



DRIHM

DISTRIBUTED RESEARCH INFRASTRUCTURE
FOR HYDRO-METEOROLOGY

Overview Nicola Rebora

European Commission
Information Society and Media

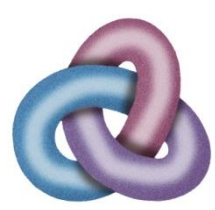


POLITÉCNICA



advancing the frontiers





DRIHM
Distributed Research Infrastructure for
Hydro-Meteorology
1st YEAR REVIEW MEETING

BU33 (Avenue de Beaulieu 33 – BE-1160 Auderghem, Bruxelles)

25 October 2012

09:30-10:00 Project Overview (A. Parodi, CIMA, 20'+10')

10:00-11:00 WP8: HMR experiment suites and WP6: Application Services (Q. Harpham, HRW, 45'+15')

11:00-11:15 Coffee break

11:15-11:45 WP7: Use Case and Application Requirements Analysis (A. Clematis, IMATI-CNR, 20'+10')

11:45-12:15 WP5: Infrastructure Operation and Management, Data and Resource Management (N. gentschen Felde, LMU, 20'+10')

12:15-13:30 Lunch break

13:30-14:00 WP2: Dissemination and Outreach (N. Rebora, CIMA, 20'+10')

14:00-14:30 WP3: Support, Training and Education and WP4: Policy Management, Sustainability and Long Term Vision (B. Jagers, DELTARES, 20'+10')

14:30-15:30 WP1: Project Management (A. Parodi, CIMA, 45'+15')

1530-16:00 Reviewers Meeting

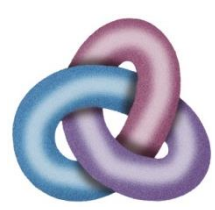
16:00-1630 Review results



➔ The Project

The Partners

The Story so Far



DRIHM @ glance

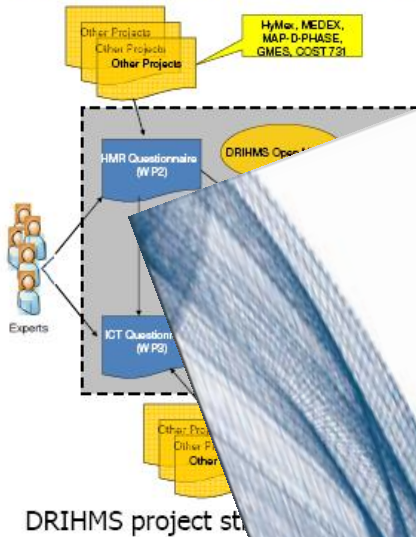
- To **support** the development and deployment of a **HMR e-Science environment**
- To **promote** the establishment and diffusion of a **service-oriented culture** (involving specialist scientist users, members of public services, members of the general public)
- To provide **integrated HMR services**
- To design and deploy **user-friendly interfaces**
- To provide HMR e-Science **support centres** and corresponding **training activities**
- To support hydro-meteorological **forecasting chains**





DRIHM History

DRIHMS Consultation Process



HMR Hot Topics

Full audience	Meteorology	Hydro-Meteorology	Hydrology	Others
Probabilistic forecasting	Probabilistic forecasting	Model verification metrics	Model verification metrics	Model verification metrics
Model verification metrics	Other	Data merging / fusion	Probabilistic forecasting	Probabilistic forecasting
Data merging / fusion	Model verification metrics	Probabilistic forecasting	Precipitation downscaling	Precipitation downscaling
Precipitation downscaling	Precipitation downscaling	Precipitation downscaling	Data merging / fusion	Data merging / fusion

Results revealed clear choices of hot topics and accompanying ICT

Hot topics for HMR research were identified as probabilistic (among meteorologists) and model verification metrics (among meteorologists and hydrologists);

And, the most important ICT challenges were the definition of standards, definition of libraries of tools for data handling and reliability and reliability of high-performance computing

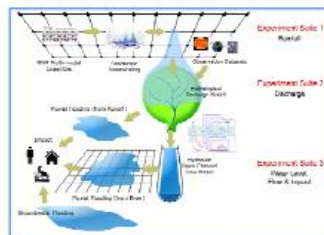
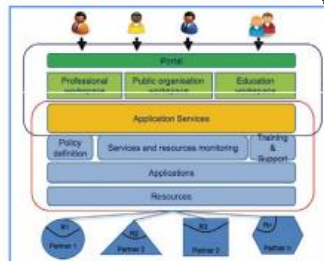
As regards, the key ICT challenges were availability of model compatible formats, and the availability of libraries of well-tested software

These practices yielded a large variety of methods of working, the processing and communication of large data sets

Research was given only a secondary priority by this

Accounting and billing issues seem to be regarded as

A Roadmap for HMR e-Science



Conceptual view of the meteorological problem forecasting chain

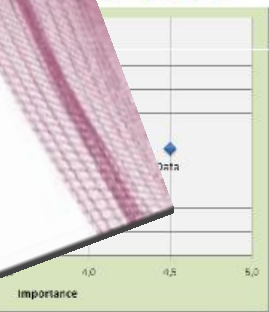


THE WHITE PAPER

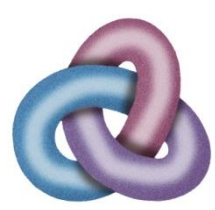
DISTRIBUTED RESEARCH INFRASTRUCTURE FOR HYDRO-METEOROLOGY STUDY

ANNAIRE

for HMR

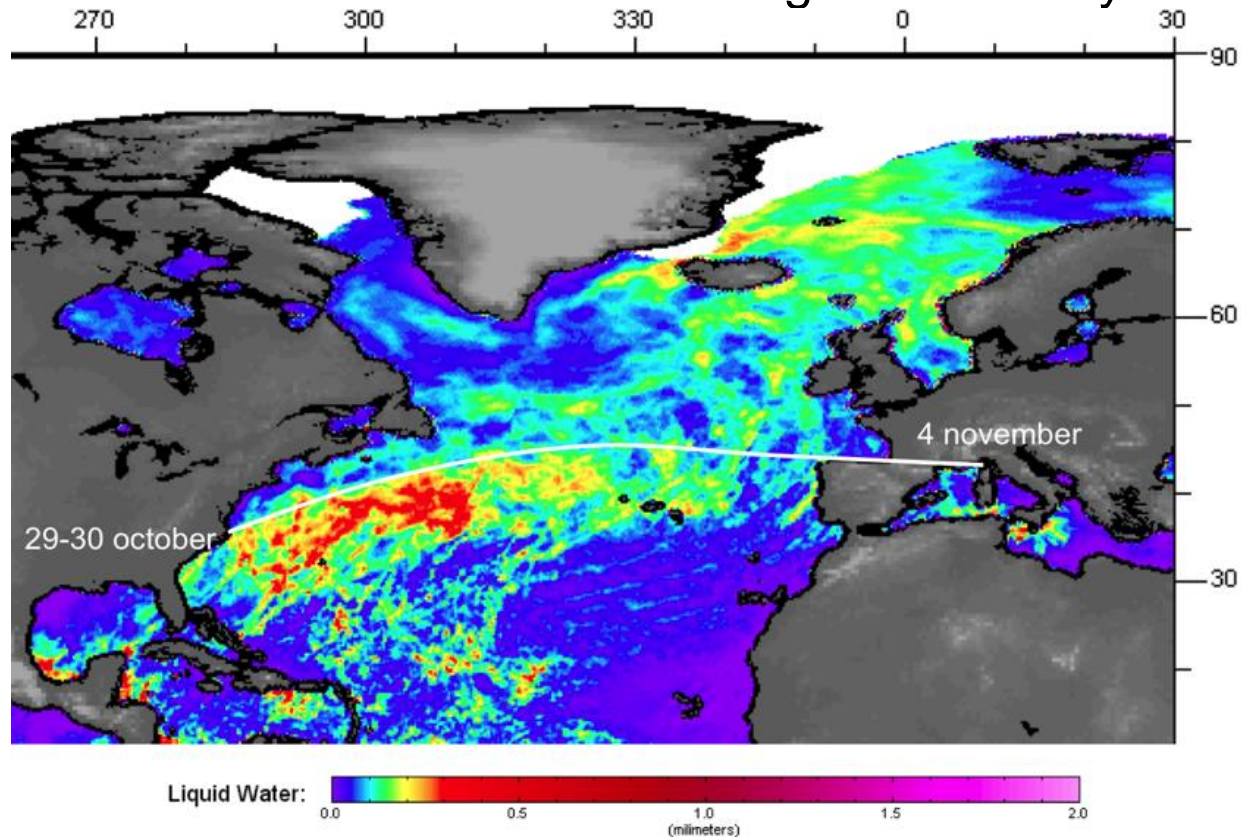


- Important results related to the HMR hot topics are:
- Respondents perceive data management as very important but they do not see significant progress in the next years.
 - High Performance Computing is perceived important and they expect significant progress within the next years.
 - Workflow management is perceived important but no significant progress is expected even short term.
 - Portals and user interfaces are perceived important and the existing solutions seem to fulfill most of the requirements already.
 - Virtual Organization (VO) management is perceived to be less important but sufficiently mature already.



Why DRIHM?

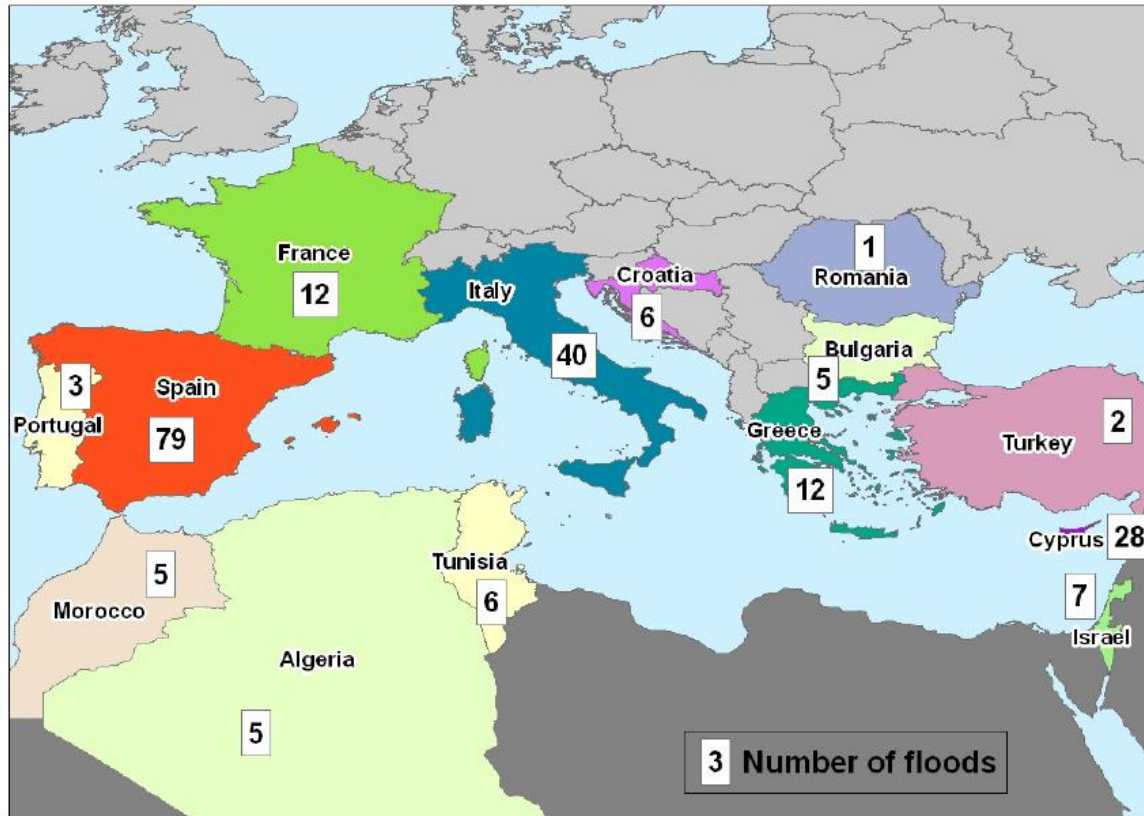
- Forecasting severe storms and floods is a key topic in HMR/early warning
- Storms do not respect country boundaries – a pan-European approach to data access and modeling is necessary



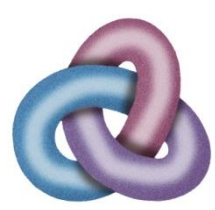
Satellite cloud liquid water composite (week ending 5/11/2011) clearly shows the cyclone track from USA east coast to Mediterranean.



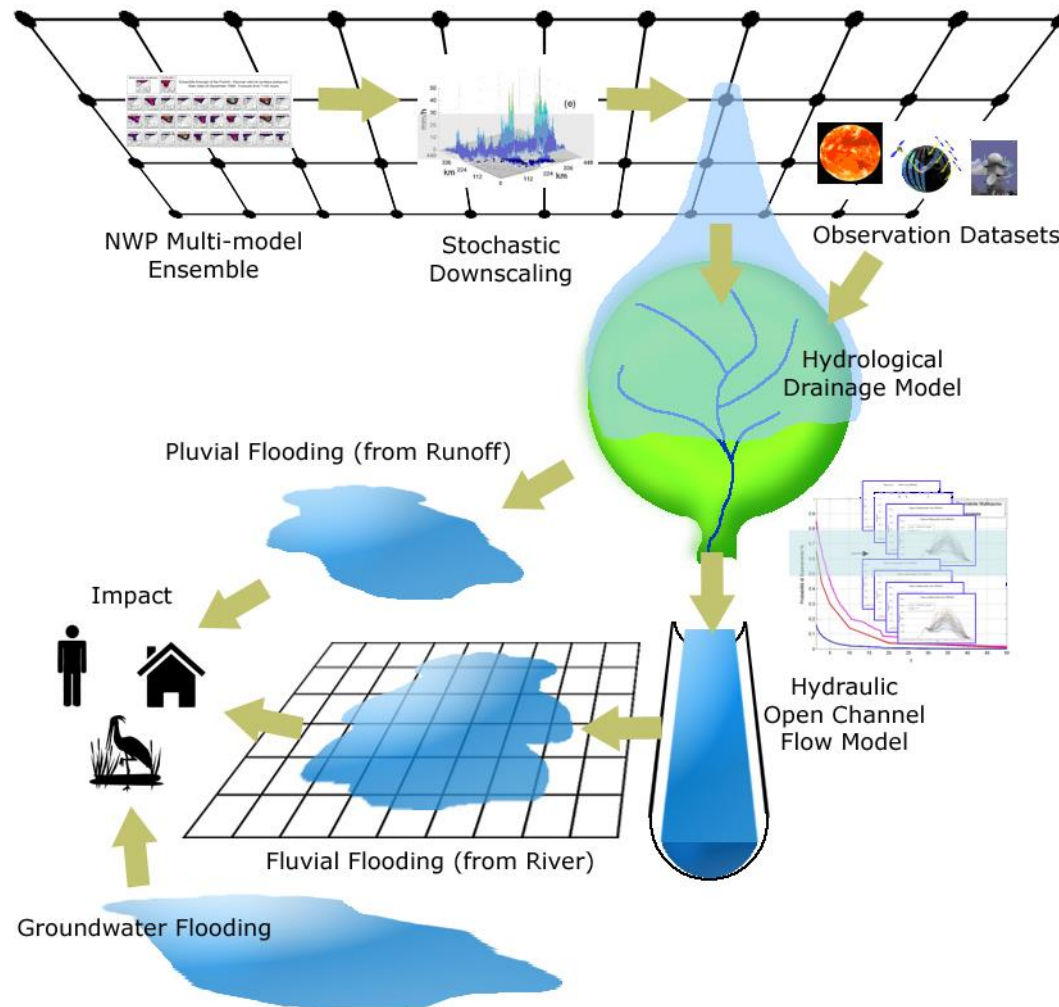
Why DRIHM?



- The FLASH project estimated over 29 billion euros the material damages produced by floods in the Mediterranean region during the 1990-2006 period
- The total number of casualties has been estimated over 4,500, concentrating in the Mediterranean African countries especially



Experiment Suites



Experiment Suite 1

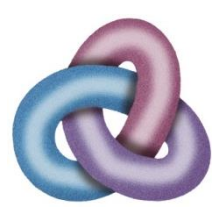
Rainfall

Experiment Suite 2

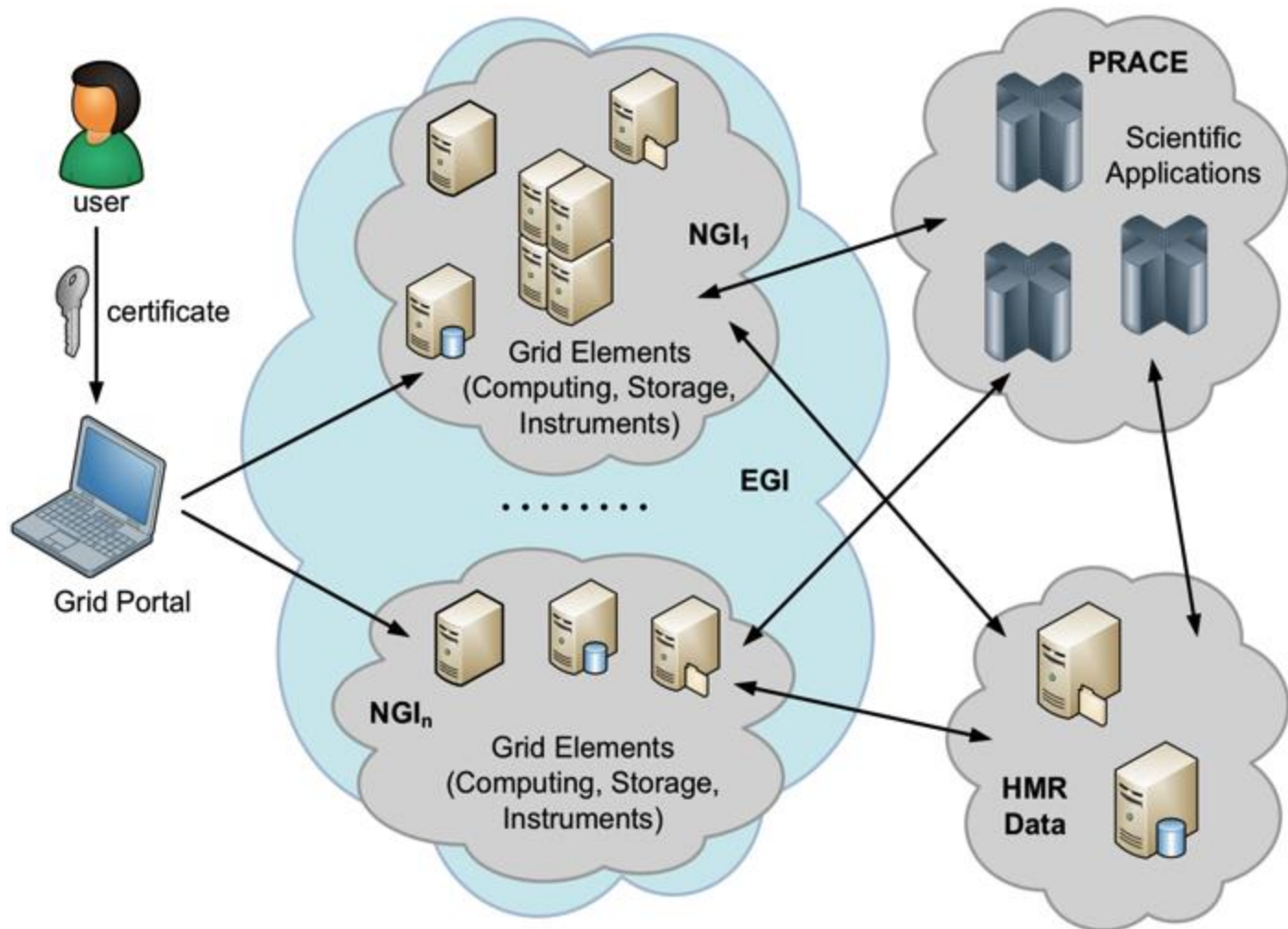
Discharge

Experiment Suite 3

Water Level,
Flow & Impact

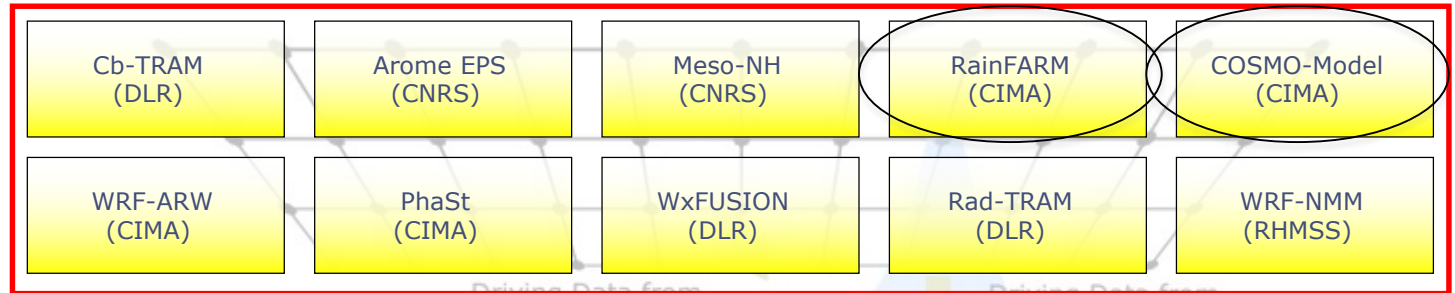


DRIHM e-Science environment



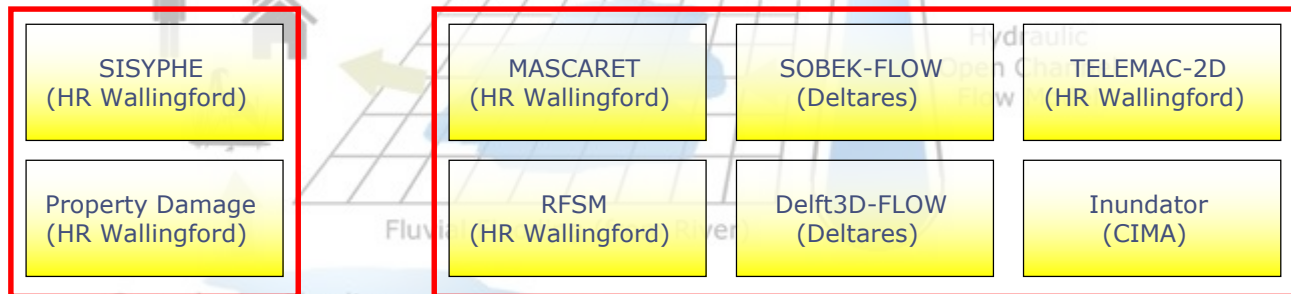
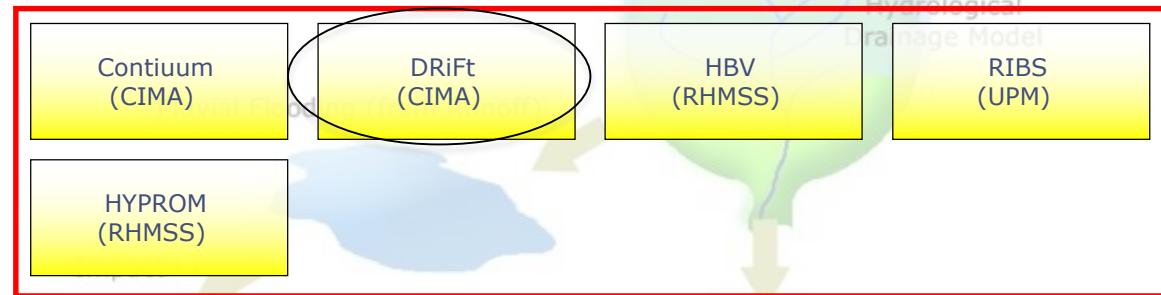


The DRIHM Models



Meteorologic

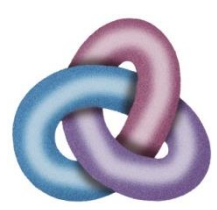
Hydrologic



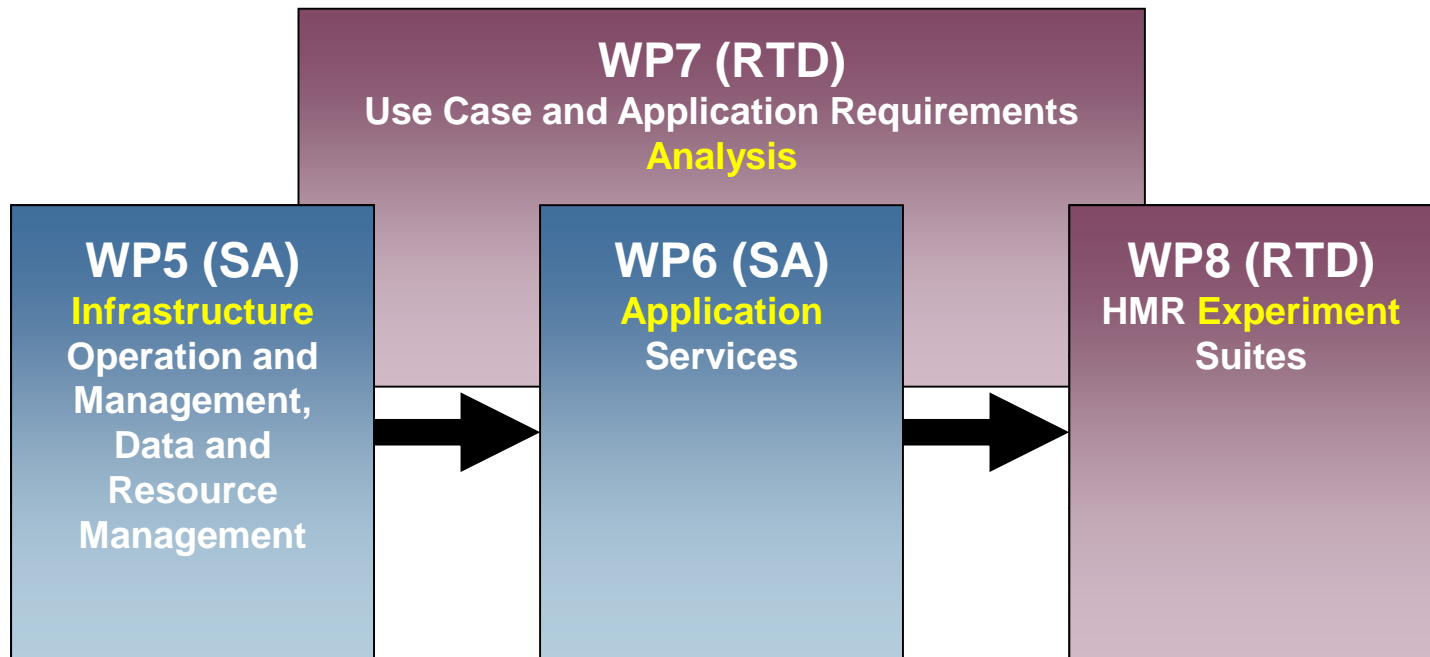
Impact

Hydraulic





DRIHM Workpackages

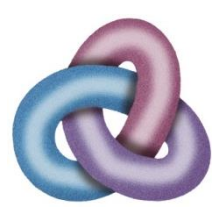


WP1 (MGT)
Management

WP2 (Coord)
Dissemination
and Outreach

WP3 (Coord)
Support, **Training**
and Education

WP4 (Coord)
Policy
Management,
Sustainability and
Long Term Vision



The Workpackages

WP1 Management

Keeping to the plan...

WP2 Dissemination

Targeted information for those who need to know...

WP3 Training

Training end-user to the e-Science environment...

WP4 Sustainability

Making DRIHM lasting forever...

WP5 Infrastructure

Turning DRIHM in production mode...

WP6 Application

Developing and implementing DRIHM services...

WP7 Analysis

Collecting requirements to evolve the e-Science environment...

WP8 Experiment

Have fun with the DRIHM...





The Project

➔ The Partners

The Story so Far



DRIHM Team

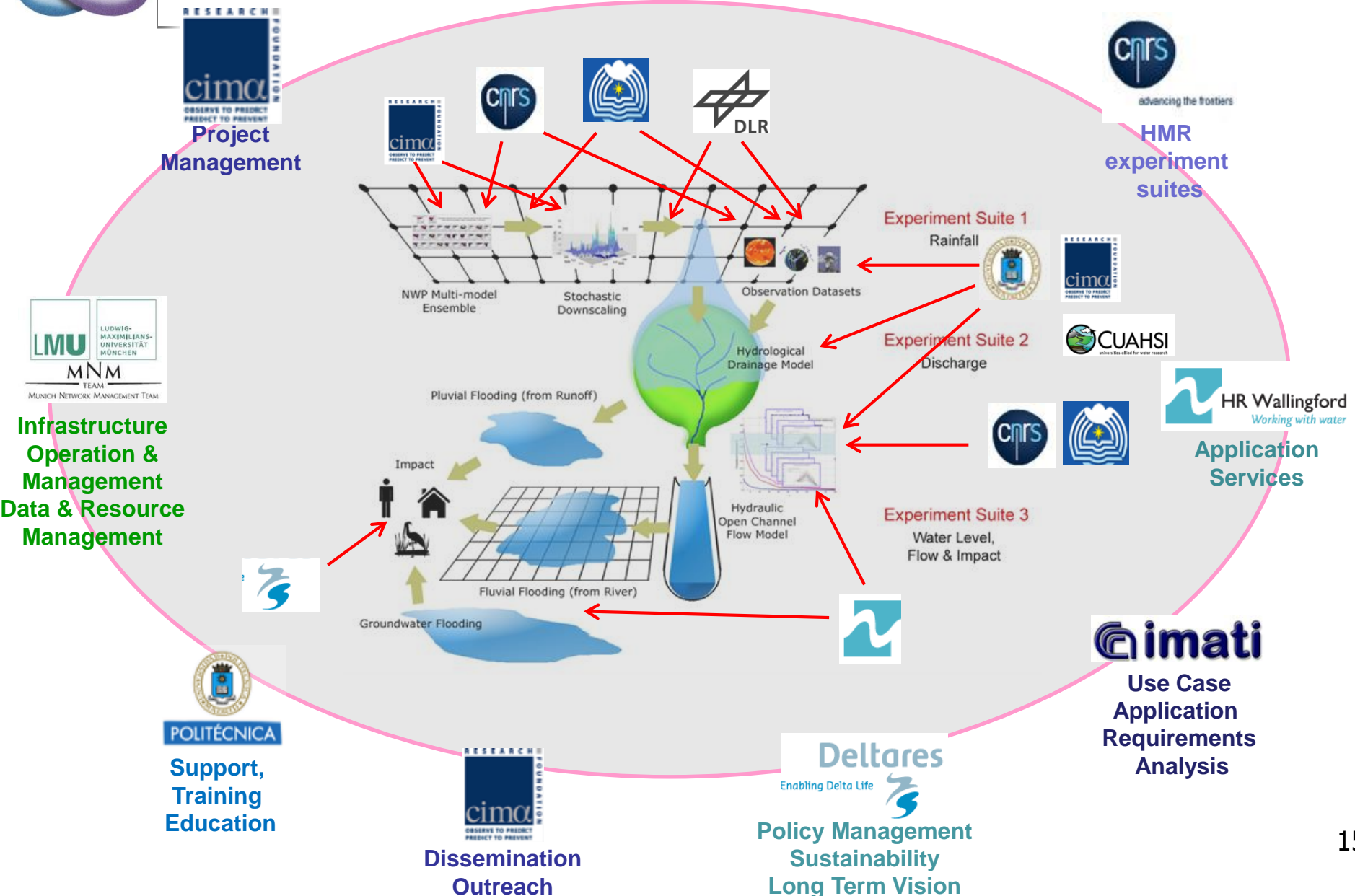


CIMA		Antonio Parodi		Nicola Rebora
LMU		Dieter Kranzlmüller		Michael Schiffrers
DLR		Arnold Tafferner		Caroline Forster
IMATI-CNR		Andrea Clematis		Daniele D'Agostino
UPM		Luis Garrote		Maria C. Llasat
CNRS		Veronique Ducrocq		Evelyne Richard
CERFACS		Pierre-Henri Cros		
RHMSS		Vladimir Dimitrijevic		Ljiljana Dekic
DELTARES		Bert Jagers		Albrecht Weerts
HR Wallingford		Quillon Harpham		Mike Panzeri
CUAHSI		Rick Hooper		Jennifer Arrigo



Roles and Contributions of Project Partners

Outer shell: work packages – Interior: models and data

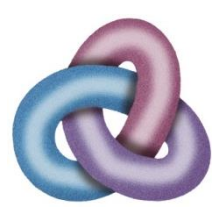




The Project

The Partners

➡ The Story so Far



Elaboration of a common approach

Answer to the question:

How can we make researchers, civil protection and citizen scientists communicate over ICT infrastructure and share model and data?

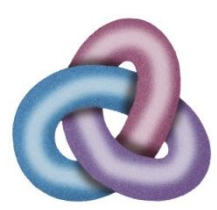
Various Meetings:

Munich, Savona ... with the aim to discuss initial experiment set-ups proposed by partners → example next slides

Following talks will present achievements with regard to:

- *Definition of use cases*
- *Definition of requirements*
- *Set-up infrastructure*
- *Dissemination activities*





Identification of HMR critical cases

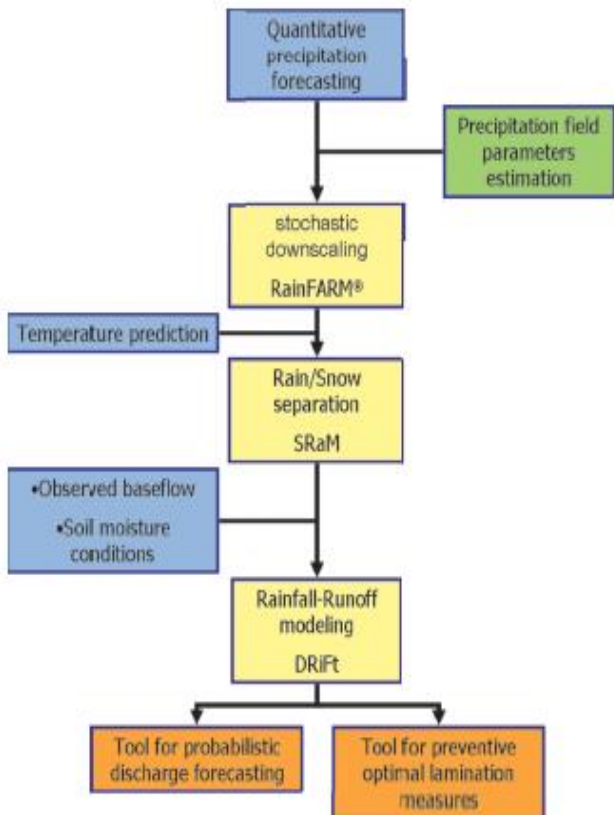
1. *Rain episode of June 22nd – July 5th 2010 in Serbia*
2. *Period of October-November 2011 in the north-western Mediterranean area*
3. *Rain episode of November 1st – 8th 2011 in Catalunya*
4. *Flash flood episode on 4th of November 2011, Genoa, Italy*



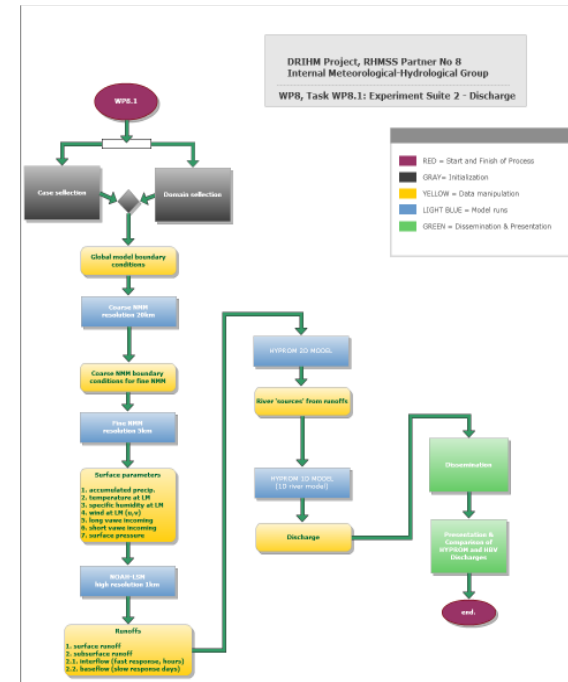
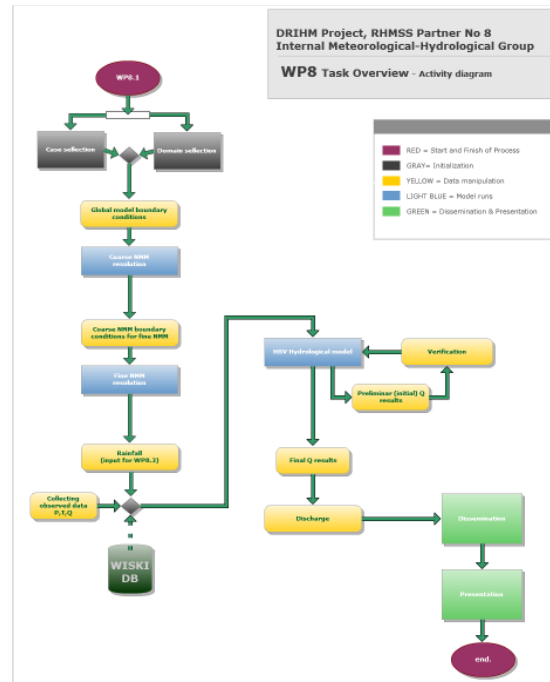
Flash flood of the Genoa town center. Top right corner: the similar event of 1970



Baseline experiments suite versions



CIMA baseline chain



RHMSS baseline chain



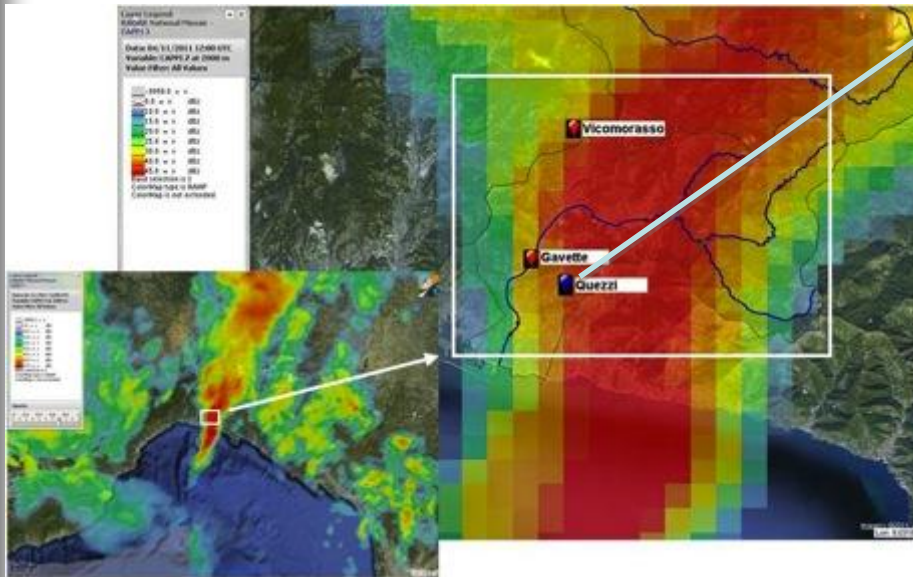
Requirements collection & Limitations today¹⁹



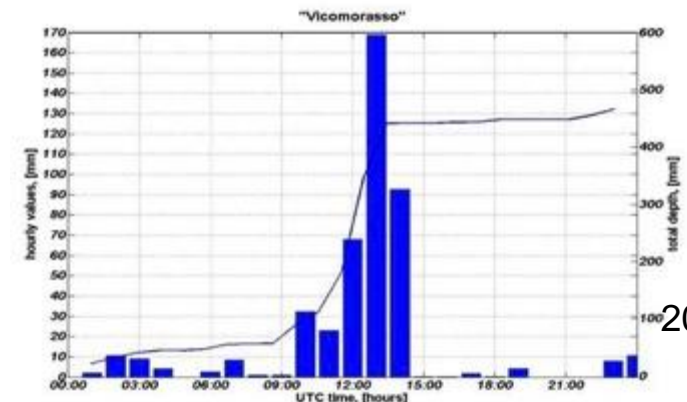
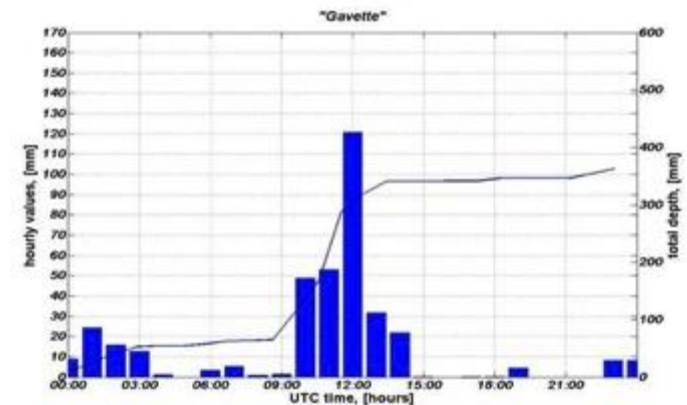
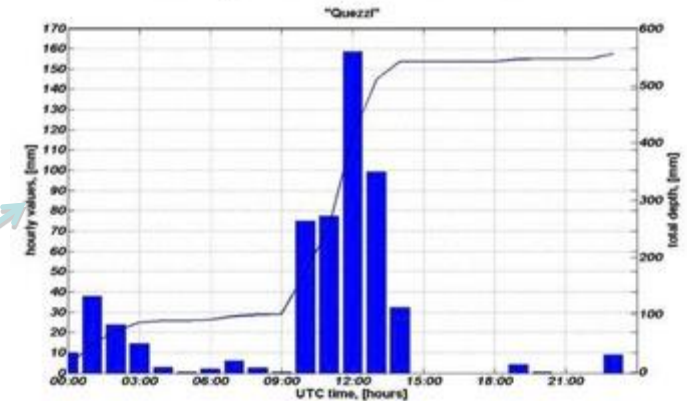
The citizen scientist role



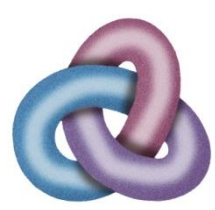
About 90 Personal Weather Stations (PWS) are available in Liguria region



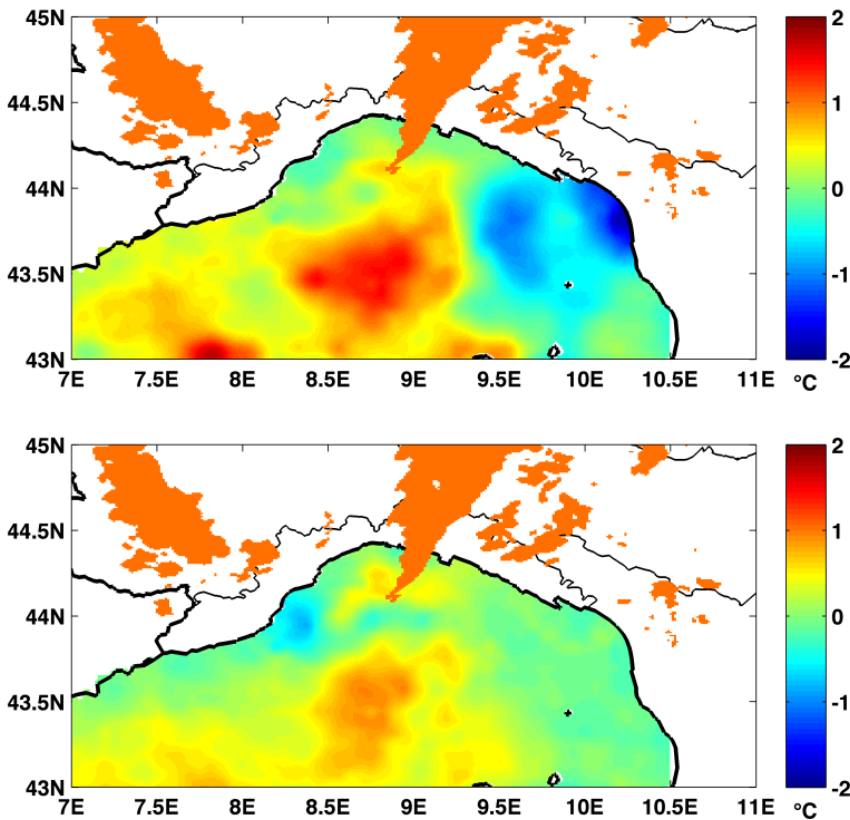
Hourly Rainfall Timeseries



- PWS were useful in the real-time monitoring of the Genoa flash-flood event together with official weather stations
- A PWS, "Quezzi", owned by a citizen-scientist, registered the peak rainfall depth over 6 hours (about 450 mm) observed during the torrential event
- PWS data will be published on the DRIHM e-Infrastructure
- Contribution of citizen-scientists to the DRIHM User Forum



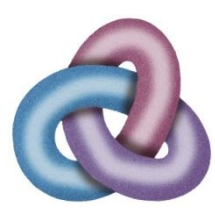
And the climate change...



The orange areas represent the pixels with reflectivity values larger than 25 dBZ (Italian Radar Mosaic, November 4th at 11:00 UTC). Sea Surface Temperature Anomaly by G1SST (upper panel) and GMES MyOcean (lower panel).

EXtreme PREcipitation and Hydrological climate Scenario Simulations (EXPRESS-Hydro) project: WRF dynamical downscaling of EC-EARTH scenarios.

These simulations are being included in the CMIP5 archive and in DRIHM, thus making possible to attract also climatologists towards the forthcoming DRIHM services.



Outlook

HRM chains are usually clumsily stitched together so that it is ONLY model i (of level 1) and model j (at level 2) and model k (at level 3) that fit together because somebody worked for many years to get it together.

Adding another data set, replacing model j by model j_2 , finding out sensitivities etc is tedious and thus hampers progress.

DRIHM wants to make it possible to work in a modular environment.

DRIHM will provide an e-science environment for this goal.





Outlook



FOCUS ON

How DRIHM can help Mark?

Mark is an Hydro-Meteo Researcher.

He has just designed a modification to his meteo model, but he would like to validate the new model. There are two tasks required to validate a model:

- compare the prediction computed by the model with measured data
- cross-check the prediction computed by the model with those computed by other models.

Let's focus on the second task: compare at least two meteo models on the same events, and cross-check the results. Mark already has its new model, but has to fetch, install and use some alternatives.



Required steps are summarized in the following list:

- 1 Install, compile and optimize the HMR simulation models, possibly developing data converters, connector to further models and visualization tools (hours to days)
- 2 Find and retrieve input data from other repositories, via ssh, ftp and other command line tools/scripts, learning the process and all the flags (hours)
- 3 Select and retrieve large data (like static data)
- 4 Execute convert and pre-process operations on the data (hours)
- 5 Set execution parameters
- 6 Select the executable resources
- 7 Move all the data and ancillary files
- 8 Launch the execution
- 9 Monitoring of possible execution faults and re-submit in case of failure
- 10 Results retrieval
- 11 Visualization or further processing

For the first execution of a model, Mark need to perform all the eleven steps. Subsequent model runs requires steps from 2 to 11. This means days for testing against a single alternative meteo model. Moreover the IT resources required (SW tools, HW resources, IT expertise) are to be taken into account. DRIHM infrastructure can help Mark in speed-up the whole process, providing him ready to run hydro-meteo models, tools for managing data and high performances computing resources.



In a DRIHM scenario, the eleven steps become:

- 1 Select one of the provided models
- 2 Find input data from other repositories via graphical user interface
- 3 Select large data
- 4 Select the conversion and pre-processing operations
- 5 Set execution parameters
- 6 --
- 7 --
- 8 Launch the execution (the system will take care of selecting the resources, moving converting and pre-processing the data, re-submit in case of failure)
- 9 --
- 10 --
- 11 Visualization or further processing (the system will take care of results retrieval)

Now Mark can squeeze (from days to minutes) the time required to run a simulation on an alternative model, and can focus on improving the new Hydro-Meteo model and accurately validate it.



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