DRIHM

DISTRIBUTED RESEARCH INFRASTRUCTURE
FOR HYDRO-METEOROLOGY

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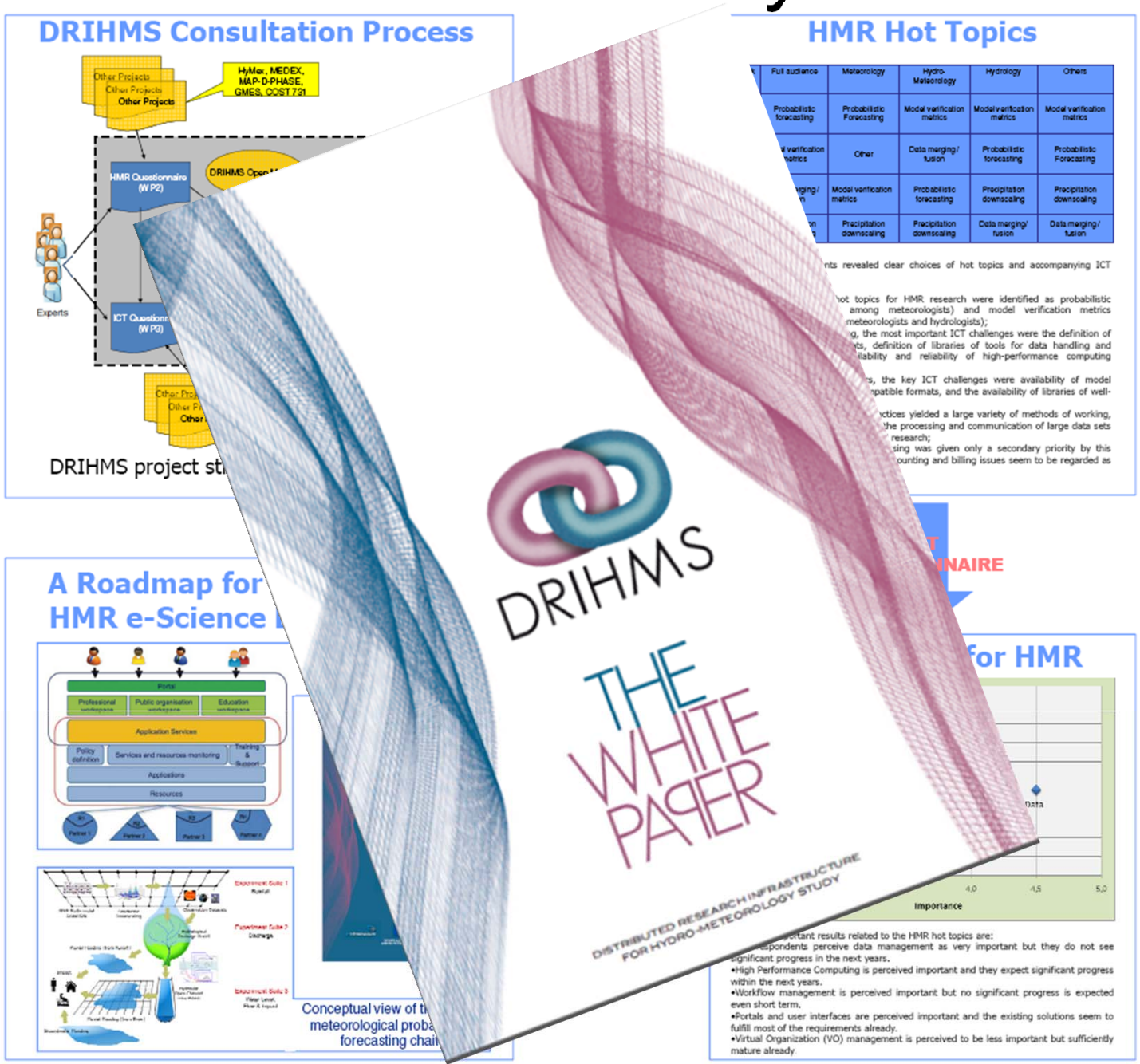
www.drihm.eu

European Commission
Information Society and Media

DRIHM Objectives

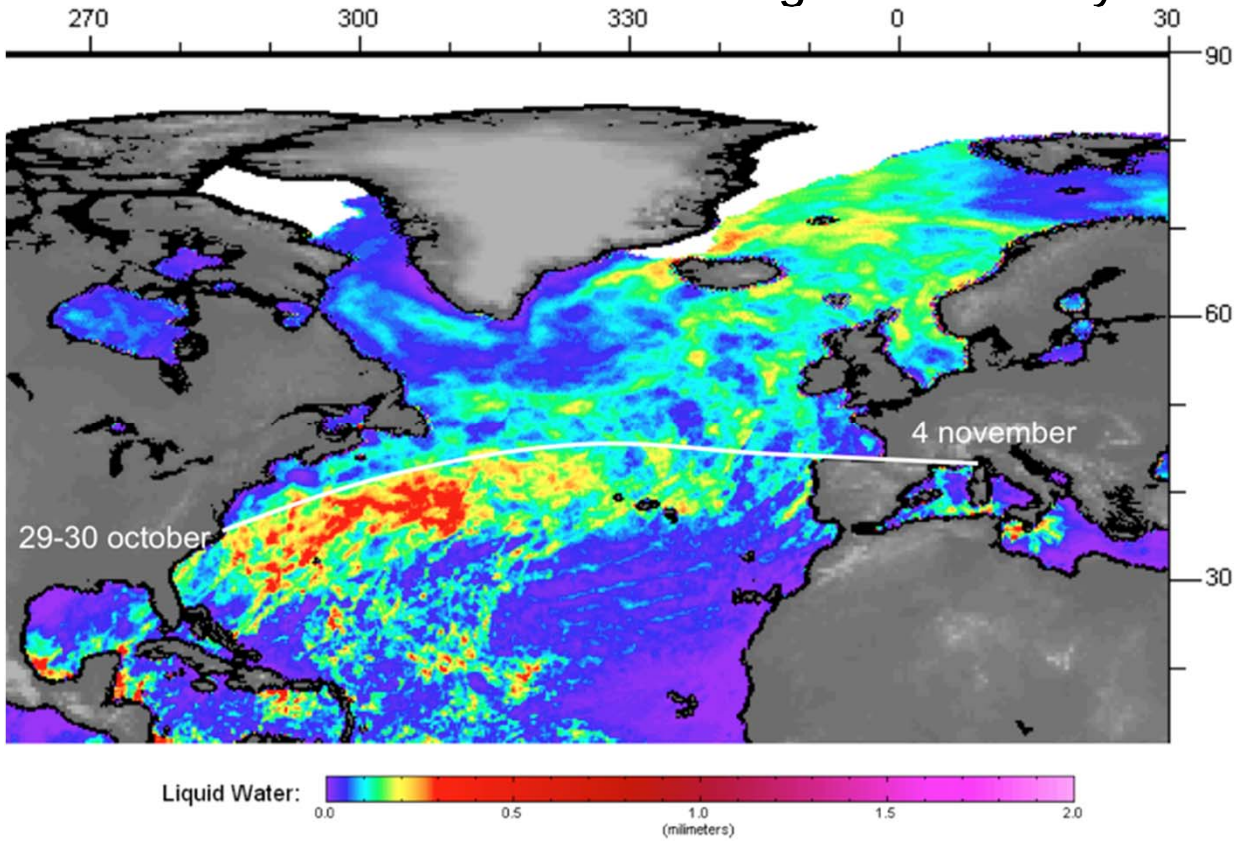
- **To support** the development and deployment of a **HMR e-Science environment**
- **To promote** the establishment and diffusion of a **service-oriented culture** (involving specialist scientist users, members of public services, members of the general public)
- To provide **integrated HMR services**
- 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



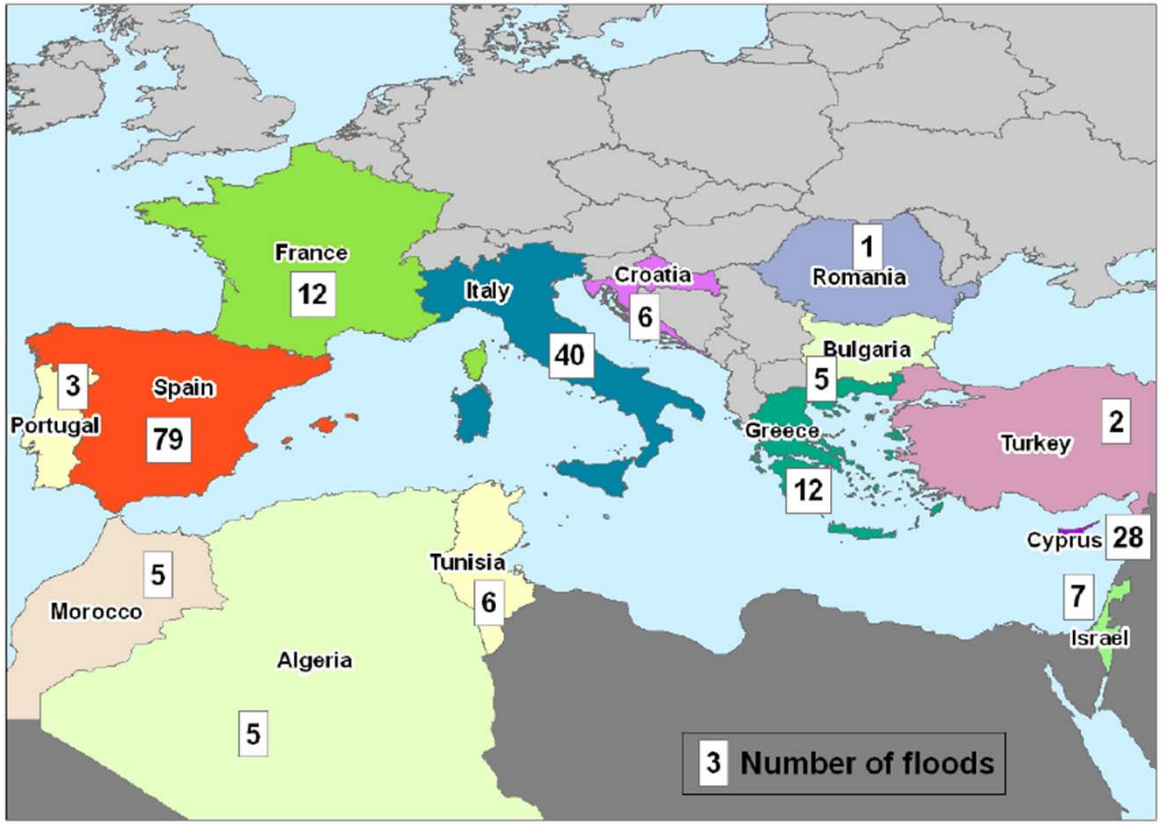
Why DRIHM?

- 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



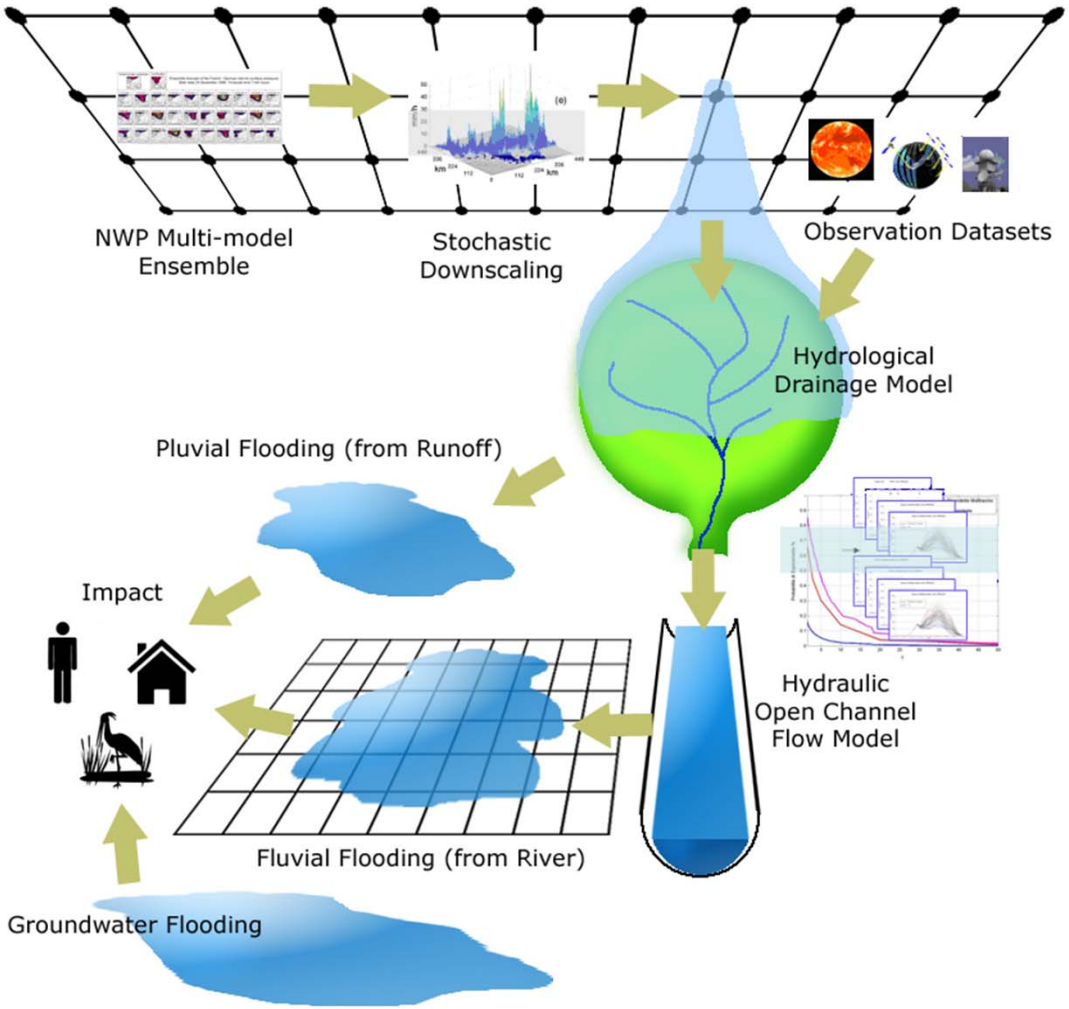
Satellite cloud liquid water composite (week ending 5/11/2011) clearly shows the cyclone track from USA east coast to Mediterranean.

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

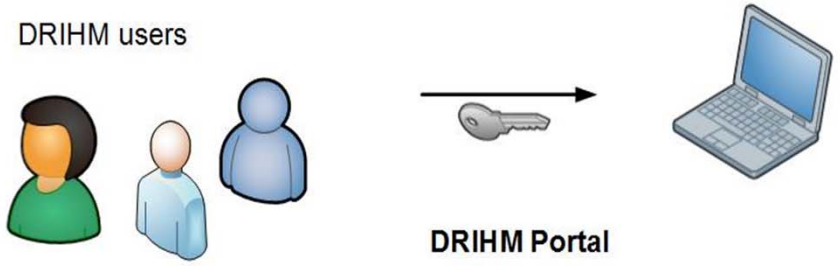


Experiment Suite 1
Rainfall

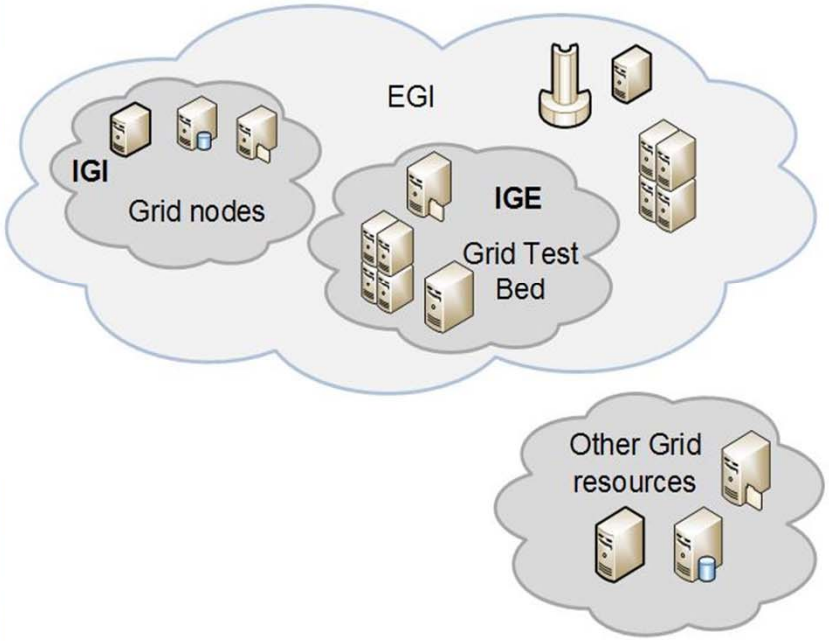
Experiment Suite 2
Discharge

Experiment Suite 3
Water Level,
Flow & Impact

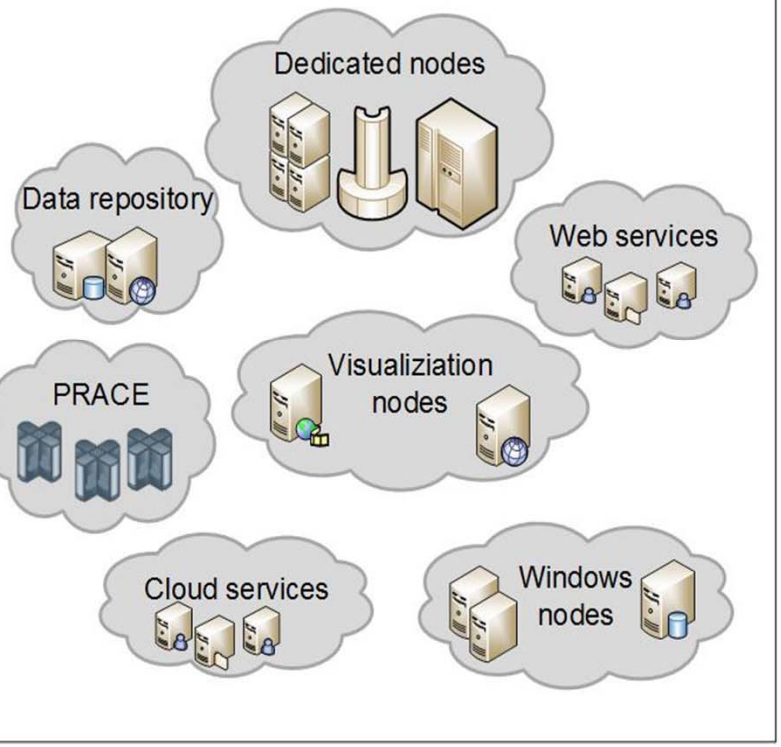
DRIHM e-Science environment



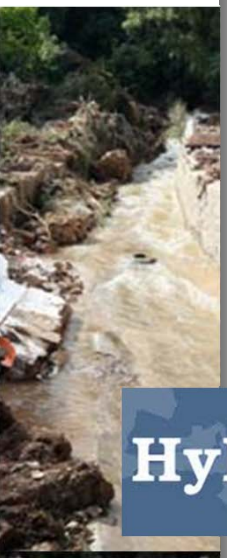
Resources accessible through the Grid: require valid Grid Certificate + DRIM VO user



Resources available out of the Grid



DDCI Ideal Architecture



HyMeX

ECMWF

DRIHM PORTAL

„DRIHM Repository" LMU
drihm-tools.pub-
.lab.nm.ifi.lmu.de
Binaries
From September on, drihm.eu will test the beta version of the „egi repository service"

WPS and critical case data repository

RESEARCH FOUNDATION
cima
OBSERVE TO PREDICT
PREDICT TO PREVENT

Serious run for meteo models

PRACE

HMR Linux-based Models

egi

Citizen Scientists and proprietary software

Testbed

Initiative for Globus in Europe

egcf

HMR Windows Models

IGI

The DRIHM Models

Meteorologic

Cb-TRAM (DLR)
Arome EPS (CNRS)
Meso-NH (CNRS)
RainFARM (CIMA)
COSMO-Model (CIMA)
WRF-ARW (CIMA)
PhaSt (CIMA)
WxFUSION (DLR)
Rad-TRAM (DLR)
WRF-NMM (RHMSS)

Hydrologic

Contiuum (CIMA)
DRiFt (CIMA)
HBV (RHMSS)
RIBS (UPM)
HYPROM (RHMSS)

Impact

SISYPHE (HR Wallingford)
Property Damage (HR Wallingford)

Hydraulic

MASCARET (HR Wallingford)
SOBEK-FLOW (Deltares)
TELEMAC-2D (HR Wallingford)
RFSM (HR Wallingford)
Delft3D-FLOW (Deltares)
Inundator (CIMA)

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 j2, 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.

Identification of HMR critical cases

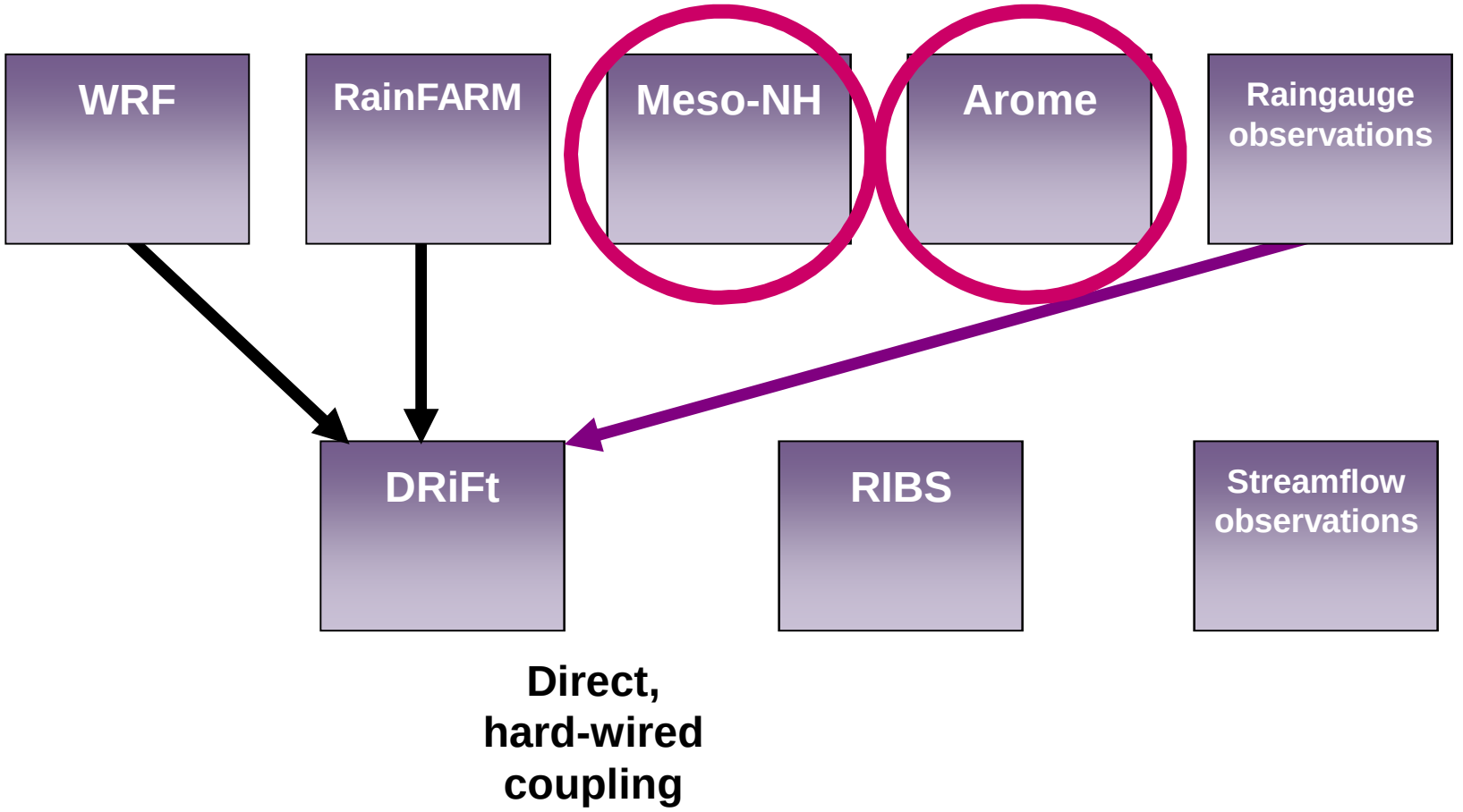
1. *Rain episode of June 22nd – July 5th 2010 in Serbia*
2. *Period of October-November 2011 in the north-western Mediterranean area*
3. *Rain episode of November 1st – 8th 2011 in Catalunya*
4. *Flash flood episode on 4th of November 2011, Genoa, Italy*

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

DRIHM Model Chains

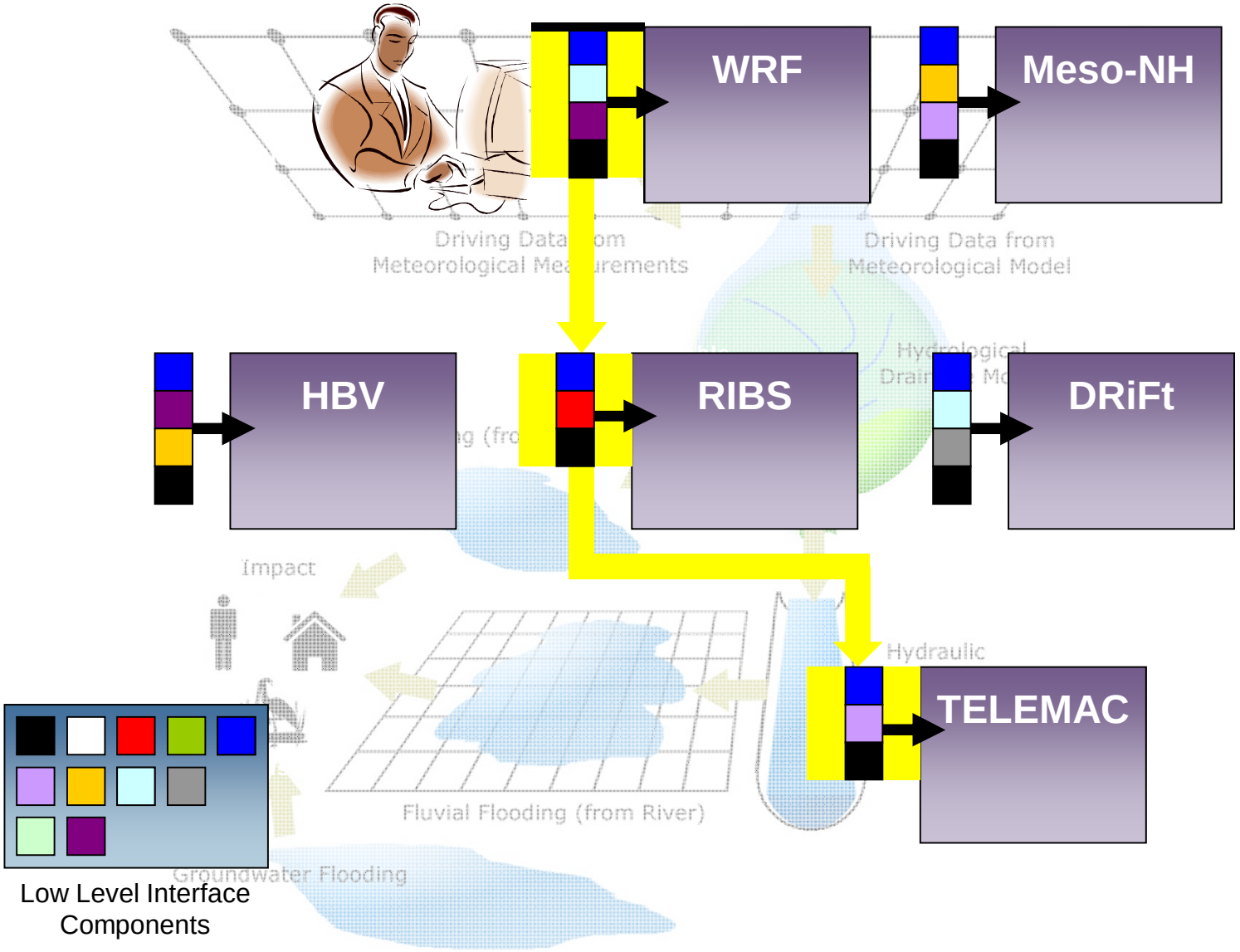
	RHMSS	CIMA	CNRS	CNRS
“Large” Scale Meteorological	WRF-NMM	COSMO-Model	Arome EPS	Meso-NH
	Deterministic	Ensemble	Probability	
	RHMSS			UPM
“Small” Scale Meteorological	WRF-NMM	RainFARM		Measured Rainfall
	Deterministic	Ensemble	Probability	
Hydrologic	HBV	HYPROM 2D	DRiFt	RIBS
	Deterministic	Ensemble	Probability	
	HRW		Deltares	Deltares
Hydraulic	TELEMAC-2D	HYPROM 1D	SOBEK-FLOW	Delft3D-FLOW
	Deterministic	Ensemble	Probability	
Impact	Property Damage			

Baseline version of experiment suites 1 & 2

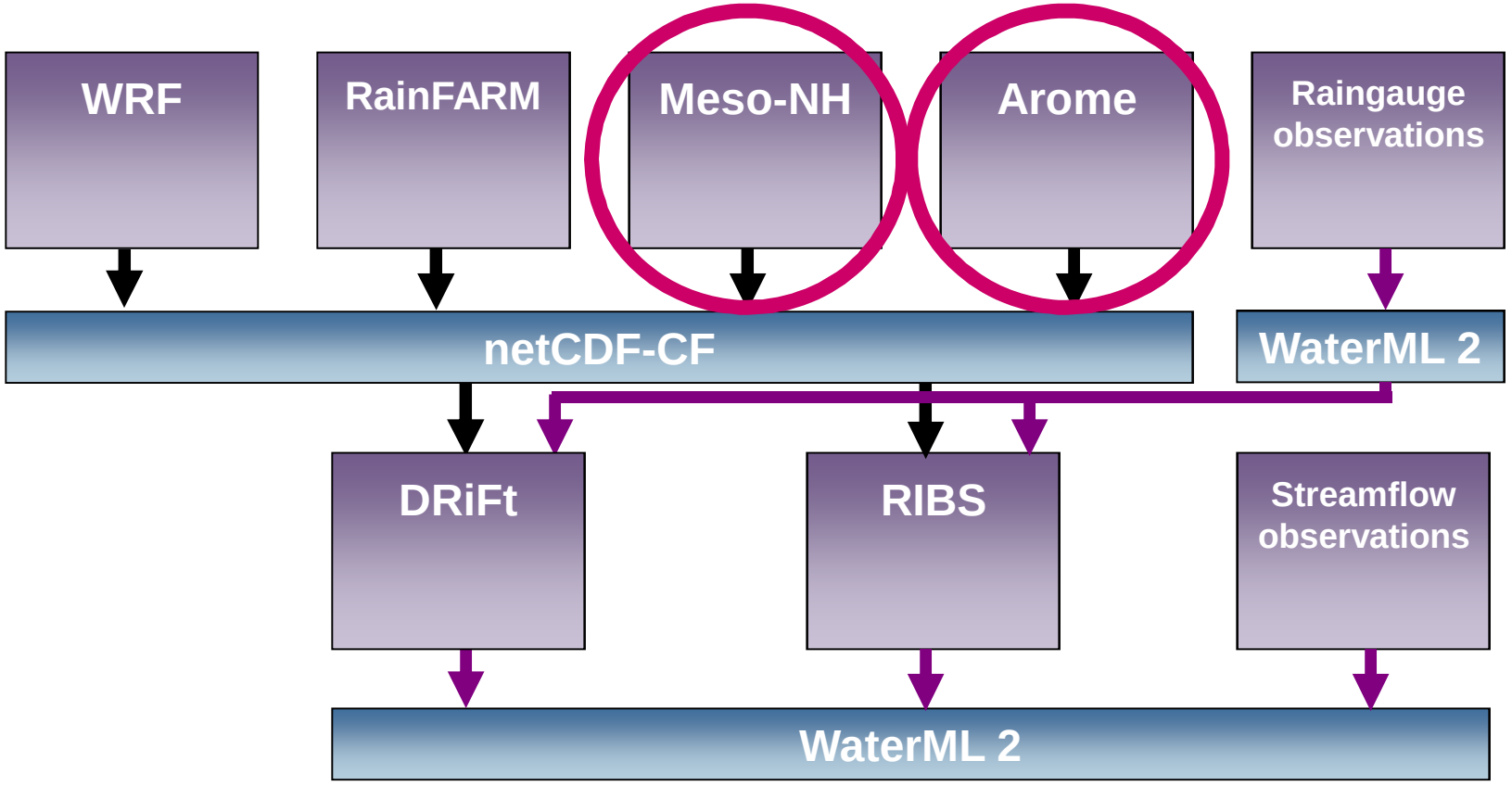


DRIHM Unified Interface Concept:

using tools like those developed within the SCI-BUS project



Advanced version of experiment suites 1 & 2

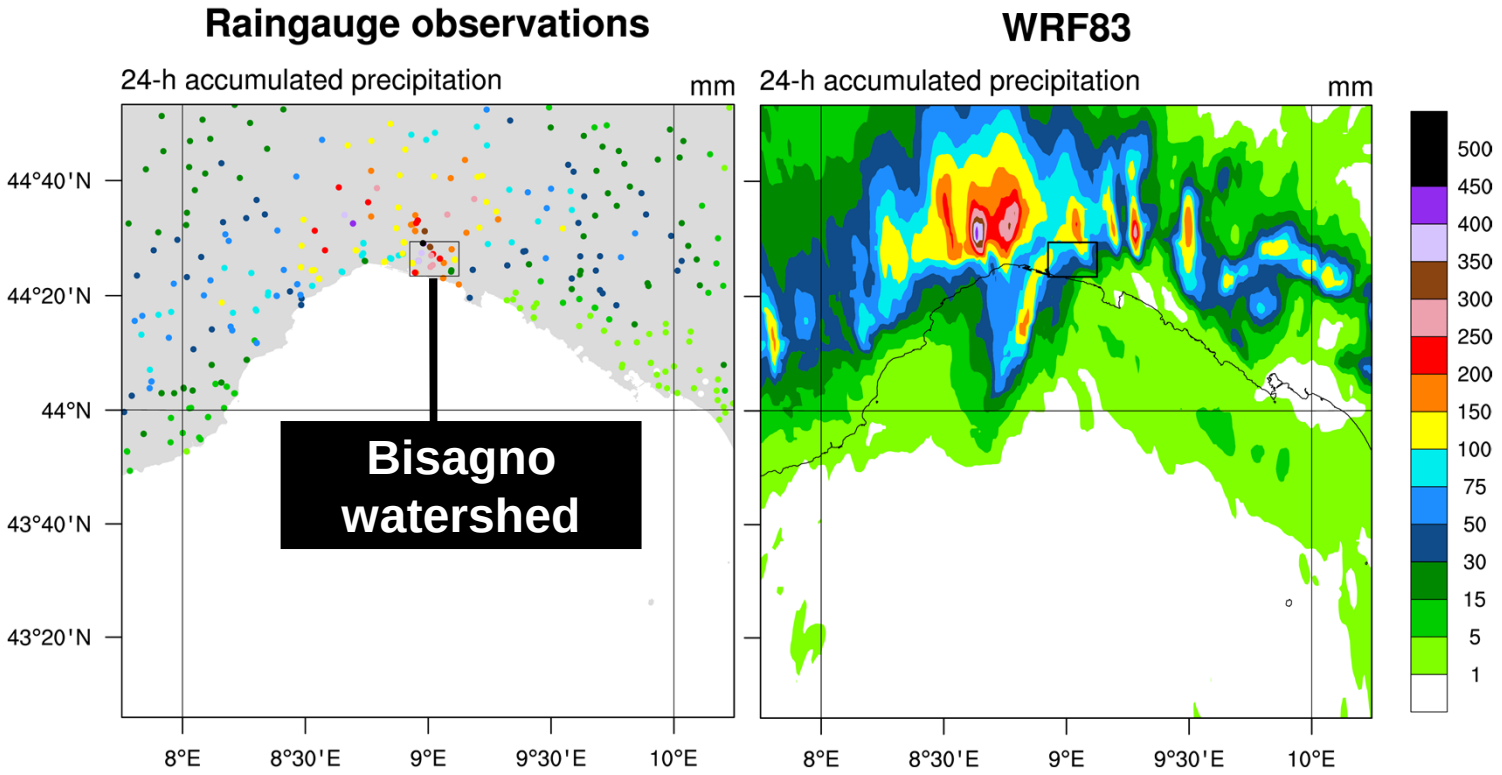


Summary of model setups

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

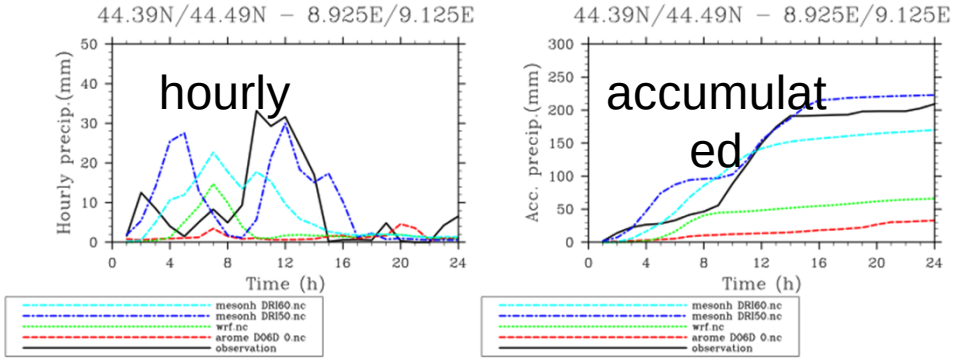
Meteorological scenarios

- *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*



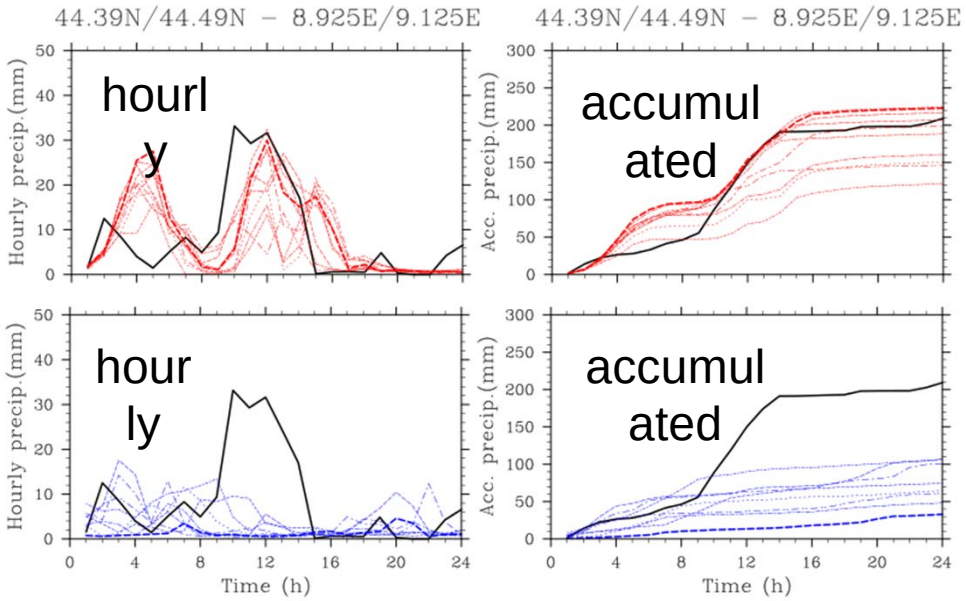
Comparison of rainfall time series

- *Rainfall time series averaged over the Bisagno catchment*



Rainfall time series for raingauge observations and different simulations

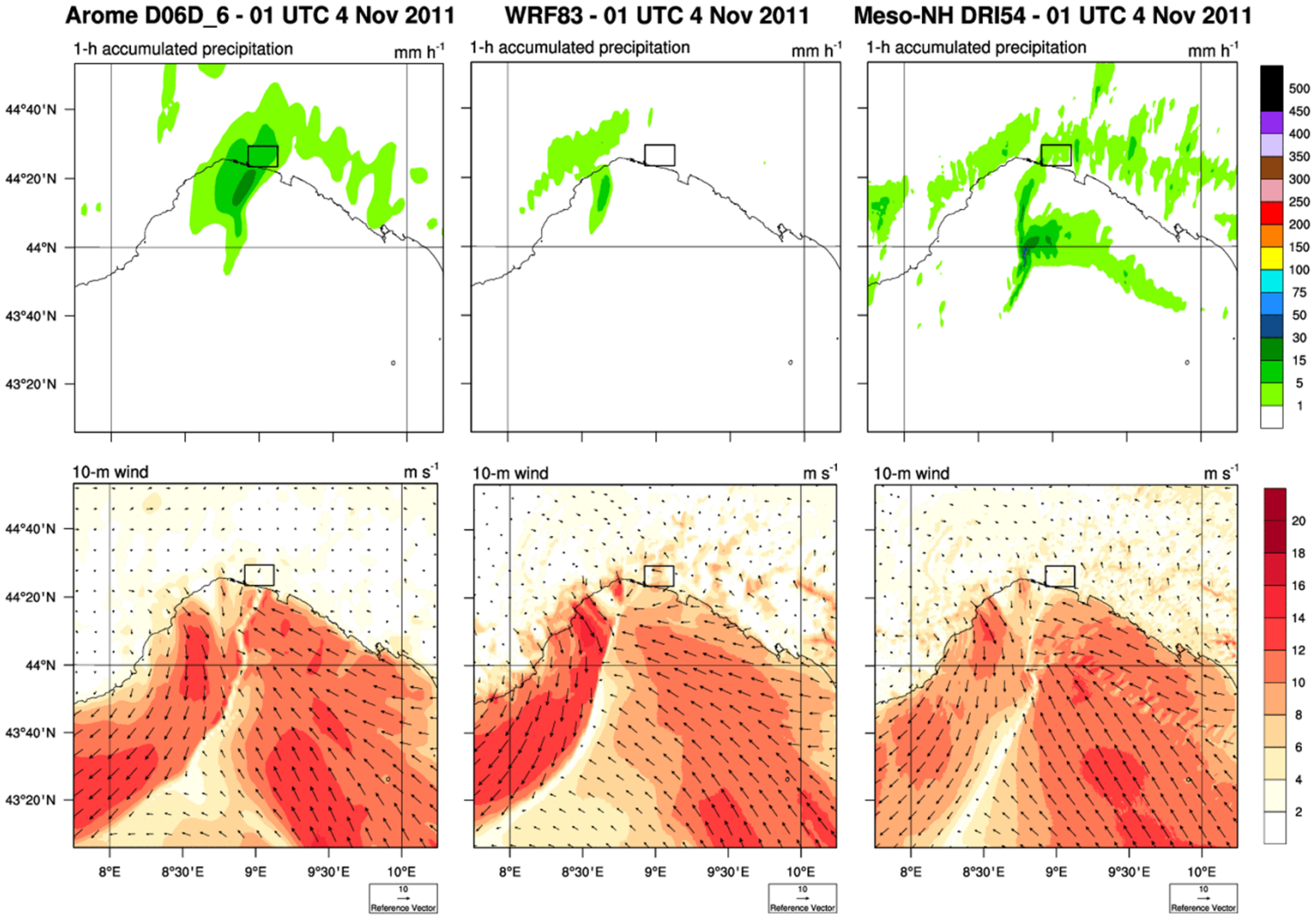
- *Ensembles*



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

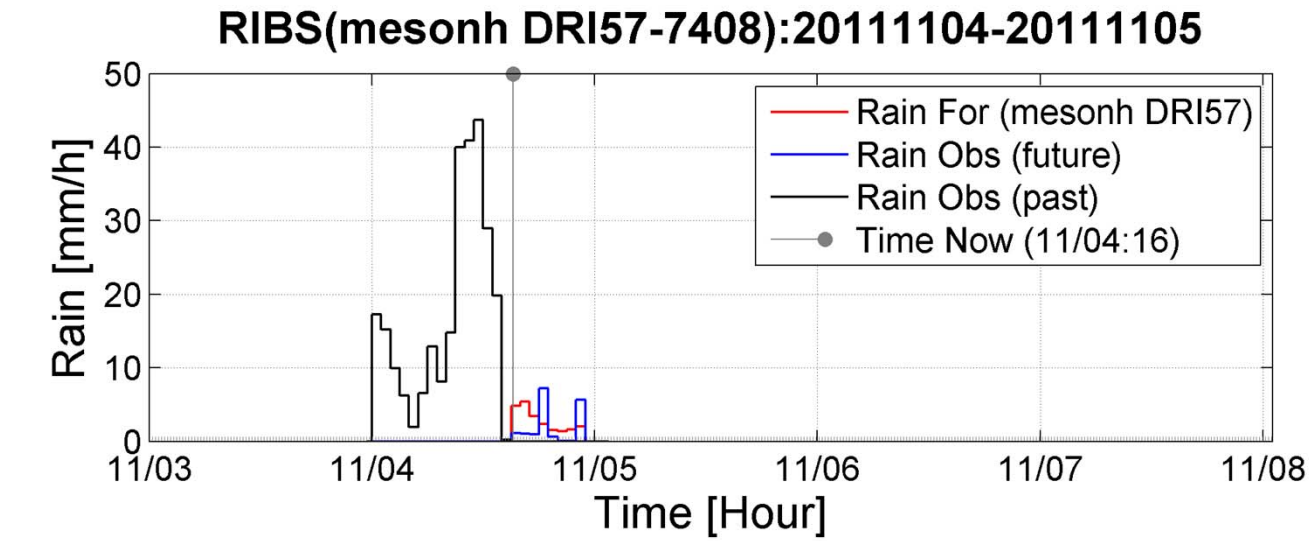
Rainfall time series for **raingauge observations** and **Arome ensemble**

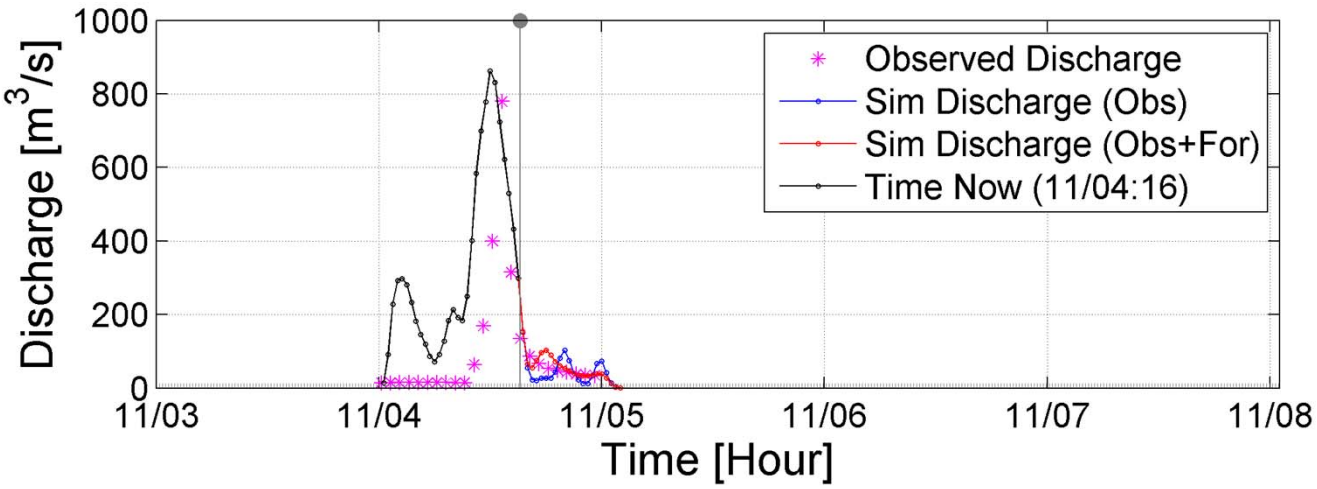
Comparison of model fields



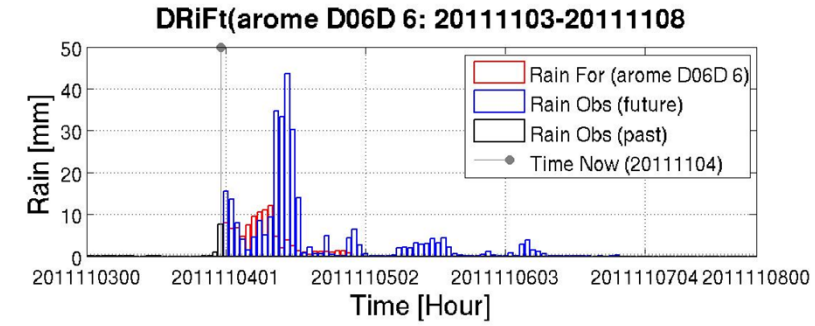
Full hydrometeorological chains

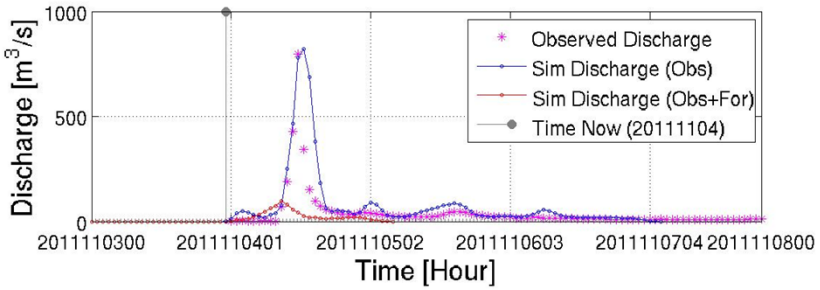
- *Summarizing all the information produced by a chain in one plot*



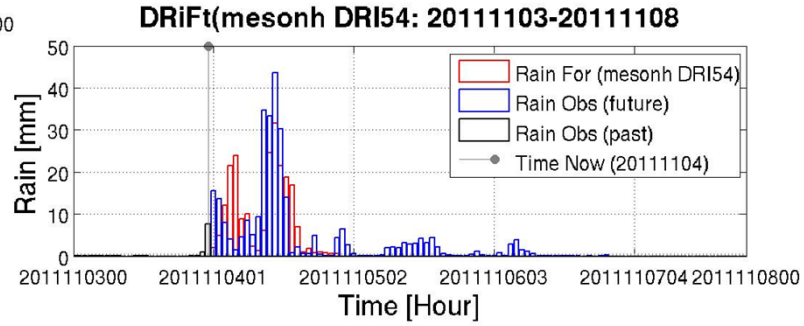


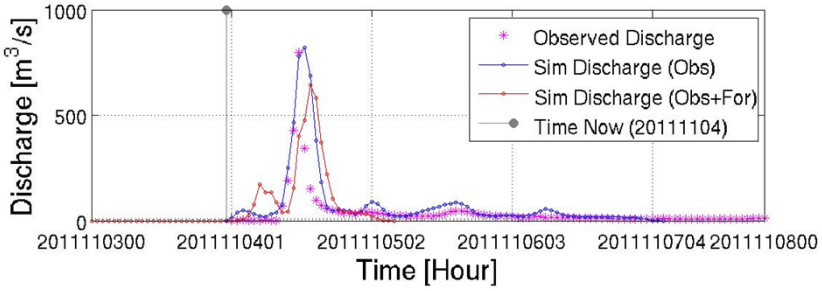
Comparison of different rainfalls





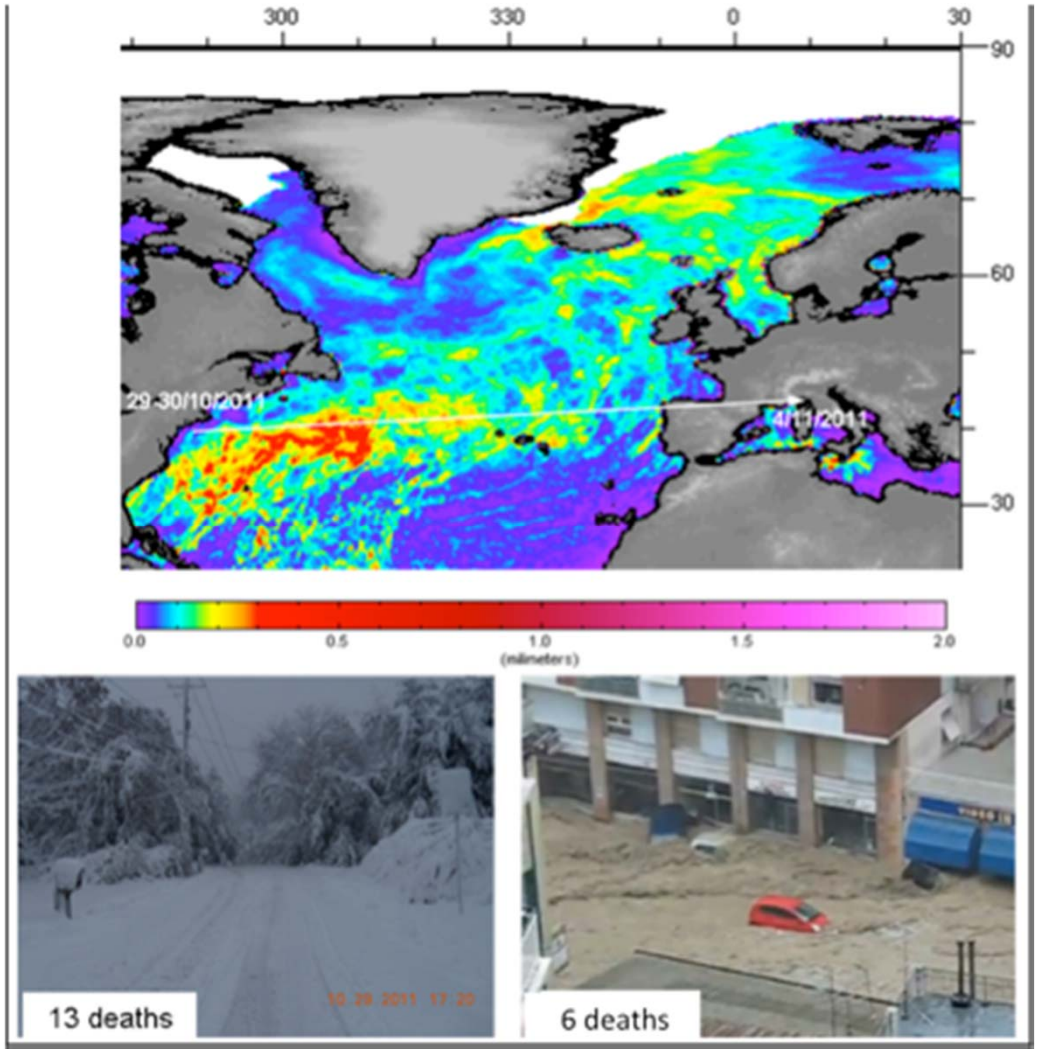
DRiFt driven by **Arome** ensemble member #6





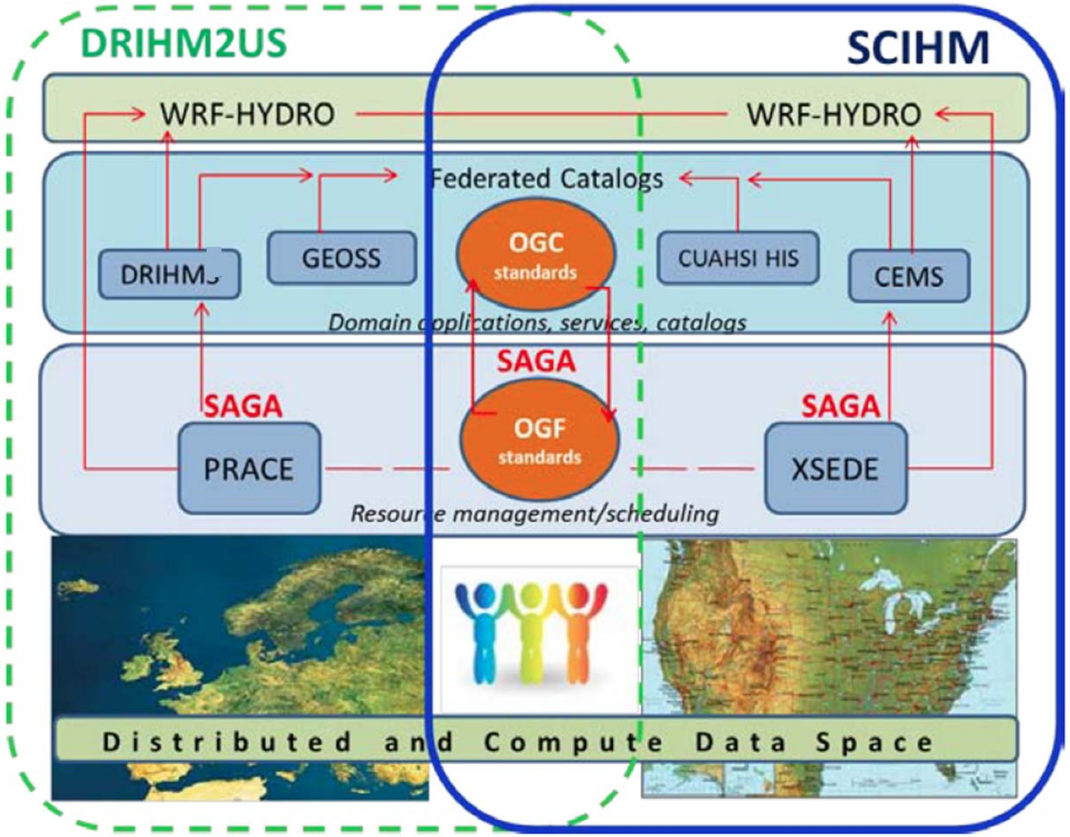
DRiFt driven by **Meso-NH** ensemble member DRI54

Thinking globally...DRIHM2US



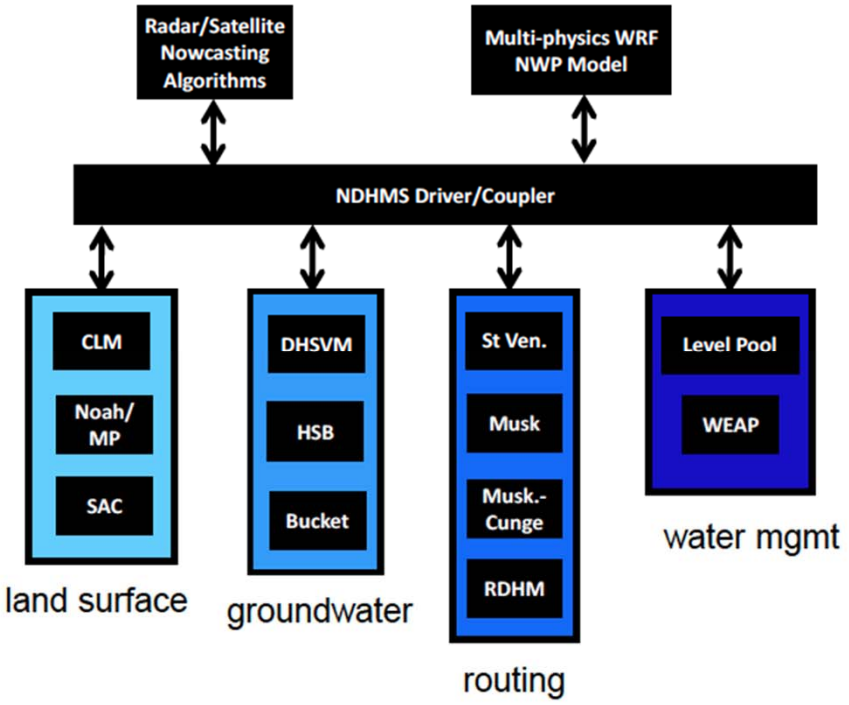
Upper panel: satellite cloud liquid water composite (week ending 5/11/2011) clearly shows the cyclone track from USA east coast to Mediterranean. Lower left panel: snowstorm impacts example on USA east coast. Lower right panel: Genoa city (Italy) under massive flash-flood event.

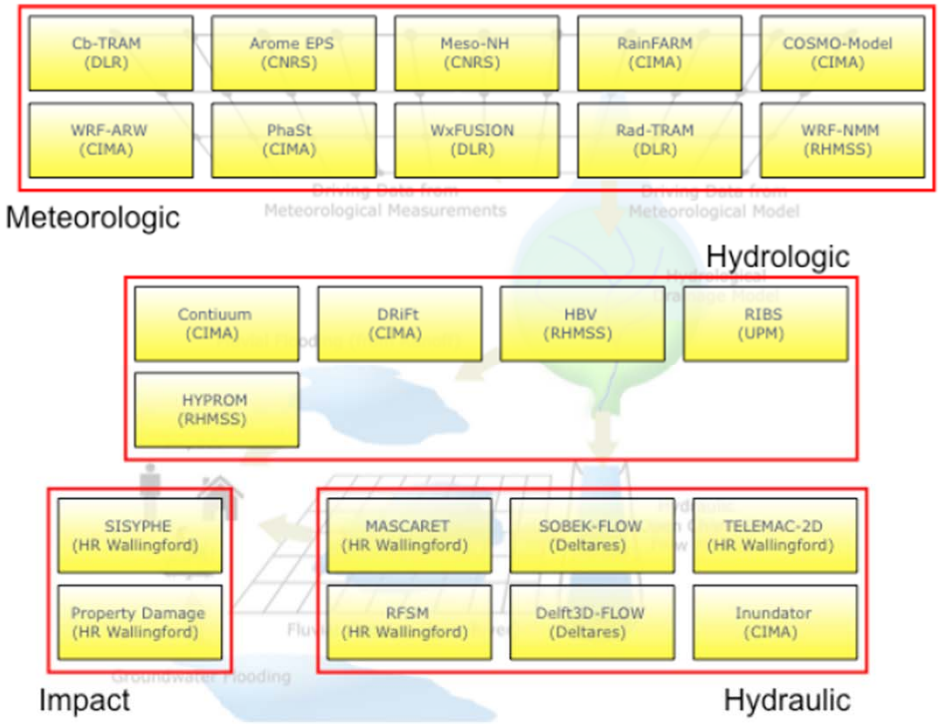
DRIHM2US interoperability testbeds



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).

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