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DISTRIBUTED RESEARCH INFRASTRUCTURE FOR HYDRO-METEOROLOGY STUDY

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ICT-infrastructures for hydrometeorology science and natural disaster societal impact assessment: the DRIHMS project

e-infrastructure

CAPACITIES

DRIHMS is co-Funded by the EC under the 7th Framework Programme

RESEARCH FOUNDATION cima OBSERVE TO PREDICT PREDICT TO PREVENT

DLR

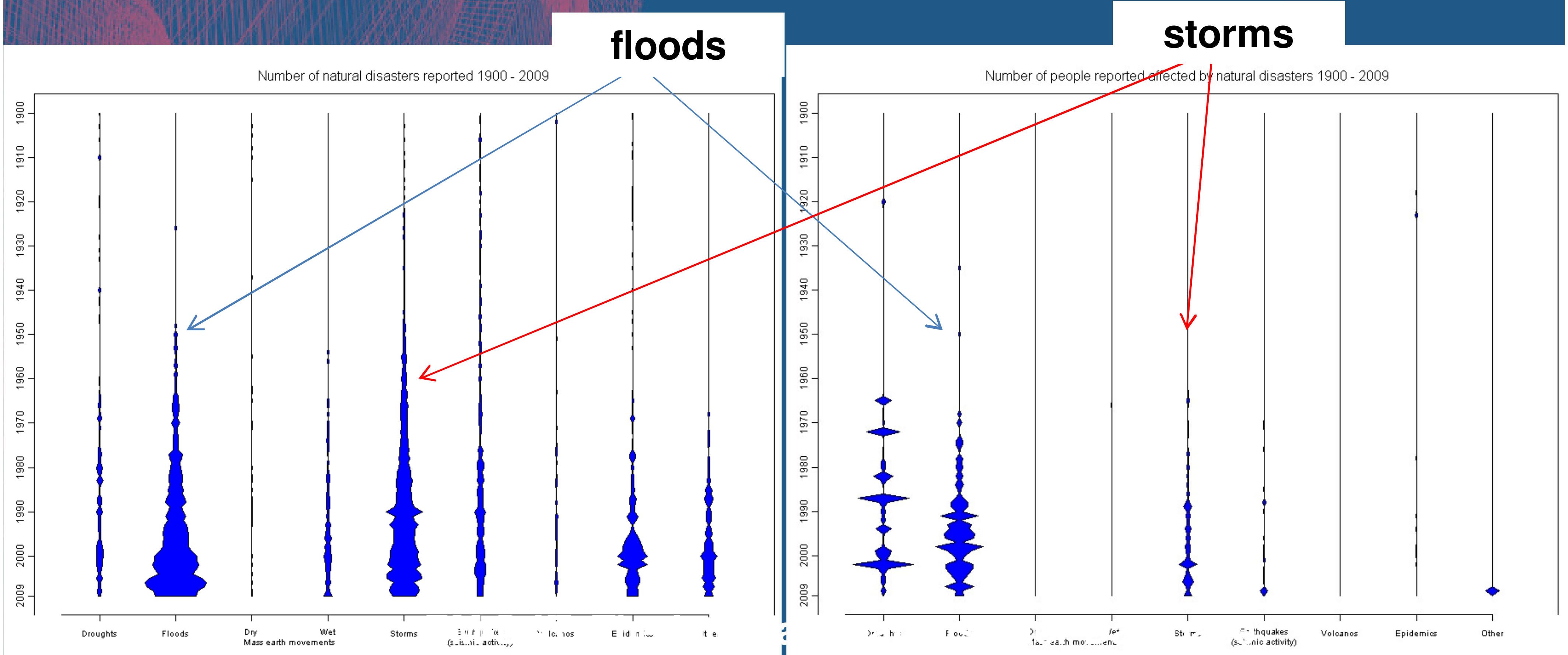
LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN
MNM TEAM MUNICH NETWORK MANAGEMENT TEAM

imati

Policy makers premises

- ✓ Lisbon strategy: knowledge and innovation as the engines of sustainable growth towards a fully inclusive information society

- ✓ Center for Research on Epidemiology of Disasters (CRED) and United Nations International Strategy for Disaster Reduction (UNISDR): flood and storm events are among the natural disasters that most impact human life

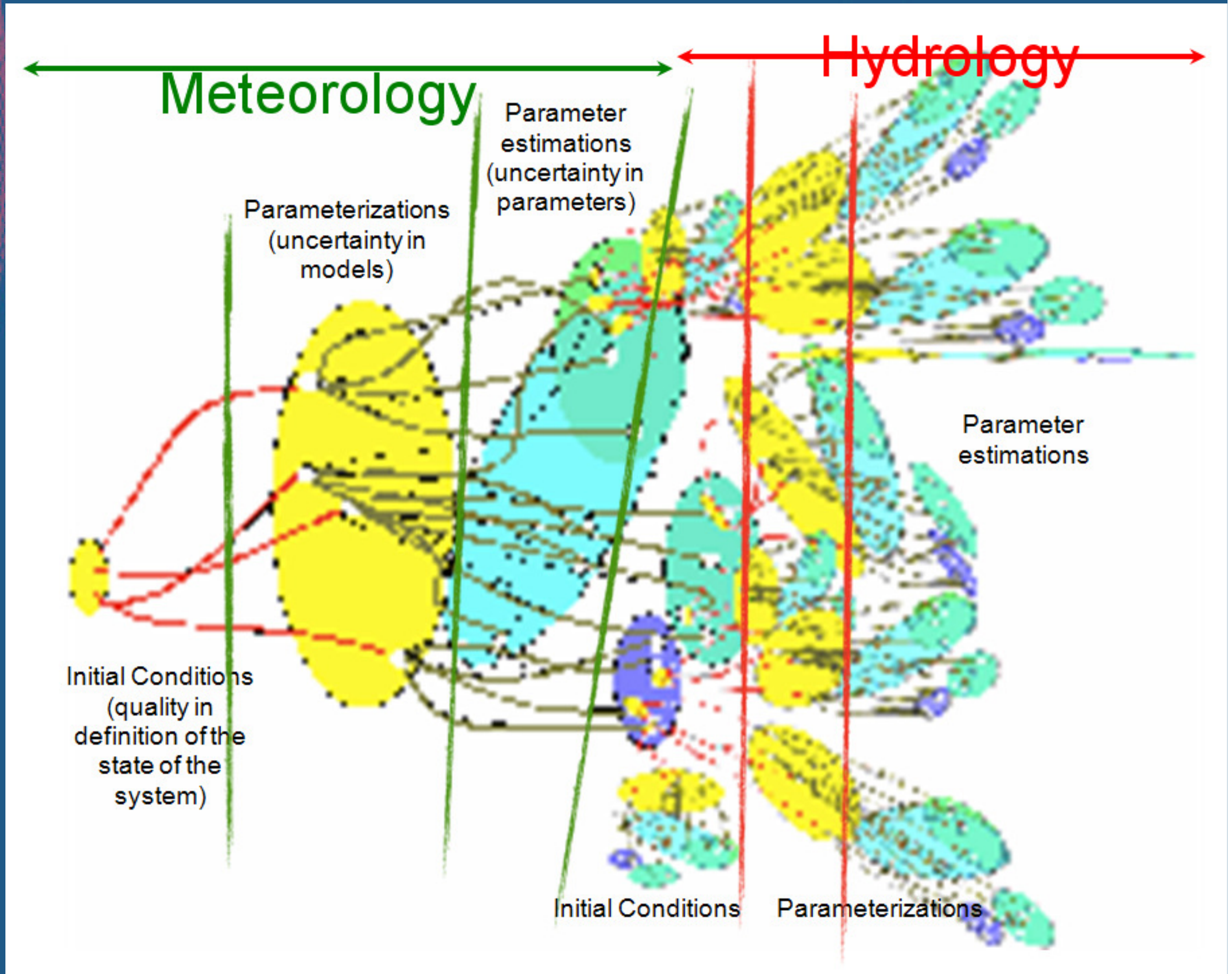


Society expectations

- ✓ The research activity in hydrometeorology (HM) <u>takes its motivation (and its funding sources!)</u> from a precise <u>request of “security” from the society</u>:
  - ➡ <u>People</u> wants to be protected from the ground effects of extreme meteorological events
  - ➡ <u>Civil Protection decision makers</u>, in order to accomplish this task, need reliable indications about where events are more likely to occur
  - ➡ <u>Operational rescue activity</u>, after the event needs updated information about the situation in the area hit by the event.

Scientific and technical state of art

- ✓ Hydrometeorological science has made strong progress over the last decade: new modelling tools, post processing methodologies and observational data are available
- ✓ Huge amount of data and information is available for the European region: size is against ease of use
- ✓ European efforts in developing e-science Infrastructures: EGEE (Enabling Grids for E-sciencE), SEE-GRID-SCI (South East Europe -GRID e-Infrastructure for regional e-Science), German C3-Grid provide an ideal basis for the sharing of complex hydrometeorological data sets and tools



Hydrometeorology predictive ability

- We can explain hydrometeorology reasons for observed patterns;
- We need to *predict* hot spots and hydrometeorology interactions;
- What is needed to improve our predictive ability?
  - "Coherent" and comparable observations in multiple locations
  - Denser observations in time and space
  - Better access to data
  - Combination of different modeling tools and post-processing tools
  - Multidisciplinary perspective

New opportunities

- ✓ For the first time in history, technology (e.g. satellites, radars but also extensive real time monitoring networks) allows to observe several processes at the same scales they has to be modeled to forecast HM processes
  - ➡ databases of NWP outputs, run by operational met-services and research centers
  - ➡ meteoradar network mosaics
  - ➡ national real time micro-meteorological networks
  - ➡ long time series of satellite observations (e.g. NOAA-AVHRR, Terra and Aqua MODIS, landsat TM and ETM+)

The problem: ...too many points and colors

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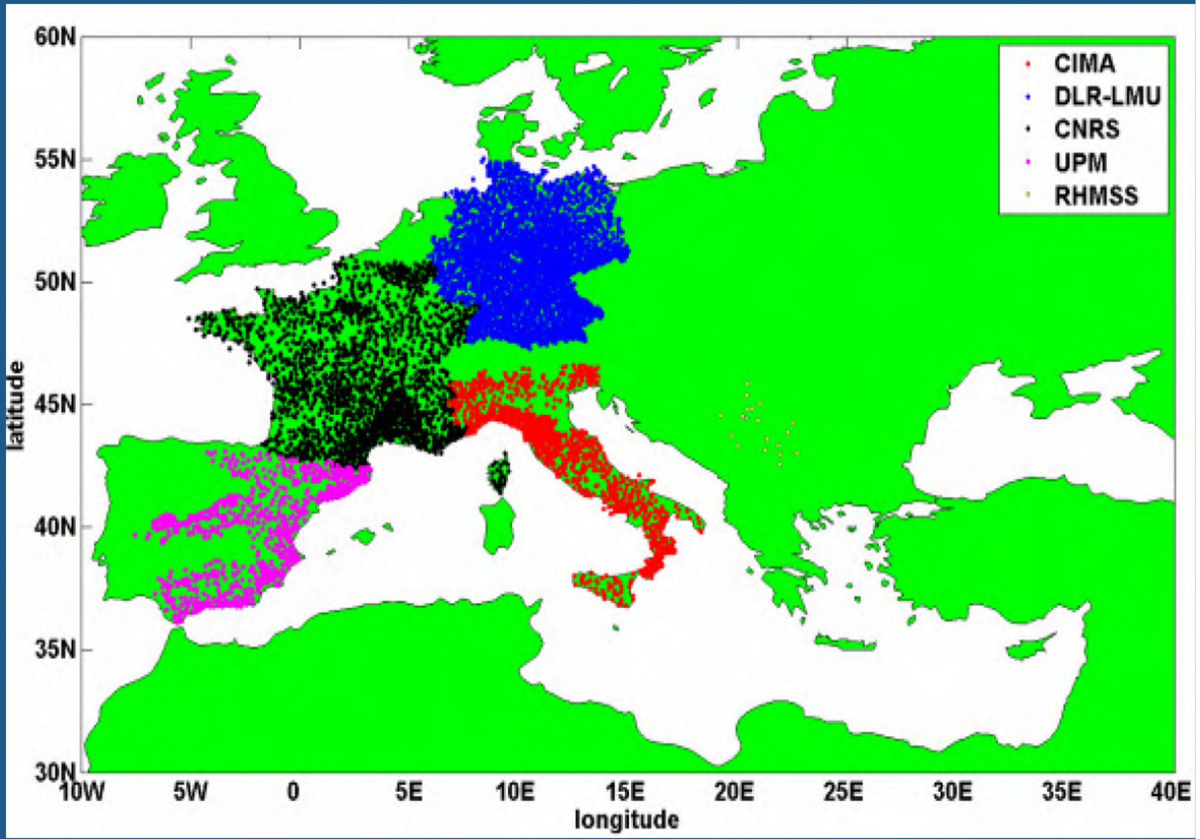
Too many points:

- Large data sets
- Demanding high computational power
- GRID technologies

Too many colors:

- Heterogeneous data
- Demanding for knowledge integration tools

Standards & Knowledge integration technologies



Limits in usability: even if available, observations are often <u>non-integrated, disconnected, unreachable by researchers...</u>

DRIHMS motivations

What is missing

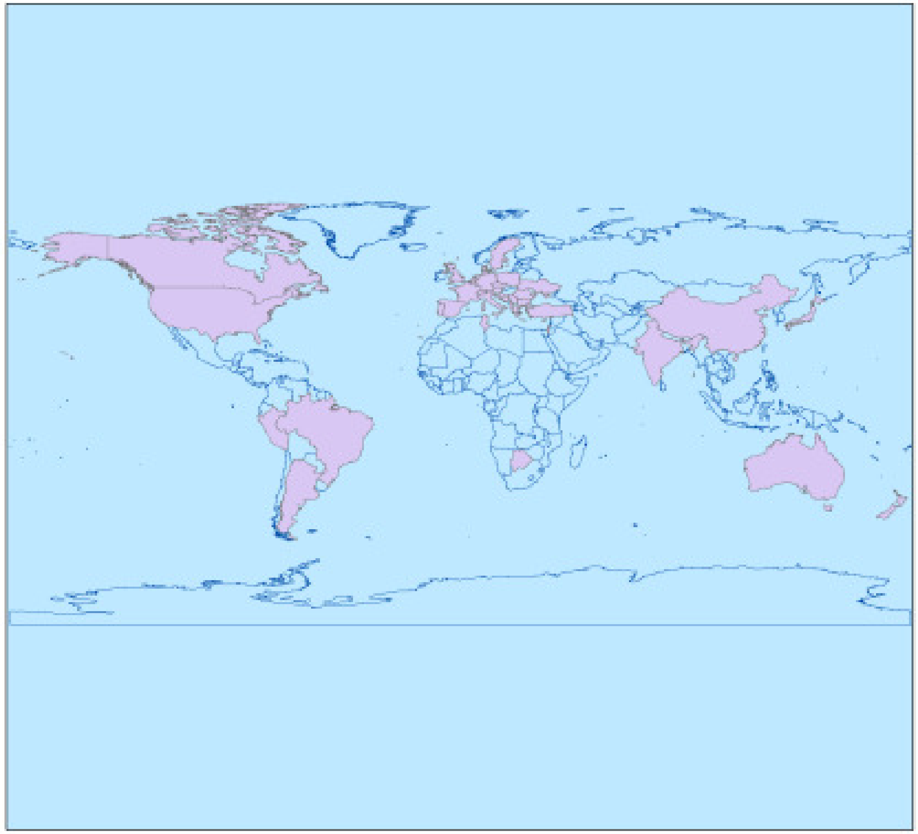
- ✓ the awareness of the potential of the Grid technology as a catalyst for future hydrometeorological research is still low
- ✓ the adoption and the exploitation have astonishingly been slow

The main goals

- ✓ To promote the Grid culture within the European hydrometeorological research community
- ✓ To boost European research excellence and competitiveness in hydrometeorological research and Grid research by bridging the gaps between these two communities

DRIHMS HMR questionnaire results

About 200 questionnaires filled



Country	Number	%
Italy	36	22.2%
France	16	9.9%
Germany	16	9.9%
USA	15	9.3%
Spain	14	8.6%
United Kingdom	6	3.7%
Austria	5	3.1%
Belgium	4	2.5%
Greece	3	1.9%
Israel	3	1.9%
Netherlands	3	1.9%
Romania	3	1.9%
Sweden	3	1.9%
Switzerland	3	1.9%
Albania	2	1.2%
Brasil	2	1.2%
Bulgaria	2	1.2%
Polonia	2	1.2%
Portugal	2	1.2%
Serbia	2	1.2%
Turkey	2	1.2%
Ukraine	2	1.2%
Argentina	1	0.6%
Australia	1	0.6%
Barbados	1	0.6%
Bosnia	1	0.6%
Botswana	1	0.6%
Canada	1	0.6%
Cech Rep.	1	0.6%
China	1	0.6%
Croatia	1	0.6%
Cyprus	1	0.6%
Denmark	1	0.6%
India	1	0.6%
Japan	1	0.6%
New Zealand	1	0.6%
Peru	1	0.6%
Tunisie	1	0.6%

Field of expertise	%
Meteorology	43
Hydro-Meteorology	40
Hydrology	10
Others	7

Table 1: Classification of people filling the questionnaires in terms of their field of expertise.

A. HMR hot topics: Score the importance of the following topics for the Hydro Meteorological Research in the next 3 years:

a. Data merging/fusion

b. Probabilistic forecasting

c. Model verification metrics

d. Precipitation downscaling

e. Other: please specify

Rank	Full audience	Meteorology	Hydro-Meteorology	Hydrology	Others
1	Probabilistic forecasting	Probabilistic Forecasting	Model verification metrics	Model verification metrics	Model verification metrics
2	Model verification metrics	Other	Data merging / fusion	Probabilistic forecasting	Probabilistic Forecasting
3	Data merging / fusion	Model verification metrics	Probabilistic forecasting	Precipitation downscaling	Precipitation downscaling
4	Precipitation downscaling	Precipitation downscaling	Precipitation downscaling	Data merging / fusion	Data merging / fusion

B2 Probabilistic forecasting

A. Definition and dependability of catalogues of available data

B. Definition and dependability of catalogues of available atmospheric and hydrologic models

C. Accessibility of the model output: how to protect the ownership/rights of the data

D. Accessibility of the model code: how to protect the ownership/rights of the models

E. Definition of common interchange data formats (like netcdf, grib, bufr) and protocols (e.g., atmospheric-hydrologic models coupling/interfacing)

F. Definition of libraries of tools for handling, processing and visualizing data (like tools for data conversion and processing, georeferencing)

G. Definition of libraries for analyzing data and output from multiple sources (e.g. statistically analyze the ensemble forecasts: mean, variance, whole pfd)

H. Availability and reliability of high performance computing resources for probabilistic forecasting

I. Availability and reliability of high capacity storage for huge volumes (i.e., 100TB)

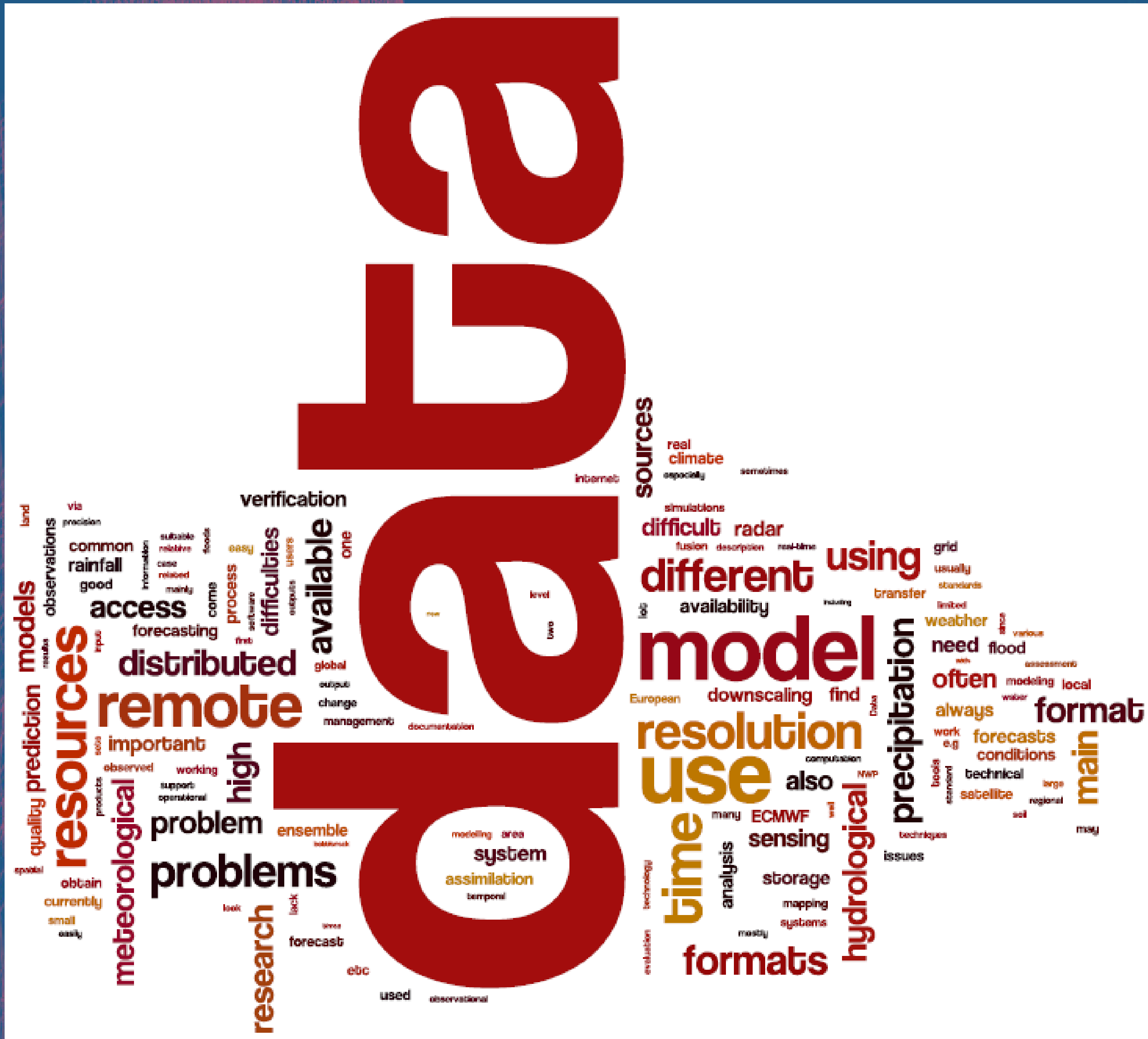
J. Availability of a standard framework to perform probabilistic forecasting (multi-model ensembles, prototype of meteorological and hydrological forecasting chain, etc.)

K. Availability of lineage and provenance information

L. Other

Rank	**Full audience**	**Hydro-Meteorology**	**Hydrology**	**Meteorology**	**Others**
1	E	E	A	E	G
2	H	F	B	H	H
3	F	H	H	I	F
4	J	G	E	F	B
5	G	B	F	J	E
6	B	A	J	G	J
7	I	J	G	A	I
8	A	I	I	B	A
9	C	C	K	L	C
10	D	D	L	D	D
11	K	K	D	C	K
12	L	L	C	K	L

Improving ICT technologies for HMR research may lead only to optimize your activity or may open new opportunities. Please shortly provide your opinion about it.



CAPACITIES

12th Plinius Conference on Mediterranean Storms

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DRIHMS EVENT AGENDA

2 September 2010

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14:45-15:00	Welcome and introduction to the meeting *A. Parodi (CIMA Research Foundation)*
15:00-15:15	Mind the gap: an analysis of distance between HMR requirements and ICT capabilities - the DRIHMS approach *A. Clematis (IMATI-CNR)*
15:15-15:30	Using European e-Infrastructures for Hydro-Meteorological Research *D. Kranzlmueller (LMU-MNM & LRZ)*
15:30-16:00	*Coffee break*
16:00-16:15	"DIGITAL EARTH": The role of hydrometeorology and terrain data for modeling natural hazards *E. Foufoula-Georgiou (University of Minnesota)*
16:15-16:30	Impact of weather on society: How to improve the utility of a weather forecast *N. Lomarda (WMO)*
16:30-17:00	Discussion

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TOPIC 6

Fri, 03 Sep, 09:00–09:30

High Performance & Grid Computing in Europe

D. Kranzlmüller

Conclusions

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- ✓ research in HM is focusing on how to exploit the potential of new sources of information provided by new monitoring technologies to improve HM extreme events prediction
- ✓ the design of research experiments is changing, aiming to validate models, quantify uncertainties and estimate parameters, under very general conditions
- ✓ this requires, for HMR community:
  - ➡ easy access to sources of information
  - ➡ large computational facilities to preprocess data and run models
  - ➡ easy access to models to perform experiments
  - ➡ enabling multidisciplinary collaborations

THE DRIHMS TEAM:

CIMA Research Foundation
www.cimafoundation.org

Institute for Atmospheric Physics (DLR)
http://www.dlr.de

Ludwig-Maximilians-Universität (LMU) München
http://www.mnm-team.org

Institute of Applied Mathematics and Information Technology (IMATI)
http://www.ge.imati.cnr.it