

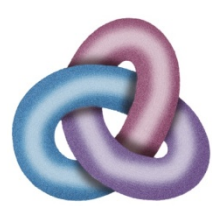
Towards an interoperable and distributed e-Infrastructure for Hydro-Meteorology: the DRIHM project

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advancing the frontiers

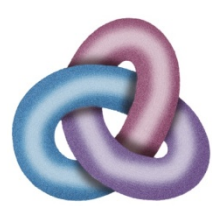




Introduction

- Forecasting severe storms and floods represents one of the challenges of 21th century
 - Hazards as floods, droughts and landslides
- Extreme precipitation and flooding events are among the greatest risks to human life
 - Significant societal and economic implications
- From a research perspective, the forecast of flood events needs to address manifold issues
 - Not only in HMR but with strong collaboration with ICT scientists for new technological solutions





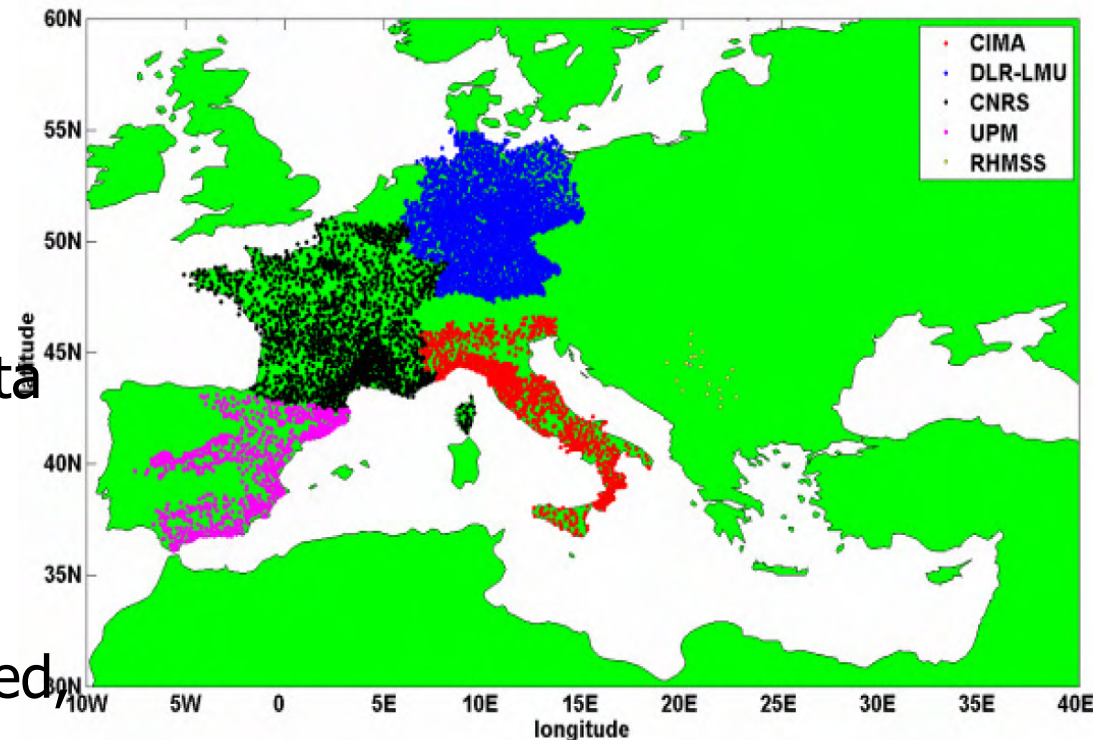
Limited usability of data

Too many points:

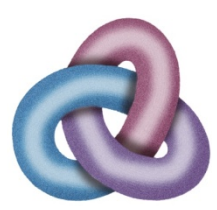
- Large data sets

Too many colors:

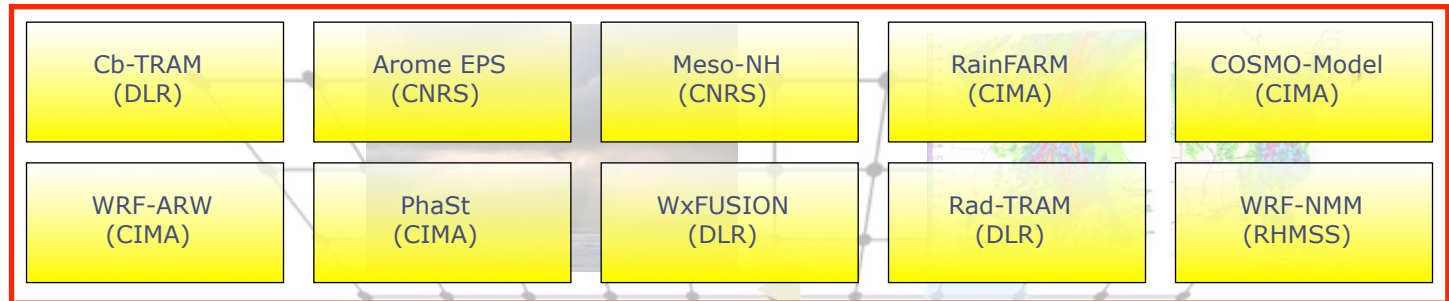
- Heterogeneous data
- Limited usability: even if available, observations are often non-integrated, disconnected, unreachable by



Organizational challenges: storms do not respect country boundaries! International collaboration in terms of data access, modeling, and expertise



Flood forecasting chain



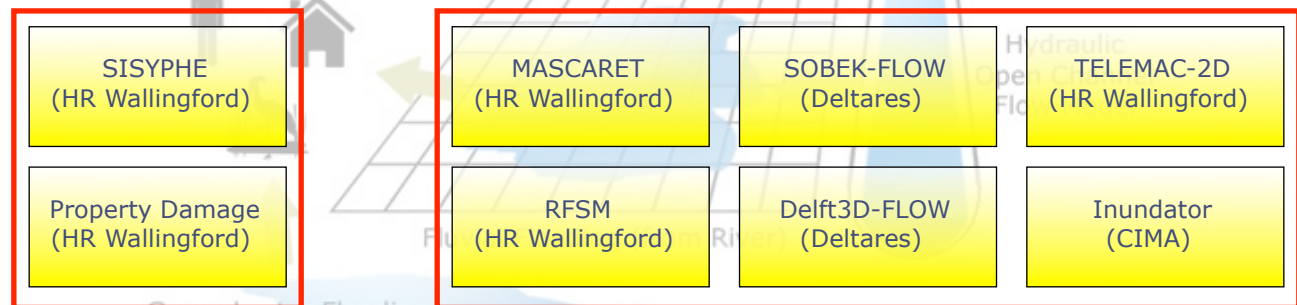
Meteorologic

Driving Data from
Meteorological Measurements

Driving Data from
Meteorological Model

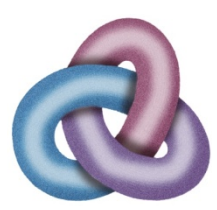
Hydrologic

HM challenges: execution of (complex) workflow built of several models from different scientific domains, i.e. meteorological, hydrological, hydraulic, and impact modeling tools



Impact

Hydraulic

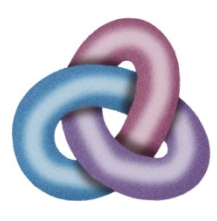


Stating the problems

- Generally, models depend on different execution environments, on organizational constraints, and on incompatible data formats and semantics
 - Up to now, HM researcher used to hard-wire a reduced set of hydro-meteorological models
- Furthermore, a single simulation requires a strong, reliable, and capable IT background
 - HMR models usually have significant requirements
 - Specific constraints on the eligible resources needed for their efficient execution

Enabling these steps though simple interfaces shielding from the complexities would be a plus as well as the ability to compare different models at each level



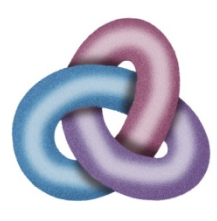


The DRIHM project

The EU co-funded FP7 DRIHM project (Distributed Research Infrastructure for Hydro-Meteorology, <http://www.drihm.eu>) aims at setting the stage for a new way of doing HMR

- Development of an e-Science environment to
 - Easily access and combine HM data and models using integrated services via user-friendly interfaces
 - Seamlessly exploit distributed computing, storage and networking facilities, as those provided by European e-Infrastructures EGI and PRACE (EU Grid Infrastructure – Partnership for Advanced Computing in EU)

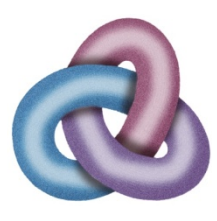




The DRIHM project

- Model integration - effort spent in model standardization in terms of data formats and semantics to compose models in a workflow
- Platform/computational requirements - design and development of the DRIHM Distributed Computing Infrastructure to effectively support the run
- DRIHM portal: the user-friendly interface provided to access services and resources to develop workflows while shielding the underlying complexities



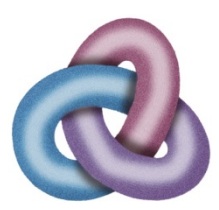


Model Integration

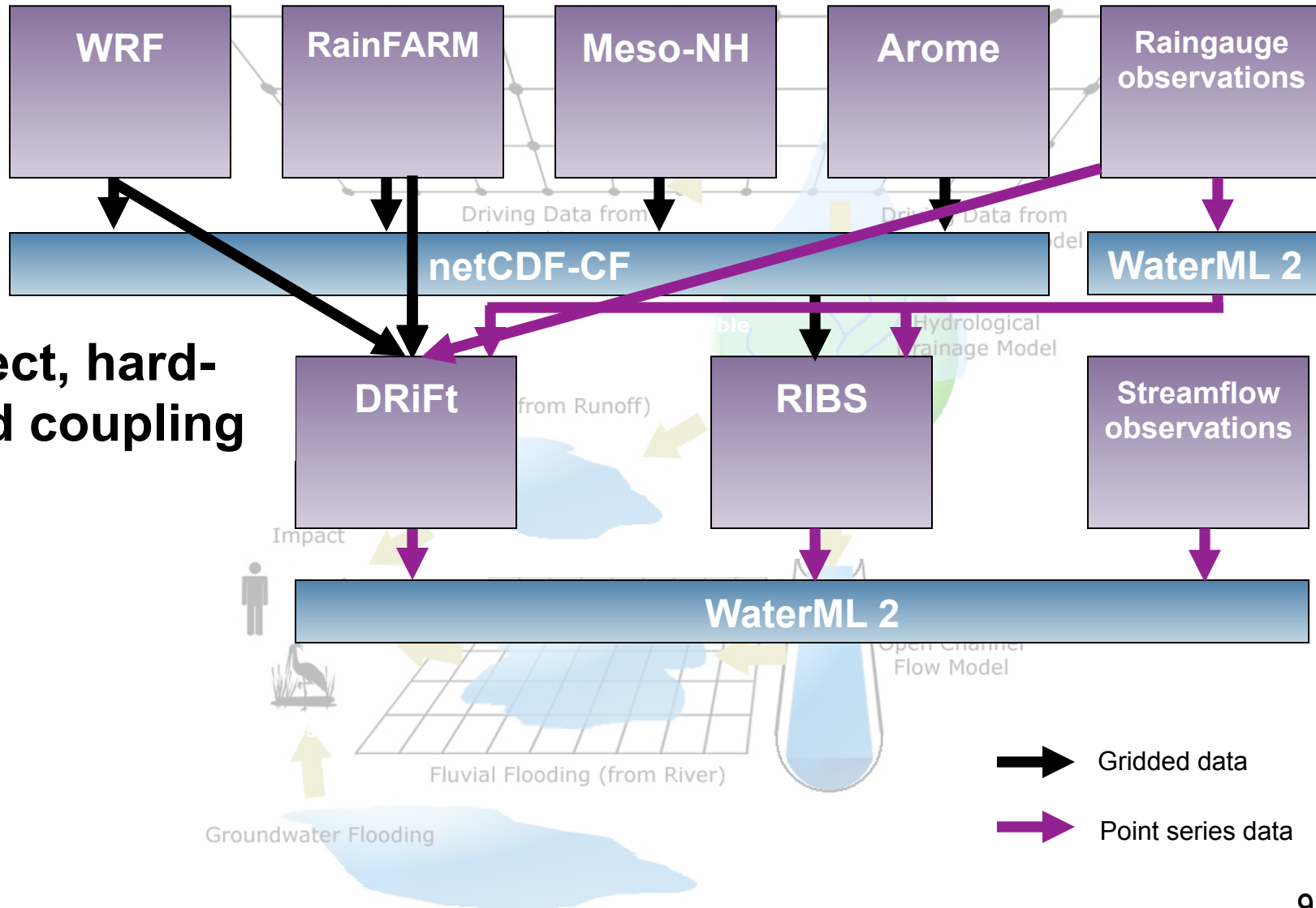
DRIHM is developing an extensible solution to design standardized interfaces to connect models on the base of existing standards

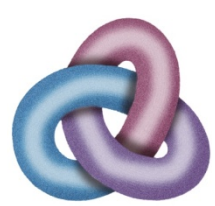
- Standardization of interfaces (file format) among models composing the chain
- Standardization of meta-tags associated with input and output, to allow checking the chain composability before running the model chain
- Consistency check, i.e. meteo simulation is performed on a domain including the drainage basin adopted in the following step



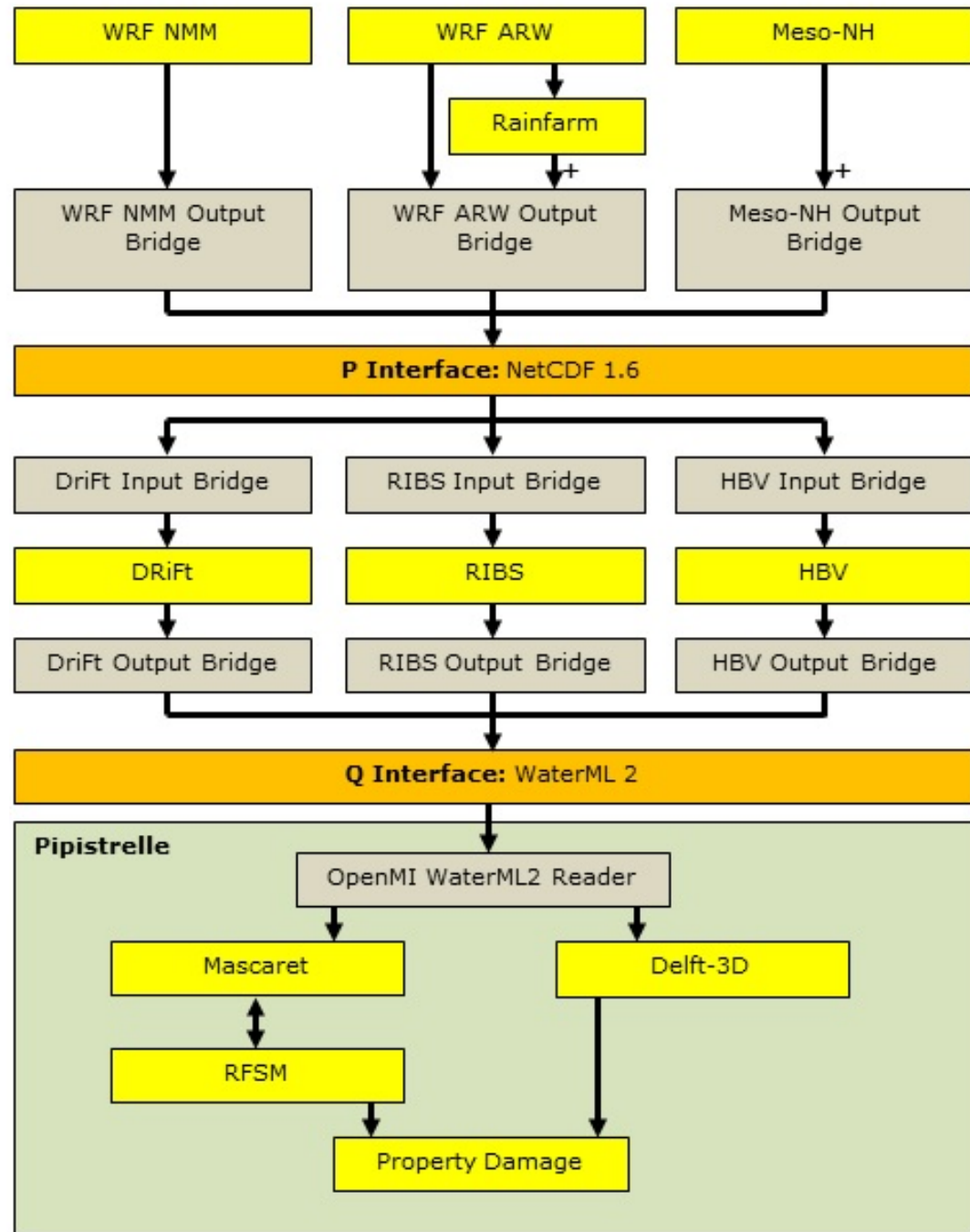
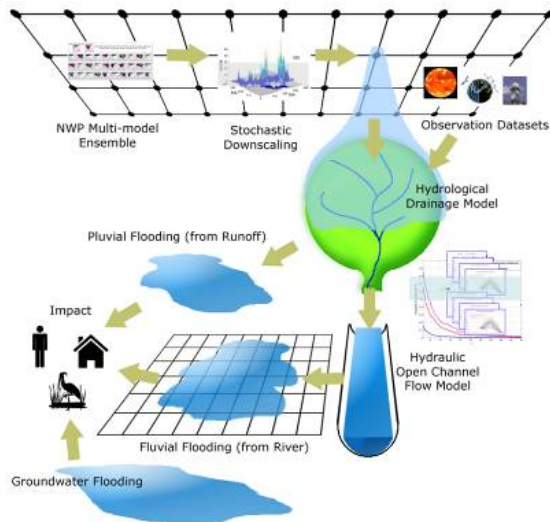


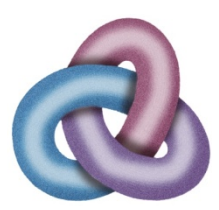
Model Integration





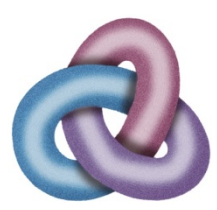
Model Integration



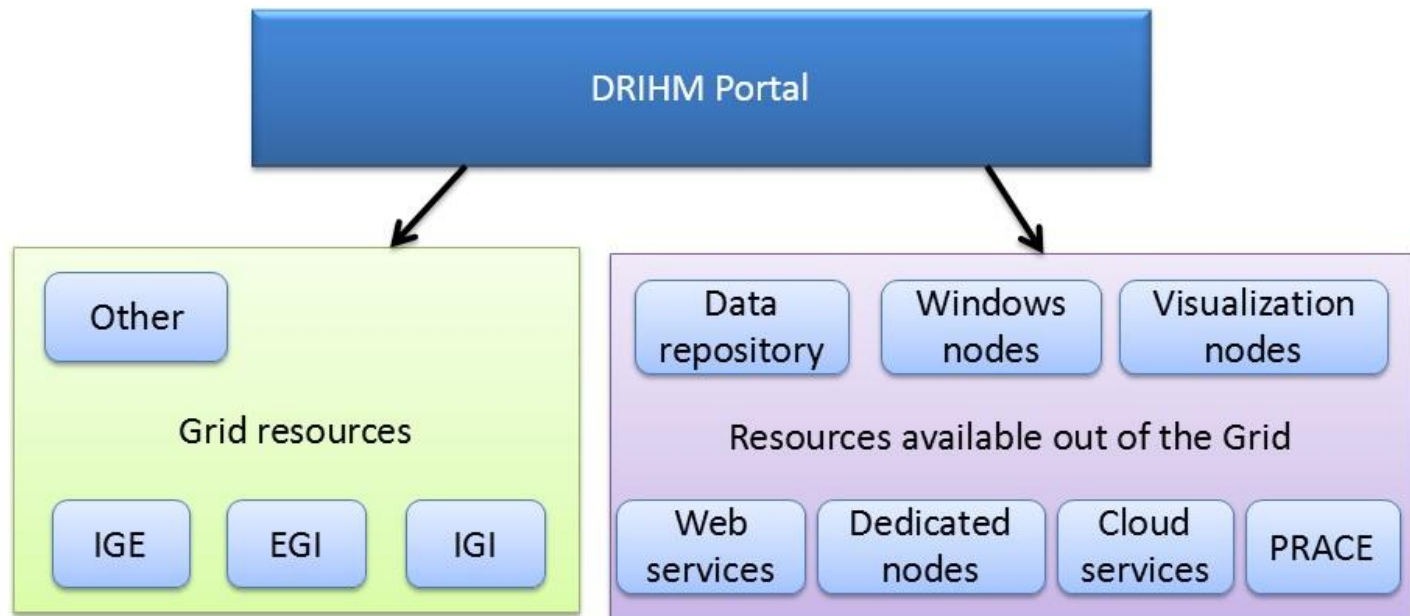


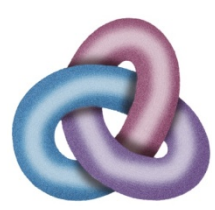
DRIHM Distributed Computing Infrastructure

- Models differ in terms of platform requirements:
 - Some models are designed for POSIX systems
 - Others are designed for Windows
 - Some depend on specific libraries (sometimes even on specific library versions)
- Need to access distributed computing, storage and networking facilities
 - DRIHM is not based on a proprietary or pre-defined computing infrastructure, but exploits available European e-Infrastructure ecosystems



DRIHM Distributed Computing Infrastructure





DRIHM Portal

Workflow Storage
Security Data Avenue

WS-PGRADE

Experiment Configuration Model Specific
Validation & Submission Model Specific Administration

DRIHM Portlets

ASM API

Workflow Interpreter Workflow Storage File Storage
Information System Application Repository gUSE Services

DCI-BRIDGE

GT5 GLITE LOCAL WEB SERVICE PBS UNICORE CLOUD

SW: 44.1102,8.2885 --- NE:44.7087,9.6817

Grid Spacing (degrees) 0.5

Parental grid ratio 3 (suggested)

Analysis of whether the model connection is feasible



Interaction with other project

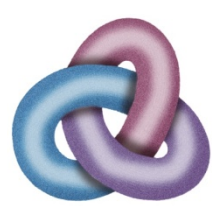
The screenshot shows the DRIHM website with the following elements:

- Header:** DRIHM logo and navigation menu (Home, About DRIHM, DRIHM Newsletters, Dissemination, User Forum, Support Centre, Contacts). A search bar is also present.
- Left Sidebar:** DRIHM logo with the text "DRIHM DISTRIBUTED RESEARCH INFRASTRUCTURE FOR HYDRO-METEOROLOGY" and "Creating scientific communities". Below it is a "DRIHM ICT-Video" section with a video player and a "Login Form" with fields for "User Name" (containing "dago") and "Password".
- Main Content Area:** A large aerial image of a city. Below it, the "DRIHM MoUs" section is titled "Home » Dissemination » DRIHM MoUs". It contains the text: "The Memorandum of Understanding (MoU) represents a strengthening in the collaboration with some projects and initiatives with similar or complementary objectives with respect to DRIHM." followed by a list of MoUs with links to PDFs: "MoU with the **Climb project**", "MoU with the **ER flow project**", "MoU with the **Sci-bus project**", "MoU with the **EGI project**", "MoU with the **IGE project**", "MoU with the **MAPPER project**", and "MOU with the **MeteoNetwork project**".

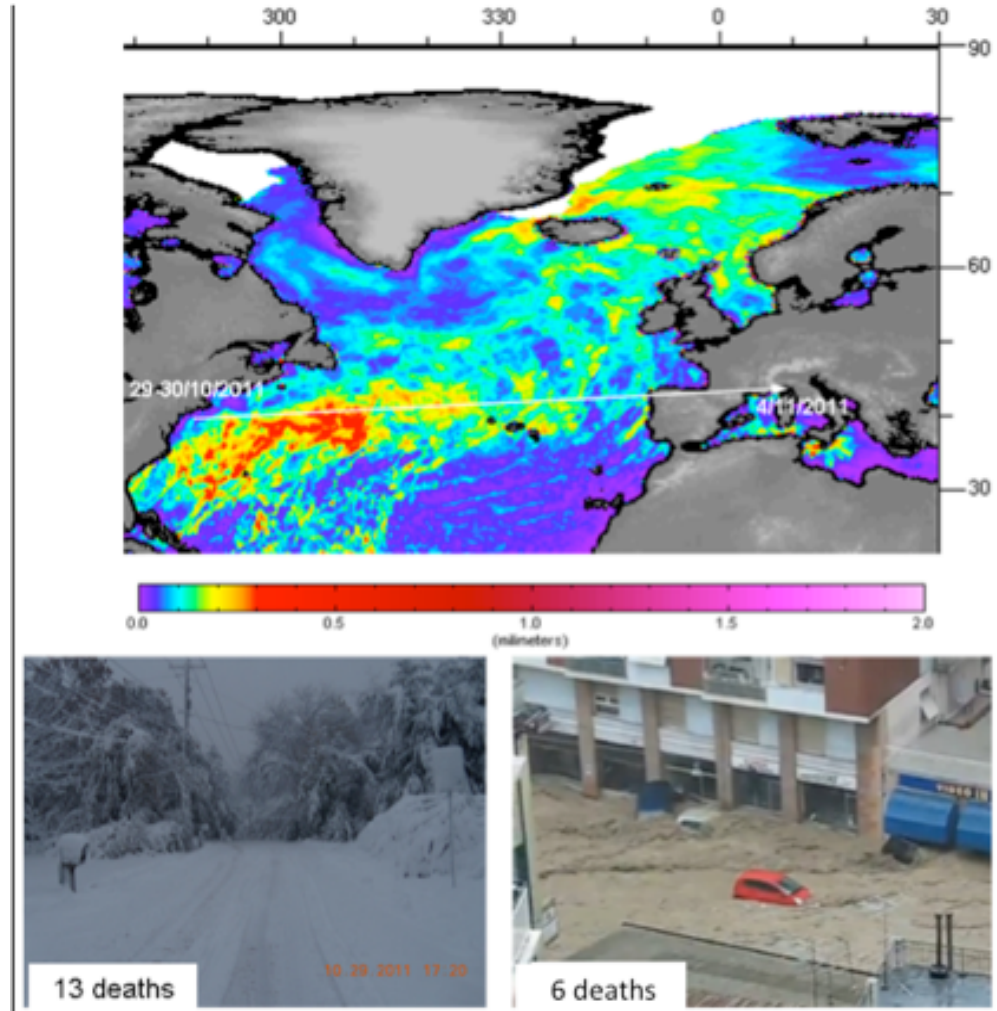
e. Links with other projects and programmes

Comment on the consortium's interaction with other related Framework Programme projects and other national/international R&D programmes and standardisation bodies (if relevant).

The consortia's interaction with other projects (both R&D and e-infrastructure) is excellent and a model to which other FP7 projects should be pointed to as an exemplar.



Thinking globally...DRIHM2US

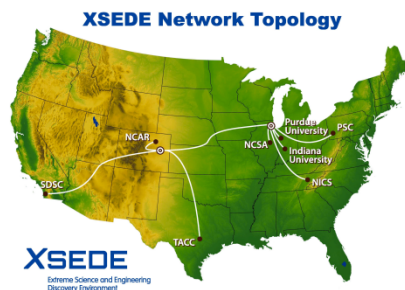


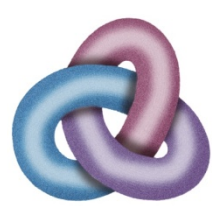
Upper panel: satellite cloud liquid water composite (week ending 5/11/2011) clearly shows the cyclone track from USA east coast to Mediterranean. Lower left panel: snowstorm impacts example on USA east coast. Lower right panel: Genoa city (Italy) under massive flash-flood event.

DRIHM2US

The EU co-funded FP7 DRIHM2US project (<http://www.drihm2us.eu>) aims at

- Promote international cooperation between Europe and USA for the development of a joint/common e-Infrastructure for HMR
- Put in place key elements to allow persistent availability and effective sharing of data and models across scientific disciplines, institutions and national boundaries, specifically across the Atlantic





To summarize





SUMMER SCHOOL

Madrid, Spain
22-25 September 2014



HYDRO-METEOROLOGICAL MODELLING USING e-SCIENCE ENVIRONMENTS

Building hydro-meteorological modelling chains and executing them on European e-Infrastructures through the DRIHM portal.

www.drihm.eu
www.upm.es

7 Move all the data and a

8 Launch the execution

9 Monitoring of possible exe
submit in case of failure

10 Results retrieval

11 Visualization or further proces

tion of a model, Mark need to
ven steps. Subsequent model runs
2 to 11. This means days for
le alternative meteo model.
es required (SW tools, HW
re to be taken into account.
help Mark in speed-up the
m ready to run hydro-
ging data and high

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