

# **Bulgarian capacity in the main GMES projects under FP7 – GEOLAND2 and SAFER**

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Remote Sensing Application Center - ReSAC

# Who we are

- Remote Sensing Application Center – ReSAC Bulgaria
  - Established in 1998 with the support of FAO/UN
  - Observer member of EARSC since 2005
  - R&D structure of Agency for Sustainable Development and Eurointegration – ASDE
    - ASDE signed a collaboration agreement with the DG JRC in 2007
- Main Objectives
  - to facilitate local, national and international authorities, as well as private enterprises
  - to introduce RS&GIS to
    - agricultural and environmental management,
    - land cover/land use,
    - soil and forest inventory,
    - water resources,
    - environmental hazards,
    - disaster management, and
    - urban planning
  - co-operation & participation in regional and international projects



The screenshot shows the official website of the Remote Sensing Application Center (ReSAC). The header features the ReSAC logo and the text 'Remote Sensing Application Center (ReSAC)' and 'Център за приложение на спътникови изображения (PESAK)'. Below the header is a navigation menu with links: Home, News, About Us, Projects, Services, Partners, and Contact. The main content area is divided into several sections: 'Welcome to Remote Sensing Application Center (ReSAC)' with a brief description of the center's mission and its status as an Observer Member of EARSC; 'News' with a list of recent events, including a workshop on 23rd October 2007 and a full-scale practice 'FIRE 2007' in Rousse and Varna; 'Services' with a description of the center's capabilities in earth observation, GIS, and orthophoto mapping; 'Projects' with a description of the center's participation in various projects, including the FORMOSAT-2 satellite as a backup sensor for the CWRIS campaigns; and 'Contact' with information on how to reach the center. The footer includes the website address 'www.resac-bg.org' and a copyright notice for 2007 ReSAC.

# GMES – main idea

- ▶ **Global Monitoring for Environment and Security (GMES)** is an Earth monitoring initiative led by the European Community and carried out in partnership with the Member States and the European Space Agency. Its primary objective is to provide, under Community control, information services, which give access to accurate data and information in the field of environment and security and are tailored to the needs of a wide range of users. In doing so, it will foster better exploitation of the industrial potential of policies of innovation, research and technological development in the field of Earth observation and to provide information services.
- ▶ In order to achieve the objective of GMES on a sustainable basis, it is necessary to coordinate the activities of the various partners involved in GMES, and to develop, establish and operate service and observation capacity meeting demands of users.



Products

Services

Know-how

EO Sensors

Raw EO Data

Processed EO

Thematic  
products

Integrated  
applications

Dissemination,  
data access

**S**  
**e**  
**r**  
**v**

Distribution

Preprocessing

**c**  
**h**  
**a**  
**i**  
**n**  
**s**

Data  
integration

Web GIS  
services

**E**  
**x**

Sound knowledge in  
EO state-of-the art

Sound knowledge in  
RS/IP state-of-the-art

Existing ReSAC capacity

**i**  
**s**  
**e**

Local needs and  
data  
specifications

Local needs and  
data specifications,  
IT knowledge

# FP7(6) and GMES

- ▶ Space theme under FP7: to support a European Space Programme focusing on applications such as GMES;
- ▶ Sustaining a competitive industry, including manufacturers, service providers and operators, requires new research and technologies;
- ▶ Priority activities:
  - **Space-based applications serving European society ;**
  - **Exploration of space ;**
  - **Strengthening Space foundations.**
- ▶ **FP7 Budget for the Space theme - € 1.4 billion**

# ReSAC in FP7

- ▶ Geoland2: pre-operational land service of GMES:
  - CMS: Seasonal/Annual Terrestrial Change Monitoring (SATChMo)
  - CIS: AgriEnvironment and Spatial Planning
  
- ▶ SAFER: pre-operational emergency service of GMES
  - Flood Risk Management
  - Assets Mapping

# Geoland2 - SATChMo

- ▶ SATChMo Core Mapping Service (CMS) is designed to deliver annual and/or seasonal bio- and geophysical parameter maps and statistics for Europe and Africa with an emphasis on agricultural land use and environmental characteristics.

# SATChMo related ReSAC's capacities

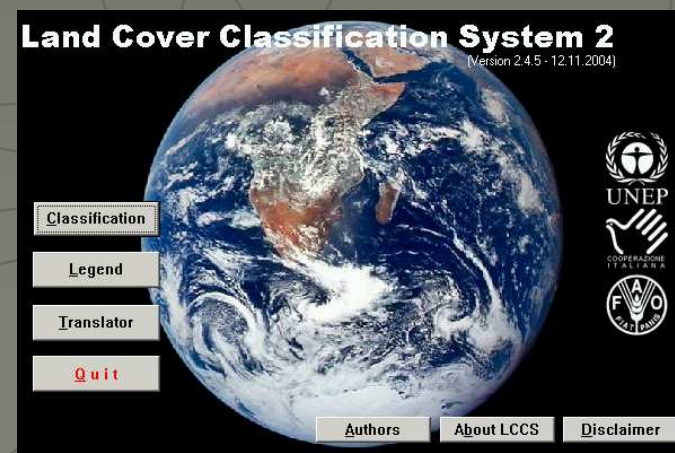
## First implementation in 1999

- ▶ Concept adopted by the Ministry of Agriculture and Forestry
- ▶ In the Frame of FAO project TCP/BUL/8922
- ▶ With main objective to help the strengthen the agriculture development
- ▶ By mapping the land cover using RS data
- ▶ Follow-up cooperation with Romania in the frame of FAO project TCP/ROM 2801

## LCCS in Bulgaria

## Extension to other domains, by creating thematic LC datasets for (2000 to date)

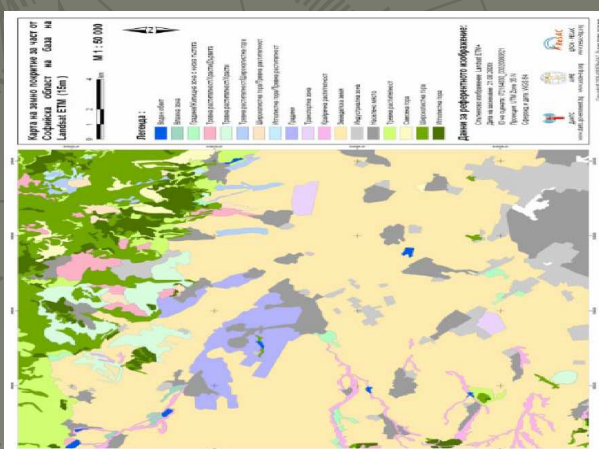
- ▶ Development of EU transport corridors
- ▶ Biomass estimation for energy efficiency
- ▶ Monitoring data accuracy-cadastre and regulation plans
- ▶ Monitoring of urban sprawl
- ▶ Risk Management – floods and forest fires
- ▶ Land use planning



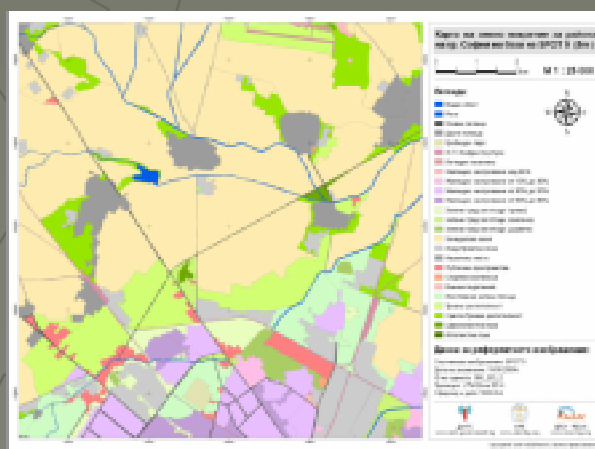
...LCCS3 is already in  
test phase in ReSAC

# SATChMo related ReSAC's capacities

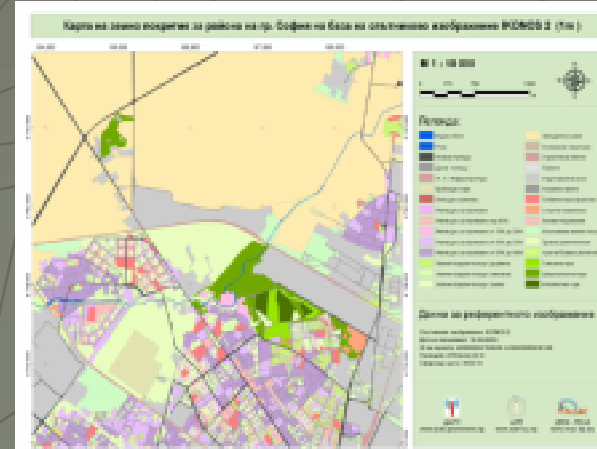
- ▶ Reference land cover database as a core information used for harmonization and verification of all other relevant thematic spatial datasets
- ▶ Land cover/Land Use maps on the base of LCCS methodology of FAO



Scale 1:50 000, Landsat-15m res.



Scale 1:25 000 , SPOT 5 – 5m res.



Scale 1: 10 000, IKONOS – 1m res.

# Geoland2 – Spatial Planning

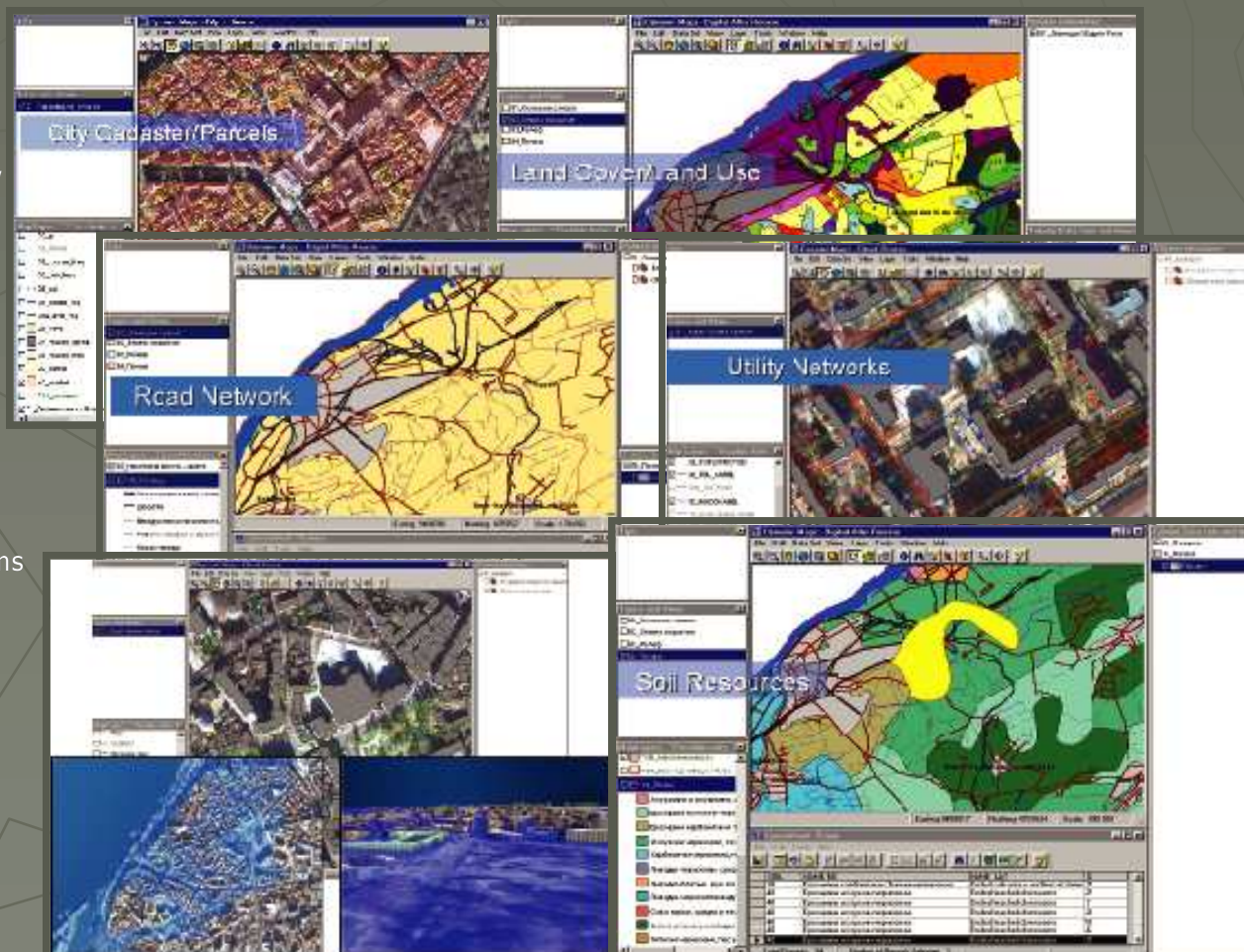
- ▶ The mission of the Core Information Service (CIS) Spatial Planning is to **describe, explain and forecast urban land use change**.
- ▶ The main objective is to introduce innovative Earth Observation derived land cover / use products into spatial planning procedures and methods at European, national and regional level.

# Spatial Planning related ReSAC's capacities

## ► Data integration

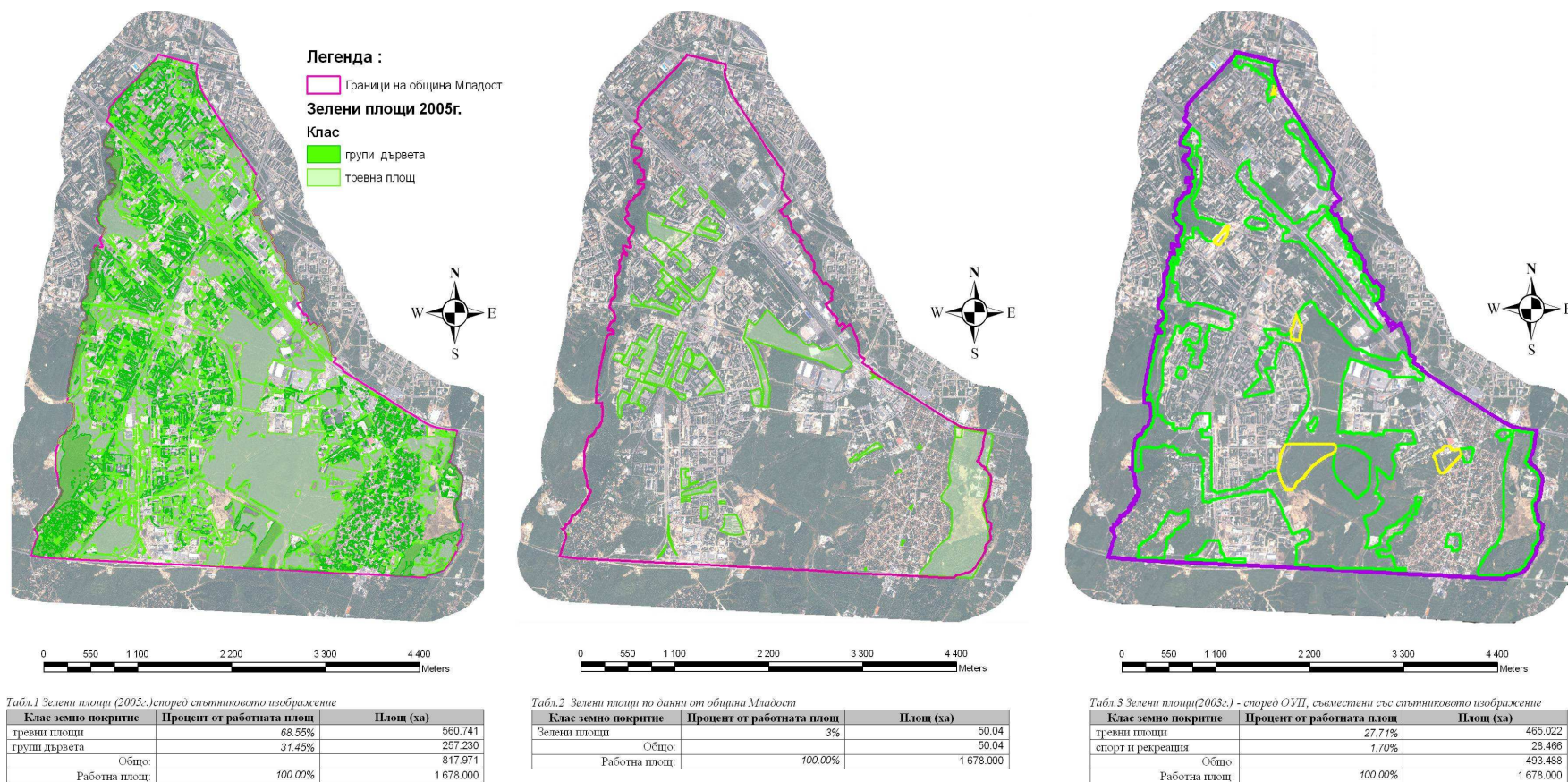
- RS
  - Passive sensors satellite imageries
  - Active sensors data /radar/
- GIS
  - Urban data
    - Cadastral units
    - Settlements
    - Urban green systems
    - Buildings
    - Road network
    - Pipelines
    - Suburban infrastructure
  - Natural resources
    - Water bodies and streams
    - Soil types and humidity
    - Precipitation
    - Forest inventory
    - Wetland inventory

## Dynamic atlas of Rousse for Environmental and Urban Management

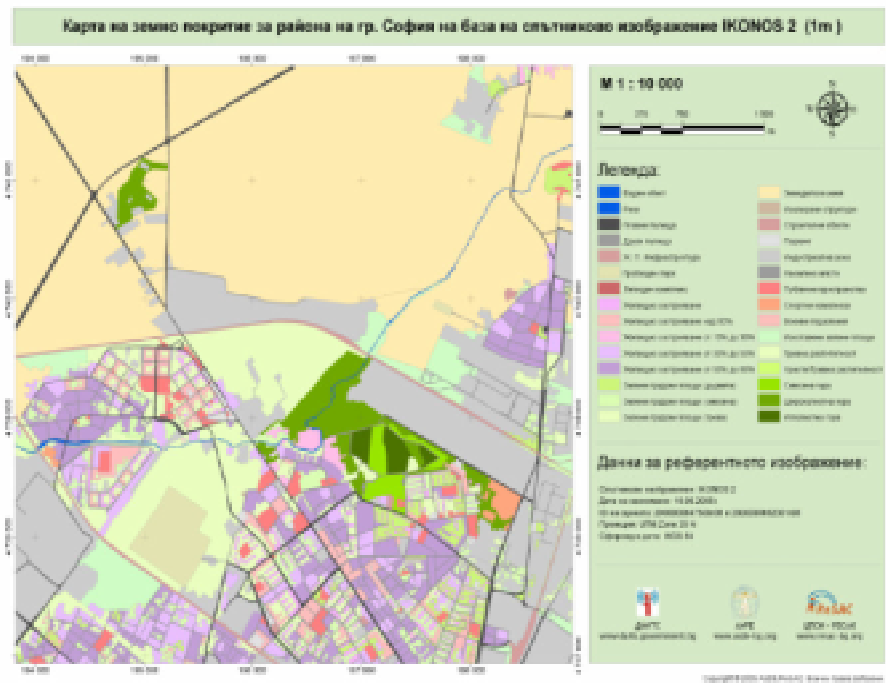


# Spatial Planning related ReSAC's capacities

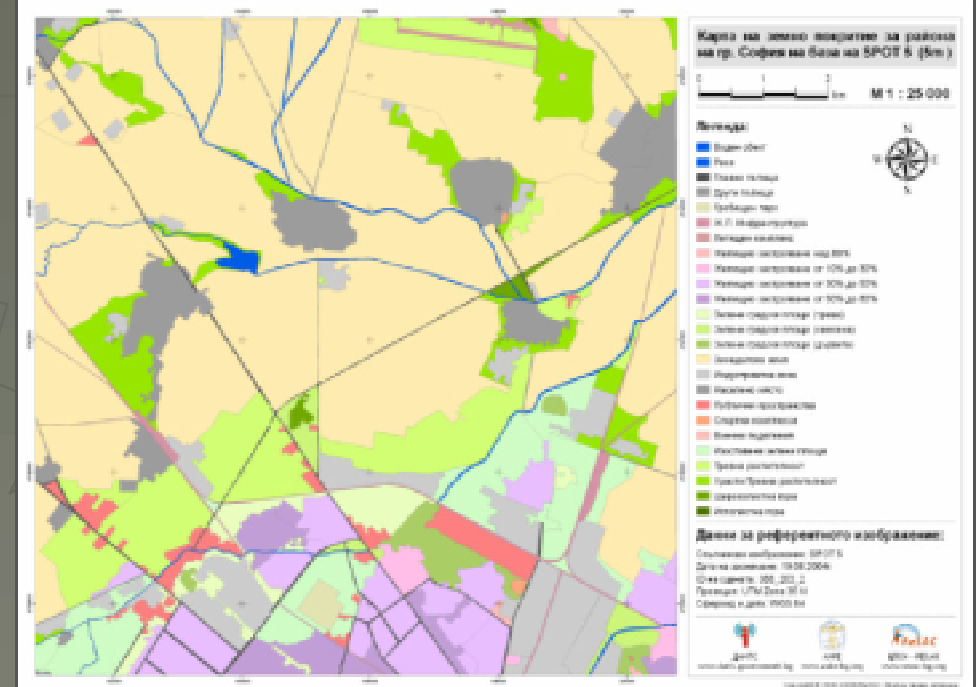
## Mapping development of urban green areas



# Spatial Planning related ReSAC's capacities



**Scale 1: 10 000, IKONOS – 1m res.**



Scale 1:25 000 , SPOT 5 – 5m res.

- ▶ Urban Land cover/Land use changes mapping using LCSS methodology
  - Urbanisation trends;
  - Building density;
  - Land take trends...

# Geoland2 – Agri-Environment

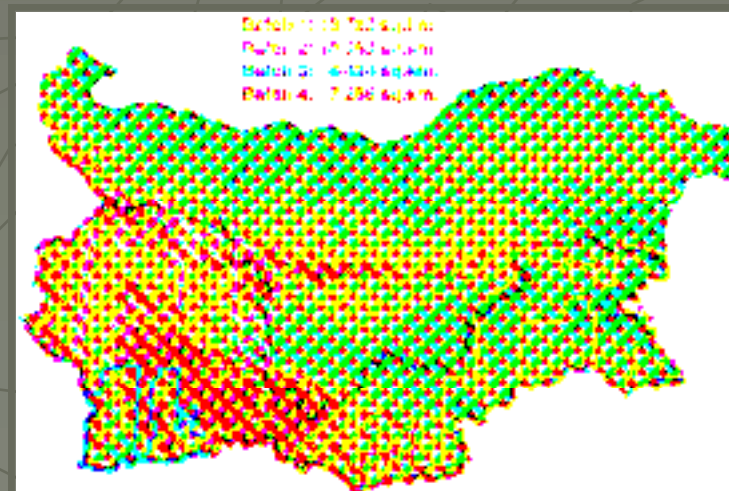
- ▶ AgriEnv aims at developing and improving agri-environmental indicators assessing:
  - The agriculture state and trends
  - The farming pressure on water and soil resources
  - The contribution of agricultural land use changes to sustainability in terms of impacts on biodiversity and landscapes.
- ▶ Those indicators will be generated simultaneously on selected demonstration sites, so as to be able to train users on the combined interest of the indicators. They will be supplied at two scales: at the national / catchment scale to provide an overview of the general status of the site and at the scale of hot spot areas requiring more specific monitoring techniques.
- ▶ The indicators will be produced using as far as possible automatic, flexible and standardised processing chains relying on in situ and Earth Observation (EO) data, and on the outputs of the three CMS of the projects, thanks to the interoperability of the various processing chains.

# Agri-Environment related ReSAC's capacities

## Creation of OrthoImage map of Bulgaria

### OrthoBG - Deliverables

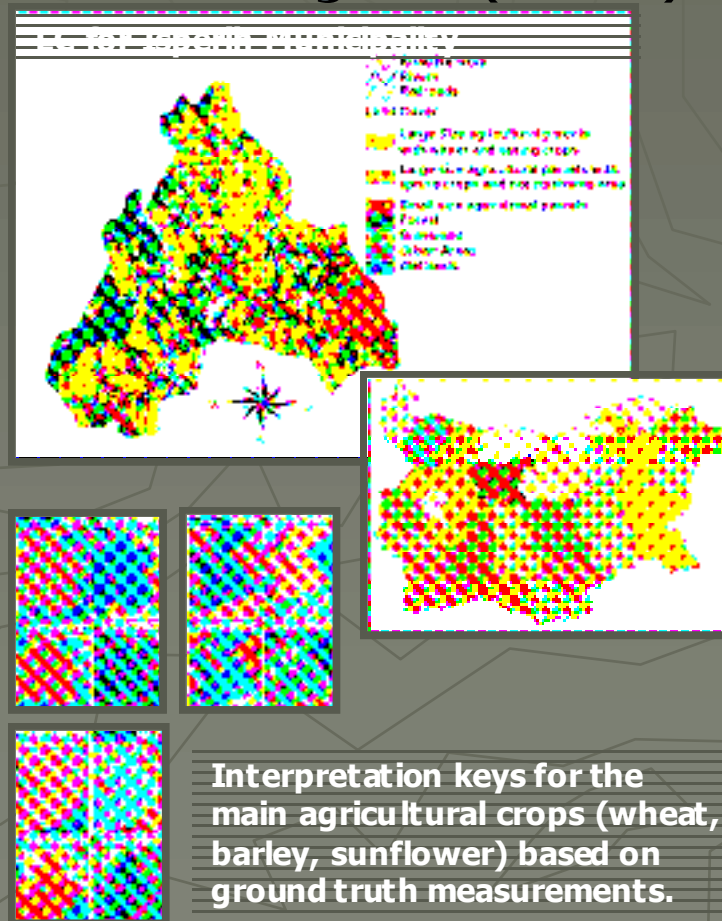
- ▶ Digital RGB orthophoto map with spatial resolution 0.7-1 m for 33,364 km<sup>2</sup> (based on QuickBird and IKONOS data);
- ▶ Reference 3D digital elevation model for 34,000 km<sup>2</sup> with spatial resolution 25 m;
- ▶ Digital B/W orthophoto map with spatial resolution 5 m for 34,000 km<sup>2</sup> (based on SPOT-5 data);
- ▶ 2,600 orthophoto tiles 4x4 km compatible with the aerophoto grid;
- ▶ Quality check and metadata reports for the orthoimages and DEM;
- ▶ Final report.



# Agri-Environment related ReSAC's capacities

## Pilot Study on CwRS of Area Based Subsidies in Bulgaria (04-05)

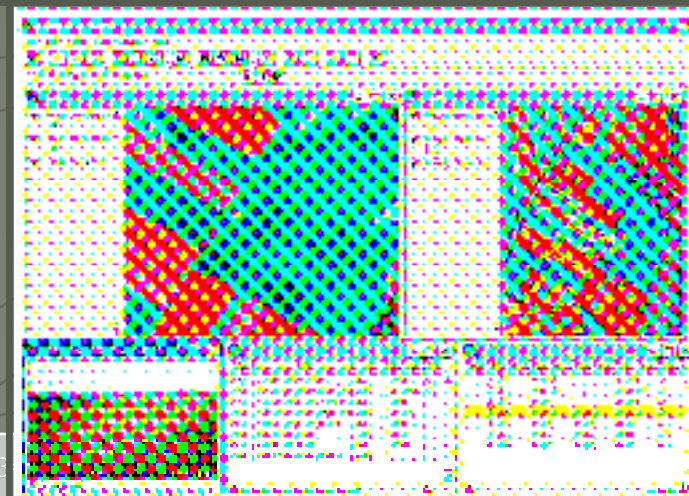
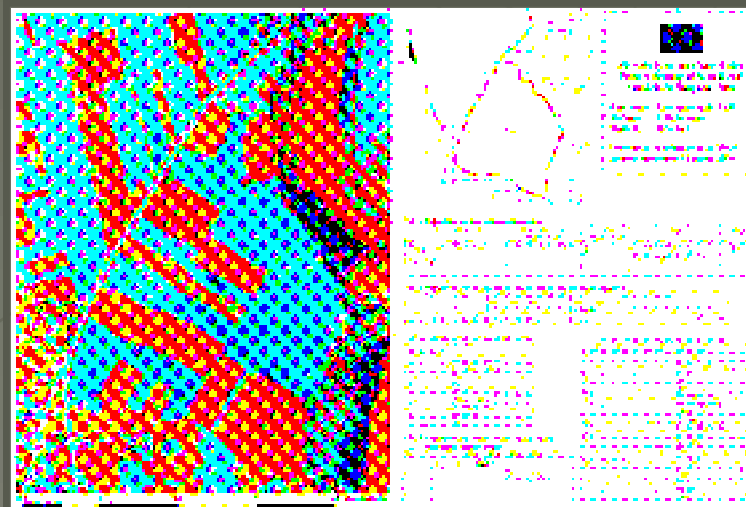
- ▶ Related to the LPIS and control implementation in BG, complying to EU's recommendations and the new CAP reform
- ▶ IACS has to be linked to a geographic database of agricultural parcels (LPIS), for graphic declaration of farmers and control.
- ▶ Control
  - 5% checks on-the-spot by state civil servants
  - RS as a cost-effective technique for support
- ▶ Prj. Duration: 12 months, starting in Jan 2004
  - Financed by JRC/IPSC/MARS unit in Ispra, Italy
  - RESABU consortium: Remote Sensing Application Center - ReSAC-BASA, AIRE/CTS (France, Spain) and Intelgeo (Bulgaria).
  - Supervised by State Fund Agriculture (SFA).



# Agri-Environment related ReSAC's capacities

## Pilot Study on CwRS of Area Based Subsidies in Bulgaria (04-05)

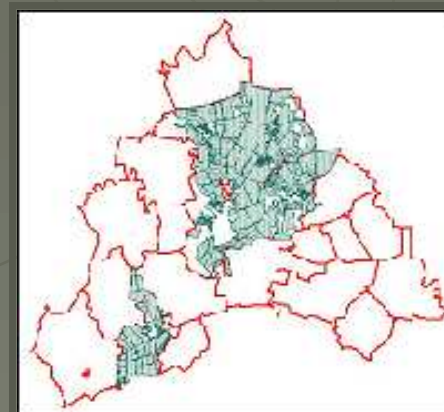
- ▶ Aiming at the definition of:
  - the sampling method for the selection of dossiers to be controlled
  - criteria to be respected for the application form format
  - the best adapted methodology for digitising of land parcels
  - the best adapted methodology for land use identification
  - the technical tolerances
  - the methodology for field visit



# Agri-Environment related ReSAC's capacities

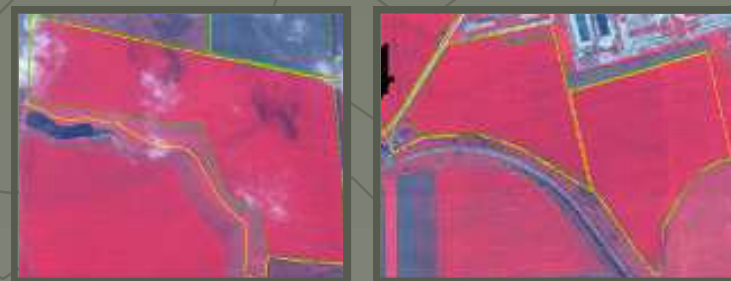
## Pilot Project for establishment of LPIS in Bulgaria

- ▶ The MAF of Bulgaria with the support of MARS-PAC of the IPSC at the JRC/EC started two pilot projects for the preparation of the methodology for the creation of the Land Parcel Identification System (LPIS) implemented by ReSAC. A third project for the implementation of voice activated technologies in LPIS was launched for the Municipality of Vraca.
- ▶ The aim of the projects was to prepare technical recommendations for the LPIS and to assess the eligibility on base of 3 pilot areas
- ▶ Specific objectives
  - To test the process of implementation of LPIS in terms of technology and resources needed.
  - To prepare the methodology for the elaboration of LPIS in Bulgaria.
  - To demonstrate the technical deployment of LPIS and the IACS GIS at national scale
  - To provide technical recommendations for the implementation of the Bulgarian IACS-GIS
  - To assess the status of the arable land in BG and to quantify the volume of the abandoned lands



**LPIS for Selected Settlements in Isperih for which 344 physical blocks were created.**

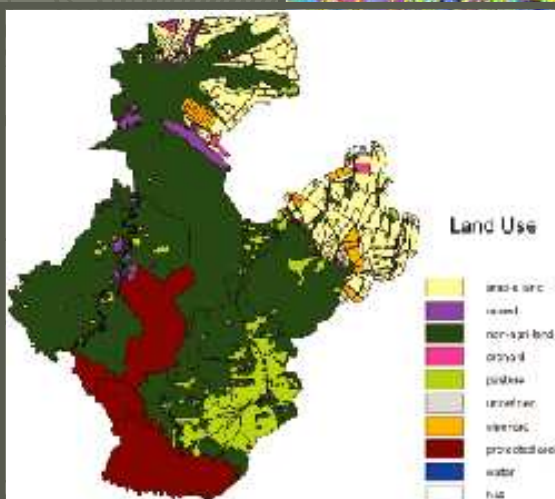
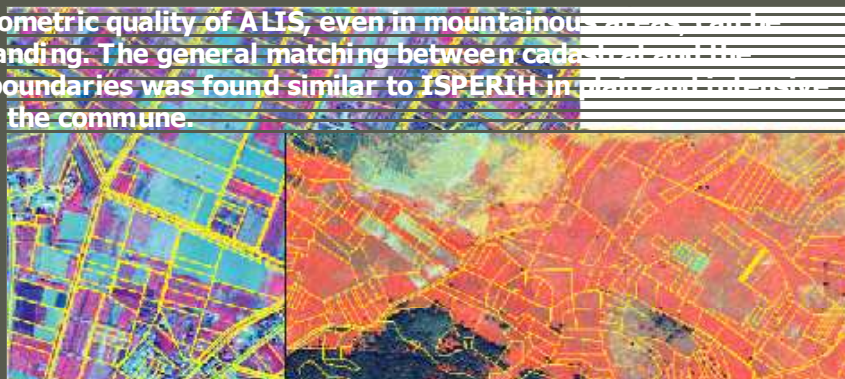
### Analysis of the Physical Blocks - Rule 75% / 90%



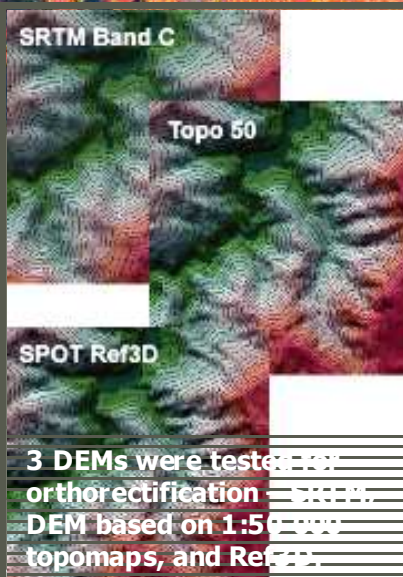
# Agri-Environment related ReSAC's capacities

## Pilot Project for establishment of LPIS in Bulgaria

The overall good geometric quality of ALIS, even in mountainous areas, can be considered as outstanding. The general matching between cadastral and the agricultural parcel boundaries was found similar to ISPERIH in plain and intensive agricultural parts of the commune.



LPIS Database for part of Assenovgrad Municipality.



### ► The results from the pilot projects aided the Bulgarian MAF

- To find the best approach to use the agricultural cadastre in the LPIS database
- To define the type of the reference parcel
- To delineate the abandoned land and pastures
- To organise the overall process for the national LPIS database creation

# Agri-Environment related ReSAC's capacities

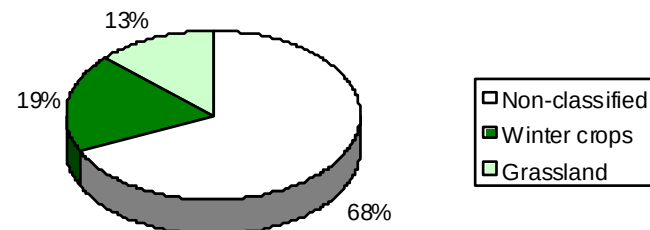


## LEGEND

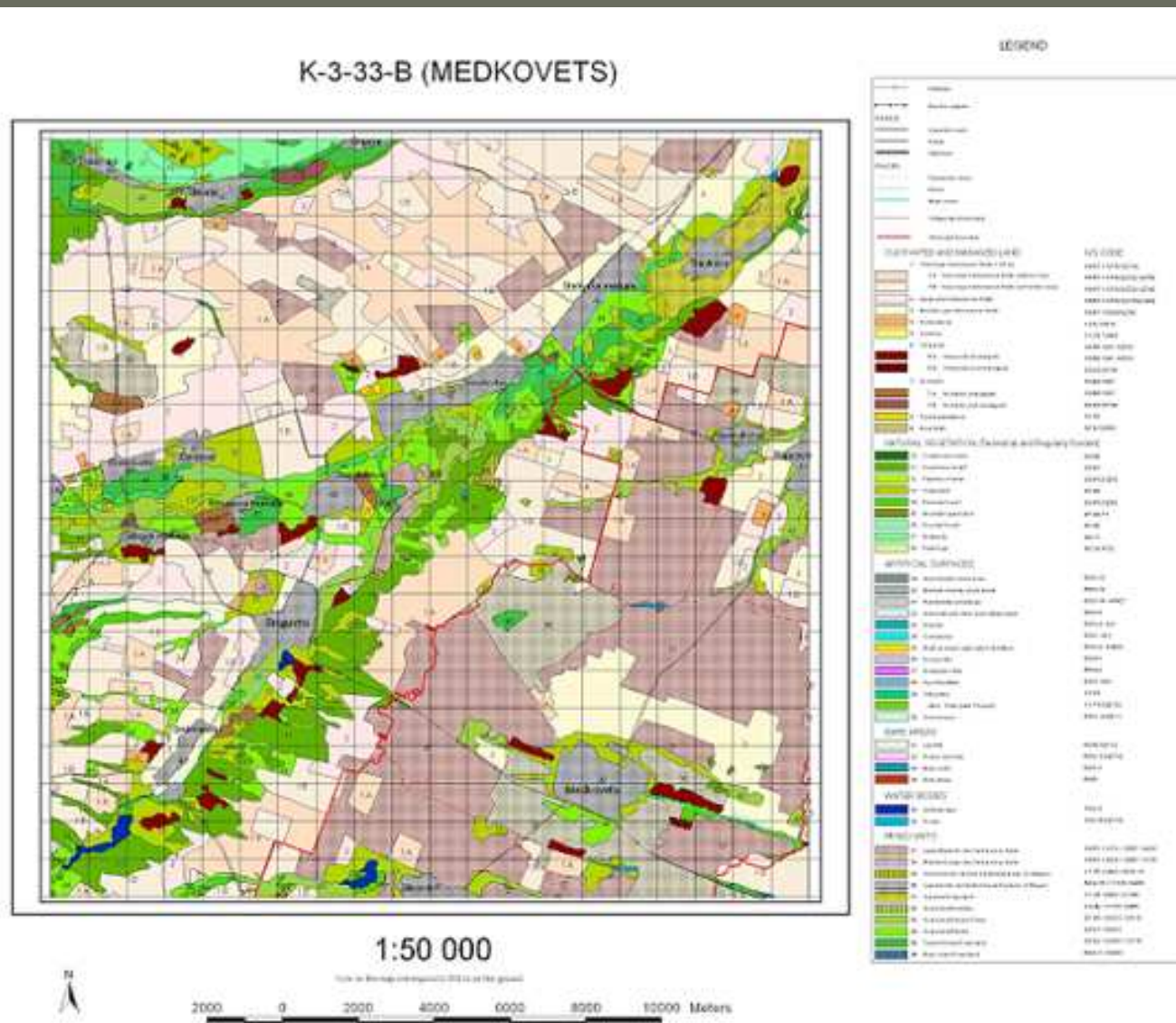


Assessment of Winter Crops and Grassland Areas for Plovdiv Region - fragment

| Type           | Percent % | Area /ha/ |
|----------------|-----------|-----------|
| Non-classified | 68.01     | 108830.70 |
| Winter crops   | 18.82     | 30117.44  |
| Grassland      | 13.15     | 21051.85  |
| Total          | 100,00    | 160000.00 |



# Agri-Environment related ReSAC's capacities



Land cover maps using LCCS methodology of FAO:

- Emphasize on agricultural areas.

# Agri-Environment related ReSAC's capacities

ArcView GIS 3.2

File Edit Table Field Window Help

0 of 472 selected

Attributes of Lc\_hayredin.shp

| Shape   | Legend_no | Soil_and_erosion        | Land_Cover_class                | Area_m2  |
|---------|-----------|-------------------------|---------------------------------|----------|
| Polygon | 14        | Kastanozem Wind         | Riverine forest                 | 10962.50 |
| Polygon | 2         | Chernozems Water, sheet | Large size herbaceous fields    | 11307.25 |
| Polygon | 1.B       | Kastanozem Water, sheet | Very large herbaceous fields (n | 11894.00 |
| Polygon | 1.B       | Kastanozem Wind         | Very large herbaceous fields (n | 12014.75 |
| Polygon | 38        | Chernozems Wind         | Medium/Large size herbaceous    | 12270.25 |
| Polygon | 38        | Kastanozem Wind         | Medium/Large size herbaceous    | 12893.00 |
| Polygon | 1.B       | Kastanozem Wind         | Very large herbaceous fields (n | 12960.00 |
| Polygon | 5         | Kastanozem Wind         | Gardens                         | 13026.25 |
| Polygon | 1.A       | Kastanozem Water, sheet | Very large herbaceous fields (a | 13111.50 |
| Polygon | 13        | Kastanozem Wind         | Grassland                       | 13129.00 |
| Polygon | 2         | Kastanozem Water, sheet | Large size herbaceous fields    | 13263.00 |
| Polygon | 1.A       | Kastanozem Water, sheet | Very large herbaceous fields (a | 13767.25 |
| Polygon | 1.B       | Kastanozem Wind         | Very large herbaceous fields (n | 14714.75 |
| Polygon | 1.A       | Regosols Water, rill    | Very large herbaceous fields (a | 14775.75 |
| Polygon | 5         | Chernozems Water, sheet | Gardens                         | 14814.50 |
| Polygon | 13        | Kastanozem Water, sheet | Grassland                       | 15065.00 |
| Polygon | 2         | Kastanozem Water, sheet | Large size herbaceous fields    | 15842.75 |
| Polygon | 1.A       | Kastanozem Water, sheet | Very large herbaceous fields (a | 17127.50 |
| Polygon | 2         | Kastanozem Water, sheet | Large size herbaceous fields    | 18568.50 |
| Polygon | 3         | Kastanozem Wind         | Medium size herbaceous fields   | 18634.00 |
| Polygon | 2         | Chernozems Wind         | Large size herbaceous fields    | 19121.50 |
| Polygon | 36        | PONDS                   | Ponds                           | 20308.50 |
| Polygon | 14        | Kastanozem Wind         | Riverine forest                 | 21207.75 |
| Polygon | 38        | Kastanozem Water, sheet | Medium/Large size herbaceous    | 21975.50 |
| Polygon | 1.A       | Chernozems Wind         | Very large herbaceous fields (a | 22545.25 |
| Polygon | 38        | Chernozems Wind         | Medium/Large size herbaceous    | 25071.00 |
| Polygon | 3         | Kastanozem Water, sheet | Medium size herbaceous fields   | 25737.50 |
| Polygon | 1.B       | Kastanozem Water, sheet | Very large herbaceous fields (n | 25799.50 |
| Polygon | 3         | Regosols Water, rill    | Medium size herbaceous fields   | 26209.25 |
| Polygon | 37        | Kastanozem Water, sheet | Large/Medium size herbaceous    | 26884.25 |

Database for Land Cover and Soil/Erosion Types

-Updated soil type classes on the base of satellite images;

-Updated soil erosion information on the base of topomaps and satellite images

# SAFER – Flood Risk Management and Assets Mapping

## ▶ Flood Risk Management Objective:

- Consolidate and validate a “Plain flood risk management” service from mapping to modelling, including damage assessment and online provision

## ▶ Assets Mapping Objective:

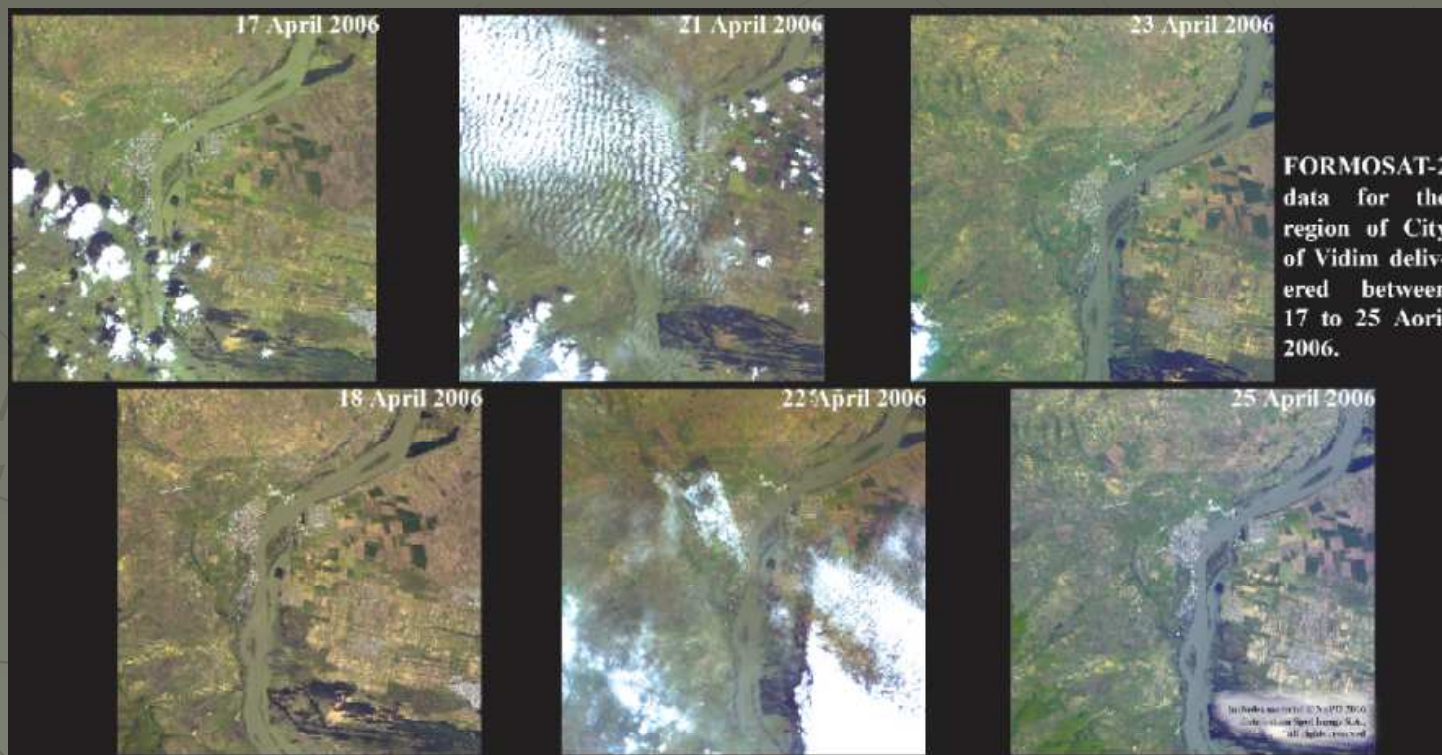
- Consolidation, validation and initial provision of assets maps for European water management and civil protection users, based on a harmonised approach, and thus fulfilling the requirements of a cross-cutting / generic service.

## ▶ Flash Floods Forecasting:

- Bulgarian partner – National Institute for Meteorology and Hydrology;
- WP leader Meteo France

# SAFER related ReSAC's capacities

## Rapid Mapping



By the request of ReSAC on 17 of April 2006 Spot Image launched an everyday acquisition of FORMOSAT-2 and SPOT satellite images for three regions in the country - Vidin, Belene and Silistra. The images were delivered every day through FTP and immediately processed in order to extract valuable information for the crisis situation.

# SAFER related ReSAC's capacities

**NORTH WEST BULGARIA, Fast Track Service / Danube River Floods in April 2006 1:15 000**



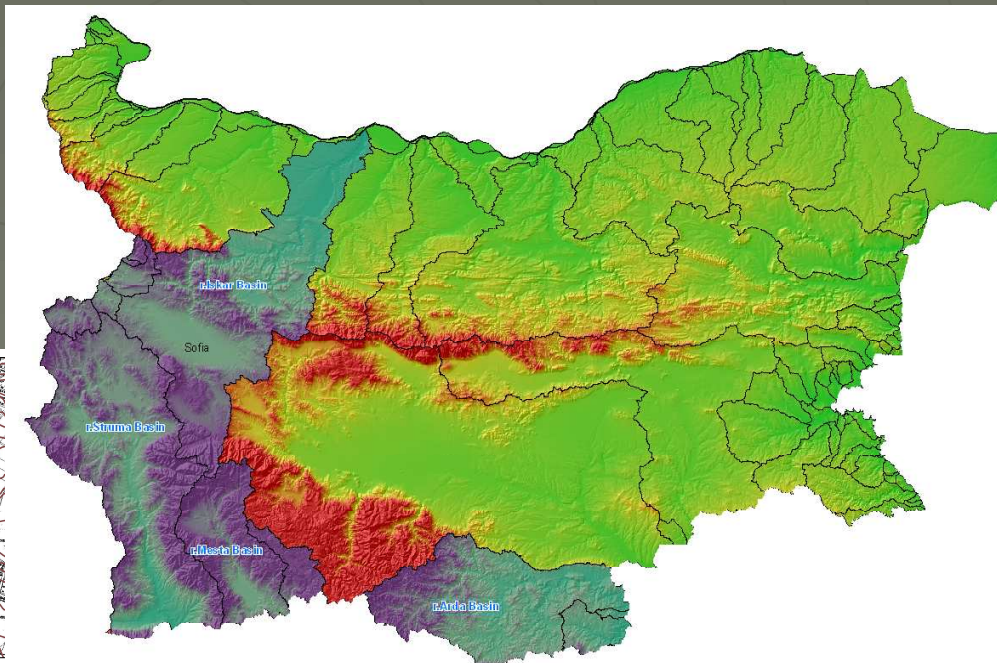
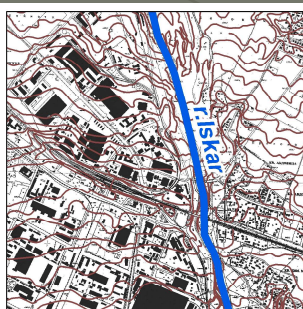
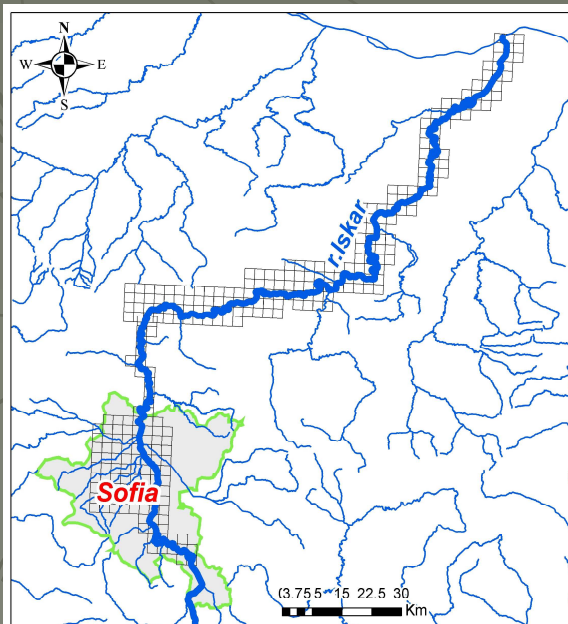
North West Bulgaria -  
City of Lom, Fast Track  
Map of Danube River  
Floods in April 2006.

The Map is based on  
FORMOSAT-2 data and  
SPOT-5 archived images.

# SAFER related ReSAC's capacities

Preliminary assessment of river basin's flood risk and their associated coastal zones

Preparation of high scale DEM from topomaps and LIDAR for hydraulic models for major rivers.



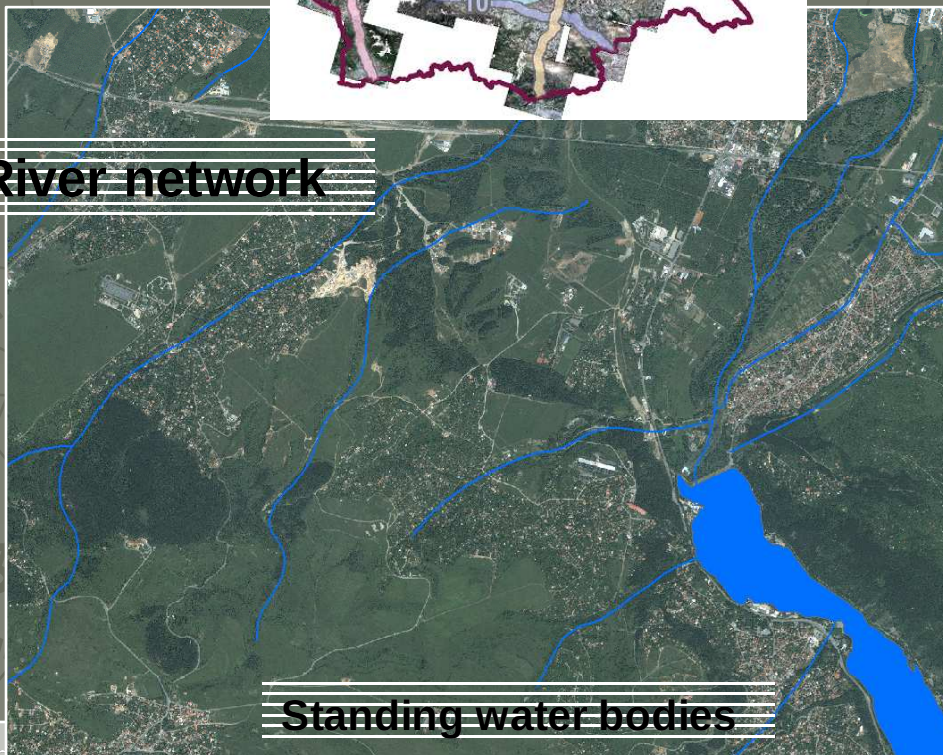
Preparation of low scale DEM from Reference 3D product for hydrological models for several Bulgarian river basins.

# SAFER related ReSAC's capacities

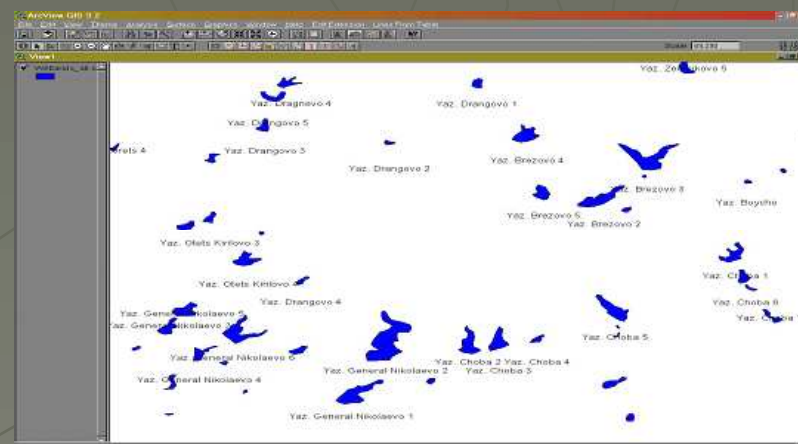
Preliminary assessment of river basin's flood risk and their associated coastal zones



**River network**



**Standing water bodies**



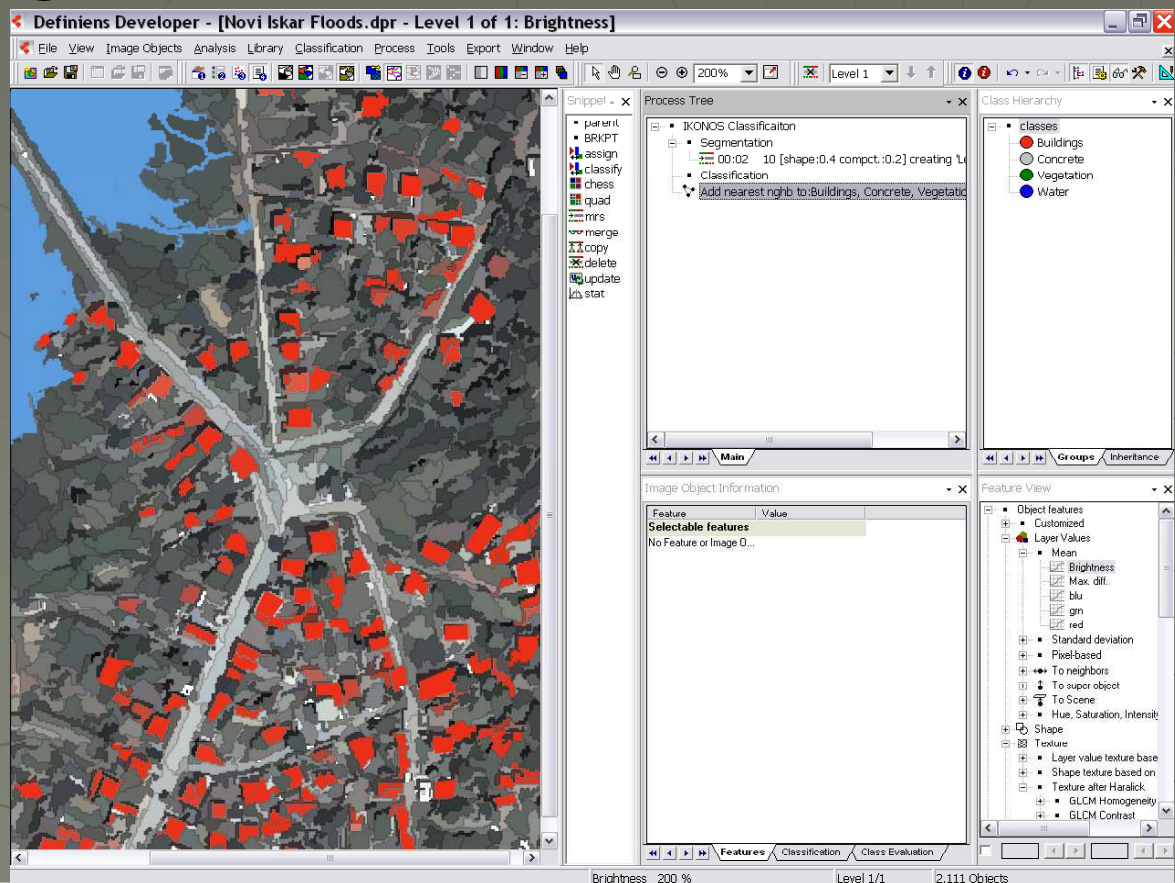
**Water objects Database**

| Shape   | X-coord      | Y-coord       | Area_ha | Perimeter | Wetlandnam             | Existence | Settlement      | Catchment   | Date     |
|---------|--------------|---------------|---------|-----------|------------------------|-----------|-----------------|-------------|----------|
| Polygon | 721682.35435 | 4608325.11656 | 0.731   | 348.310   | Yaz. Soushtsa 1        | both      | Borovo          | Mesta       | 28.01.97 |
| Polygon | 814170.86236 | 4725224.53867 | 2.148   | 601.481   | Yaz. Soushtsa 2        | both      | Soushtsa        | Styama      | 07.07.00 |
| Polygon | 721595.23994 | 4608390.32396 | 0.623   | 376.737   | Yaz. Soushtsa 3        | both      | Borovo          | Mesta       | 28.01.97 |
| Polygon | 814226.63879 | 4725063.62761 | 0.736   | 366.640   | Yaz. Soushtsa 4        | both      | Soushtsa        | Styama      | 07.07.00 |
| Polygon | 814695.10895 | 4724621.21749 | 1.086   | 407.763   | Yaz. Soushtsa 5        | map       | Soushtsa        | Styama      | 07.07.00 |
| Polygon | 827971.17327 | 4648155.89470 | 32.533  | 3417.813  | Yaz. Soushtsa 6        | both      | Dolnoslav       | Cherkazitsa | 28.01.97 |
| Polygon | 775916.24219 | 4710330.56734 | 14.652  | 2037.525  | Yaz. Strelcha 1        | both      | Strelcha        | Pyasuchnik  | 07.07.00 |
| Polygon | 799631.93327 | 4704292.06378 | 1.859   | 555.488   | Yaz. Staro Zholozere 1 | both      | Staro Zholozere | Styama      | 28.01.97 |
| Polygon | 799879.73131 | 4704102.50346 | 2.092   | 718.165   | Yaz. Staro Zhelezare 2 | both      | Staro Zhelezare | Styama      | 28.01.97 |
| Polygon | 800197.04434 | 4703797.30514 | 0.639   | 302.113   | Yaz. Staro Zhelezare 3 | both      | Staro Zhelezare | Styama      | 28.01.97 |
| Polygon | 800205.63043 | 4703797.30514 | 1.094   | 343.013   | Yaz. Staro Zhelezare 4 | both      | Staro Zhelezare | Styama      | 28.01.97 |

# SAFER related ReSAC's capacities

Preliminary assessment of river basin's flood risk and their associated coastal zones

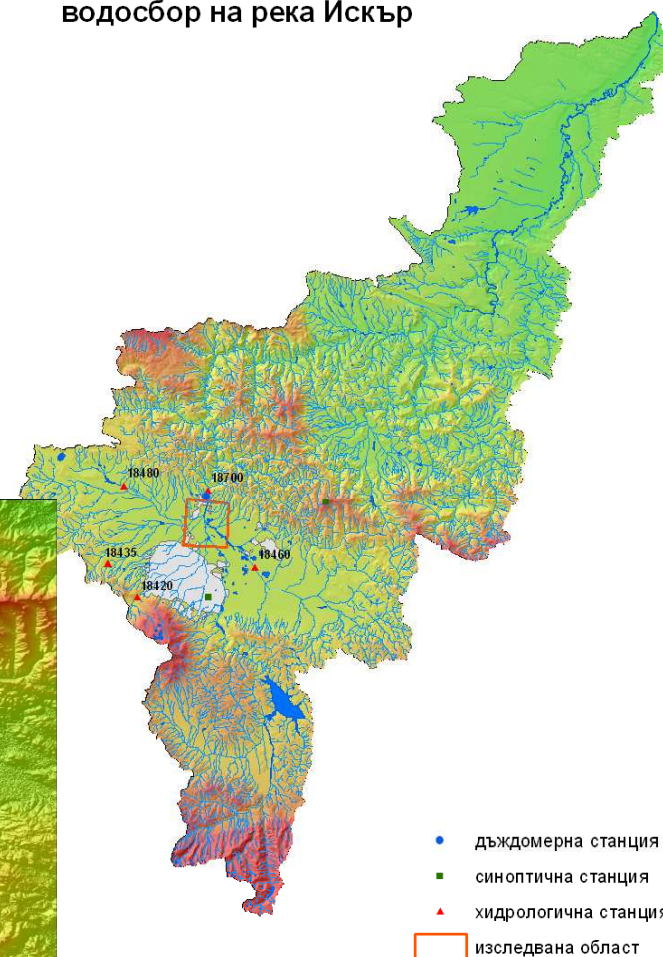
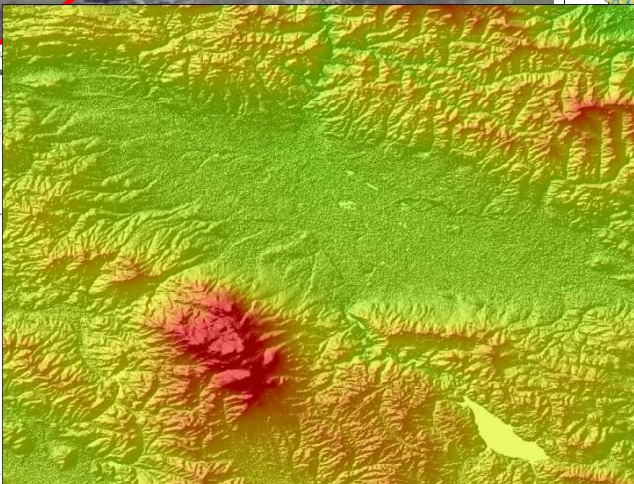
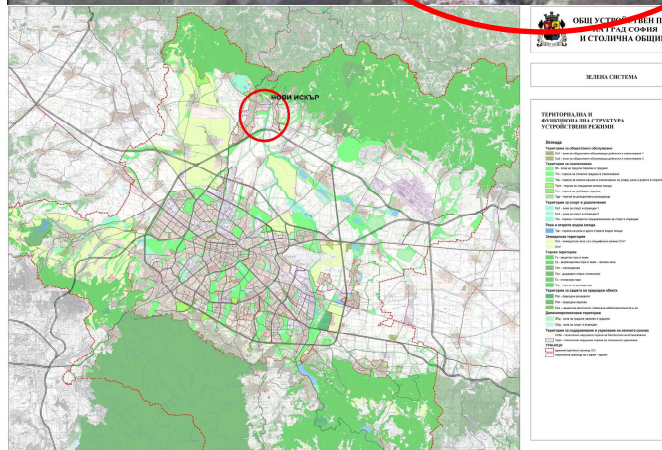
- Asset Mapping based on VHR satellite data



# Pilot project for Preliminary assessment of potential losses from floods for Sofia Valley

Valley

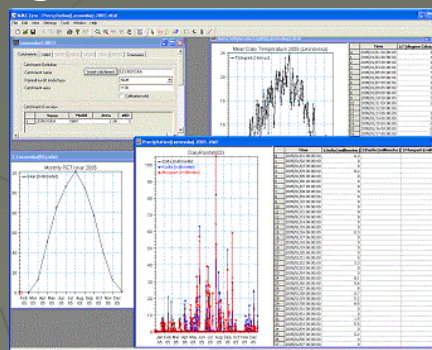
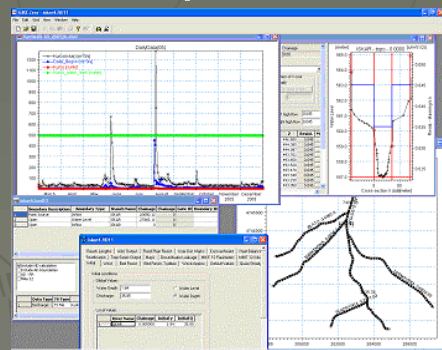
- Pilot area location

An aerial photograph of a valley area. A large red circle is drawn over the central part of the image, highlighting a specific region. The landscape is a mix of green fields, brown patches, and some buildings. A road or path runs through the center of the highlighted area. In the bottom right corner, there is a small inset image showing a topographical map or elevation data.

# SAFER related ReSAC's capacities

Pilot project for Preliminary assessment of potential losses from floods for Sofia Valley

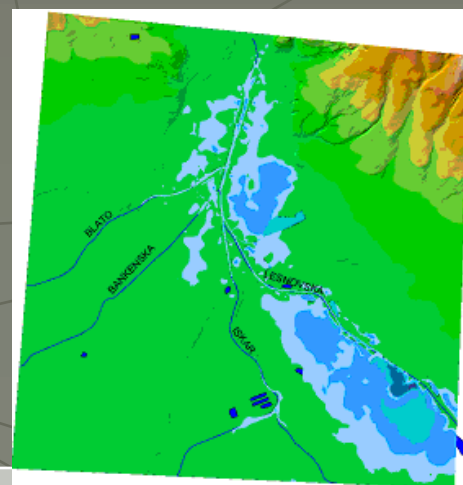
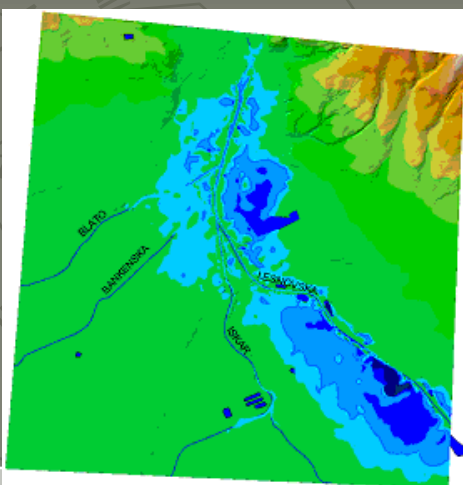
Hydraulic modelling using MIKE 11:



Cross-sections measured:



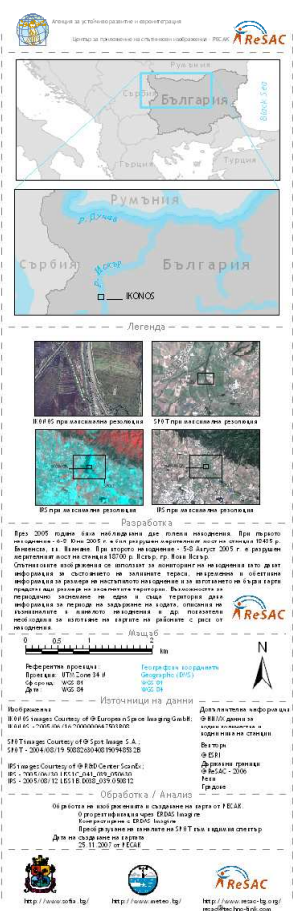
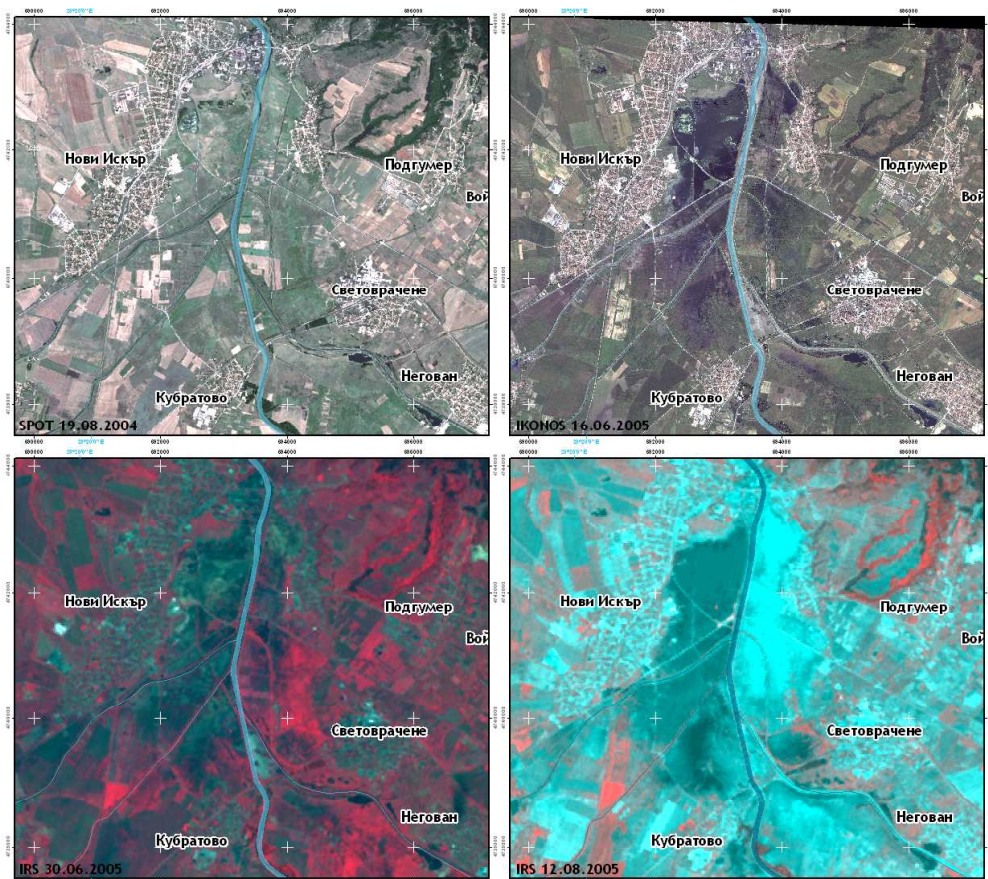
Modelling with  
the support of  
NIMH-Bulgaria



# SAFER related ReSAC's capacities

# Flood maps based on time series satellite data.

Карта на наводнените територии край гр.Нови Искър - юни-август 2005 1:50 000



# SAFER related ReSAC's capacities

Примерна карта на наводнени територии при симулиране на височина на вълната 2 м.  
на река Русенски лом в района на с. Басарбово

Наводнени територии върху аерофото снимка



Легенда:

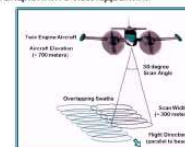
Аерофото снимка



Наводнени територии



Цифровият модел на релефа е генериран от измервания с LIDAR. LIDAR е активен сензор за събиране на данни по метода на дистанционните изследвания.



Референтна проекция:  
Проекция: UTM Zone 34 N  
Съоръжение: WGS 84  
Дата: WGS 84

Изображения:  
с ReSAC - 2008  
аерофото снимка

Географски координати:  
Географска (DMS)  
WGS 84  
WGS 84

Вектори:  
с ReSAC - 2008  
Градски  
Симулирано водно ниво

Обработка / Анализ

Обработка на изобразяването и създаване на карта от ReSAC.  
Дата на създаване на картата:  
26.06.2008 от ReSAC

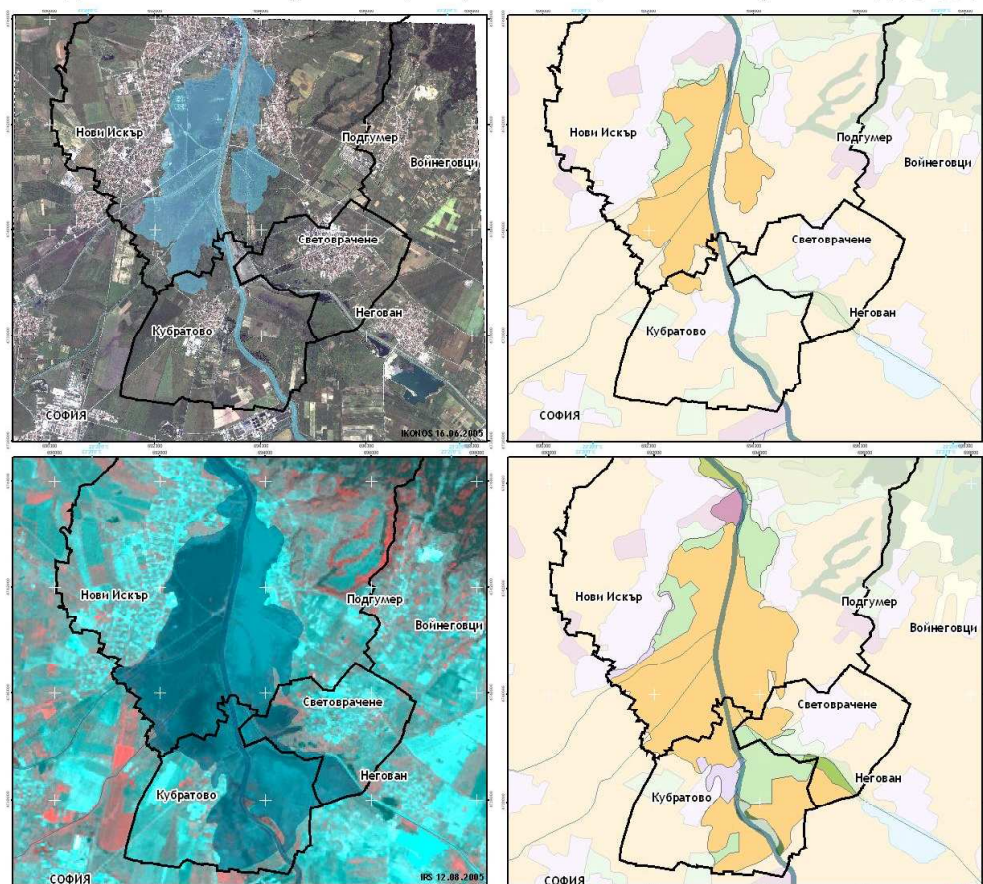


Flood  
simulations –  
different  
scenarios.

# SAFER related ReSAC's capacities

## Assessment of the land cover types flooded.

Наводненията от юни-август 2005 край гр.Нови Искър по земно покритие 1:60 000



# GMES Phases – way ahead

- ▶ 1998 – GME(S) foundations
- ▶ 2001-2003 – Initial research period
- ▶ 2004-2008 – Building first GMES capacity
- ▶ 2008-2011 – Development of pre-operational GMES services
- ▶ 2011-2013 – I operational phase
- ▶ 2014... GMES fully operational
- ▶ GMES is European Initiative, but local and regional decisions need local and regional expertise;
- ▶ Sustainability and better use of GMES services could be assured by building and developing local and regional capacity in EO.

# Thank you for your attention

## Remote Sensing Application Center - ReSAC

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