DRIHM2US

DISTRIBUTED RESEARCH INFRASTRUCTURE FOR HYDRO-METEOROLOGY TO UNITED STATES OF AMERICA

D3.3: Domain Expert Networking Report

Abstract: This document reports on the four planned Domain Expert Meetings and related activities

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Document Information Page

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Table of Contents

1 Executive Summary

The purpose of this report is to document the domain expert networking activities, focused around the project's four domain expert networking sessions. In order to avoid overlap with deliverables from the other work-packages, this report will concentrate on the meeting details themselves and the activities of its own work package 3. An additional report, D3.2, is scoped to cover the specific interoperability experiments undertaken by this work package and so this report will be confined to relevant outlines and discussion. Three versions of this report will be produced during the course of the project and so it has been structured to allow additions to be added and easily identified. The initial version charts progress up to and including the first domain networking session and activities immediately following.

The first domain expert meeting took place in Vienna, Austria within the EGU conference and was designed to be an open exchange of ideas following up specific areas of interest and planned initiatives. A joint DRIHM2US / DRIHM[1] scientific session with a targeted scope was, in part, used to set this path with contributions from both ICT and HMR communities. To place the ideas and priorities in context and to set the agenda for the activities to follow, this was consolidated with a conference splinter meeting. The initial ideas set out and papers offered at the scientific session were developed into closely related categories with considerable overlap between each. Data and model interoperability covered the structure of datasets and the passage of data between models; cataloguing and vocabularies covered the metadata aspects required for discovery and use. The two use cases of Genoa (Europe) and Boulder Creek (USA) were held up to provide a grounding for the discussions. Three interoperability studies were initiated allowing the elements necessary for common infrastructures for data and models to be further understood as well as to provide direct implementation of standards such as WaterML and OpenMI. Each experiment is valid in itself, but the overall objective is to build these services together into modelling and data infrastructures which cross disciplines and are harmonized between the EU and the USA wherever possible and sensible.

The second expert networking session has been planned as a dedicated meeting at CUAHSI offices in Boston, taking place in early October 2013.

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[1] DRIHM, the companion project to DRIHM2US, Contract No: RI-28356, FP7 Capacities.

2 Introduction

This report is one of the three which are output from DRIHM2US work package 3 [1] "Joint Prototypes and Expert Networking", covering the domain expert networking sessions and interoperability experiments / joint prototypes arising from the project. The Terms of reference for domain expert meetings (D3.1) was completed in month 2 of the project; the first release of this report (D3.3) follows directly and is due at the end of month 9. The third deliverable, D3.2, the Interoperability experiment report, is due first in month 17.

The purpose of this report is to document the domain expert networking activities, focused around the project's four domain expert networking sessions outlined in D3.1. Notwithstanding the usual project communication traffic and teleconferences, as the only planned face-to-face meetings, these sessions constitute the principal opportunity for shaping the project. As such, they are expected to cover all of the DRIHM2US work packages. In order to avoid overlap with deliverables from the other work-packages, this report will concentrate on the meeting details themselves and the activities of work package 3. It is also noted that D3.2 is scoped to cover the interoperability experiments undertaken by work package 3 and so full reports of these will also not be given here, although general progress, context and some discussion will be included.

As with D3.1, this report is part of task T3.2 "Domain Expert Networking Sessions". It has three delivery increments: the initial delivery mentioned above at the end of project month 9 (July 2013), an update at the end of month 17 (March 2014) and a final delivery at the end of month 24 (October 2014). In order for updates to be easily identified, this report has been written and structured to allow updated sections to be added and labelled, keeping the content from previous versions the same.

3 Schedule

3.1 Initial Schedule

A draft programme for the four domain expert meetings was outlined in D3.1 [2]. The programme has been followed approximately and is summarised in the table below alongside the delivery dates of this report and the other reports in this work package.

Report Delivery	Meeting	Project Month
D3.1		Month 2
	First Domain Expert Meeting (Complete)	Month 5
D3.3 Initial (this report)		Month 9
	Second Domain Expert Meeting (Planned)	Month 12
D3.2 Initial		Month 17
D3.3 Update		Month 17
	Third Domain Expert Meeting (Expected)	Month 16-19
	Fourth Domain Expert Meeting (Expected)	Month 20
D3.2 Final		Month 24
D3.3 Final		Month 24

Table 1: Schedule for work package 3 domain expert meetings and reporting

At the time of writing the initial version of this report, the first meeting had taken place and the second was planned. The initial version will therefore cover the completed "First Domain Expert Meeting" and outline the rationale and plans for the second. The update of this report in month 17 will cover the results of the second meeting and possibly also the third. It can be seen that the current schedule (designed to take advantage of the pivotal 8th International Congress on Environmental Modelling and Software now scheduled for month 20) potentially puts the second and third meetings close together. This may not be the most effective solution and will be managed as the dates approach. The final delivery of this report will cover the conclusion of work package 3.

4 First Domain Expert Meeting – Vienna, April 2013

4.1 Outline

Scheduled to follow the planned programme, the first domain expert meeting took place in Vienna, Austria within the EGU conference between 8th and 12th April 2013. It comprised of a joint DRIHM2US / DRIHM scientific oral and poster session on Monday 8th and a day of discussions on Friday 12th with the delegates attending the conference during the intervening days.

This first domain expert meeting was designed to be an open exchange of ideas following up specific areas of interest and planned initiatives as written in the DRIHM2US work description [3]. As such, a scientific session with a targeted scope was, in part, used to set this path for later and more detailed analysis, as well as to support the requirements of WP4, dissemination. Certain specific aspects of the session description pointed to the direct needs of the project. Firstly, the collaboration between the ICT and Hydro-Meteorological communities was foremost. The DRIHM2US (and indeed DRIHM) projects place this interaction at the centre of their activities. The joint DRIHM2US / DRIHM session was designed to attract the interest of both in order to continue building this interaction. Contributions from both communities, sometimes in collaboration and sometimes independently, were given. Secondly and directly consistent with the purpose of the project, a strong emphasis was placed on e-Infrastructures supporting research into hydro-meteorology. In addition to an update on the progress of the DRIHM project, other such contributions included "Globus-based Services for the Hydro-Meteorology Scientific Community" and "Multiscaling in Hydro-Meteorologic Research: Recent Results from the European MAPPER Project". Thirdly, data and model integration and sharing was given a high priority. This too lies at the heart of DRIHM2US (and DRIHM). It was felt appropriate to explore a number of avenues in order to shape the approach to these issues and provide a reasonable and sustainable solution. There was considerable variety in this aspect, with some contributions directly relevant to the project and others tangential. Such presentations included "Torrential rainfall event in Genoa: Coupled WRF-NMM and HBV model" and "A new method for combining radar and rain gauge data: Modified Conditional Merging".

Certain contributions reported on initiatives to be taken up (or already started) in DRIHM2US. The main idea behind the project is to take ideas and services formulated or applied as part of

DRIHM and harmonise them with their counterparts in the USA. Where relevant services would be directly adopted, rather than duplicated. Standards would always be applied where possible and sensible. Such presentations included "WRF4G project: Adaptation of WRF Model to Distributed Computing Infrastructures", "Advancing hydrometeorological prediction capabilities through standards-based cyberinfrastructure development: The community WRF-Hydro modeling system" and "Mashup aggregation of citizen-scientists weather observations and application of OGC standards to weather data for Hydro-Meteorological Research needs". Other contributions, such as "Standards-based publication and sharing of time series information in the DRIHM project: a EU-US collaboration" and "The building of the EUDAT Cross-Disciplinary Data Infrastructure" also pointed directly to on-going or potential collaborations under the DRIHM / DRIHM2US umbrella.

Full details of the session are given in Appendix I.

To place the ideas and priorities from the scientific session directly in context and to set the agenda for the joint technical DRIHM2US / SCIHM activities to follow, the first domain expert project meeting was consolidated with a conference splinter meeting. As is consistent with conference protocol, the meeting was open and in addition to interested conference delegates and members of the DRIHM project, the following specific DRIHM2US and US counterpart SCIHM project members were in attendance:

Attendee	Organisation	Project (DRIHM2US WP Lead)
Antonio Parodi	CIMA Research Foundation	DRIHM2US (WP1)
Nicola Rebora	CIMA Research Foundation	DRIHM2US
Michael Schiffers	LMU	DRIHM2US (WP2)
Nils Felde	LMU	DRIHM2US
Andrea Clematis	CNR-IMATI	DRIHM2US (WP4)
Alfonso Quarati	CNR-IMATI	DRIHM2US
Quillon Harpham	HR Wallingford	DRIHM2US (WP3)
Bert Jagers	Deltares	DRIHM2US (WP5)
Ilya Zaslavsky	CUAHSI (SDSC)	SCIHM
David Gochis	NCAR	SCIHM
Shantenu Jha	Rutgers University	SCIHM

Prof. V. Chandrasekar	Colorado State University	International Advisory Board

Table 2: First domain expert meeting attendees from DRIHM2US / SCIHM consortium

Following reviews of the DRIHM2US domain expert networking terms of reference, project deliverable D3.1 [2] and the equivalent document for SCIHM, the agenda for the meeting built on the scientific session by selecting key initial collaborative elements. These were drawn from areas where trans-Atlantic collaboration was known to be required. Indeed, these elements were among the prime motivators for the project and had been written into the description of work [1] and terms of reference [2]:

- Comparative analysis of certain components underlying the e-Infrastructures supporting hydro-meteorological research activities both in Europe and the United States:-
  - **Geospatial cataloguing**: exploring the full outcome of an optimal use of standards in order to catalogue any items with a geospatial attribute. With relevance to DRIHM and SCIHM, these items constitute geospatial datasets (such as observations or model run results), model engines (core code) and model instances (application of core code model engines to geography).
  - **Data and model integration**: exploring methods for ingesting data into models as boundary conditions for the model runs. Again, standards would play a strong part in facilitating solutions for maximum reusability and interoperability. Such standards would include web services capable of receiving query requests and offering data.
  - **Model interoperability**: A direct assessment of the interoperability of two models offered by consortium members: WRF-HYDRO from NCAR and Continuum from CIMA Research Foundation.
- Assessment of options for the structure and operation of a future organisation: drawing on publicly available information obtained mostly from personal contacts to allow the assembly of a set of requirements and options for any post-project managerial structure.

Briefings of the DRIHM critical use case (Genoa flash flood, November 2011) and the SCIHM use case (a storm over Boulder Creek, Colorado) were also presented as the target use cases testing interoperability across the projects:

- Genoa flash flood: On Nov 4th 2011 a third of the annual rainfall (450mm) fell in 6 hours. Six people were killed in the resultant flash flood, trees were uprooted, cars swept away and shop-fronts were shattered. It was the worst disaster since a similar flood killed 25 people in 1970.
- Boulder Creek: An intense rainfall event which took place over Boulder Creek, just to the west of Boulder, Colorado, which has already been modelled using WRF.

In addition to the scientific session and project splinter meeting, certain DRIHM2US project partners (HR Wallingford and Deltares) also attended the FluidEarth 2 launch [2] and OpenMI Association AGM, an event hosted in the UK the following week (18th – 19th April) describing the progress and plans for the HR Wallingford initiative implementing the OpenMI version 2.0 standard. This initiative drew from activities in DRIHM and DRIHM2US and brought together a subset of the hydraulic integrated modelling community from Europe. Future plans for both of these projects were shared with the group and discussed in open forum.

4.2 Discussion

The initial ideas set out and papers offered at the scientific session were developed into closely related categories with considerable overlap between each. Data and model interoperability covered the structure of datasets and the passage of data between models; cataloguing and vocabularies covered the metadata aspects required for discovery and use. The two use cases of Genoa (Europe) and Boulder Creek (USA) were held up to provide a grounding for the discussions.

4.2.1 Data and Model Interoperability

A key contribution expected from the DRIHM2US / SCIHM collaboration is in assisting with the development of an interoperable configuration for the WRF model. As a prime example of a meteorological model which will serve data (as model results) to other models, the issues discussed were typical of those of other model integration scenarios.

Each hydro-meteorological model will require a set of input files and configuration parameters.

The specification devised for WRF is intended to be run for both use cases and will indicate general feasibility and boundaries for applying similar configurations in other use cases. Datasets include: A digital elevation model (grid), land use and land cover (grid), soil types (grid), hydrography (point series), precipitation (point series), discharge (point series). WRF has an extensive preprocessing system to aid the user in preparing the files necessary in order to run the models. The WRF preprocessing system has predefined packaged static data, with a resolution of 1-20 km. Semi-automated preprocessing systems can hamper integration strategies with other models and datasets. As the project progresses, usage of the WRF preprocessing system is expected to highlight any such issues although WRF is usually the first model in the chain and, as such is not usually receiving data from other active models. At the outward interface, however, WRF is expected to pass data to hydrological models or stochastic downscalers, potentially at every time step. The output files are typically very large (4-5 Gb) and a data strategy is needed to reduce the volume.

The following steps were devised to address this:

i) Always prepare metadata and catalogue all outputs; it is not the metadata that takes up the space. A minimum set would include: real time run timestamp, input datasets, configuration and setup parameters, run result, owning organisation or individual. Preferably provenance metadata and usage notes would also be included.
ii) The use cases in question do not require the full 3-dimensional capability of WRF – hydrological models are only usually concerned with water when it hits the ground. Nor are all the parameters offered by the model required, many can be omitted. Therefore there is considerable scope to output only the data that is required: rainfall, temperature at 2m, wind at 10m, latent and sensible fluxes, relative humidity at 2m.

Such a strategy for streamlining the model interactions, i.e. collecting only parameters necessary and modifying spatial outputs, is feasible at any model-model interface. Indeed, such adaptation is often essential. This is most pronounced in the hydrometeorological model chain when the spatial requirements of the models differ. The source model may produce output as a structured grid, the target model may require it as an unstructured mesh or as a polyline.

Issues can also occur with the general spatial resolution, even if the spatial structures match. The WRF example is a case in point – WRF issues data at a 1km resolution, whereas hydrologic

models are intended to operate on a much finer scale and hydraulic models finer still, at perhaps 1m resolution. Similar issues can occur with the resolution of the timestep. If the timesteps don't match precisely (say 20 minutes and 15 minutes) a simple interpolation can be performed, but if a source model is giving one result every day and a target is requiring one every minute, then an interpolation would offer a result too crude for the target model. However, this is not an issue in this case with WRF offering outputs every 15 minutes.

Another key contribution expected from this work is in the provision of standardised point timeseries data, data which is provided at a single point in space varying only in time, such as that provided by a static instrument. A standardised solution is sought which will provide structure for the data and preferably also allow standardised incorporation into model compositions. Prompted by the collaboration with CUAHSI and the opportunity to undertake joint experiments, the WaterML2 standard has already been adopted by the DRIHM and DRIHM2US consortia for point series data.

CUAHSI Hydrologic Information System is an online distributed system to support the sharing of hydrologic data from multiple repositories and databases via standard water data service protocols; software for data publication, discovery, access and integration.

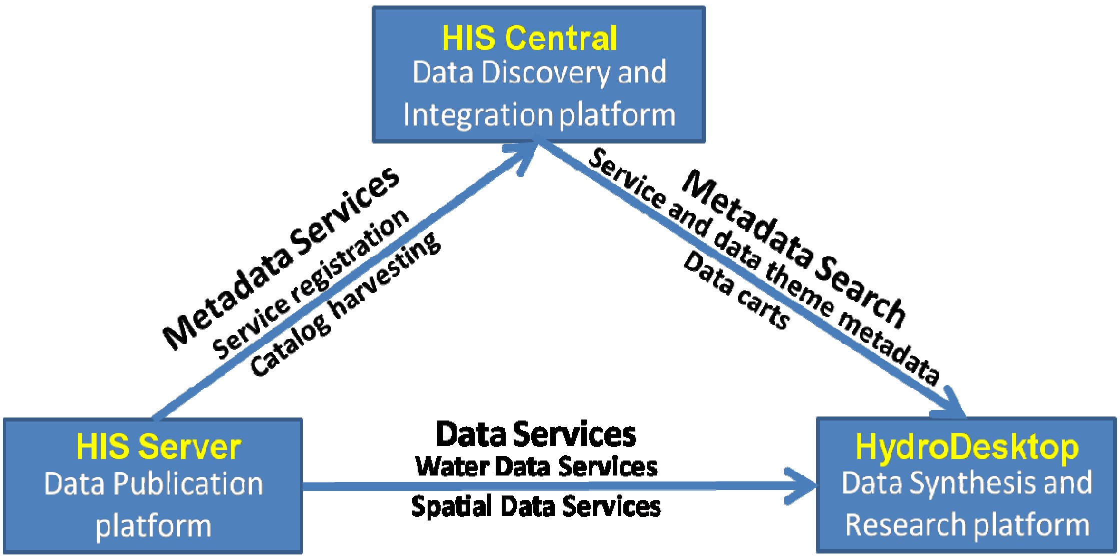

Figure 1: HIS and Hydrodesktop, source CUAHSI

As part of the DRIHM project point timeseries data is being held in the HIS system and offered through web services in WaterML2 format. This has been achieved with no modifications to

the base HIS system. It is possible for other model components to query the service via http and receive the resultant WaterML2 file.

Figure 2: DRIHM data offered through HIS, source CUAHSI

As part of the DRIHM2US project, an experiment will be undertaken to assess the interoperability of this service with the FluidEarth implementation of OpenMI 2.0. DRIHM pointseries data will be fed directly into OpenMI 2.0 compositions from HIS through a transform module and into an OpenMI 'input exchange item'. This will involve the creation of FluidEarth OpenMI2.0 components which access the HIS service. These will connected to the receiving models in the compositon through adaptors applying the necessary translations and interpretations. Clearly, since the data in HIS is measured instrument data there is no opportunity for a two-way connection allowing both components to influence each other as the composition proceeds through time. The connection is one-way, with the HIS source feeding the receiving model.

4.2.2 Cataloguing and Vocabularies

Cataloguing services and metadata standards play a key part in environmental modelling infrastructures. It must be possible to find models and data and, having done so, use them with confidence. The modelling infrastructures being studied by the DRIHM2US / SCIHM collaborations are no exception, moreover they seek to take the lead in aspects particular to their specific use cases.

The metadata standards incorporated by the projects must allow the relevant models and data to be found. The DRIHM project has ISO19139 [4] metadata records of model engines and instances held in the FluidEarth catalogue, an open source GeoNetwork implementation. The base ISO19139 standard has been extended to meet the requirements of environmental models, including in particular, new fields for technical details such as programming language, run time and platform and functional details such as input and output streams.

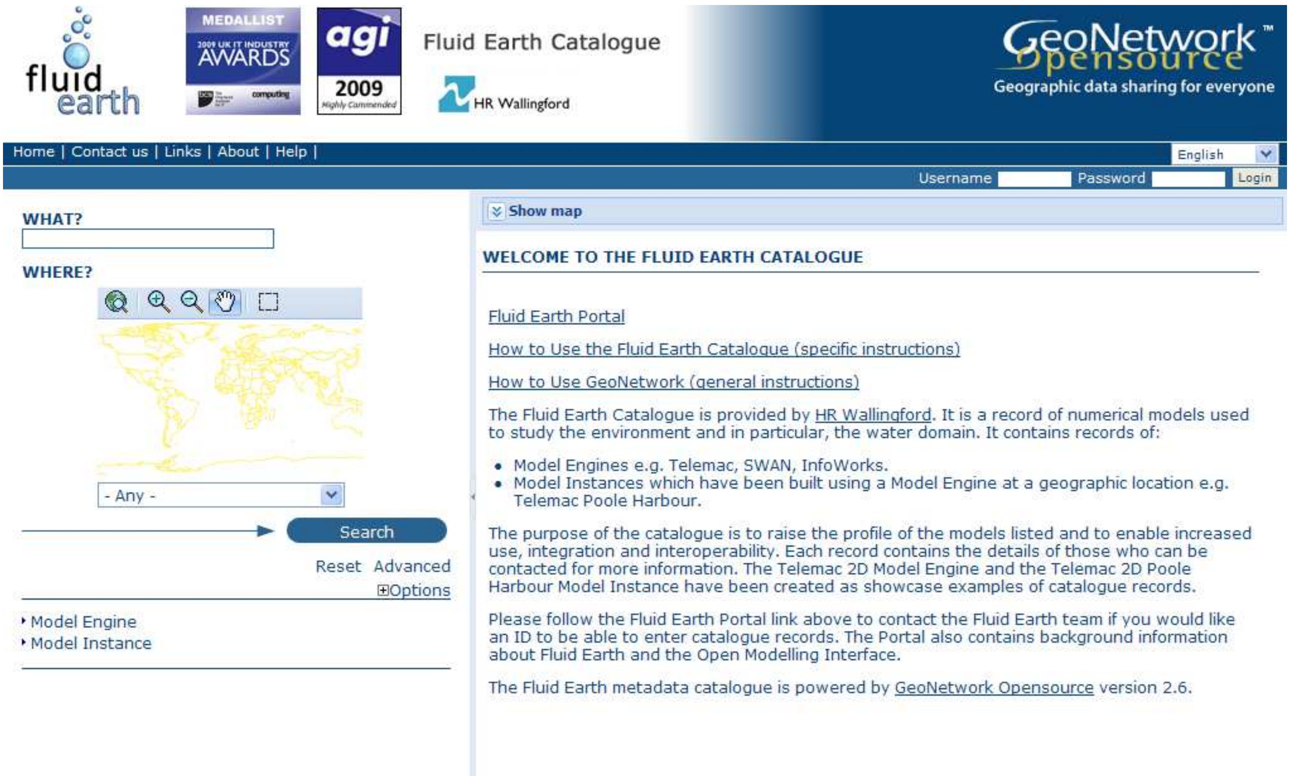

Figure 3: The FluidEarth Catalogue home page, source HR Wallingford

The DRIHM2US project will undertake an interoperability experiment to assess the compatibility of this DRIHM service with similar services cataloguing models and data from SCIHM project partners. Interoperability has been established to a large extent within the U.S. and the experiment will assess the out-of-the-box interoperability provided by services such as GeoNetwork which are based on established standards. Standards such as ISO19139 consist of both 'discovery' and 'use' metadata. This interoperability experiment will focus first on 'discovery' metadata since multiple catalogue services must first discover each other's content, however, specialised 'use' metadata such as valid technical platform or output data parameters are equally expected to apply to the discovery of models.

Hydro-meterological modelling systems such as WRF tend to operate with highly bespoke metadata structures pertaining to the specific requirements of the model workflow and built into the workflow framework supporting tools. The Genoa and Boulder Creek use cases, when registering a WRF Package which has been prepared by the WRF Pre-processing System (WPS) in a service such as the Catalog Service for the Web (CSW), will need to be provided with such specific metadata and other types of data (such as vectors, time series) which are outside WPS will need to be registered in the catalog in a standard manner. As the Genoa and Boulder Creek use cases are compared it is expected that two federated CSW catalogs will be created. As discussed above, the timeseries data supporting the studies will be hosted through an HIS server and these datasets will be catalogued alongside the WRF packages.

These specific use cases bring into sharp focus the requirements for 'use' metadata. If modelling studies are retain maximum value in the medium term and if it is going to be possible to re-run past studies then the 'use' metadata must contain the necessary information enabling this.

Cataloguing models from a variety of disciplines (in this case meteorology, hydrology and hydraulics) exposes differences in the scientific terminologies employed by the different groups. Sometimes the same phenomenon is expressed in two different ways, sometimes specialised details are brought out by one community and not another, sometimes terminology simply doesn't exist across all disciplines. Certain disciplines are supported by vocabulary dictionaries, indeed the DRIHM project has endeavoured to follow the CF Standard Names convention [5] wherever possible. Also, working groups such as the OGC Geosemantics DWG

[6] seek to establish frameworks for representing specific domain knowledge in a consistent and representable form.

The application of the WRF model as a source to provide standardised output to other models has immediately given rise to such semantic issues. Terminology inherent within WRF does not necessarily find direct application in the models which would receive its output data. Standard WRF vocabularies must be used within the WRF system (including supporting data not necessarily part of the WRF package) but when the data leaves and enters the domain of other models, vocabulary mappings will become necessary (e.g. HydrologicModel.maize=WRF.crop; HydrologicModel.wheat=WRF.crop). These mappings will need to be prepared as part of the model composition.

4.3 Conclusions

The detailed discussions which took place at the first domain expert networking session allowed three interoperability studies to commence:

- Placing WRF in a model chain supporting DRIHM2US models as part of the Genoa use case and comparing this function with that of the Boulder Creek use case.
- Incorporating WaterML data hosted by HIS directly into an OpenMI composition through web services and dedicated OpenMI components.
- Cataloguing interoperability tests involving the FluidEarth [7] GeoNetwork implementation adopted as part of the DRIHM project.

These studies will allow the elements necessary for common infrastructures for data and models to be further understood as well as to provide direct implementation of standards such as WaterML and OpenMI. The components built will support the development of these infrastructures which will have been strengthened by application in real use cases. Certain outputs (such as the OpenMI components, the catalogue entries and the vocabulary mappings) will be directly transferrable to other use cases and others will set the pattern for application elsewhere.

The end goal of this work, the context in which completed services will reside, requires more

clarification. First and foremost, this is built upon the cross-domain understanding gained from the process of executing the studies. Each experiment is valid in itself, but the overall objective is to build these services together into modelling and data infrastructures which cross disciplines and are harmonized between the EU and the USA wherever possible.

The increased focus required to achieve this warrants some of the remaining domain expert networking meetings to take place outside the setting of a conference. Hosting meetings at conferences have a number of advantages: delegates are likely to be at the conference anyway and so investments in travel and time can yield more value, logistics are usually simpler and experts to hand, not least the opportunity for wider, open-ended discussion and dissemination with a wide set of possible participants. However, the conference may not be of interest to all parties – DRIHM2US is a meeting of ICT experts and hydro-meteorological researchers – there is overlap but not entirely; meeting delegates can be distracted by alternative sessions and other meetings and, with conferences such as EGU, the project does not have control of the meeting schedule. Conferences are seen as the best setting when open ended, scoping discussion and wide dissemination are the priorities and dedicated meetings are preferred for focused working groups and planning sessions. As such, the second expert networking session has been planned as a dedicated meeting at CUAHSI offices in Boston, taking place in early October 2013.

5 Acronyms and References

5.1 Acronyms and Abbreviations

Acronym / Abbreviation	Definition
CSW	Catalog Service for the Web
CUAHSI	Consortium of Universities for the Advancement of Hydrologic Science, Inc.
DRIHM	Distributed Research Infrastructure for Hydro-Meteorology
DRIHM2US	Distributed Research Infrastructure for Hydro-Meteorology to United State of America
DWG	Domain Working Group
EGU	European Geosciences Union
EUDAT	European Data Infrastructure
HBV	Hydrologiska Byråns Vattenbalansavdelning
HIS	Hydrologic Information System
HMR	Hydro-Meteorological Research
iEMSs	International Congress on Environmental Modelling and Software
ICT	Information and Communications Technology
MAPPER	Multiscale Applications on European e-Infrastructures
NCAR	National Center for Atmospheric Reseach
NGI	National Grid Initiative
OGC	Open Geospatial Consortium
OpenMI	Open Modelling Interface
SCIHM	Standards-Based Cyberinfrastructure for Hydro-meteorology
WaterML	Water Markup Language
WRF	Weather Research and Forecasting
WRF-NMM	Weather Research and Forecasting Nonhydrostatic Mesoscale Model
WPS (1)	Web Processing Service
WPS (2)	WRF Pre-processing System

5.2 References

[1]. Parodi, A. et al.: DRIHM2US Description of Work (DoW), 2012.
[2]. Harpham Q. et al.: DRIHM2US D3.1 Terms of reference for domain expert meetings, 2012.
[3]. 7th Framework Programme DRIHM2US Grant Agreement 313122, Appendix I – "Description of Work", 2012.
[4]. ISO19139 Definition, http://www.iso.org/iso/catalogue_detail.htm?csnumber=32557, 2007.
[5]. CF Standard Name Table, http://cf-pcmdi.llnl.gov/documents/cf-standard-names/, Accessed 2013.
[6]. OGC Geosemantics Domain Working Group: http://www.opengeospatial.org/projects/groups/semantics, accessed 2013.
[7]. Harpham, Q. et al.: FluidEarth – A Platform for Integrated Modelling Using the OpenMI Standard, EGU2011-2136, 2011.

Appendix I – EGU Session Details

NH1.8: ICT-based hydro-meteorology science and natural disaster societal impact assessment

Convener: Antonio Parodi

Co-Conveners: Nicola Rebora, Andrea Clematis, Dieter Kranzlmueller, Michael Schiffers

Hydro-Meteorology Research (HMR) is an area of critical scientific importance and of high societal relevance. It plays a key role in guiding predictions relevant to the safety and prosperity of humans and ecosystems from highly urbanized areas, to coastal zones, and to agricultural landscapes. Of special interest and urgency within HMR is the problem of understanding and predicting the impacts of severe hydro-meteorological events, such as flash-floods and landslides in complex orography areas, on humans and the environment, under the incoming climate change effects.

At the heart of this challenge, lies the ability to have easy access to hydro-meteorological data and models, and to facilitate the collaboration between meteorologists, hydrologists, and Earth science experts for accelerated scientific advances in hydrometeorological research.

This session is intended to attract the interest and promote the discussion between scientists from HMR and ICT communities, together with delegates from relevant European and worldwide stakeholders about how to further boost the research excellence and competitiveness in the fields of hydrometeorological research and ICT research by bridging the gaps between these two scientific communities.

Special emphasis is given to contributions reporting about e-Infrastructures / cyberinfrastructure for hydro-meteorology and related Earth Science disciplines, new paradigms for data sharing as well as the emergency topic of urgent computing in Earth science. Results concerning the applications of new Grid and high performance computing services to the study of extreme hydrometeorological events are also encouraged.

Oral Programme

Authors	Title
Ralf Ludwig and the CLIMB Project Team	Uncertainties in assessing climate change impacts on the hydrology of Mediterranean basins
Antonio S. Cofino, Valvanuz Fernández Quiruelas, Markel García Díez, Jose C. Blanco Real and Jesús Fernández	WRF4G project: Adaptation of WRF Model to Distributed Computing Infrastructures
Damien Lecarpentier, Alberto Michelini and Peter Wittenburg	The building of the EUDAT Cross-Disciplinary Data Infrastructure
Pieter Groenemeijer	Severe Weather Research at the European Severe Storms Laboratory
Ioan-Lucian Muntean, Matthias Hofmann and Helmut Heller	Globus-based Services for the Hydro-Meteorology Scientific Community
Toshio Koike, Richard Lawford and Douglas Cripe	GEOSS Water Cycle Integrator
Sylvie Joussaume	IS-ENES: The Infrastructure for the European Network for Earth System modelling
Marie-claire ten Veldhuis and Birna van Riemsdijk	High resolution weather data for urban hydrological modelling and impact assessment, ICT requirements and future challenges
Jim Freer and the EVOp Team	The Environmental Virtual Observatory pilot project: An application of the hydrological multi-modelling FUSE framework for ~1100 UK catchments
David Richardson, Michael Nyenhuis, Ervin Zsoter and Florian Pappenberger	GEOSS interoperability for Weather, Ocean and Water
Mark Filipiak and Rob Baxter	ICORDI - International Collaboration on Research Data Infrastructure
Antonello Provenzale	The NextData Project: a national Italian system

	for the retrieval, storage, access and diffusion of environmental and climate data from mountain and marine areas

Table I.1: EGU Oral Session NH1.8

Poster Programme

Authors	Title
de Rosa Michele and Marzano Frank Silvio	Neural Ensemble Bayesian Nowcasting of Geostationary Multispectral Imagery for Hydro-Meteorological Applications
Gochis David, Parodi Antonio, Hooper Rick, Jha Shantenu and Zaslavsky Ilya	Advancing hydrometeorological prediction capabilities through standards-based cyberinfrastructure development: The community WRF-Hydro modeling system
Flores Isabel, Sordo-Ward Alvaro, Mediero Luis and Garrote Luis	Synthetic generation of arbitrarily long series of flood hydrographs for flood risk assessment
Ivkovic Marija, Dekic Ljiljana and Mihalovic Ana	Torrential rainfall event in Genoa: Coupled WRF-NMM and HBV model
Bedrina Tatiana, Parodi Antonio, Quarati Alfonso and Clematis Andrea	Mashup aggregation of citizen-scientists weather observations and application of OGC standards to weather data for Hydro-Meteorological Research needs
Schueller Felix, Ostermann Simon, Janetschek Matthias, Prodan Radu and Mayr Georg	The RainCloud project: Harnessing Cloud Computing for a meteorological application at the Tyrolean Avalanche Service
Leinenweber Lewis and Bermudez Luis	International Virtual Observatory System for Water Resources Information
Hooper Richard, Zaslavsky Ilya, Parodi Antonio, Gochis David, Jha Shantenu, Whitenack Thomas, Valentine David, Caumont Olivier, Dekic Ljiljana, Ivkovic	Standards-based publication and sharing of time series information in the DRIHM project: a EU-US collaboration

Marija, Molini Luca, Bedrina Tatiana, Gijsbers Peter J.A., de Rooij Erik and Rebora Nicola	
Donners John, Genseberger Menno, Jagers Bert, de Goede Erik and Mourits Adri	Delft3D-FLOW on PRACE infrastructures for real life hydrodynamic applications.
Terzo Olivier	Infrastructure Systems for Advanced Computing in E-science applications
Parodi Antonio and the DRIHM Team	DRIHM (Distributed Research Infrastructure for Hydro-Meteorology): first year of activities
Pignone Flavio, Rebora Nicola, Vulpiani Gianfranco, Silvestro Francesco and Castelli Fabio	RAINFUSION: A new method for combining radar and raingauge data
Pignone Flavio, Rebora Nicola and Silvestro Francesco	A new method for combining radar and raingauge data: Modified Conditional Merging
Schiffers Michael	Multiscaling in Hydro-Meteorologic Research: Recent Results from the European MAPPER Project
Mazza Edoardo	METEONETWORK: 2002-2012, 10 years of activities
Tafferner Arnold and Forster Caroline	Tools for nowcasting severe convection with satellite and radar data
Chandrasekar Venkatachalam, Chen Haonan, Philips Brenda, Seo Dong-jun, Junyent Francesc, Bajaj Apoorva, Zink Mike, Mcenery John, Sukheswalla Zubin, Cannon Amy, Lyons Eric and Westbrook David	The CASA Dallas Fort Worth Remote Sensing Network ICT for Urban Disaster Mitigation

Table I.2: EGU Poster Session NH1.8