



BRIGAIID

BRIDGING THE GAP FOR INNOVATIONS
IN DISASTER RESILIENCE

ACTION PLAN IN CASE OF ACCIDENT AT THE PROTECTION DIKES





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Base of implementation of an alarming-
warning system of the floodable
objectives located inside of dyke
protected enclosures which are
exposed to failure risk during
exceptional floods.



Goals



- areas in the case of critical situations emergence on embankment works that protect certain areas
- The anticipation of a possible accident on dykes (using a sensors system integrated to the whole product)
- Content creation of a framework and procedural steps for an action plan in case of accidents on dykes.
- The project is intended for flood protection

FURTHER DEVELOPMENT

The action plan in case of accidents on dykes should contain:

- risks and assumptions for dyke failure;
- determination of the flooded areas in the event of failure;
- an alarm system warning in case of danger;
- actions to be taken during the preceding periods of dyke failure and damage control during the event itself.
- flood mitigation on the event;
- a program to educate the population at risk on flooding occurrence and behavior to be adopted during such events

DOC. PHASE

Study Needs - Presentation of Dike failures and Registered Damage

- Scope
- Analysis of the risk of failure
- Monitoring of structural behavior at national and international level
- Methods and equipment for monitoring the state of the dykes
- Simulation models for dyke defenses and wave propagation generated by dyke failure

CASE STUDY & TESTING

- Consultation of dyke administrators and location verification
- Collection of basic data (topo data, characteristic data for hydro works, hydrological data)
- Structural behavior model for structural integrity assessment
- Hydraulic simulation model construction
- Flood wave propagation generated by breakage of defense dyke
- Proposed system for tracking the behavior of defensive dikes
- Proposed content framework action plan in case of breaking of the defense dikes

Early warning

The project seeks to reduce damage by:
determining areas sensitive to the
occurrence of critical situations in indigestion
early anticipation of a possible dyke accident
(using the early warning provided)
making a framework content for an action
plan in the event of an accident at the dams.

FLOODS

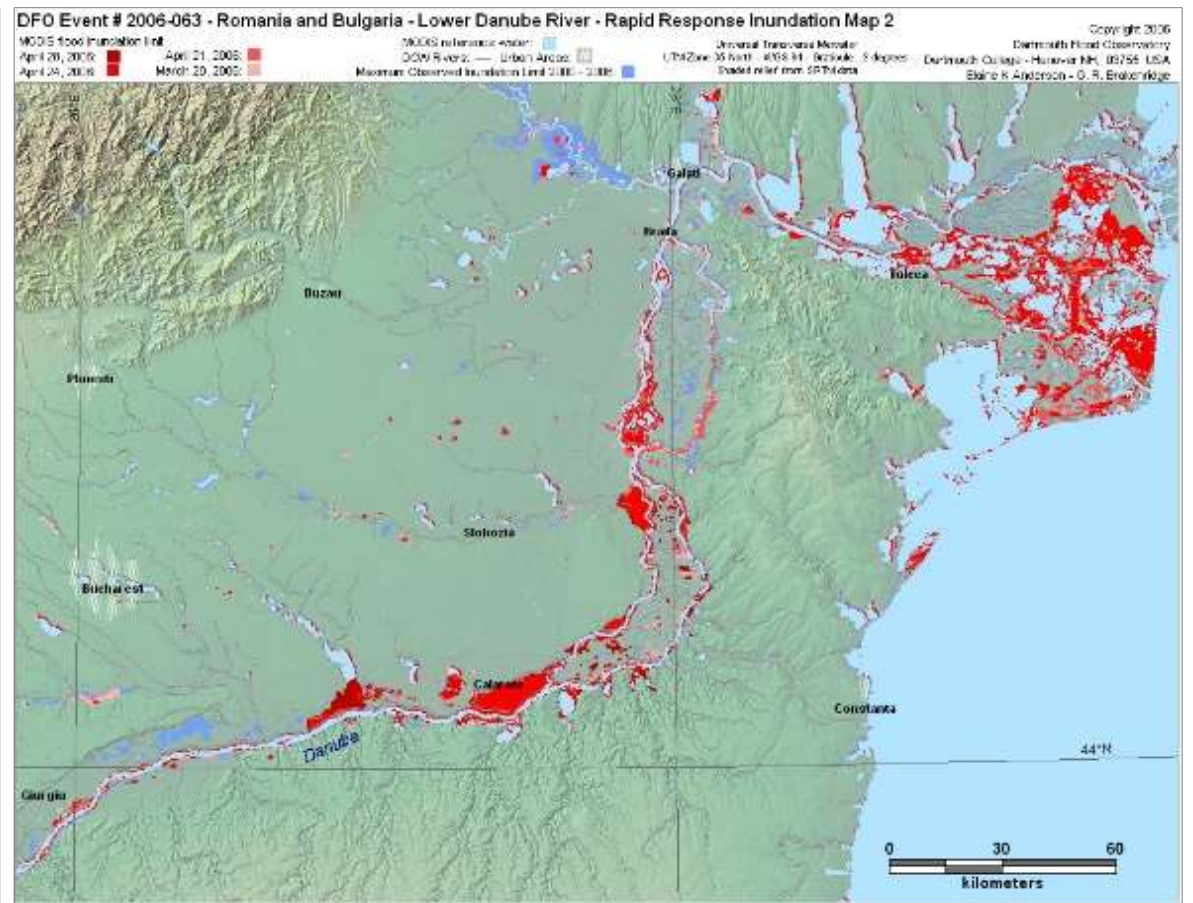
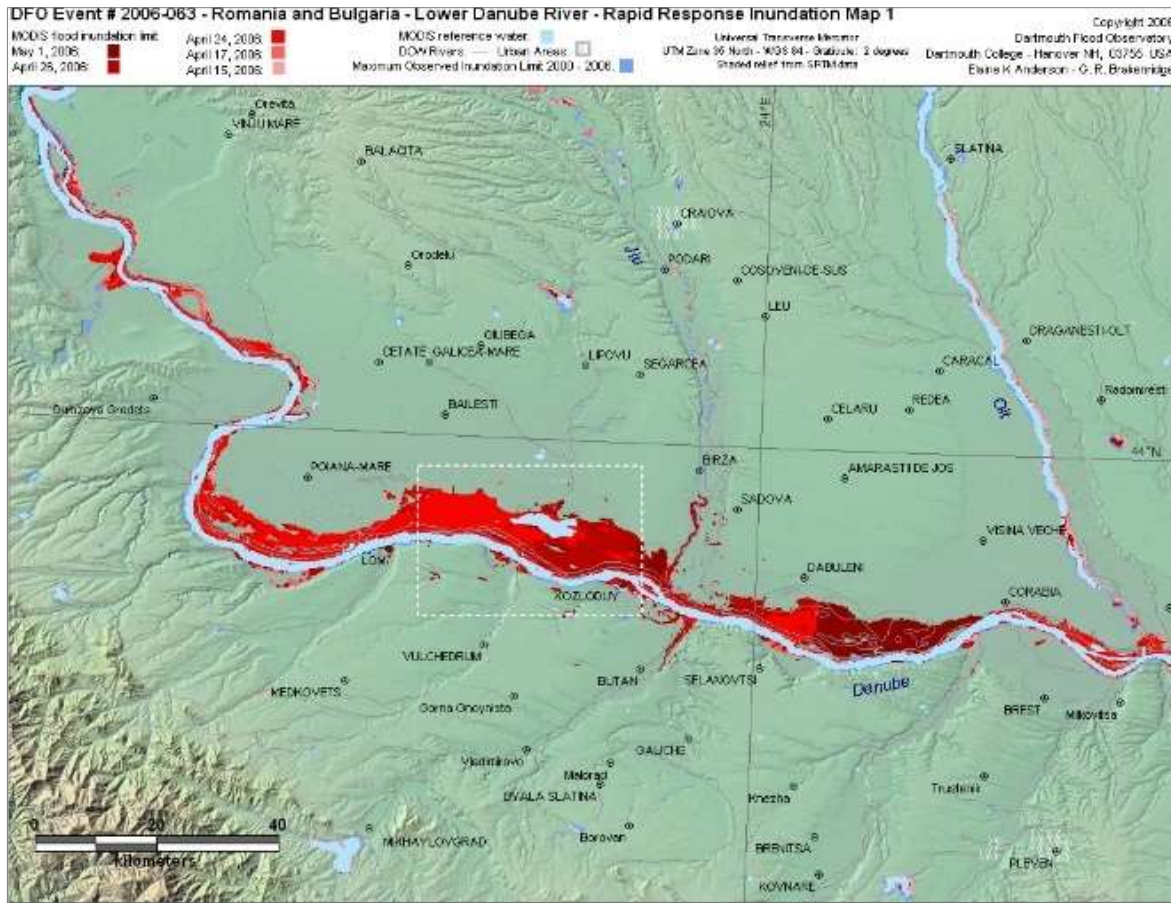
Determination of
floodable areas in the
event of failure;
A hazard warning alarm
system;

EXTREME WEATHER

The actions to be carried
out during the pre-crisis
period during the
production and
propagation of the flood
and after its cessation;

SOCIAL IMPACT

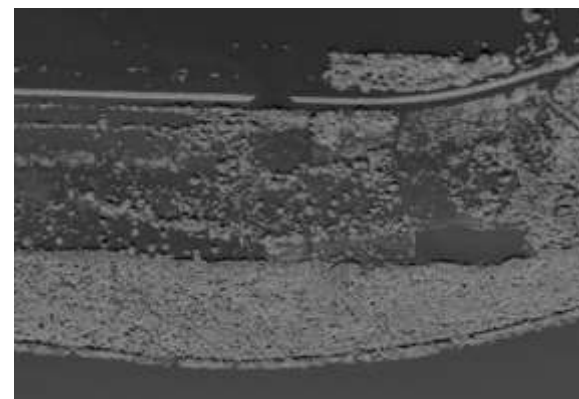
A program to educate the
population at risk of
flooding.



2006 Danube Flood



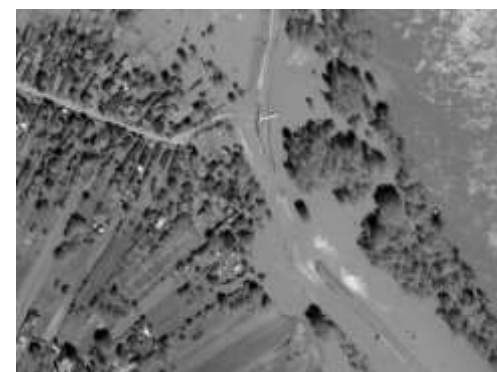
Floodable area in Serbia, Croatia si Bosnia si Mai 2014



Sava - Račinovci, Croatia – dike breach



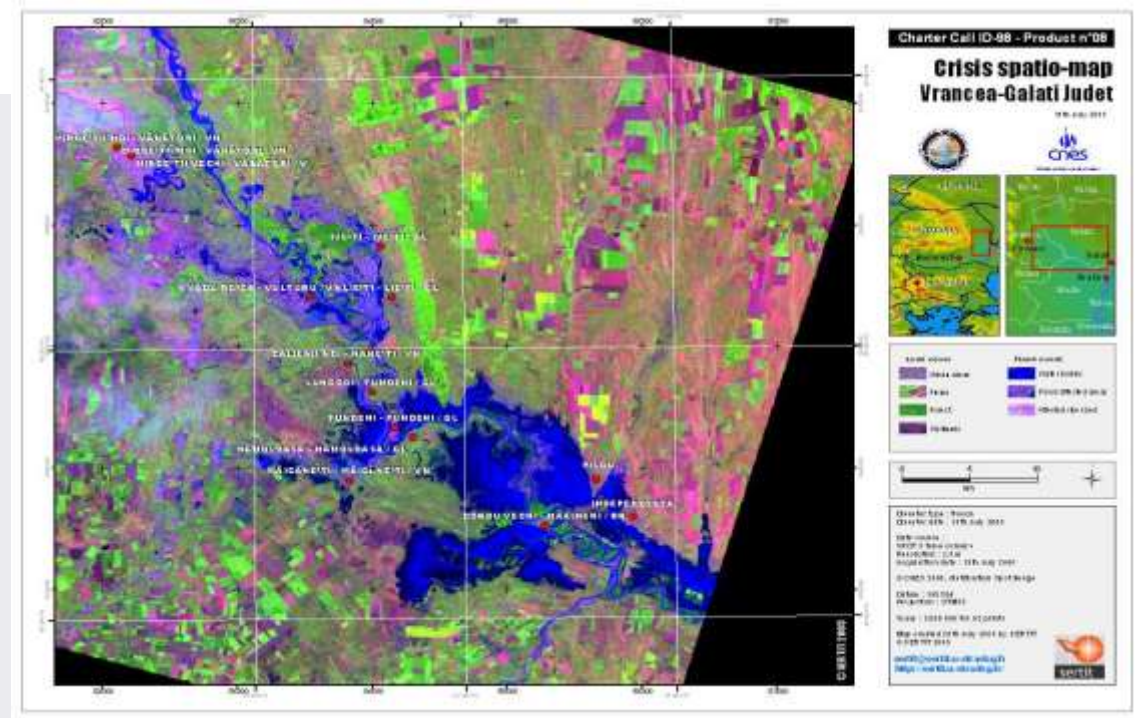
Sava - Batkovići, Bosnia si Hertegovina – dike breach



Raul Sava - Obrenovac, Serbia - bresa si zona inundata

2005 Siret Flood

The historic flood in 2005 reached maximum flow rates of 0.3% over Siret river tributaries, and the historical flows of 4650 m³ / s were recorded on the Siret river, corresponding to a probability of exceedance of 0.5%. The majority of dikes on Siret river was performed between 1970-1980 for a calculation rate corresponding to a probability of exceedance $\leq 1\%$ and have an average height of approx. 3 m. On the course of the Lower Siret, all the course is endiked



Flood of 50000 ha of land, 30 socio economical objectives. 3600 houses completely wiped.



Analizing the 1950-2015 disaster rate (fig 1) we conclude that 1990-1995 is relevant, comparative to the pre 1990 period that presents the data is scarce.

Potential client assesment

Years with the most extensive losses 1995-2016

| year | occurrence | Total deaths | Total affected | Total damage mii \$ |
|------|------------|--------------|----------------|------------------------|
| 2011 | 155 | 6157 | 136445723 | 70757047 |
| 2013 | 148 | 9756 | 30075880 | 54782566 |
| 2010 | 184 | 8356 | 188794298 | 49137575 |
| 1998 | 57 | 6300 | 259599378 | 40758031 |
| 2014 | 127 | 3173 | 40346360 | 35708242 |
| 1995 | 57 | 7183 | 177870869 | 26728552 |
| 1996 | 64 | 6829 | 178310465 | 26115000 |
| 2012 | 136 | 3544 | 63962019 | 25790538 |
| 2007 | 192 | 8142 | 170570154 | 23728547 |
| 2003 | 149 | 3822 | 168967507 | 20791028 |
| 2008 | 155 | 3884 | 44806228 | 19617144 |
| 2005 | 182 | 5724 | 75003166 | 17932414 |
| 2000 | 86 | 5140 | 69552416 | 17639557 |
| 2015 | 103 | 2399 | 27846890 | 15251100 |
| 1999 | 68 | 32543 | 119905529 | 14405342 |
| 2002 | 137 | 3799 | 160691607 | 14334179 |
| 1997 | 61 | 5019 | 13858180 | 12035946 |
| 2004 | 126 | 6963 | 116970795 | 10383038 |
| 2006 | 151 | 3627 | 59734933 | 8003878 |
| 2009 | 5745 | 30274719 | 7805942 | 7805942 |
| 2001 | 105 | 4426 | 24553886 | 4486412 |



Countries with the most extensive flood damage between 1995-2015

| country_name | occurrence | Total deaths | Total affected | Total damage mii \$ |
|--|------------|--------------|----------------|------------------------|
| China | 162 | 20936 | 1455831008 | 179088808 |
| Thailand | 46 | 2515 | 42982471 | 41998017 |
| India | 137 | 24948 | 319372647 | 39408779 |
| United States of America (the) | 91 | 610 | 11963146 | 38151330 |
| United Kingdom of Great Britain and Northern Ireland | 23 | 41 | 433843 | 21897230 |
| Pakistan | 51 | 7291 | 48427871 | 18707148 |
| Korea (the Democratic People's Republic of) | 18 | 1625 | 8521553 | 15342800 |
| Germany | 10 | 20 | 113000 | 13930000 |
| Australia | 35 | 99 | 264034 | 13123500 |
| Italy | 24 | 161 | 74173 | 12036000 |
| Canada | 25 | 35 | 170574 | 8104600 |
| Bangladesh | 36 | 4330 | 94014844 | 7728300 |
| Poland | 9 | 113 | 346250 | 7380000 |
| France | 18 | 146 | 62066 | 6710350 |
| Indonesia | 103 | 3635 | 5607386 | 6466463 |
| Czech Republic (the) | 12 | 100 | 1622217 | 5744112 |
| Brazil | 62 | 2496 | 6997142 | 4900870 |
| Japan | 14 | 220 | 221299 | 4864000 |
| Austria | 10 | 24 | 61616 | 4512000 |
| Russian Federation (the) | 39 | 561 | 1134538 | 3735575 |



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