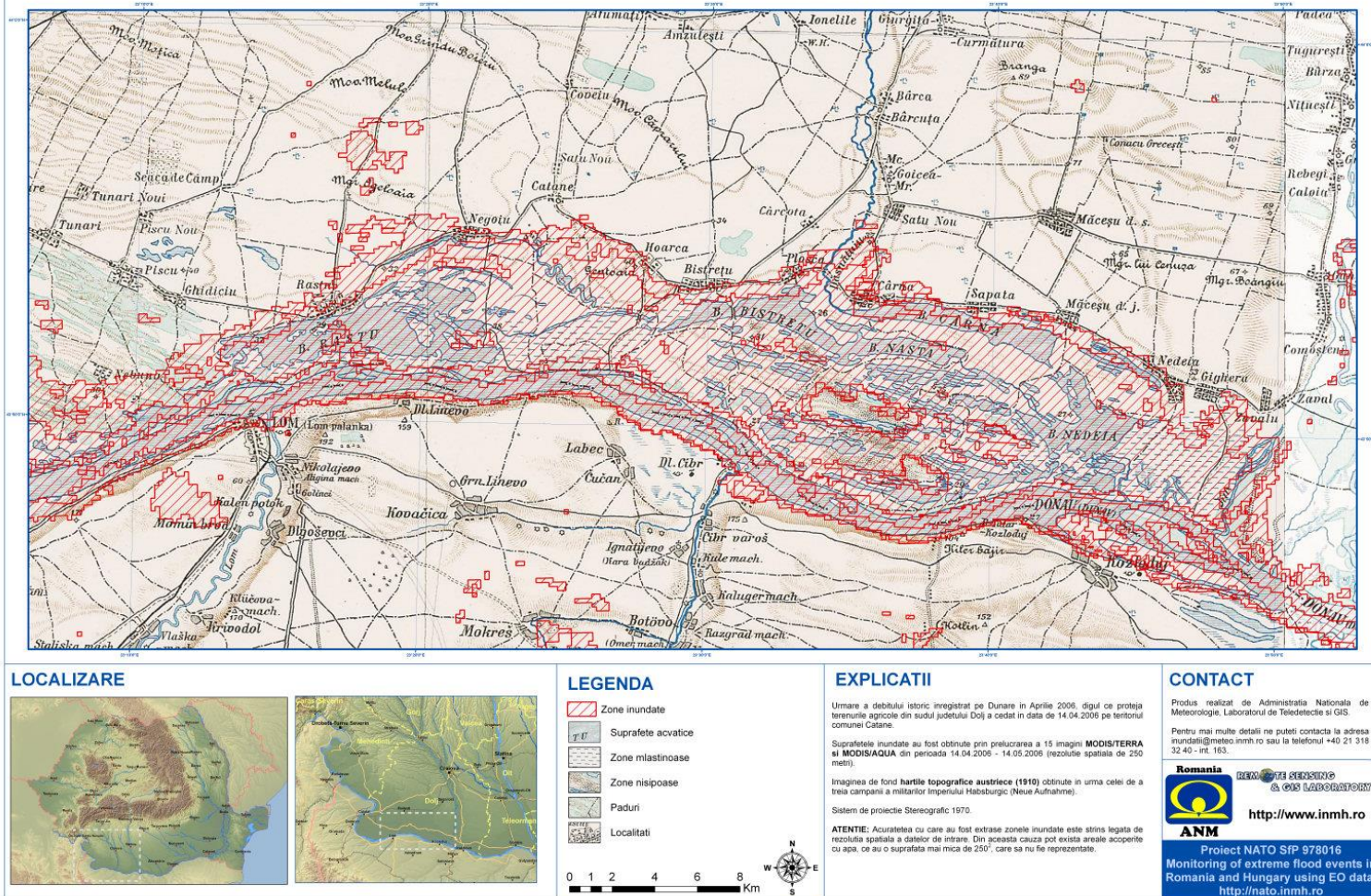


3D Fly-through



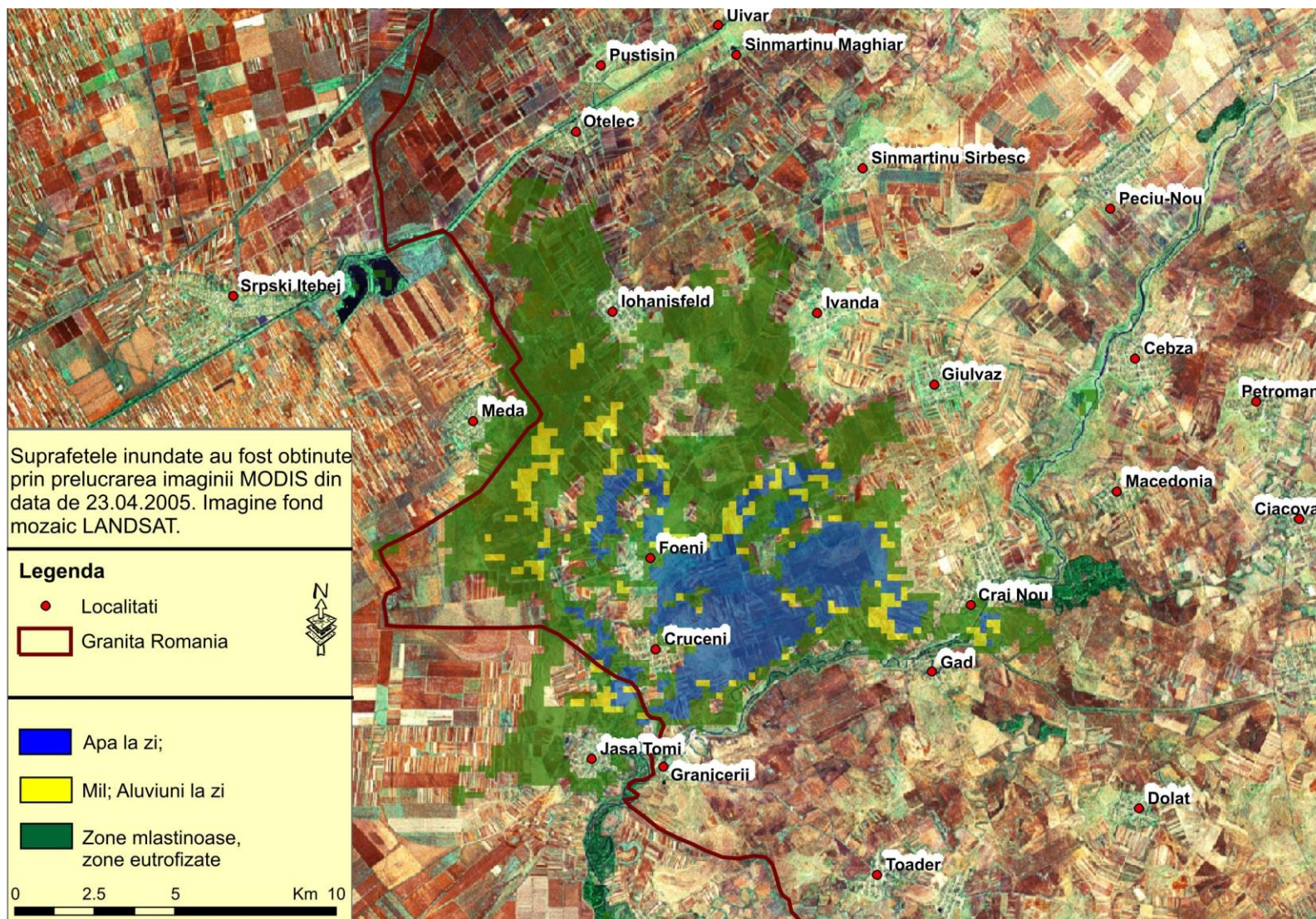
Integration with historical data

Zonele inundate din Lunca Dunarii: Sector Ghidici - Rast - Bistret - Macesu de Jos. 14.04.2006 - 14.05.2006



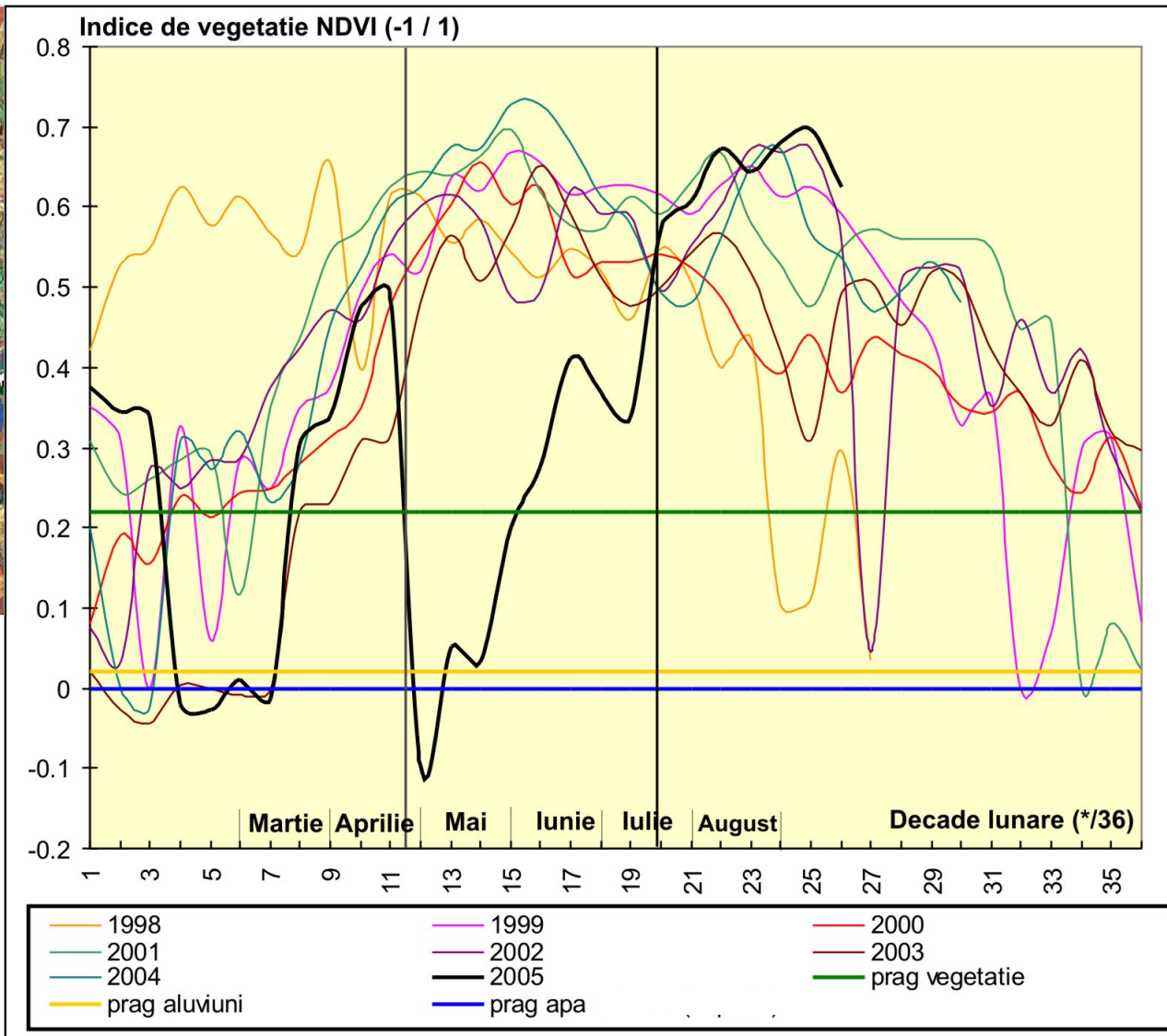
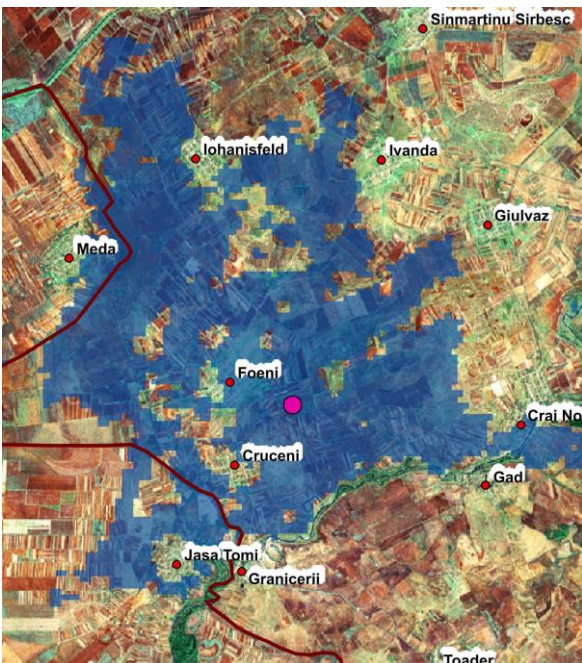


Water classification example



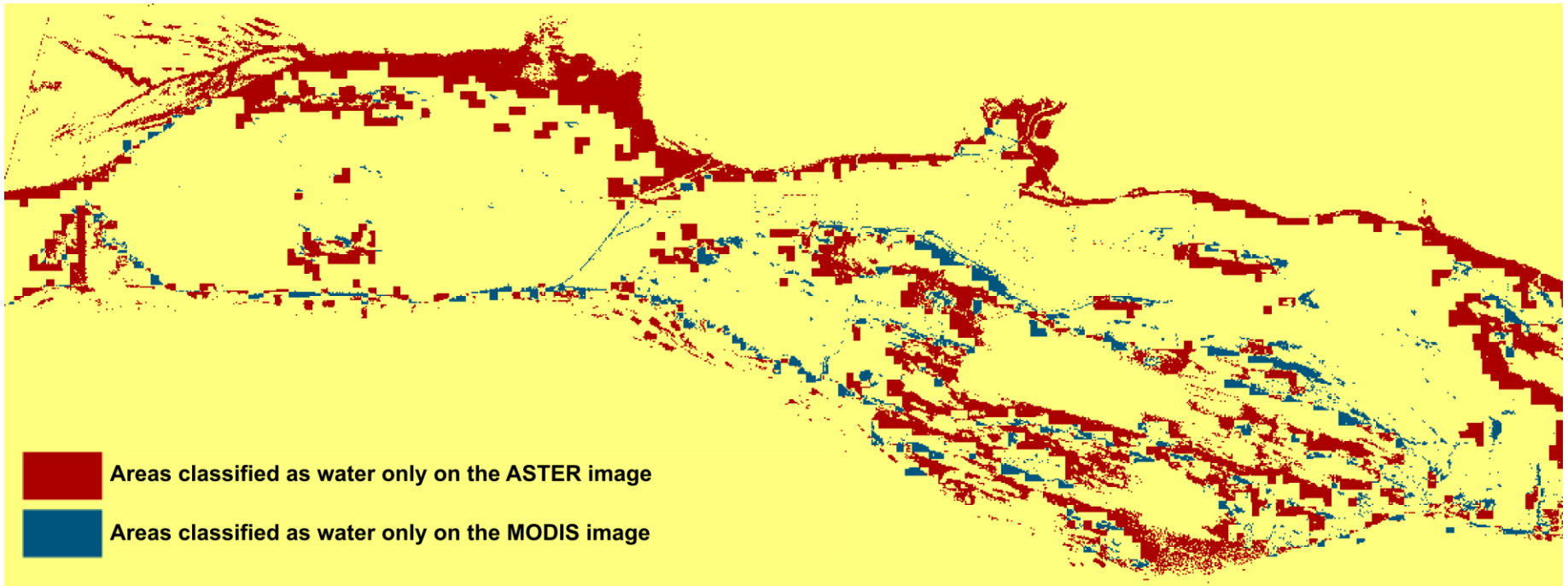
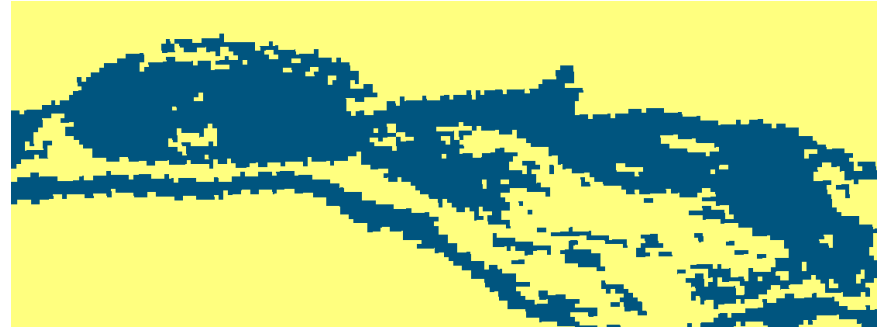
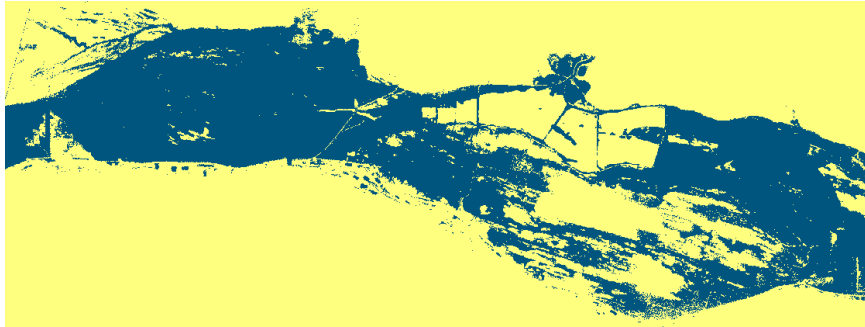


Post-crisis monitoring example





Validation example





Conclusions & future work

Numbers:

- Service activations: 6
- 2005: 82 products
- 2006: 124 products
- 2008: 39 products
- 2010: 41 products

What's next:

- Extend the service to cover other types of disasters
- Dedicated geoportal
- Better communication with the end-users
- Identification of new data sources
- Further algorithm development and validation
- Find new financial opportunities



The end

Thanks for your attention. Questions?