



Brussels, 03.09.2002

EC Research on Floods in the framework of environmental research

1. Background information

Major flooding has occurred nearly every year somewhere in Europe during the last decade. The most prominent events before this year were Rhine (December 1993 and January 1995), Odra (July 1997), England/Wales and Central Europe (October 1998), Danube (May 1999), England/Wales and Switzerland/Northern Italy (Autumn 2000), Wisla (July 2001).

The EC has financed research on floods in the framework of the various environmental research programmes. Flooding has been regarded as both a natural hazard and a water resource management issue. Research has concentrated on achieving a better understanding of causes and on methods of prediction and management of floods and their damage. Emphasis has also been given to climate change related mechanisms and properties of the hydrological cycle (e.g. rainfall, runoff, etc.), that may significantly influence flood characteristics.

Under FP2 (EPOCH programme, 1989-1992) 6 related research projects were supported with an EC contribution of around 4.6 M€ In FP3 (Environment programme, 1991-1994) 12 projects were supported with an EC contribution of around 8.4 M€. Under FP4 (Environment and Climate programme, 1994-1998), 14 projects with an EC contribution of around 10 M€ were funded.

In FP5, flood research was supported principally by the Key Actions "Global Change, Climate and Biodiversity" and "Sustainable Management and Quality of Water" to the extent of some 35 M€

2. The Key Action "Sustainable Management and Quality of Water": In Europe real-time flood forecasting schemes have been developed without a clear understanding of their real potential and limitations. They were not conceived as a means for reducing the "uncertainty" of future outcomes. Accordingly **this Key Action supports research leading to more reliable operational decisions.** It is aiming at improving the scientific and technological limitations of existing flood forecasting and warning systems and at creating a chain based upon measurements, models and information technology with the perspective of quantifying and reducing the uncertainty of forecasted future scenarios.

Two activities are of particular interest. First, the creation of a cluster (ACTIF) to establish a focus on flood forecasting research in Europe and to facilitate the development of methods, techniques and know-how, to enhance complementarity and synergy between the FP5 projects and to co-ordinate the collection of data and interpretation of project results, and to **disseminate related information to the public, policy makers, end-users and other stakeholders.** Second, the compilation of a comprehensive manual for creation of natural flood defences (ECOFLOOD) to **stimulate the creation of floodplains that both protect the environment against floods and provide opportunities for restoration and protection of highly valuable ecosystems.**

Other work aims to better understand the climate change related mechanisms of the hydrological cycle, and to assess the uncertainty in predictions of climate change impacts of changes and in climate variability on crucial hydrological and hydraulic systems, such as those used for flood protection.

3. The Key Action “Global Change, Climate and Biodiversity”: The aim of this Key Action is to develop the scientific, technological and socio-economic basis and tools necessary to study and understand changes in the environment. One important issue is to fund generic research to support the fight against major natural and technological hazards including hydro-geological hazards.

Main objective of these projects is the development of new and improved methodologies to forecast, mitigate and prevent floods through:

- increased understanding of mechanisms and processes;
- integrated studies of the occurrence of extreme flood events;
- linkage of meteorological and hydrological events with climatic forcing (related to historical as well as to future events in a changing climate);
- assessment, management and mitigation of risks resulting from floods, landslides, avalanches and large storms;
- examination of relations of floods with land use and land cover changes.

FP-5 projects with relevance to research on this year's flood events deal with:

- **the development of a European flood forecasting system for 4-10 days in advance, which can provide daily information on potential floods** (Project EFFS). Based on this early warning, forecasters can implement enhanced local forecasting and disaster prevention plans. EFFS organises jointly with JRC an international conference in Rotterdam in March 2003 to present and discuss the main research results (including critical assessments of flood forecasting and warning during the recent European floods);
- **the investigation of extreme flood processes and uncertainty, which will allow a more reliable estimate of potential flood risk in the event of extreme floods** (Project IMPACT). This will lead to improved accuracy of predicting flood conditions in urban areas, which is highly relevant for the recent floods. The IMPACT consortium has already started to collate field data from the recent flood events;
- **the mitigation of climate induced hazards** (Project MITCH). This project concentrates on linking the various research institutes from completed European research projects, which dealt with the management and mitigation of natural hazards (main focus on floods). The aim is to assist planning and emergency management by evaluating the state of research and by attempting to match that with both users perceptions and needs. MITCH could provide a forum to specifically examine the effectiveness and lessons to learn from emergency management in reducing and mitigating the flood damage of the recent European floods.

A short description of two prominent FP4 projects and all ongoing FP5 flood research projects is given in the annex.

4. Outstanding research challenges

Past research projects highlighted outstanding research challenges and called for raising awareness and enhancing the consultative process between users and the researchers.

- **More concerted EU research action is needed to make use of recent technological advances in radar, satellite, and aircraft measurement techniques for real-data rainfall collection.** An optimal combination of these data with in-situ data from rain gauges is needed for application in operational weather forecast and river basin models and post-event field surveys;
- **Intelligent coupling of numerical weather forecast models with runoff models** is still an important matter of research (both to be operated at different scales in space and time, which makes coupling very difficult);

- Model intercomparison studies and GIS systems for direct comparison of model forecasts are very important to support **the choice of the right flood forecasting model to meet the user's specific needs**;
- **Hydrologists and meteorologists should be more closely linked together** to improve the ability and to reduce the uncertainty of river basin models and operational flood forecasting systems. First results from the recent floods show that the newly developed river models for Prague (CZ) were inaccurate and underestimated the magnitude of the floods but over-predicted the consequences. This had profound impacts on the disaster planning process. Large river models need to be updated in real-time. **The disaster planning process throughout Europe is still insufficiently linked with the modelling.** The flooding of Prague with such dreadful economic consequences illustrates this requirement.
- **Flash-floods have been significantly less studied than floods occurring in basins larger than ca 500 km².** In many flash-flood cases, the rain accumulations and the discharges are simply unknown over most of the concerned drainage basins. Flash-floods develop at space and time scales that conventional observation systems of rain and discharges in rivers are not able to monitor. As these events are rare, they also escape to temporary experimental settings (e.g. MAP). During such periods, methodical assessments of social, economic and ecological impacts are very seldom. Consequently, the atmospheric and hydrological generating mechanisms of flash-floods are poorly understood;
- There exist several **strategies for flood protection and management.** Current management strategies tend to favour structural large-scale defence measure, such as dikes, dams, flood control diversions, etc. However, it will never be possible to guarantee absolute safety and therefore a change of paradigm towards non-structural flood protection measures, such as floodplain management, flood forecasting and warning systems, risk assessment (e.g. identification and ground truth mapping of regions/localities of highest flooding risk in a given river drainage basin), economic instruments, awareness raising and improving information is needed;
- A significant portion of the increase in flood hazard has been caused by direct human pressure, which will continue to be active in the future. However it is becoming more evident that climate variability and climate change will increase the overall number and intensity of extreme events and water related disasters. These **implications of climate variability and climate change have not been fully considered in current water policy and decision-making frameworks and need to receive proper attention**;
- Several EC projects paid particular attention to **involving end users in research projects** in order to increase awareness, rectify various misconceptions about floods and flood protection rooted in people's mind and inform and help stakeholders making rational decisions for choice of flood protection strategies. This consultative process **should be strengthened.**

5. Future research perspectives in FP6

In FP6 flood research will be supported under the priority thematic area "Sustainable development, global change and ecosystems". Floods together with other extreme events like drought have to be seen within the context of sustainability. Results of past and ongoing EC funded research projects and the ideas expressed in the recent Expression of Interest on the priority theme 1.1.6.3 "Global Change and Ecosystems " call for **more integrated approaches, bringing together flood forecasting and management, climate change and variability, floodplain evolution and sustainability in the context of socio-economic growth, and strategies and technologies for natural hazards reduction and mitigation of their consequences.**

ANNEX

Examples of results and their application for past and ongoing research projects

A) Past research projects (FP4)

Several past EC research projects provide important scientific and technological insights and contributions for policy implementation, as it can be highlighted in the following two examples:

- The **WRINCLE** project

The impacts of climate change and climate variability on the hydrology and water resource systems of Europe are of major concern. Decision makers and water resource managers require hydrological information for the future in spatially detailed and easily understood formats. Currently, the only credible source of possible future climate projections is the output from General Circulation Models (GCMs). However, there is a serious obstacle to the provision of hydrological climate change scenarios. The observed spatial variability of rainfall cannot be represented by GCMs operating with very large grid squares, and as important hydrological processes occur at hillslope and catchment scales of up to only a few 100 km², we are unable to simulate runoff and streamflow correctly using GCM output directly. The WRINCLE project was initiated in order to develop a strategy for using GCM output in a sophisticated way: a 'downscaling' procedure to produce realistic spatial-temporal rainfall fields.

The major advances and products of the WRINCLE projects are the following:

- Improved statistical downscaling procedures for daily rainfall, which allows more reliable estimates of future rainfall at high spatial resolution to be derived from coarse GCM results;
- Regionalised model for predicting river flows from rainfall inputs, which allows more reliable estimates of future river flows;
- Regionalised model for predicting snow accumulation and melt from rainfall and temperature inputs, which allows more reliable estimates of future water availability from seasonal snow melt in mountainous regions;
- European model for producing detailed rainfall time-series for current and future climates. This allows high space and time resolution time series to be generated, which may be used for hydrological and engineering designs for flood protection, water resource systems etc;
- European data sets at 50 km resolution giving statistics of key hydrologic variables for current and future climates and available on internet at dedicated web-site and on CD. This allows hydrological scenarios to be generated at any location in Europe to be used in hydrological and engineering designs;

- The **EUROTAS** project

The EUROTAS project took a catchment scale view of flood management through linking hydrological and hydrodynamic models of flood propagation with a GIS and a database to economic and land-use data to provide a perspective on both flood hazard and flood vulnerability. Through an Integrated Catchment Model (ICM) the change in risk can be identified for river management and flood defence strategies and interventions. This approach facilitates dialogue between government organisations, industry and other stakeholders in the use and management of the floodplain and assists with the development of sustainable solutions to unacceptable flood risks. Five catchments (one of them the Elbe catchment situated in the Czech Republic and Germany) for the demonstration of the ICM were chosen to provide several climatic types and flooding regimes and they also represented some transboundary catchments, which are of specific interest in the context of European flood management. The project has resulted in:

- a prototype Integrated Catchment Model (ICM) for flood risk assessment which facilitates the compilation of data, commissioning process model simulations, viewing of simulation results and interpretation of results in terms of flood risk;
- development of procedures for model use to examine flood risk (hazard and vulnerability), for current conditions and for scenarios of river engineering measures, land-use and climatic forcing;
- development of a prototype Decision Support System (DSS). This allows mitigation flood risk to a specific town or larger area of catchment, either in the context to design a defence scheme for flood risk management or in the examination of future scenarios for environmental change;
- development of an Expanded Downscaling (EDS) method to generate future climate change scenarios on flooding at a specific site based on historic records and scenario predictions from General Circulation Models (GCM);
- advancement in knowledge and understanding on assessment of flood risks for current conditions and under future scenarios in specific river catchments across Europe.

B) Ongoing research projects (FP5)

The following 12 FP5 projects are related to flood research:

ACTIF: *Achieving Technology Innovation in Flood Forecasting*

The ACTIF project is an accompanying measure currently under negotiation, which should commence work in late 2002. ACTIF shares a common approach to some parts of MITCH but on the more specific issue of flood forecasting, with the objective of clustering and consolidating the research actions and outputs on this theme across the Fifth Framework Programme. ACTIF aims to broaden the scope of flood forecasting and warning by integrating results across several current EC research projects.

Thus ACTIF will contribute the promotion of sustainable development through the reduction of economic loss from flooding and improvement of public safety by non-structural methods. It will improve the interdisciplinary scientific linkages between specialists in meteorology, hydrology and hazard mitigation with principal users. These are concerned with the planning, design and operation of facilities aimed at providing protection and support of society from the impacts of flooding. ACTIF will, therefore, also seek to recognise the needs of society from the scientist, particularly in the working group on forecast dissemination requirements.

ADC-RBM: *Advanced Study Course in River Basin Modelling for Flood Risk Mitigation*

The aim of this course is to disseminate in October 2002 to 40 young European researchers and professionals knowledge and understanding from recent research on river basin modelling and the management and mitigation of river flood risk. The course is given by guest lecturers from leading European institutes in the areas of integrated modelling tools and systems, river sediment mechanics, flood forecasting and warning, risk assessment, economics of flood alleviation, sustainable flood defence options.

CARPE DIEM: *Critical assessment of Available Radar Precipitation Estimation techniques and Development of Innovative approaches for Environmental Management*

CARPE DIEM aims to improve real-time estimation of radar rainfall fields for flood and flash-flood forecasting, by coupling multi-parameter polarisation radar data and NWP, and exploiting NWP results in order to improve the interpretation of radar observations. The principal objective will be to assimilate in the currently available NWP methods information from Doppler Radar moments and reflectivity along with other remote sensing data. CARPE DIEM seeks to identify how conventional raingauges, Doppler radar data, together with remote sensing data, may be

best linked to NWP models so that the prediction and estimation of severe rainfall can be qualitatively and quantitatively improved.

ECOFLOOD: *Towards Natural Flood Reduction Strategies*

Former floodplains in many European countries increasingly suffer from serious floods due to intensified human activities and a climatic change. At the same time, highly valuable floodplain habitats are degrading. There are interesting opportunities to create areas that can both serve as a flood defence and as valuable wetland ecosystems. This requires integration of many research fields, such as bio-geochemistry, hydrology, socio-economy and ecology. Although each of these research fields is investigated thoroughly, there is a knowledge gap regarding their interrelations and scientific output is often not appropriate for stakeholders. The ECOFLOOD accompanying measure (contract currently under negotiation) will support a series of workshops and a conference to reduce the gap between the research community and the stakeholders and to elaborate a manual for stimulating the idea of natural floods defence strategies.

EFFS: *A European Flood Forecasting System*

EFFS is developing a prototype of a European flood forecasting model system for 4-10 days in advance, which can provide daily information on potential floods for large rivers, and flash floods in small basins. It utilises state-of-the-art meteorological forecasts from weather services of the various EC member states to provide early flood warning to local river basin and civil protection authorities.

Based on this early warning, forecasters can implement enhanced local forecasting and disaster prevention plans. At this moment the EFFS project consortium is being enlarged to include institutes from Eastern European countries. EFFS organises jointly with JRC an international conference in Rotterdam in March 2003 to present and discuss the main results of EFFS (including critical assessments of flood forecasting and warning during the recent European floods).

FLOODMAN: *Near real-time flood forecasting, warning and management system based on satellite radar images, hydrological and hydraulic models and in-situ data.*

The FLOODMAN project is currently under negotiation and should commence work in late 2002. The main objective of this project is to develop, demonstrate and validate a prototype information system for cost effective near-real time flood forecasting, warning and management using EO data, in particular space borne Synthetic Aperture Radar (SAR) data, hydrological and hydraulic models and in-situ data. The project will develop improved methods for near-real time continuous monitoring of flood extent from EO data, in particular space borne radar data. Utilisation of near real-time information on flood extent combined with risk assessment and model data in an expert system will provide the users with a new an innovative tool in support for flood management and forecasting.

The results of this project will improve the operative monitoring and management of water resources by improving the spatial quality of current information and the accuracy of forecasting models. Combining such information with risk assessment data in a distributed GIS environment will bring the management of flooding a major step forward. The consortium will use RADARSAT images from this year's floods to test the potential of such EO data in flood monitoring.

FLOODRELIEF: *REaL-tImE Flood Decision Support System Integrating Hydrological, Meteorological and Remote Sensing Technologies*

The main objective of FLOODRELIEF (contract currently under negotiation) is to address the limitations of current flood predictions by developing and demonstrating a new generation of flood forecasting methodologies. In particular accurate rainfall forecasts using numerical weather forecasting models are intended to provide significant increases in forecast lead-time and thereby give greater opportunity to investigate flood warning and protection measures. The project activities include developing and refining a novel meteorological modelling approach using Internet technology and data assimilation techniques that permits accurate, cost effective real-time meteorological modelling. Improving the spatial and temporal resolution of rainfall forecasts by developing and improving the capabilities of dynamical downscaling using state-of-the-art non-hydrostatic modelling.

Advantage will be taken of the higher spatial and temporal resolution of weather radar data combined with meteorological models to develop novel quantitative precipitation forecasts (QPF) that can resolve flood-producing storms at even smaller scales. Improved flexible grid-based flood forecasting models will be developed that can better take advantage of grid-based input data from radar and meteorological modelling and treat the coupling of land and atmosphere. Furthermore the project aims to develop a framework and implement a number of novel and efficient operational quantitative methodologies for estimating forecast uncertainties and to develop a highly accessible Internet-based real-time Decision Support System (DSS), integrating these new capabilities. These improved technologies for flood forecasting will be evaluated through tests on two highly flood prone regional basins.

IMPACT: *Investigation of Extreme Flood Processes and Uncertainty*

The IMPACT project focuses on three main flood process areas, namely breach formation, flood propagation and sediment transport. The work IMPACT is doing will allow a more reliable estimate of potential flood risk in the event of extreme floods and failure of defences. In addition, the uncertainty associated with predicting these processes will also be assessed and implications for end user application considered. This will contribute to improved accuracy in flood prediction models.

First assessments for the recent floods showed that the modelling work undertaken for Prague was fairly inaccurate in comparison to the real event. The magnitude of the floods was first underestimated, but the conditions resulting from a given flood were also over predicted. If a more accurate prediction of conditions had been made – and the range of uncertainty associated with the prediction also given – then emergency action may well have improved. The IMPACT consortium already started to collate more data from the recent flood events.

MANTISSA: *Microwave Attenuation as a New Tool for Improving Stormwater Supervision Administration*

The principal objective of the MANTISSA Project is to carry out field experiments, based upon theoretical analysis, to test the feasibility of using microwave attenuation measurements to improve the management of stormwater flows, including flash floods, in steep-sided rural and urban drainage basins. The use of microwave attenuation measurements will be investigated both singularly, and within hybrid observing systems using rain-gauges, communication links and weather radar information.

During the first half of the MANTISSA project three new prototype microwave links have been designed and assembled for deployment in Germany (Emscher catchment) and Italy (Sondria catchment and Rio Centonara catchment). It is planned to mount an integrated field experiment, open to other research groups, in the Rio Centonara catchment between April and June 2003. A new stochastic state space approach to the implementation of hydrological models has been

developed. An alpha version of the software is now available, and a beta version should be available in autumn 2002. This new modelling infrastructure will be utilised to assess the utility of microwave communication link estimates of line integrated rainfall for flood forecasting in comparison with the use of rain-gauge and radar data.

MITCH: *Mitigation of Climate Induced Hazards*

MITCH is concentrating on bringing together the various research institutes from completed European RTD projects, which dealt with the management and mitigation of natural hazards with a meteorological cause, in order to assist planning and management. The main focus is on flood forecasting and warning, but it also includes other flood related hazards, such as landslips and debris flow, and longer term climate hazards, such as drought, and the possible impact of climate change on the frequency and magnitude of such hazards.

Through a series of 3 workshops and an active website it is enabling important links between researchers and end-users in the field of natural hazard mitigation and management. MITCH could provide a forum to specifically examine the effectiveness and lessons to learn from emergency management in reducing and mitigating the flood damage of the recent European floods.

MUSIC: *Multi-sensor precipitation measurements integration, calibration and flood forecasting*

The MUSIC project aims at improving the reliability of rainfall estimation techniques based on radar and Meteosat, by combining them, in an objective and optimal way, with the traditional rain-gauge observations. A further project objective is to communicate and to disseminate results to the authorities involved in real-time flood forecasting and management. For each of the above sensing technologies the project will develop improved precipitation estimation algorithms, assess their uncertainty and use an innovative combination of the output data of the three independent data sources to provide a more reliable short term flood forecasting system together with a measure of its uncertainty. The system will considerably improve the flash flood forecasting reliability and precision and will shorten the time required to detect events, which lead to catastrophic flood events. The system is applicable to small as well as to medium size catchment areas and can be used for very short term (1 to 6 hours) forecasting systems and, in combination with a Local Area Meteorological Model, for medium term (up to 2 days) forecasting systems.

SPHERE: *Systematic, Palaeoflood and Historical data for the improvement of flood Risk Estimation*

The catastrophic floods that have occurred recently in Europe warn of the critical need for hydrologic data on floods over long-time scales. Paleohydrological techniques provide indirect information on hydrologic variability and extreme floods over long-time intervals (100 to 10,000 yr.) and may be used in combination with historical flood data (last 1,000 yr.) and direct gauge records (last 30-50 yr.).

New methods of reconstructing paleofloods and the historical flood record of these basins lead to the elaboration of a complete catalogue of major past floods. Systematic and non-systematic data are being combined for flood frequency analysis, using improved methods for the adjustment of distribution functions. The generated database can be used in the long-term to improve knowledge of the relationships between extreme flood events and associated climatic forcing, which helps to suggest strategies for improving public awareness and risk education regarding extreme flood events.



EU Research on Floods

February 2003

- *Past and current research during the 5th EU Research Framework Programme (FP5)*
- *Outlook into the 6th EU Research Framework Programme (FP6)*
- **GMES**
- **EU-MEDIN**

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Motivation for EU Research on Floods -> recent disasters



A very similar flood situation happened in Jan. 1995 again.

Photograph (BfG):
Koblenz, Germany,
published on
New York Times
cover page

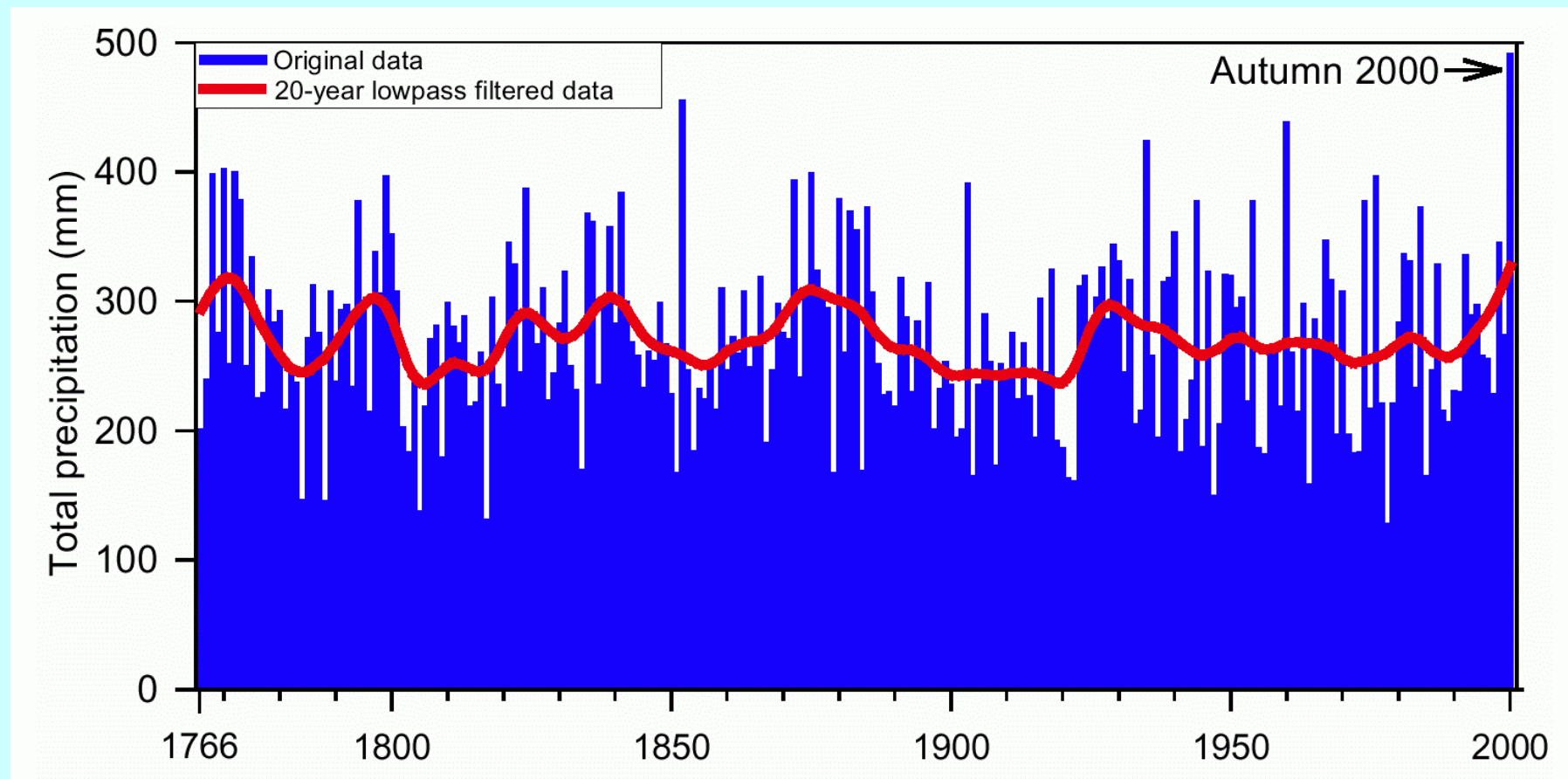
Rhine and Mosel river flooding in December 1993



Motivation for EU Research on floods -> climate change

The Flood Disaster in Europe, Autumn 2000

Time-series of seasonal precipitation for England and Wales (after CRU, UK)





DG RTD: FP5 - Environment & Sustainable Development Programme

- ◆ EC funded research in the FP5 **Generic activity**
'Fight against major natural and technological hazards'
(DG RTD/I.2) - 1998-2002

- ◆ More than **80 research projects** with a **total EU contribution**
of **~ 70 Million Euro** regarding:
 - **Floods**
 - **Landslides**
 - **Avalanches**
 - **Forest Fires**
 - **Earthquakes**
 - **Volcano eruptions**
 - **Industrial risks**



DG RTD: FP5 Research on Floods **(EU Support about 35 Million Euro)**

Development of new & improved methodologies to forecast, mitigate and prevent floods through:

- ◆ increased understanding of mechanisms & processes;
- ◆ integrated studies of the occurrence of extreme flood events;
- ◆ linkage of meteorological and hydrological events with climatic forcing;
- ◆ assessment, management and mitigation of risks resulting from floods, landslides, avalanches and large storms;
- ◆ examination of relations of floods with landuse and landcover changes.



FP5 Projects on Floods “Natural Hazards”

◆ ***EFFS***: *A European Flood Forecasting System*

<http://effs.wldelft.nl>

- ◆ develops a prototype of a European flood forecasting system for 4-10 days in advance, which could provide daily information on potential floods for large rivers, and flash floods in small basins.

◆ ***SPHERE***: *Systematic, Palaeoflood and Historical data for the improvement of flood Risk Estimation*

<http://www.ccma.csic.es/dpts/suelos/hidro/sphere/index.html>

- ◆ develops a new approach which complements hydrologic modelling and the application of historical and paleoflood hydrology to increase the temporal framework of the largest floods over time spans from decades to millennia; in order to improve estimation of extreme flood occurrences.



FP5 Projects on Floods “Natural Hazards”

◆ **THARMIT**: *Torrent Hazard Control in the European Alps*

<http://www.geol.unipd.it/convegna/EUtharmit.htm>

- ◆ develops practical tools and methodologies for hazard assessment, prevention and mitigation, and devises methods for saving and monitoring potentially dangerous areas.

◆ **CARPE DIEM**: *Critical assessment of Available Radar Precipitation Estimation techniques and Development of Innovative approaches for Environmental Management.*

<http://carpediem.am.ub.es/home>

- ◆ improves real-time estimation of radar rainfall fields for flood forecasting by coupling multi-parameter polarisation radar data and NWP, and exploits NWP results in order to improve the interpretation of radar observations.



FP5 Projects on Floods “Natural Hazards”

- ◆ ***IMPACT***: *Investigation of Extreme Flood Processes and Uncertainty*

http://www.samui.co.uk/impact-project/Impact_project_overview.htm

- ◆ investigates extreme flood and defense failure processes, their risk and uncertainty. Considers dam breach formation, sediment movement, flood propagation and predictive models, within an overall framework of flood risk management.

- ◆ ***GLACIORISK***: *Survey and Prevention of Extreme Glaciological Hazards in European Mountainous Regions*

<http://glaciorisk.grenoble.cemagref.fr>

- ◆ develops scientific studies for detection, survey and prevention of glacial disasters in order to save lives and reduce damages.



FP5 Projects on Floods “Natural Hazards”

◆ ***MITCH***: *Mitigation of Climate Induced Hazards*

<http://www.mitch-ec.net>

- ◆ deals with the mitigation of natural hazards with a meteorological cause, in order to assist planning and management. The main focus is on flood forecasting and warning, but it also includes other flood related hazards, such as landslips and debris flow, and longer term climate hazards, such as drought, and the possible impact of climate change on the frequency and magnitude hazards.

◆ ***ADC-RBM***: *Advanced Study Course in River Basin Modelling for Flood Risk Mitigation - October 2002*

<http://www.bham.ac.uk/CivEng/rbm/index.htm>



FP5 Projects on Floods “Natural Hazards”

- ◆ **FLOODMAN**: *Near real-time flood forecasting, warning and management system based on satellite radar images, hydrological and hydraulic models and in-situ data*

no web page so far, because project started on Feb 1st 2003

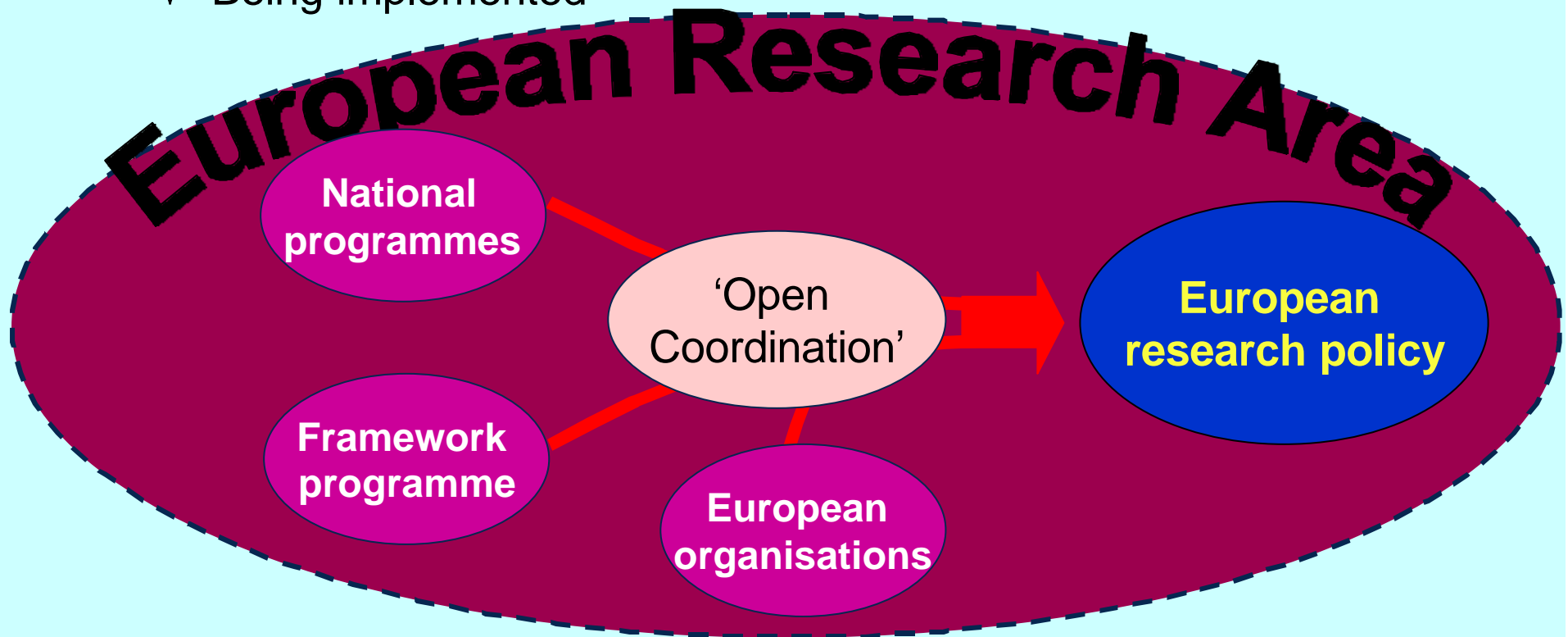
- ◆ near real-time monitoring of flood extent using spaceborne SAR, optical data & in-situ measurements, hydrological and hydraulic model data. The result will be an expert decision system for monitoring, management and forecast of floods in selected areas in Europe. The monitoring will also be used to update the hydrological/hydraulic models and thereby improving the quality of flood forecasts.



FP6 (2002-2006)

The European Research Area

- ◆ A blueprint for the future of research in Europe
- ◆ Broad support at the highest political, scientific and industrial levels
- ◆ Being implemented





The 6th Research Framework Program of the EU

Proposed budget of FP6

◆ 17.5 Billion Euro

= about 3.9% of the total EU Budget in 2001

= about 5% of the total national R+D programs

(but 25% of all public financed R+D projects)

◆ 700 Million Euro in FP6 for Research in
Sustainable Development and Global Change

◆ Average research effort in the EU only 1.9% of the
total EU GDP (USA: 2.6%, Japan: 2.9%)

◆ until 2010 to be increased to 3% of the GDP



The 6th Research Framework Program of the EU

Instruments to be used

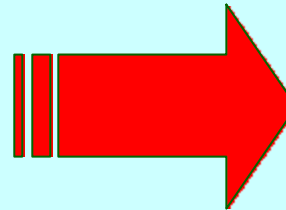
- ◆ Integrated Projects (IP) - **New!**
- ◆ Networks of Excellence (NE) - **New!**
- ◆ Specific Targeted Research Projects (STREP)
- ◆ Co-ordination actions (CA)
- ◆ Specific support actions (SSA)



The 6th Research Framework Program of the EU

Integrated Projects

Objectives
*Real breakthroughs,
Support to Industry,
Sustain. Development*



Clear and
Quantified
Deliverables and
Integration...

... across Activities

from basic research
↓
Support to SMEs
↓
Technology transfer
↓
to dissemination and training...

**50%
EC Funds**

... across Scientific Areas

*Climate change,
carbon sinks,
ozone depletion,
water cycle,
ecosystems*

... among participants and funding bodies

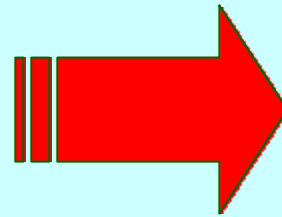
governments, contractors, industry, universities, research institutes, etc.



The 6th Research Framework Program of the EU

Networks of Excellence

Objectives
*To assemble EU
Research Capacities
and strengthen S & T
Excellence*



Advancing
Knowledge and
Integration ...

Joint Program of Activities (JPA)

*Coordination of partner's
activities, sharing
platforms and facilities,
staff mobility*

**100% EC Funds
for Integration of
resources**

***... to strengthen EU poles of
excellence***

*global change,
water management,
biodiversity,
natural disasters*

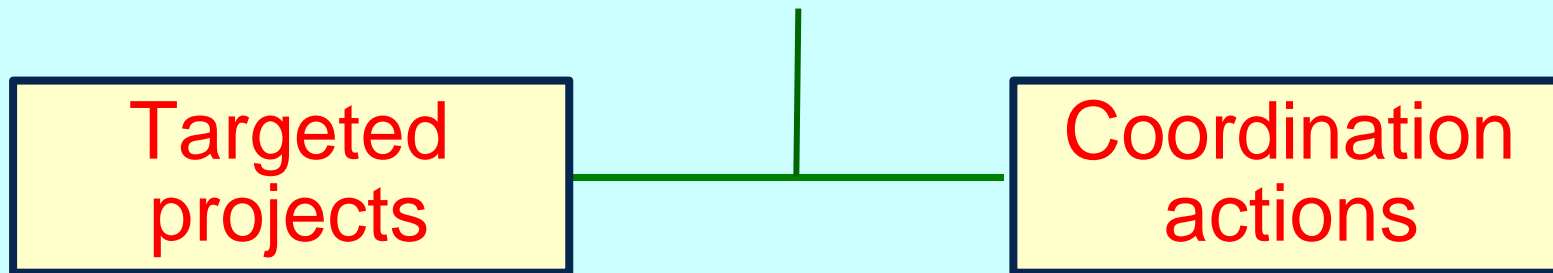
***Participants Wishing a Progressive and Lasting
Integration of Research Capacities***



FP6 Research

Stairways of Excellence

will help preparing more ambitious and strategic projects



- ◆ More traditional projects
- ◆ Research at frontier of knowledge or supporting high-tech SMEs
- ◆ EC funds to RTD activities

- ◆ Stimulating cooperation & coordination between EC and MS activities
- ◆ EC funds only for coordination actions



FP6 (2002-2006)

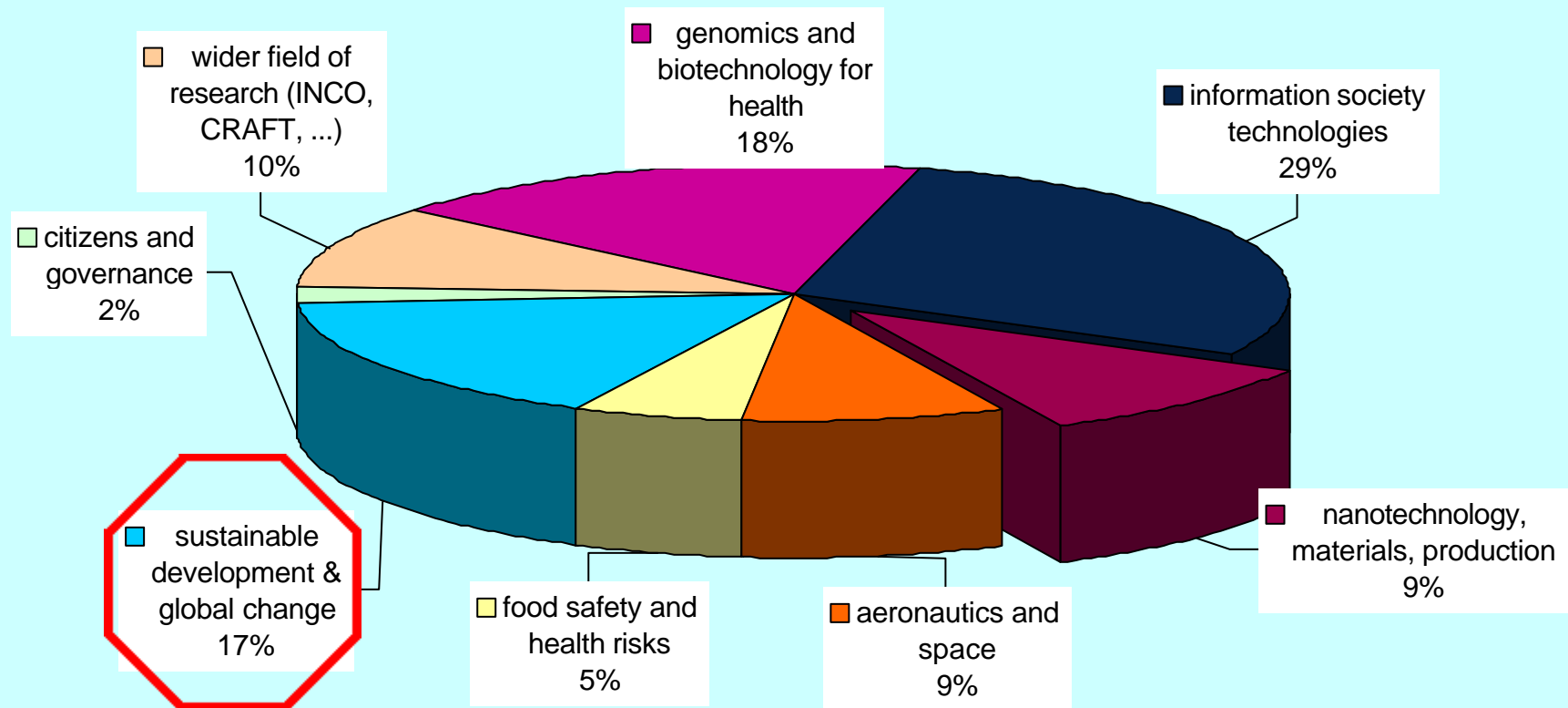
Eight Priority Areas (€17.5 billion):

- 1. Genomics and biotechnology for health
- 2. Information society technologies
- 3. Nanotechnologies, intelligent materials and new production processes
- 4. Aeronautics and space
- 5. Food Safety and health risks
- 6. Sustainable development and global change
- 7. Citizens and governance in the European knowledge-based society
- 8. Policy support - development of the work programme



FP6 (2002-2006)

FP6: Eight Priority Areas (etat in % of total FP6 etat)





FP6 Research on NATURAL DISASTERS in the context of Global Change

Key word: **Sustainability** - Integrated environmental and socio-economic systems

Objective:

Promote European research towards:

- Assessment of natural disasters (**Floods**, Fire, Earthquakes, Landslides, Volcanic Eruptions, Storms);
- Their prevention and mitigation, through improved technologies, intervention methods, pre-disaster planning and preparedness.



FP6 Research on NATURAL DISASTERS in the context of Global Change

Research Tasks (IP/NoE as well as Trad.):

- Natural hazard assessment and forecasting;
- Consideration of climate variability and climate change impacts;
- Methods and technologies for vulnerability, risk and damage assessments;
- Risk management and mitigation.



FP6 Research on NATURAL DISASTERS in the context of Global Change

FP6 Workprogramme structure:

First Call for proposals (Dec 2002)

IV.2 b) up to 1 IP or NoE on

Integrated Flood Risk Management

to be considered in proposals for an IP or NoE:

- Integrated strategies & tools for flood hazard, vulnerability and risk assessment, prevention & mitigation;
- In-land, coastal & estuarine floods;
- Operationalisation of methods & technologies, efficiency & cost of implementation;
- Exchange & dissemination to user communities.



FP6 Research on NATURAL DISASTERS in the context of Global Change

Objectives

- Overall objective of integrated flood risk management: to assess hazard, vulnerability & risk in order to devise sustainable strategies to mitigate (reduce) either the hazard, vulnerability, or risk of flooding.
- Integrated flood risk management necessarily implies the characterisation of flood hazard, flood vulnerability, flood risk and flood mitigation.



FP6 Research on NATURAL DISASTERS in the context of Global Change

Definitions

- **Flood Hazard**: deals with assessing and quantifying the hydro/geomorphological process - why, when, & where a flood of a particular magnitude and frequency may occur. The characterisation of the temporal (frequency) & spatial dimension (magnitude) is fundamental. A flood scenario may either be based on forecasted rain events; natural or man-induced triggering mechanisms; or climate change predictions.
- **Flood vulnerability**: to assess the environmental, social and economic impacts of flood scenarios. This may be achieved by mapping/identifying “vulnerable” assets (people, property, infrastructure, interruption of services, etc.). This implies quantifying the degree (total damage vs: no damage) and cost of expected losses.



FP6 Research on NATURAL DISASTERS in the context of Global Change

Definitions

- **Flood risk**: deals with the probability of a particular flood occurrence and likelihood that all vulnerable assets will be effected. This implies quantifying the monetary cost of all expected losses:
 - **high hazard**: $\geq 40\%$ chance that flood scenario A occurs within 3 years; intermediate 40-20%; low $< 20\%$. Mapping of hazard levels: h, i, and l.
 - **vulnerability**: characterisation of assets that would be affected and the determination of their intrinsic resistance (i.e.: 0 - no damage / 1 - total damage) to a hypothetical hazard of a certain intensity.
 - **risk**: $H \times V =$ mapping of risk zones and affected vulnerable assets. It should also take into consideration the potential “cost” of such losses.



FP6 Research on NATURAL DISASTERS in the context of Global Change

Definitions

- **Flood prevention & mitigation**: exploring possible mitigation measures, either structural (ie: engineering works, dams, etc.) or non-structural (landuse changes, education & public awareness, zoning laws, insurance, etc.), that will either reduce the hazard, (e.g., diverting a stream), vulnerability (e.g., building a dam); and hence risk of flooding.
- **Flood damage assessment**: deals with quantifying the damage after a real flood event. It should consider the environmental, social and economic consequences and their associated costs. Earth observation data may be useful to perform flood area mapping. The evaluation of possible mitigation strategies may be particularly relevant following a flood occurrence.



FP6 - 2003 call for research project proposals

Expertise required:

- ◆ Earth sciences & life sciences & engineering:
geomorphology, hydrology, ecology, etc.
- ◆ numerical modelling and spatial information science
- ◆ remote sensing & image interpretation
- ◆ databases, information management &
information technology
- ◆ sociology
- ◆ economics
- ◆ landuse planning & mapping
- ◆ local authorities, civil protection, re-insurance, etc.
- ◆ ...



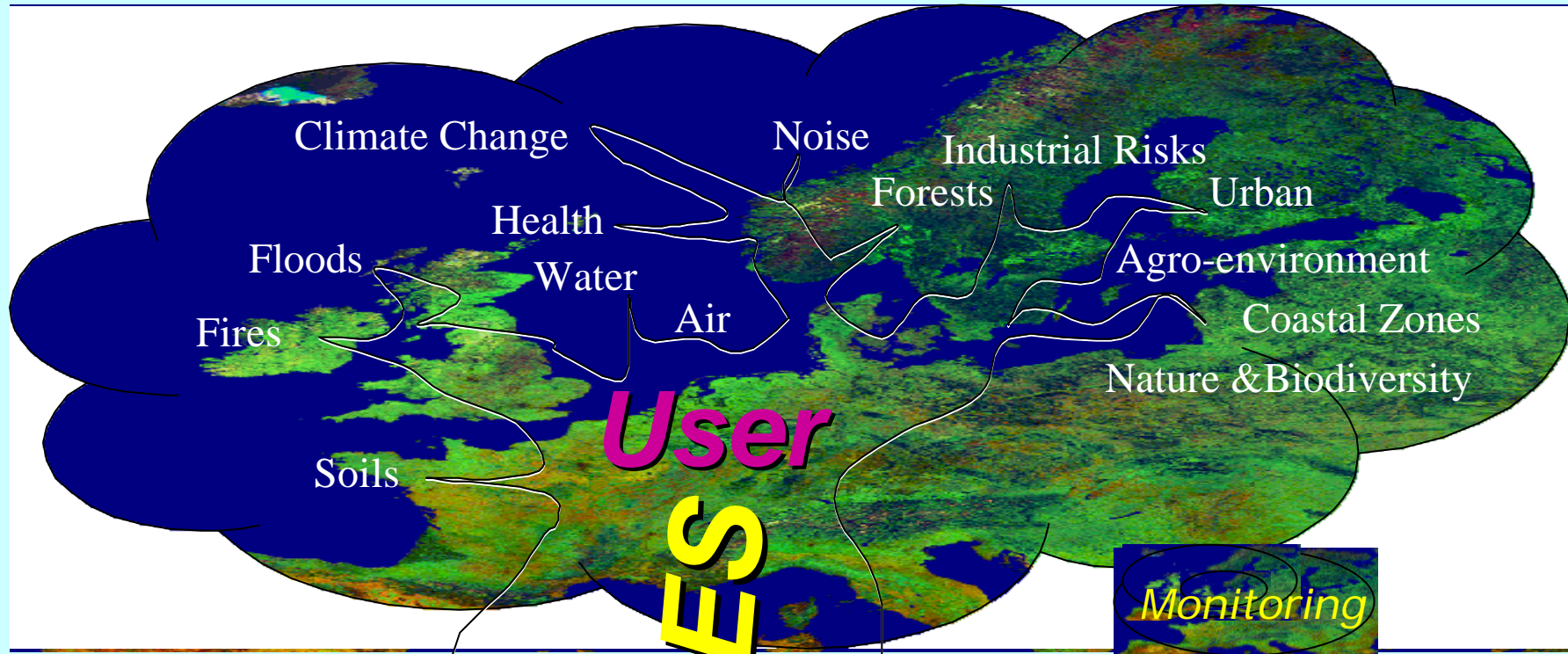
FP6 - 2003 call for research project proposals

Timeframe:

- ◆ 1st call publication date: 17 December 2002
- ◆ 1st call closure date: 8 April 2003
- ◆ 2nd call publication date: June/July 2003
- ◆ 2nd call closure date: October 2003
- ◆ 3rd call publication date: in 2004/2005



Global Monitoring for Environment and Security



GAMES

Topography
Air
Soil
Water
Habitats
Socio-Economic
Land-Use
Meteorological/climatological
Hazards/Risks

Remote Sensing and in-situ Data



Global Monitoring for Environment and Security



GMES Objectives

- ◆ **By 2003:** to identify the strengths and weaknesses of the current capacity and the needs for improvement in the scientific, technical, socio-economic and institutional domains.
- ◆ **By 2008:** to establish an operational and autonomous European capacity for Global Monitoring of the Environment and for Security.

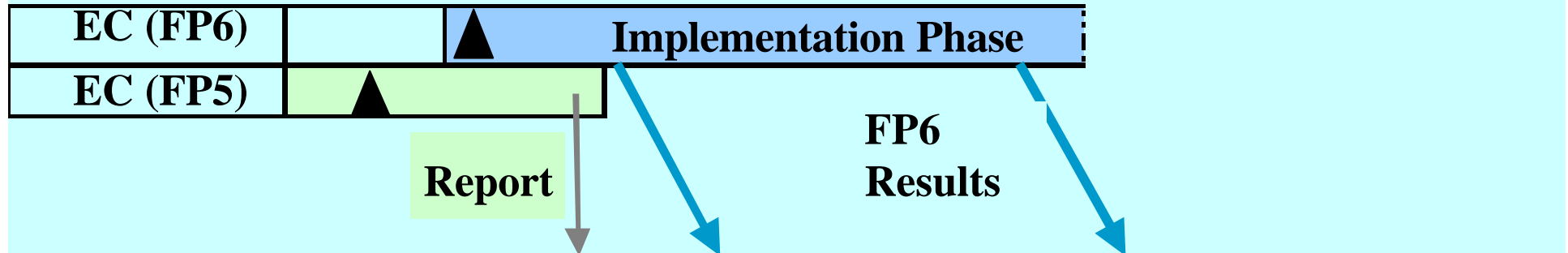


Global Monitoring for Environment and Security

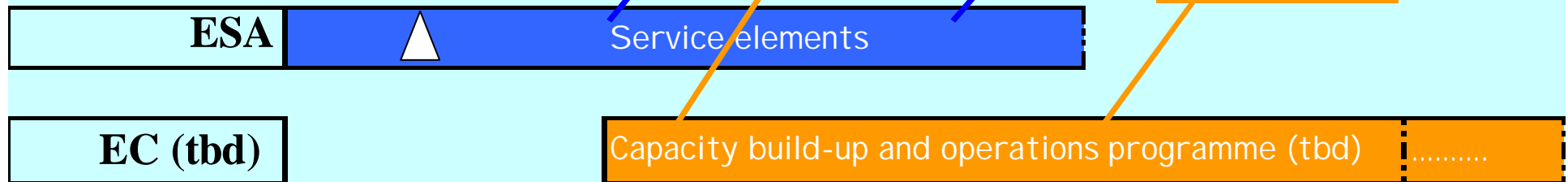


2002	2003	2004	2005	2006	2007	20082009
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R&D



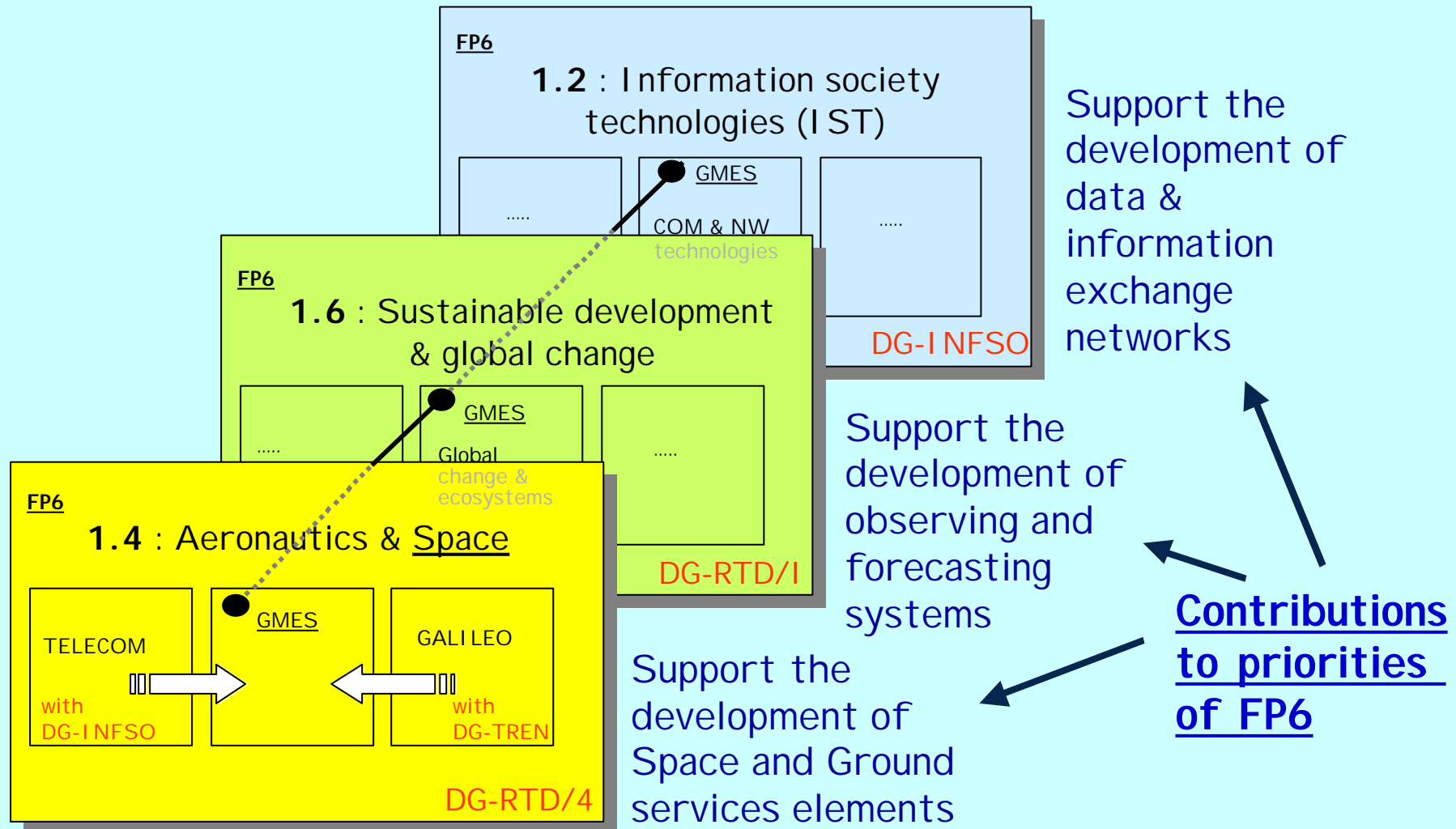
GMES Capacity Build-up



GMES Provisional Planning



Global Monitoring for Environment and Security





EU-MEDIN



“Euro-Mediterranean Disaster Information Network”

- Initiative by EC, DG Research
- Disaster themes: forest fires, floods, earthquakes, volcanoes, landslides, avalanches & technological hazards
- Aim: to foster **co-ordination** among the research & user communities for **improved disaster preparedness** and **early warning, communication, and rapid exchange of data and knowledge**, in order to better **mitigate** and **manage** disasters



EU-MEDIN



- ◆ promoting and disseminating European research (natural science and soft science) results to the RTD community;
- ◆ promoting a strategy for future data standards, formats, and methodologies;
- ◆ assist in coordinating and networking the activities of the European disaster research community;
- ◆ acting as vehicle to stimulate new integrated and applied research and common frameworks for risk assessment;



EU-MEDIN



- ◆ acting as a central node for research results including methods, tools, case studies, datasets, recommendations;
- ◆ exploring strategies to transform and disseminate research results (products, tools, methods and services) to different stakeholders (research community, operational users, public/beneficiaries);

-> EU-MEDIN Conference in Thessaloniki - 26.06. 2003



Further infos on EU Research

Current EU research projects: www.cordis.lu

Info on FP6: europa.eu.int/comm/research/fp6

GMES (open soon): www.gmes.info

EU-MEDIN: www.eu-medin.org



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