



Antonio Parodi

CIMA Foundation

www.drihm.eu

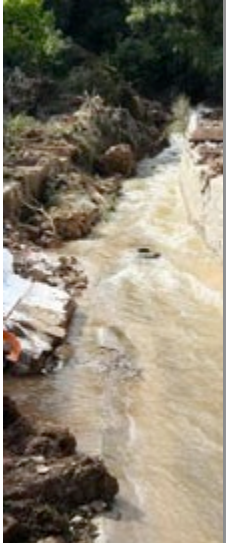


European Commission
Information Society and Media



advancing the frontiers





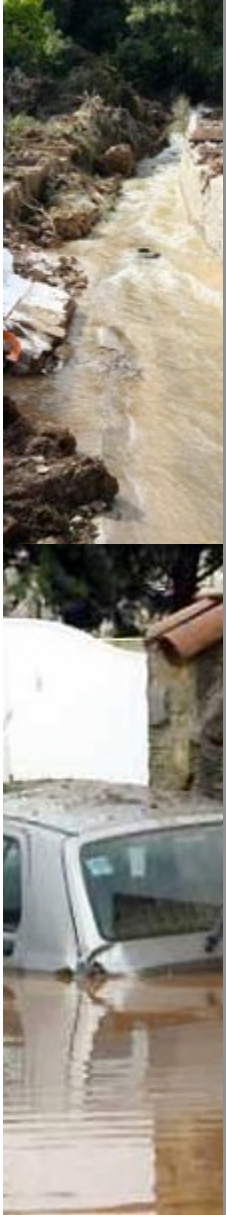
→ The Project

The Story so Far



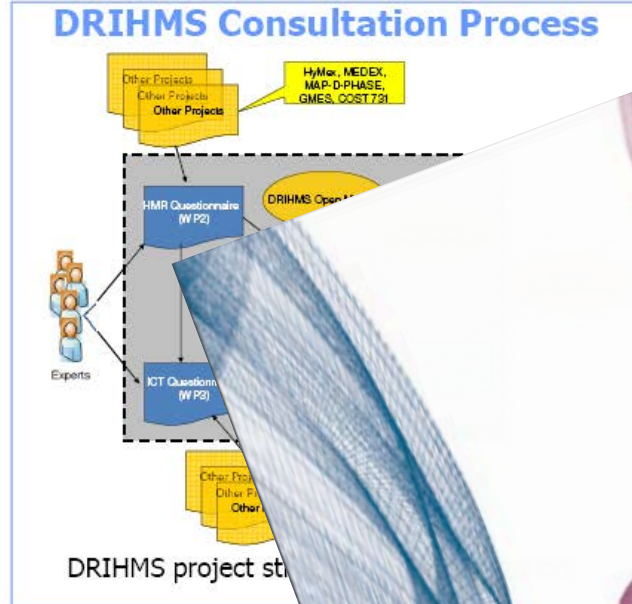
DRIHM Objectives

- **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



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
Model verification metrics	Model verification metrics	Probabilistic forecasting	Precipitation downscaling	Precipitation downscaling
Precipitation downscaling	Precipitation downscaling	Data merging/ fusion	Data merging/ fusion	Data merging/ fusion

...nts revealed clear choices of hot topics and accompanying ICT

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

...ing, the most important ICT challenges were the definition of

...ts, definition of libraries of tools for data handling and

...ability and reliability of high-performance computing

...s, the key ICT challenges were availability of model

...patible formats, and the availability of libraries of well-

...ctices yielded a large variety of methods of working,

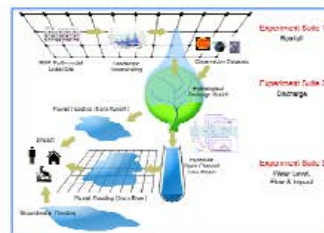
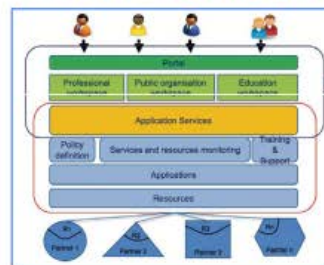
...the processing and communication of large data sets

...research;

...sing was given only a secondary priority by this

...ounting and billing issues seem to be regarded as

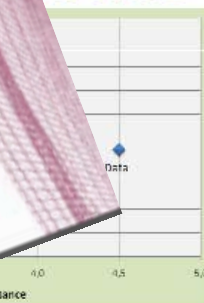
A Roadmap for HMR e-Science



Conceptual view of the meteorological forecasting chain



for HMR



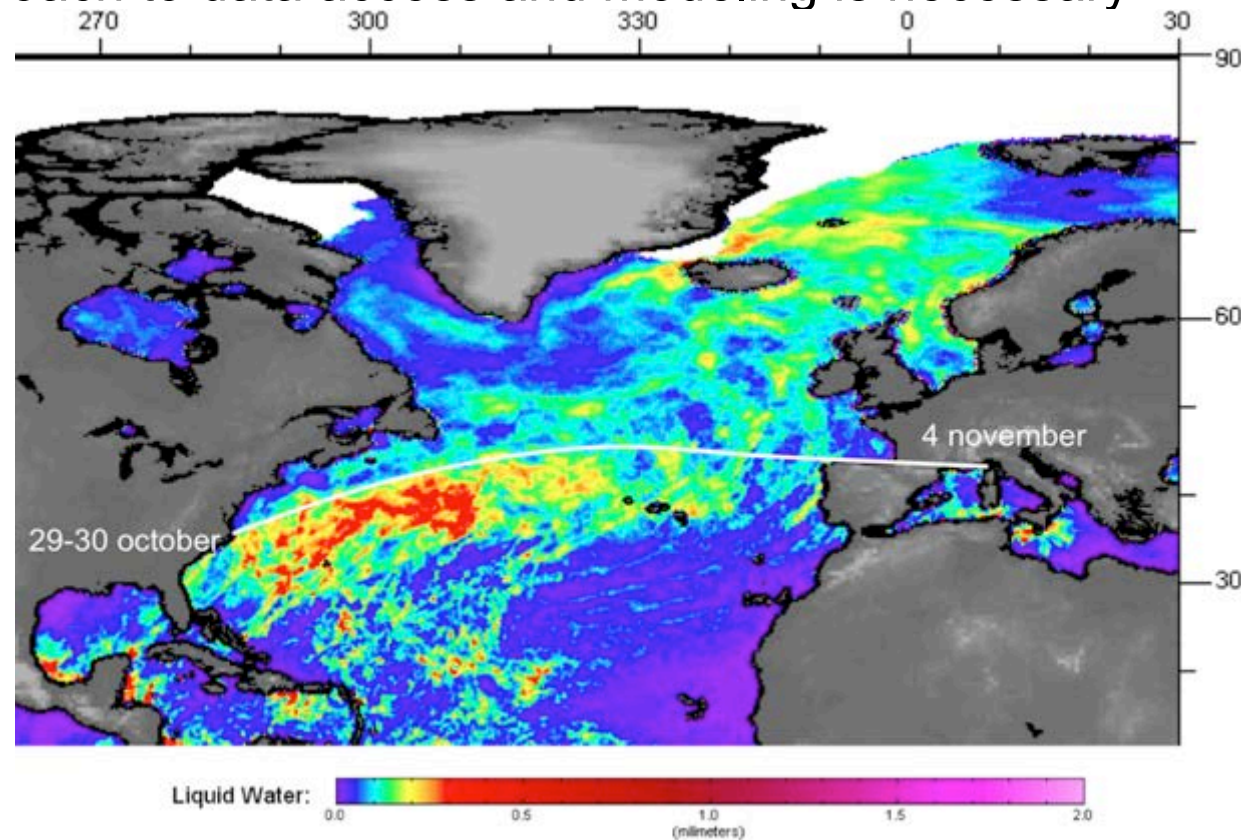
...important results related to the HMR hot topics are:

- 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?

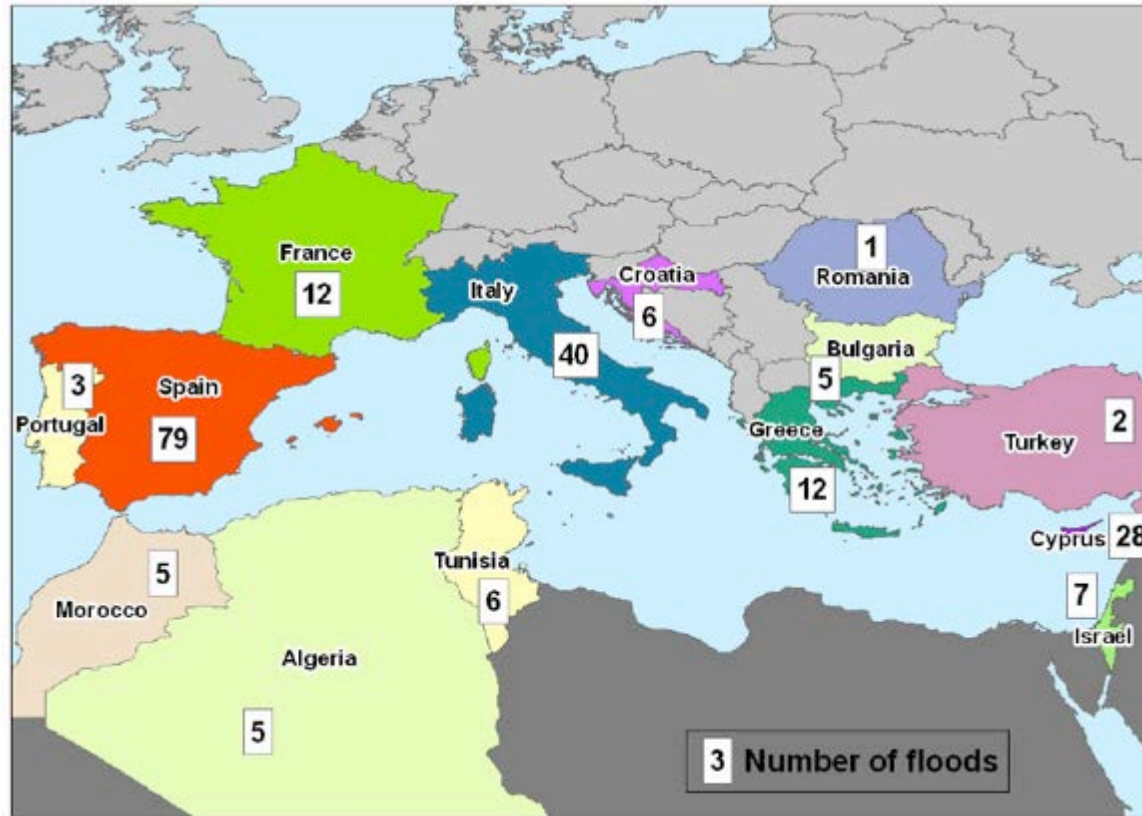
- Forecasting severe storms and floods is a key topic in HMR/early warning
- Storms do not respect country boundaries – a pan-European approach to data access and modeling is necessary



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



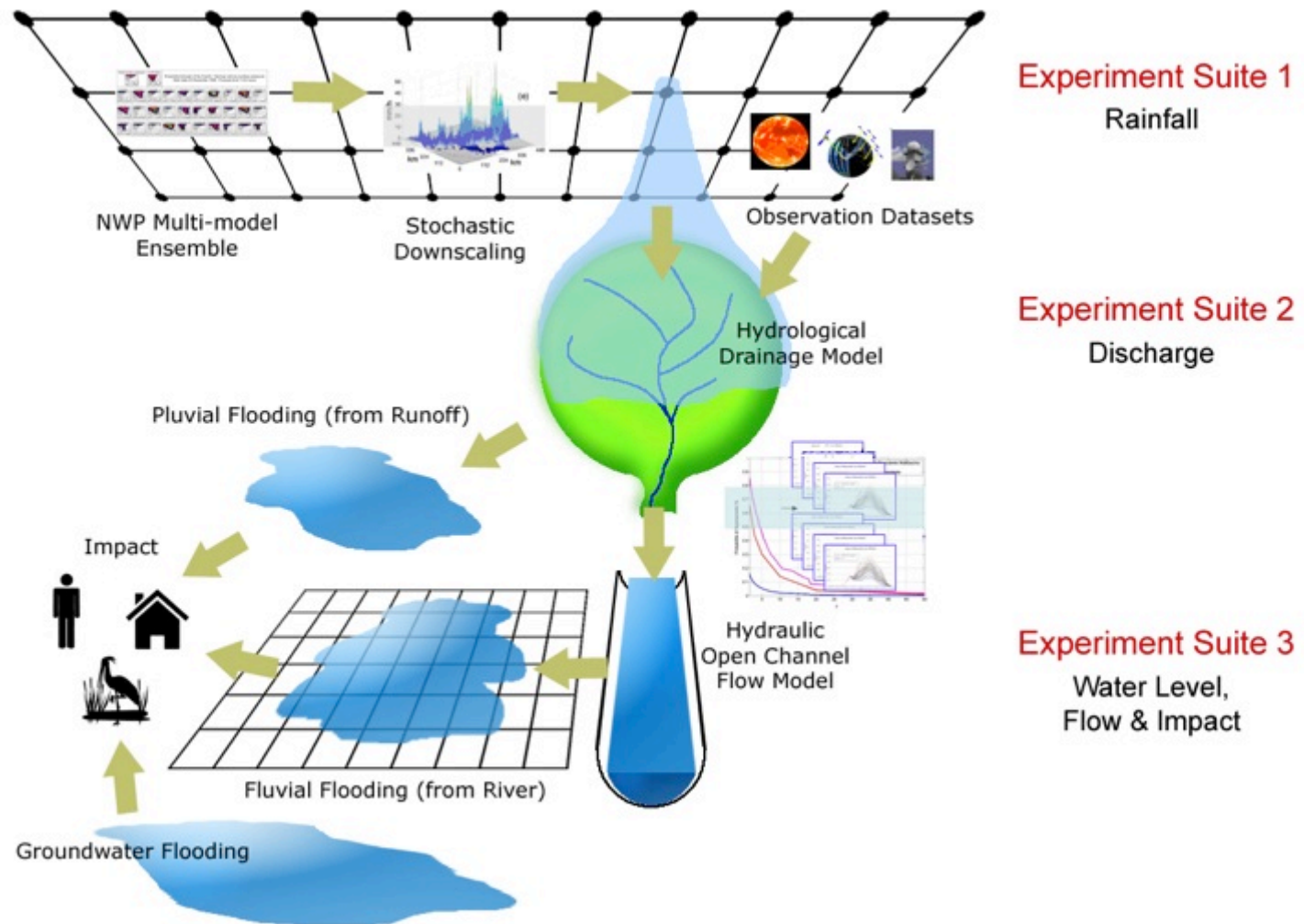
Why DRIHM?



- 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

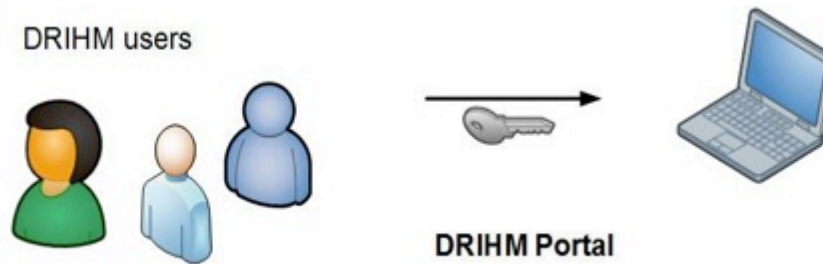


Experiment Suites

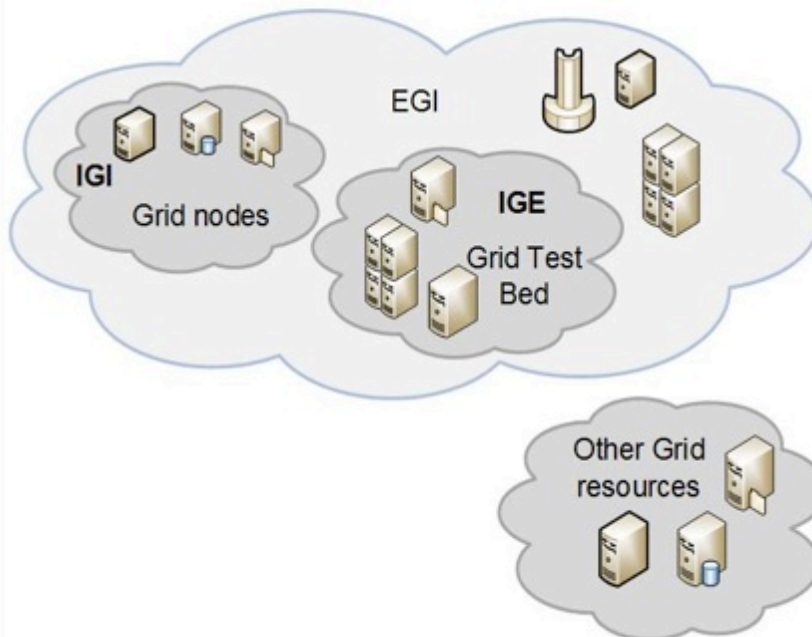




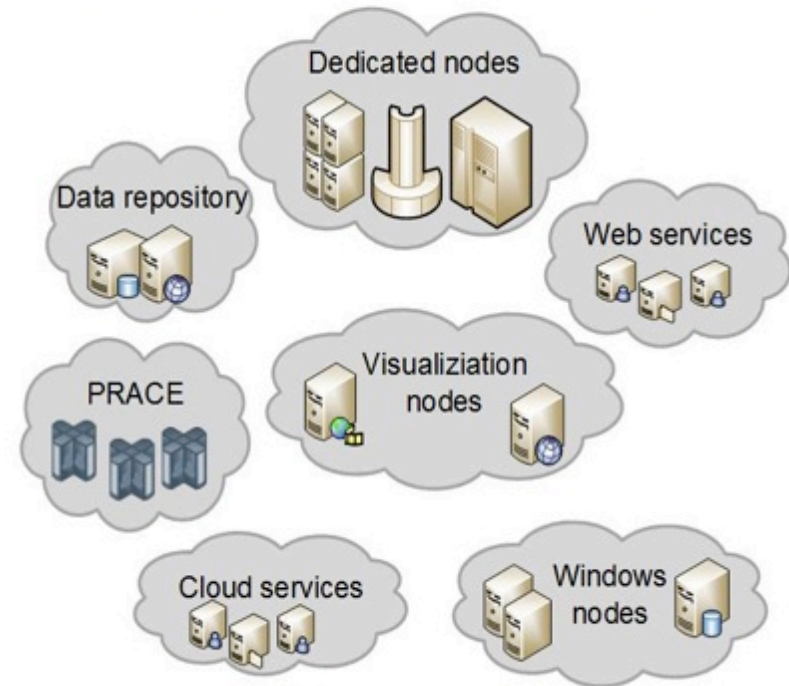
DRIHM e-Science environment



Resources accessible through the Grid: require valid Grid Certificate + DRIM VO user



Resources available out of the Grid





DDCI Ideal Architecture



HyMeX

ECMWF



WPS and
critical case
data repository



Serious run for
meteo models



HMR Linux-based
Models



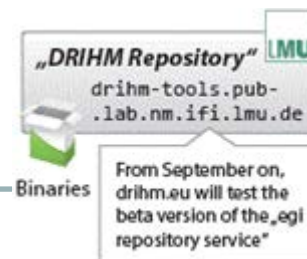
Citizen Scientists
and proprietary
software



Testbed



HMR Windows
Models

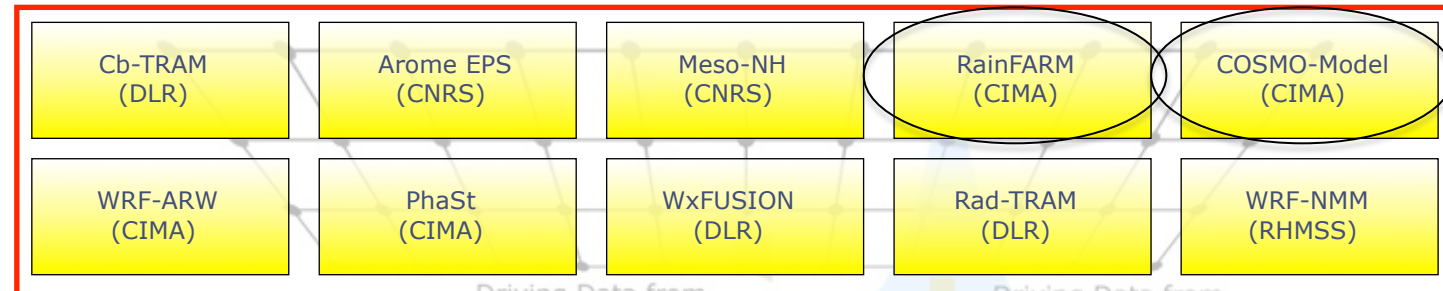


Binaries

From September on,
drihm.eu will test the
beta version of the _egi
repository service"

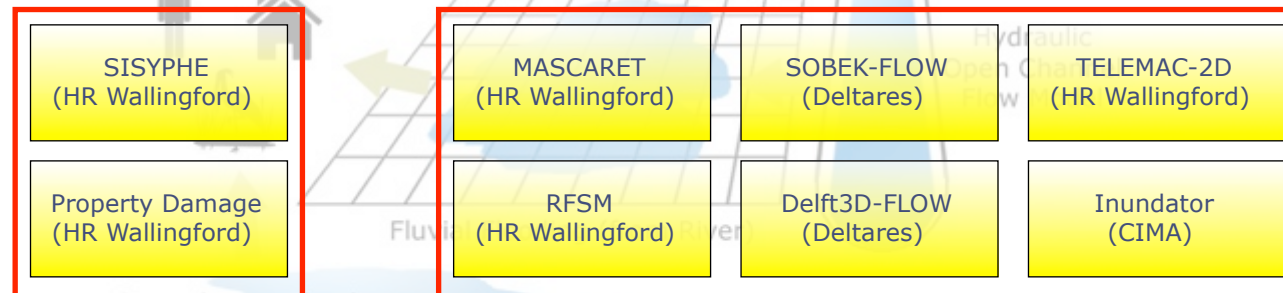
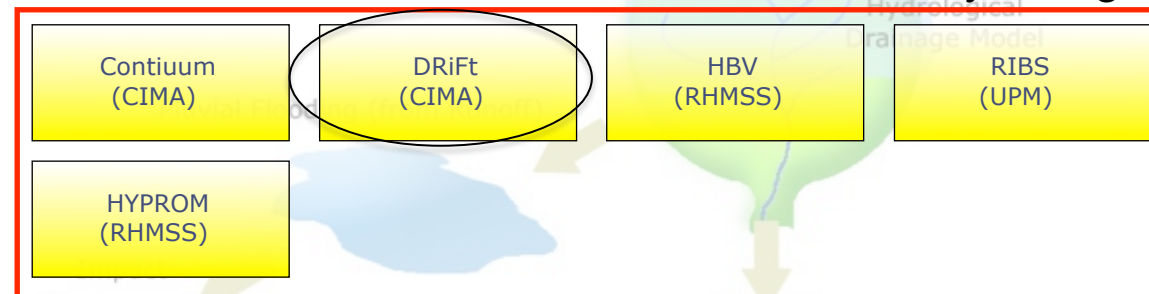


The DRIHM Models



Meteorologic

Hydrologic



Impact

Hydraulic





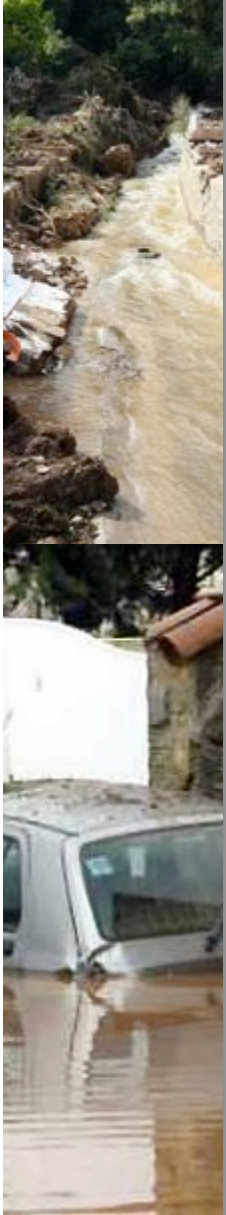
Outlook

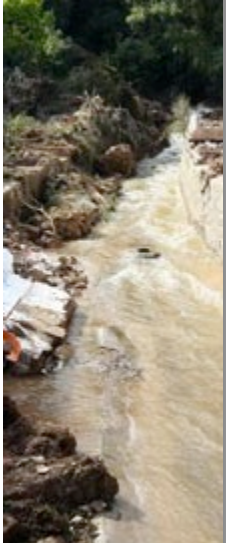
HRM chains are usually clumsily stitched together so that it is ONLY model i (of level 1) and model j (at level 2) and model k (at level 3) that fit together because somebody worked for many years to get it together.

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.





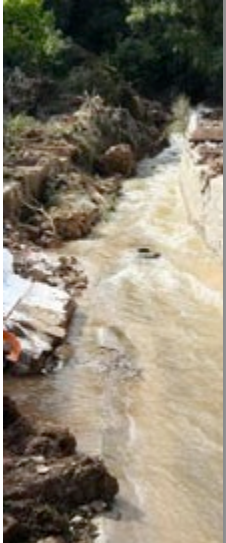
The Project

→ The Story so Far



Identification of HMR critical cases

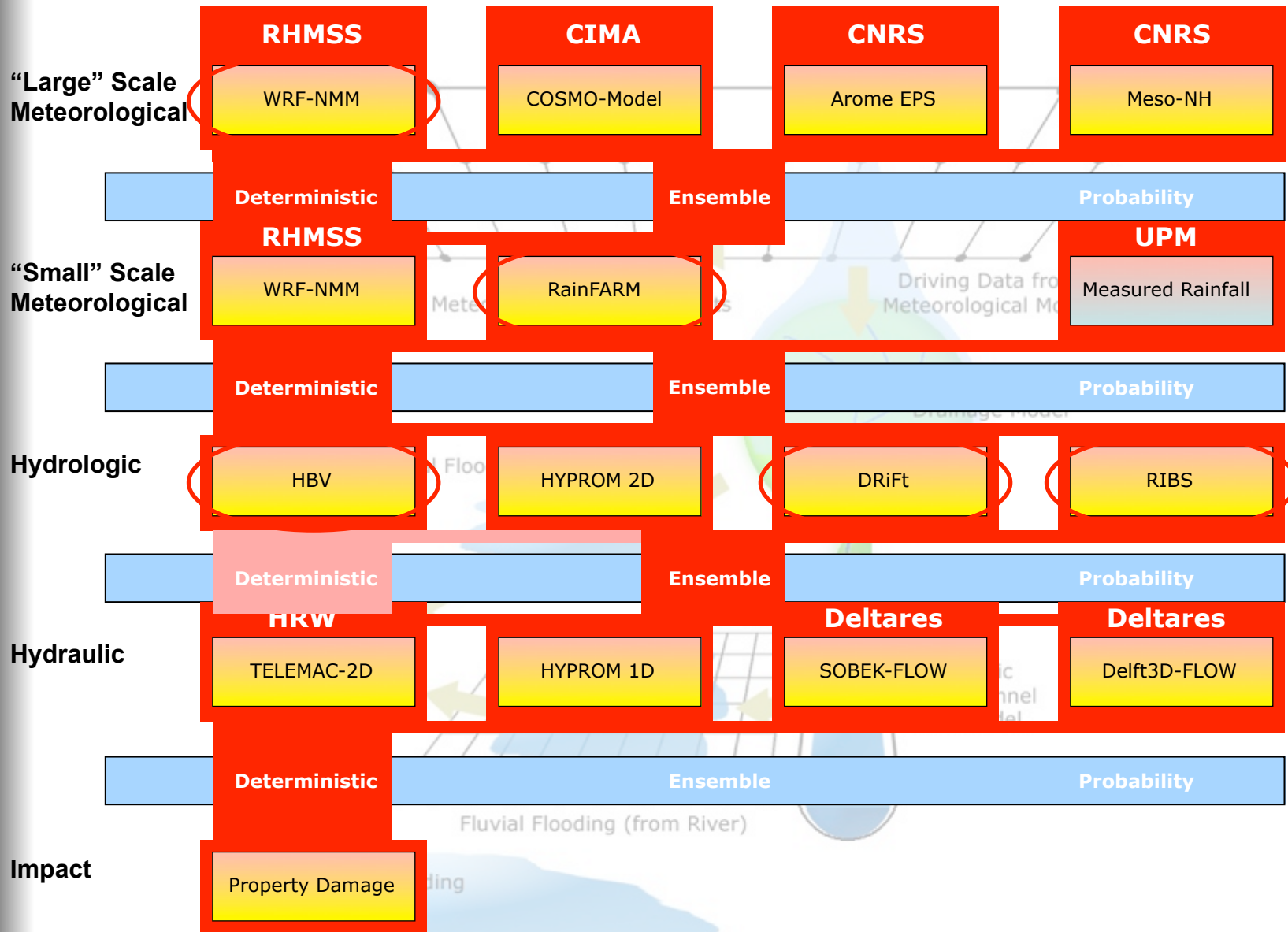
- 1. Rain episode of June 22nd – July 5th 2010 in Serbia*
- 2. Period of October-November 2011 in the north-western Mediterranean area*
- 3. Rain episode of November 1st – 8th 2011 in Catalunya*
- 4. Flash flood episode on 4th of November 2011, Genoa, Italy*



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

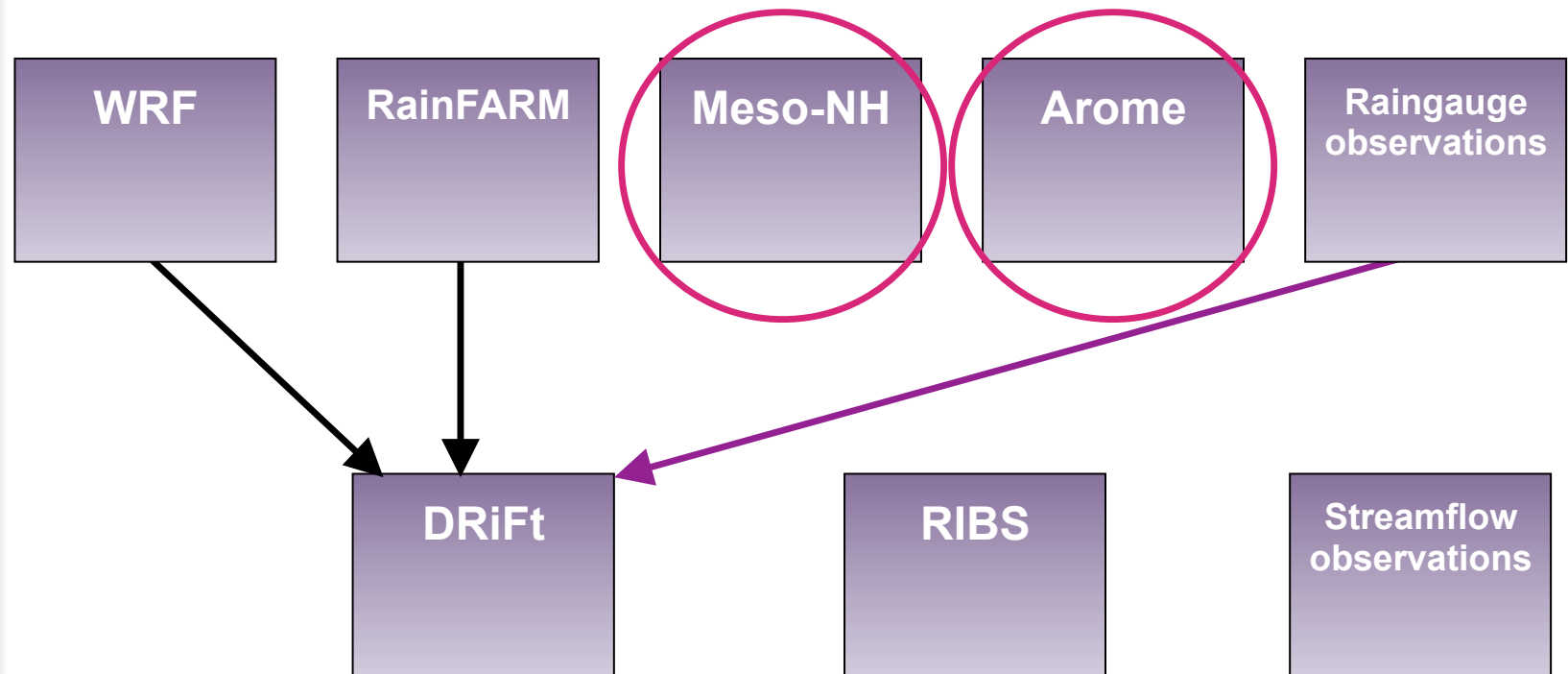


DRIHM Model Chains





Baseline version of experiment suites 1 & 2



**Direct,
hard-wired
coupling**

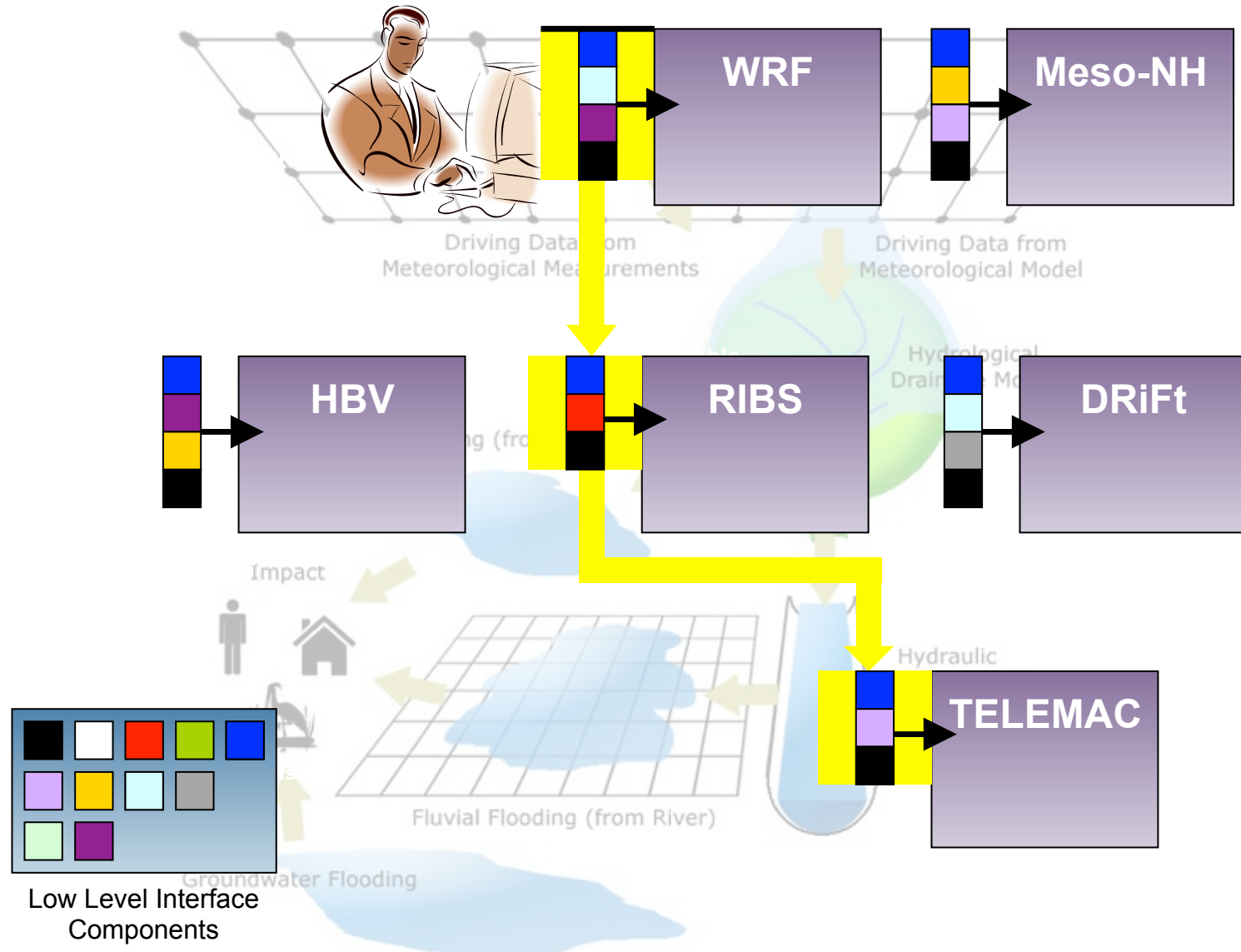
→ Gridded data
→ Point series data





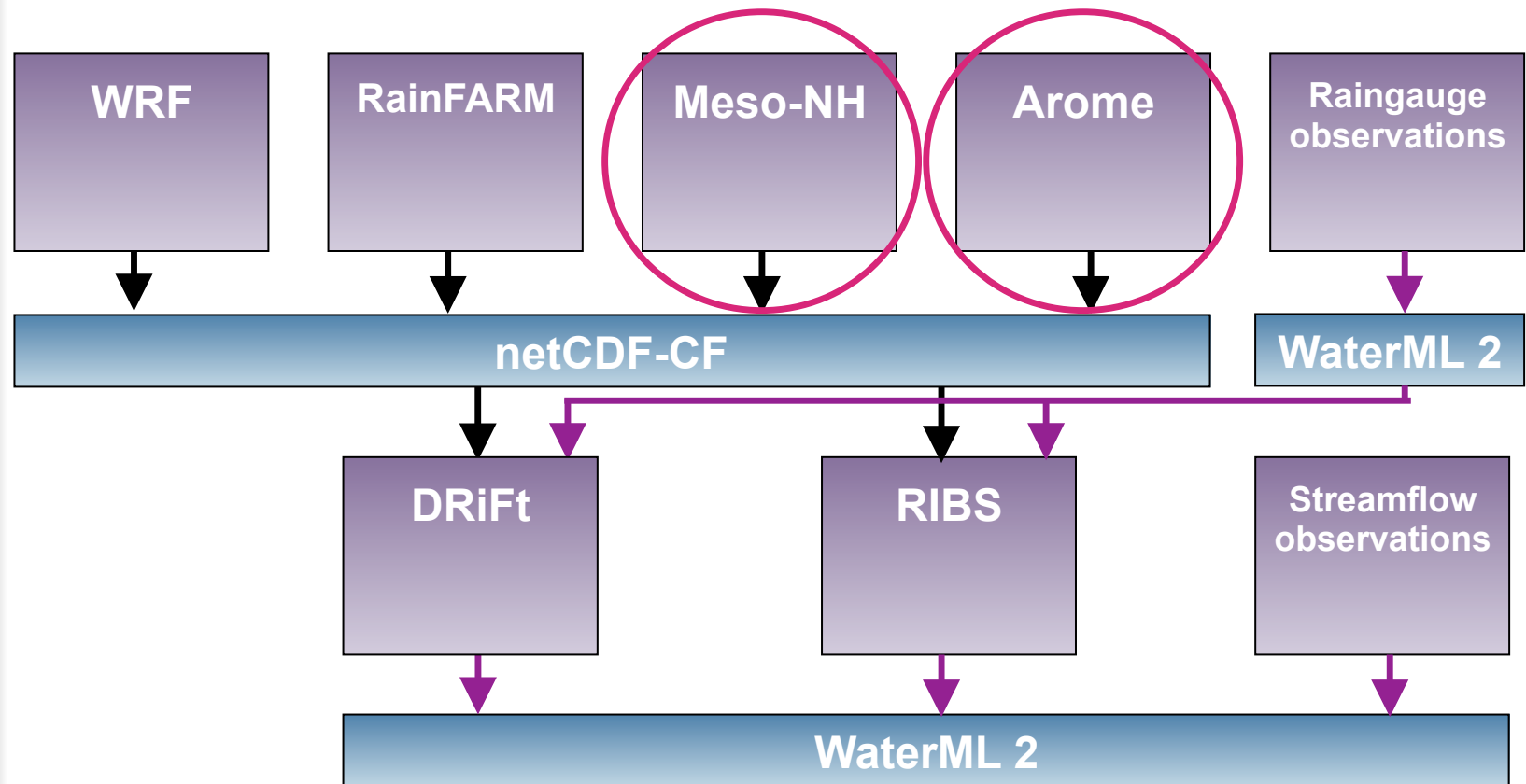
DRIHM Unified Interface Concept:

using tools like those developed within the SCI-BUS project





Advanced version of experiment suites 1 & 2



→ Gridded data
→ Point series data



Summary of model setups

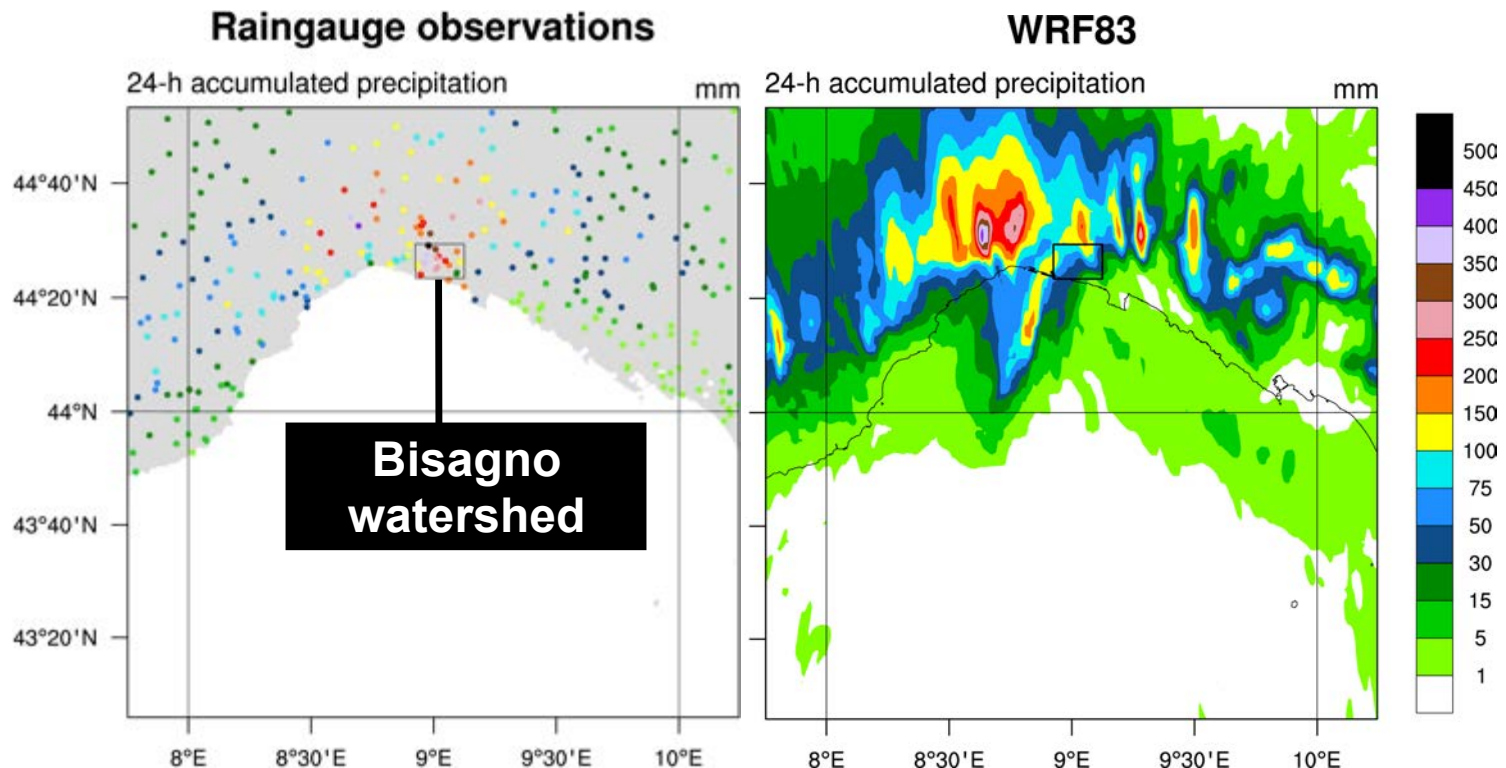


Rain source	Description	Ensemble members	Resolution (km)	# DRiFt runs	# RIBS runs
Observations	Raingauge measurements	1		1	30
WRF	IC & BC: IFS	1	1.0	1	30
Arome	IC AEARO; BC: PEARP	8	2.5	8	240
Meso-NH	IC & BC: Arpege	10	0.5	10	300
Meso-NH	IC & BC: IFS	10	0.5	10	300
RainFARM	Init. dyn. model	7	0.7	7	210
Total		37		37	1110



Meteorological scenarios

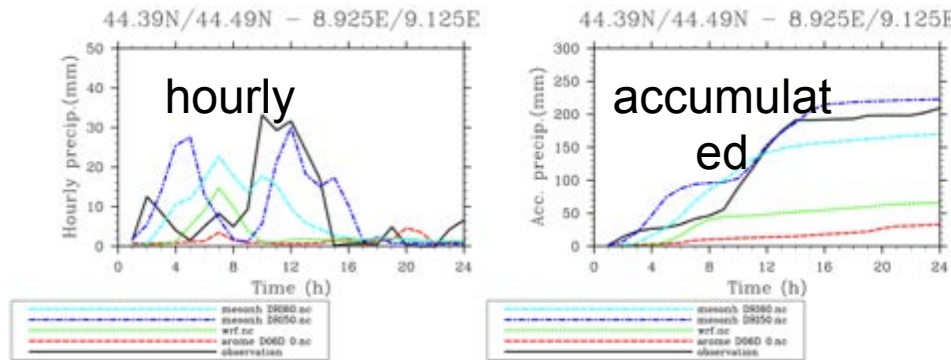
- More than 30 high-resolution, multi-model scenarios
- 3 different ensembles from 2 different ensemble prediction systems
 - In the same format (netCDF-CF)
- Allowing processing by many free, off-the-shelf post-processing and visualization softwares (here the NCAR Command Language – NCL)
- Directly comparable with WaterML 2.0 observations





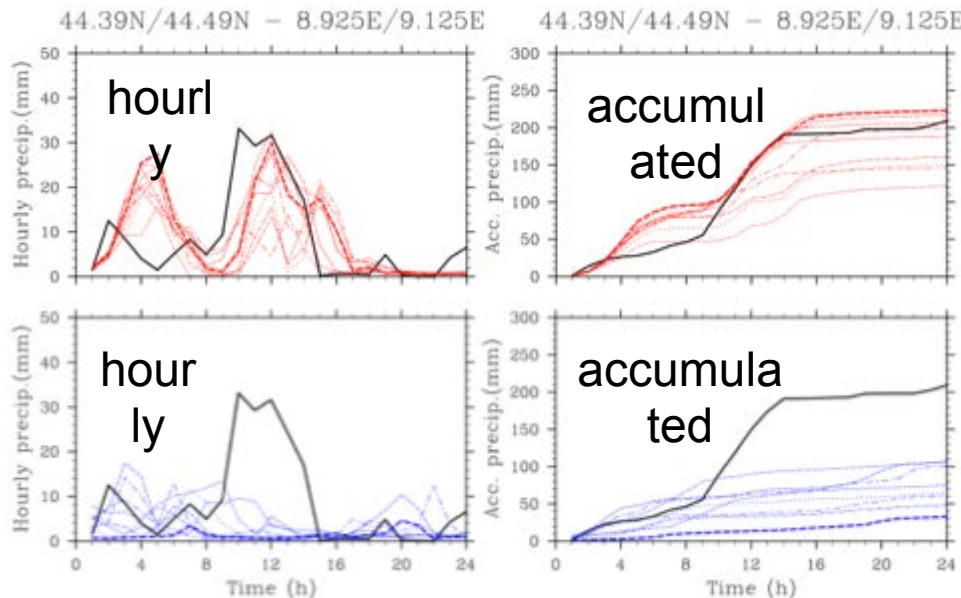
Comparison of rainfall time series

 Rainfall time series averaged over the Bisagno catchment



Rainfall time series for raingauge observations and different simulations

 Ensembles

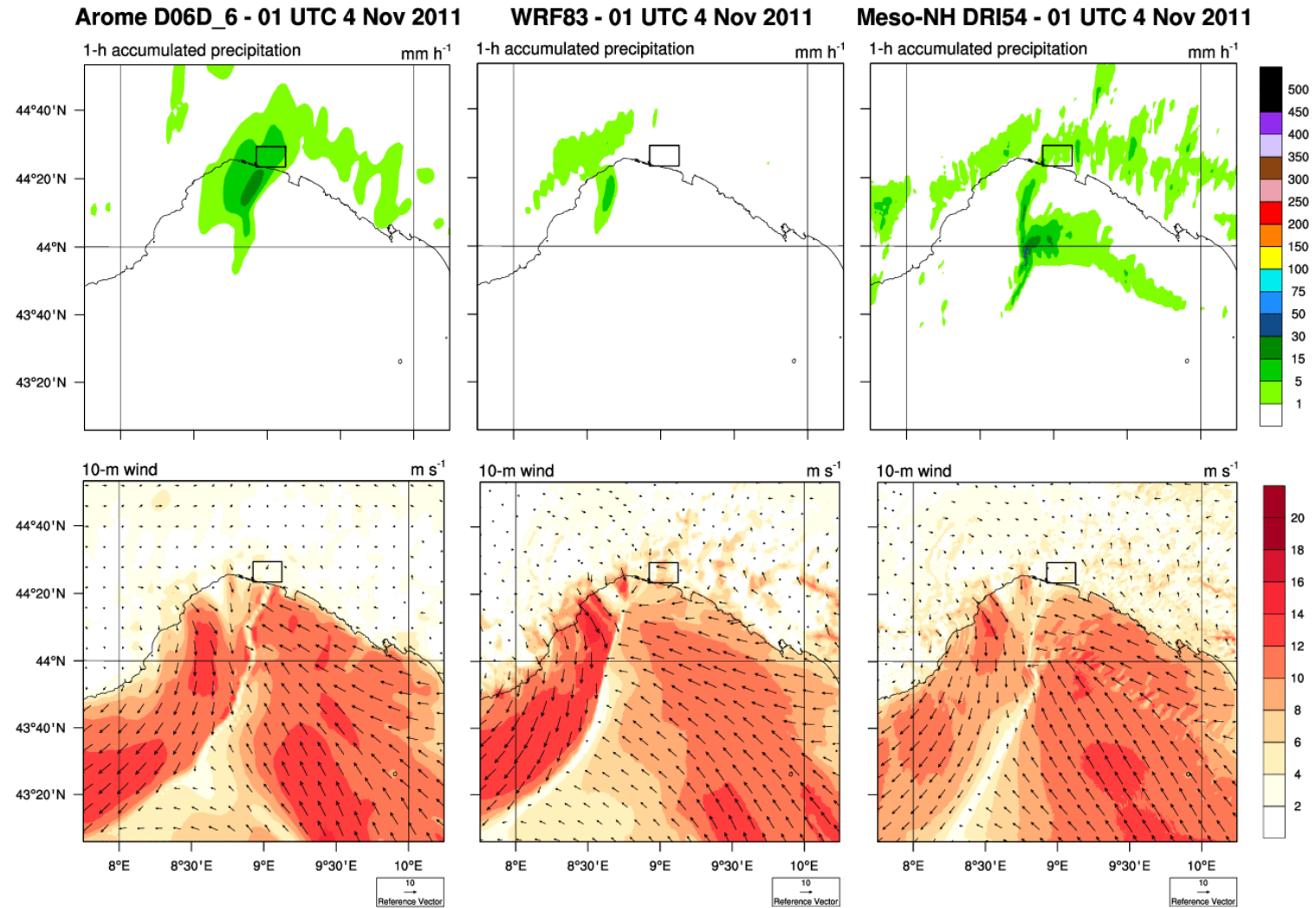


Rainfall time series for raingauge observations and **Meso-NH ensemble (DRI5X)**

Rainfall time series for raingauge observations and **Arome ensemble**



Comparison of model fields

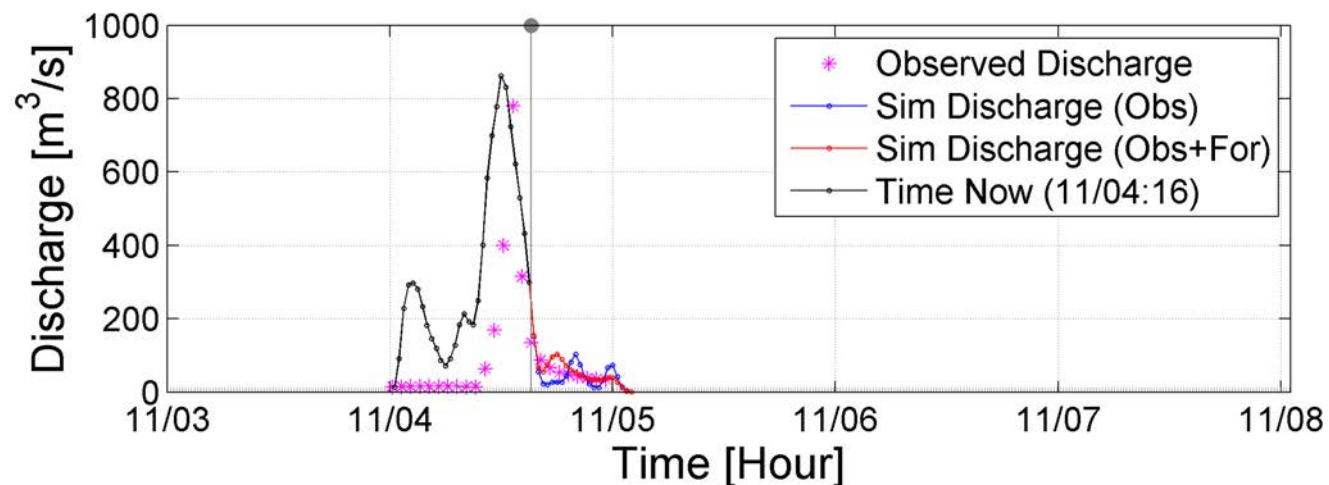
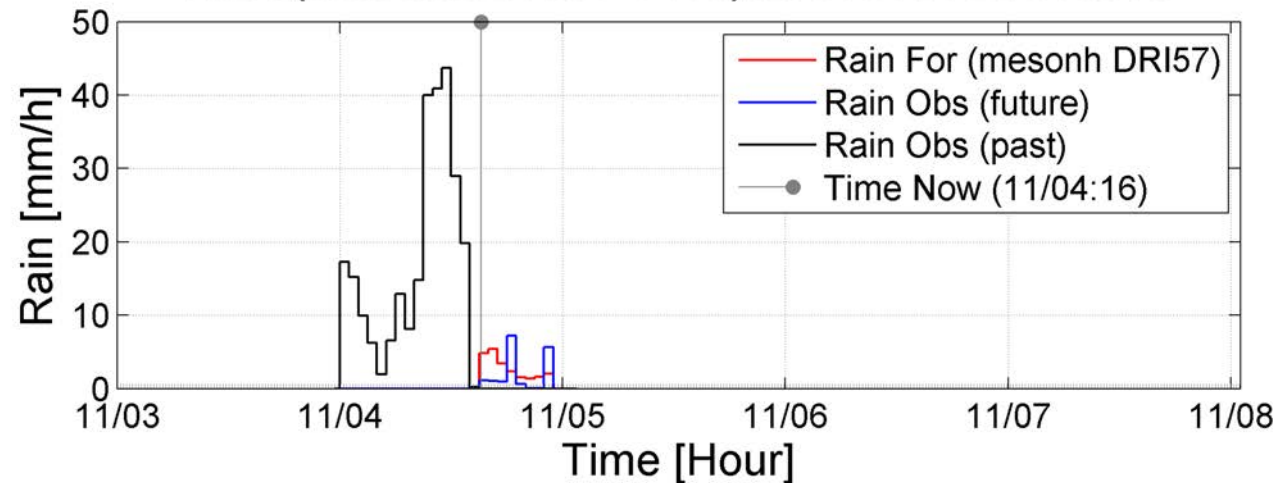




Full hydrometeorological chains

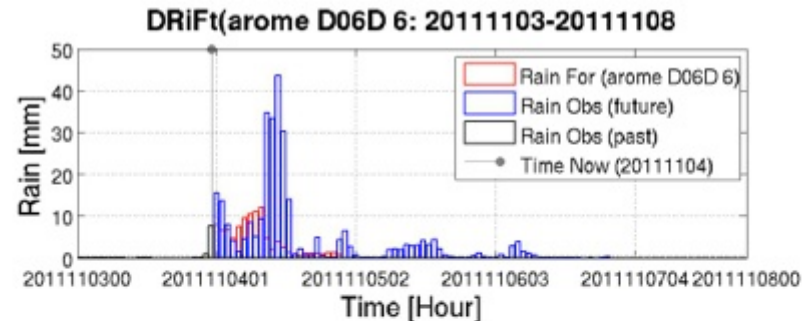
🌀 Summarizing all the information produced by a chain in one plot

RIBS(mesonh DRI57-7408):20111104-20111105

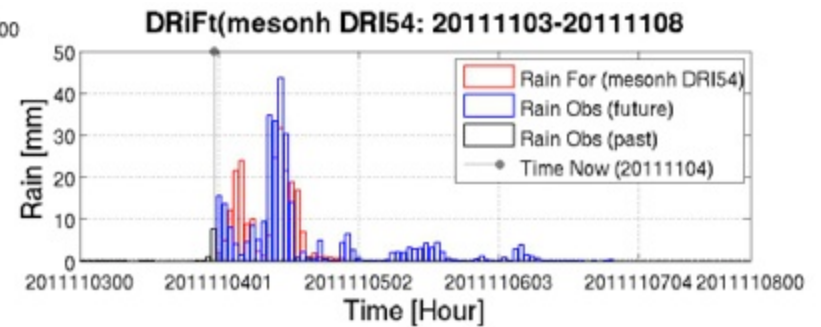
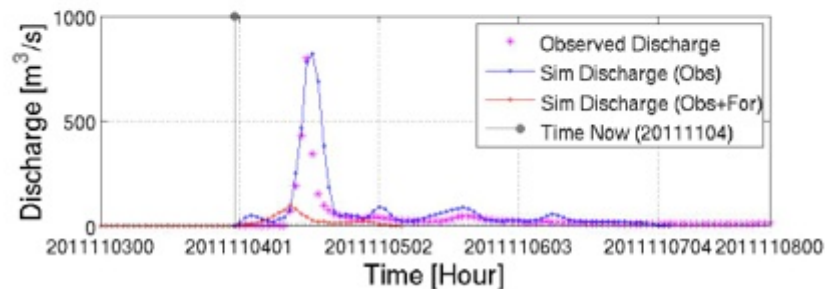




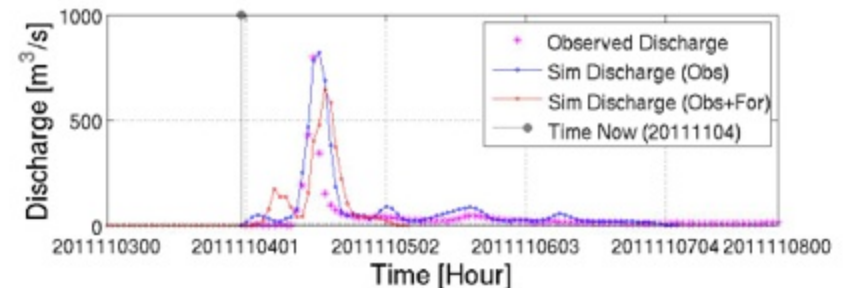
Comparison of different rainfalls



DRiFt driven by
Arome
ensemble
member #6

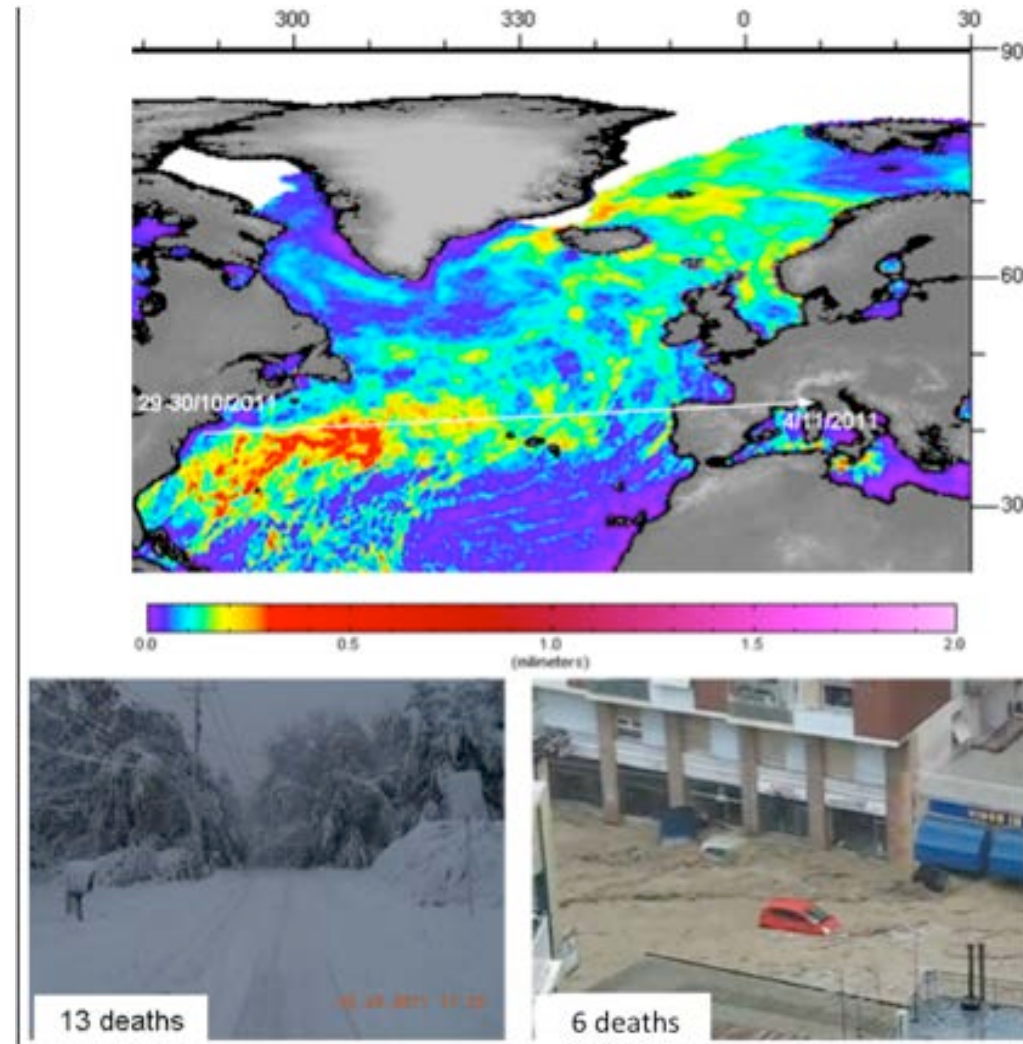


DRiFt driven by
Meso-NH
ensemble
member DRI54





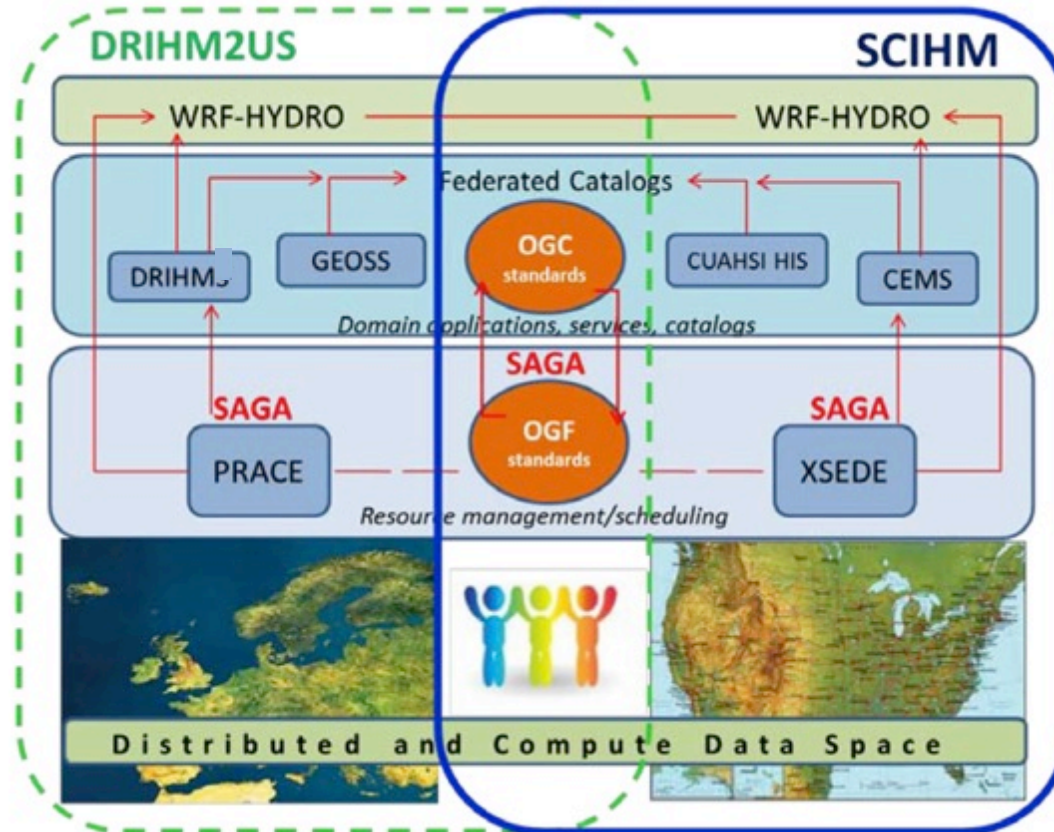
Thinking globally...DRIHM2US



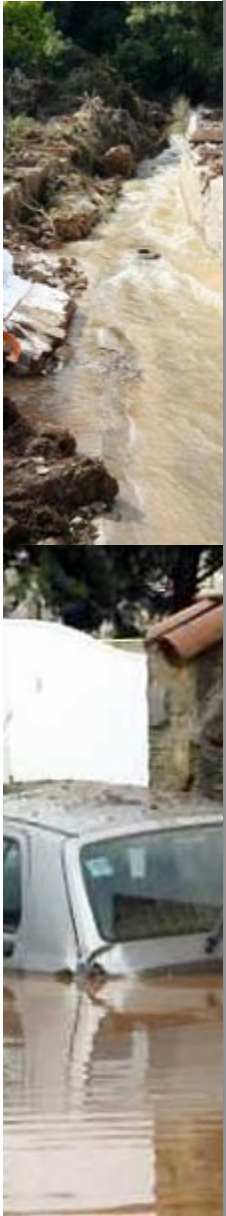
Upper panel: satellite cloud liquid water composite (week ending 5/11/2011) clearly shows the cyclone track from USA east coast to Mediterranean. Lower left panel: snowstorm impacts example on USA east coast. Lower right panel: Genoa city (Italy) under massive flash-flood event.



DRIHM2US interoperability testbeds

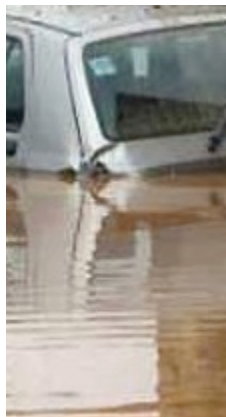
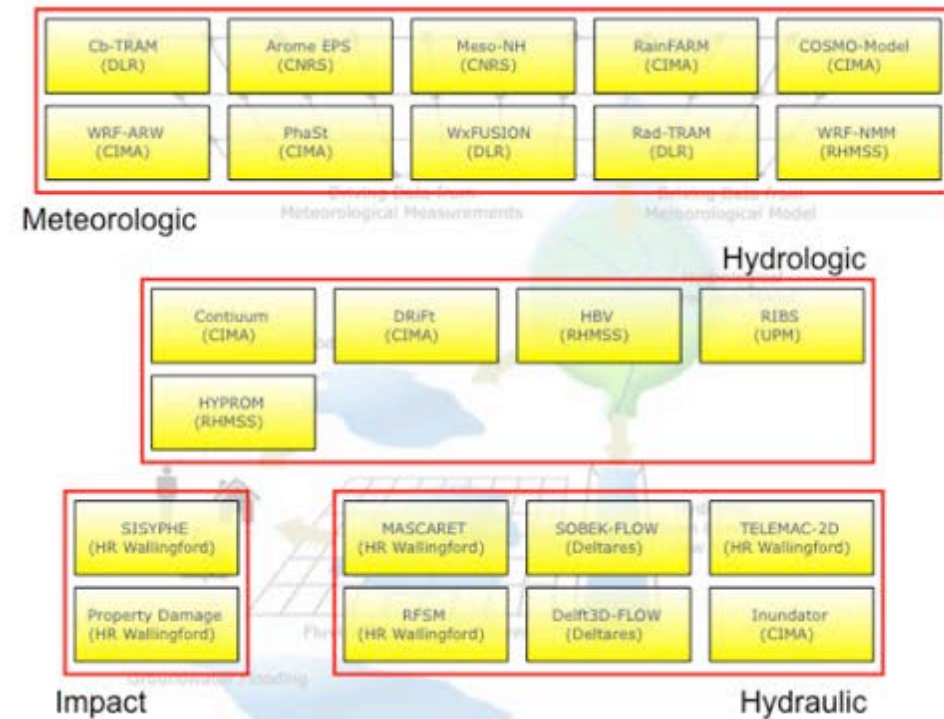
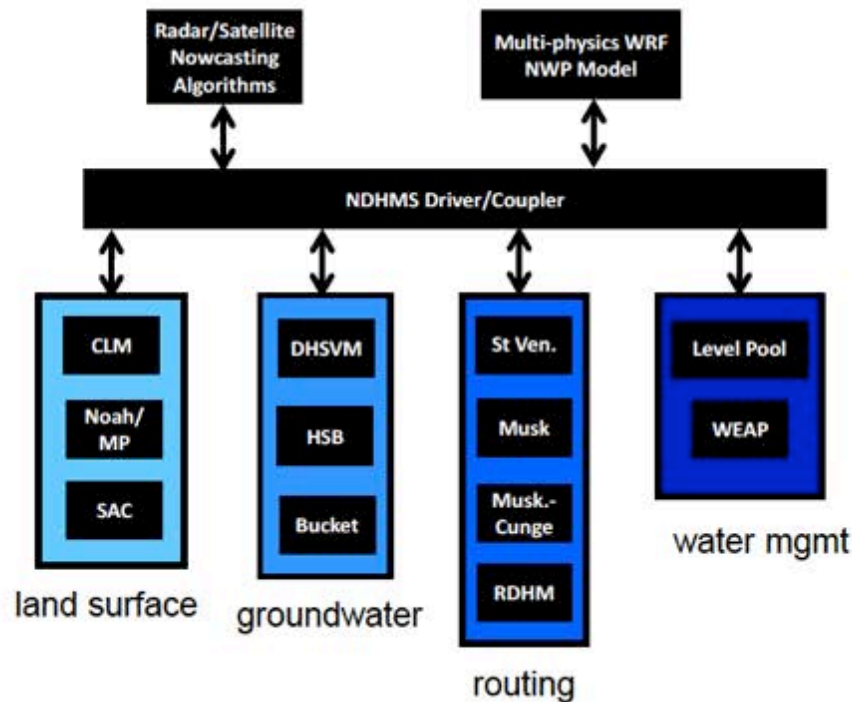
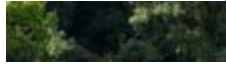


Main components of our multi-layer design and the interactions between collaborating projects in the US and Europe, in particular as organized under DRIHM2US and its US counterpart, SCIHM (Standards-based CyberInfrastructure for HydroMeteorology). The two projects overlap in their reliance on open community standards developed for high performance resource management and for domain services and catalogs, and on joint use of the data and services infrastructure, as well as parallel institutional development and community engagement.





DRIHM2US interoperability testbeds



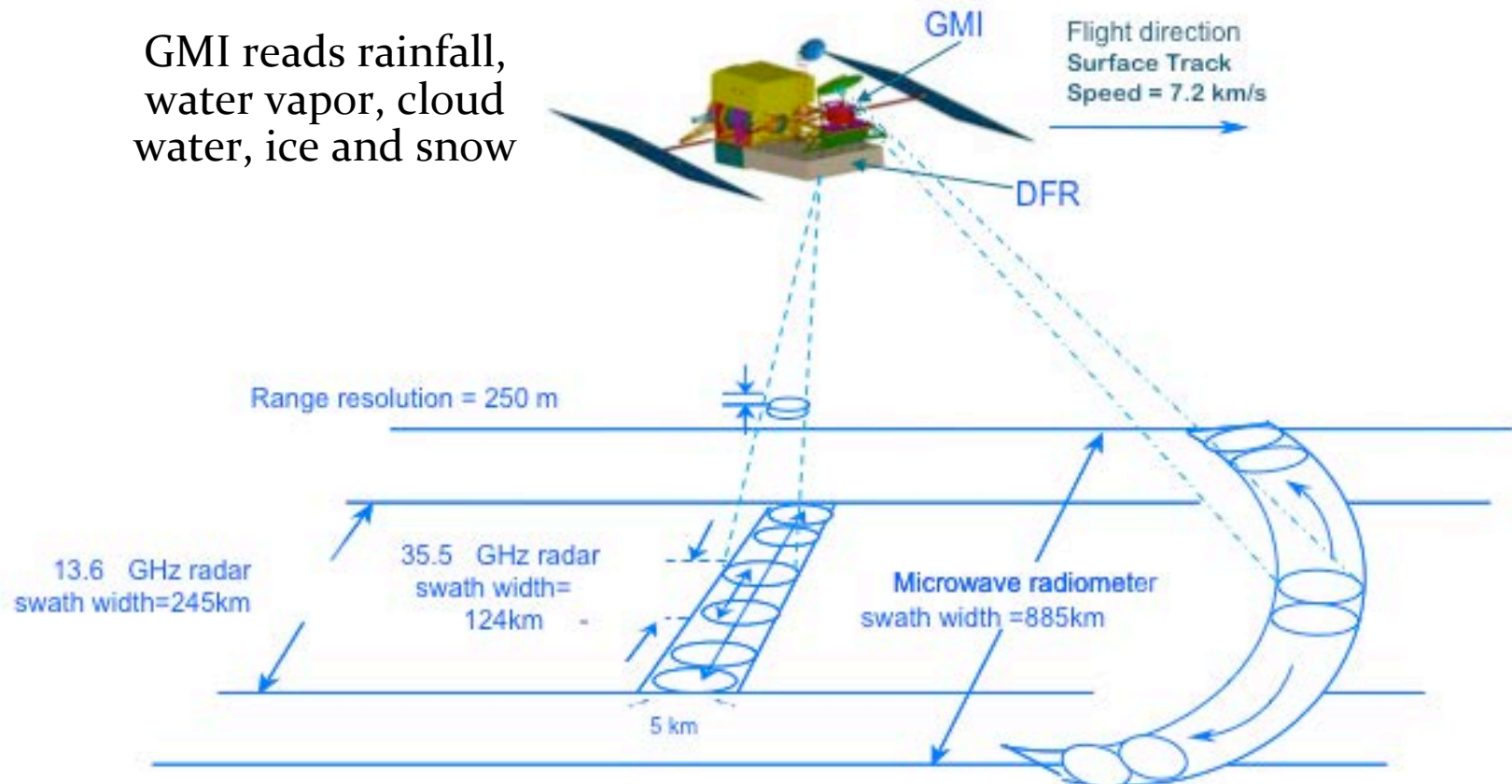
Schematic showing the suite of multi-physics options available for experimentation in the SCIHM use cases from WRF-Hydro (left) or from DRIHM (right).



Possible DRIHM(2US) contribution to GPM

DRIHM(2US) as an analysis and hindcast simulations e-infrastructure for extreme hydro-meteorological events.

GMI reads rainfall, water vapor, cloud water, ice and snow





DRIHM

DISTRIBUTED RESEARCH INFRASTRUCTURE
FOR HYDRO-METEOROLOGY

Discussion



European Commission
Information Society and Media



POLITÉCNICA



advancing the frontiers

