Spatial Data Architecture for Meteorological/Hydrological Hazards and Associated Risks Management 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.

• The paper presents the main results of some Romanian projects (INSPAM, SIGUR, and RISCASAT) for initiation and development of an interoperable framework able to contribute to a national spatial data infrastructure for hydro-meteorological hazards and associated risks management by following the European initiatives of this domain (INSPIRE, GMES). This initiative, supported by some national and European - funded projects, was materialized by the organization of a unit in the National Meteorological Administration, able to perform technical and economical assessment for developing the spatial data infrastructure for monitoring extreme meteorological/hydrological phenomena (especially floods).
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 and 2008, 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.
Floods

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Floods
Framework

Projects:

• 2003 – 2006: NATO SfP 978016, Monitoring of extreme flood events in Romania and Hungary using EO data
• 2005 – 2008: CEEX INSPAM: “Spatial Data Infrastructures with Applications in Environment Protection”
• 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

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

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 early 2007
- Version 3: started in early 2010
Data processing chain

MODIS Rapid Response
- Hot spots identification
- Generic phenomena evaluation (extent & dynamic)
- Georeferenced quick views

International Charter
- High resolution optic & radar data

NASA WIST
- Area of interest delineation
- Imagery selection
- Ordering

MODIS Image processing
- HDF file import
- Bow-tie correction
- Georeferencing
- NDVI transformation
- NDVI thresholding
- Raster to vector conversion

Water mask

Validation
- GPS surveys
- Intercomparison

Thematic products

Flood maps

Damage assessment

Animations & 3D fly-througths

Services and Applications For Emergency Response

Safer
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
Zonele inundate din sudul Moldovei (apa la zi).

Legenda
- Superficiile inundate (GIL 2006)
- Superficiile inundate (GIL 2005)
- Drumuri naționale
- Drumuri județene
- Drumuri comunale

Proiect NATO SIP 978016
Map example: Danube river 2006
Map example: Danube river 2006

ROMANIA, Danube floodings, RAST village, 19.04.2006

Legend:
- Hydrographic network (aeriel view)
- Flooded areas
- Dams
- European road network
- County roads
- Local roads, streets
- Railroad network
- Llouettes

For more details visit www.rosa.ro, www.imnh.ro
Map example: Danube Delta
Map example: Prut river 2008

Romania. Flooded areas near Radauti-Prut village. 29.07.2008 09:40 UTC
Water classification example
Post-crisis monitoring example

Indice de vegetatie NDVI (-1 / 1)
Validation example

Areas classified as water only on the ASTER image
Areas classified as water only on the MODIS image
Data access
Conclusions & future work

Numbers:
• Service activations: 5
• 2005: 82 products
• 2006: 124 products
• 2008: 39 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?