



IS-ENES2 DELIVERABLE 11.1

ENES Data Activities: Delivery Plan

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0.7	Nov, 2014	3 rd Draft	Revised with notes from General Assembly breakout groups.
0.81	Apr, 2015	4 th Draft	V0.8 Able to complete now that ESGF governance is resolved. (De-scoped to remove time-dependent information.) V0.81: With feedback, released for review.
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Abstract

The breakdown of IS-ENES2 data work packages (WP5, WP8, and WP11) into three themes: data, metadata, and impacts is described. The relationships within and between these themes, and between the themes and major external activities are described, as are the concomitant dependencies, particularly on timing. We provide a summary of how these relationships and the IS-ENES2 activity roadmap will be managed.

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Dissemination Level		
PU	Public	PU
PP	Restricted to other programme participants including the Commission Services	
RE	Restricted to a group specified by the partners of the IS-ENES2 project	
CO	Confidential, only for partners of the IS-ENES2 project	

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Executive Summary

1 Objectives

The ENES Data Activities Delivery Plan outlines the key aspects of the IS-ENES2 data related work packages and both internal dependencies and key external dependencies. It summarises the key deliverables in this area, and the method of working to achieve them.

2 Results

The major external drivers – the CMIP6 timeline and the ESGF and ESDOC software and consortia are described, with key details in the appendices. The other major external driver, supporting CORDEX (regional climate modelling) has similar requirements to the CMIPs, and so is not discussed here in detail, except where the requirements differ substantially from those of the CMIPs.

The key method of project delivery is to have three cross work package themes: data services, metadata and documentation services, and infrastructure to support the impacts community – each using networking and development leading to service delivery. These are describe in table 2, reproduced here:

	Direct Data Services <i>(Kindermann and Denvil)</i>	Metadata and Documentation Services <i>(Lawrence and Guilyardi)</i>	Impact Infrastructure <i>(Pagé and Som de Cerff)</i>
NA4: Networking <i>(Pagé and Guilyardi)</i>	Internal Global Modelling Community, ESGF	Internal Global Modelling Community, ESDOC	Internal European Impacts Community, Copernicus
JRA3: Development <i>(Juckes and Denvil)</i>	ESGF Publication Workflow ESGF Nodes	CIM Tools (both to produce and consume) CIM Standards	Portal Developments Focused Data Products
SA2: Services <i>(Toussaint and Som de Cerff)</i>	Deployed ESGF & statistics, Portal.	CIM repository Metadata Quality Control and Governance	Climate4Impacts Portal

Table 1: WP Themes and Primary Interactions & Activity

Delivery will be achieved by having theme leaders as well as work package leaders who can integrate development, networking and services.

3 Perspectives and Recommendations

IS-ENES2 does not exist in a vacuum, both activities and products need to be responsive to external events and developments. To that end, IS-ENES2 will convene and provide most of the membership of an ENES data task force (under the auspices of WP2), to provide a more joined up European focus for data development and services, going beyond this project alone. As well as the wider providing the wider European focus for IS-ENES2, the task force will, where necessary feed external requirements into IS-ENES2. In addition, IS-ENES2 needs to react with, and to, the drivers from the modelling and impact science programmes: Timelines and deliverables need to meet the science drivers.

1 Objectives

Data and metadata activities in IS-ENES2 are delivered through the interaction of three closely interlinked work packages: WP5/NA4 Data Networking; WP8/SA2 ENES Climate Data Services; and WP11/JRA3 Development for Data Infrastructure. NA4 is intended to (1) gather requirements and set standards which feed into the service and product development of JRA3, and (2) generate the guidance documents that will become part of the services delivered through SA2. JRA3 is intended to both develop and maintain software and information for deployment in the services.

These activities do not occur in a vacuum, in particular, much of the data activity involves, and even depends on, the relationship with the Earth System Grid Federation (ESGF), the Earth-System Documentation (ESDOC), and the CMIP communities. Clearly there are other upstream and downstream communities of importance, including, but not limited to specific project groups (e.g. CORDEX), major European institutions (ESA), and the impacts community – both directly via portals run by IS-ENES2, and indirectly by the intimate relationship between IS-ENES2 partners and the IPCC-Data Distribution Centre.

Here we codify the relationship between the work packages and those wider communities, in terms of key relationships and ways of working, and a timeline which takes in account the timelines of the major groups with whom we work.

1.1 Internal Structure and European External Relationships

As well as the structural work package division outline above which effectively splits activities along the lines of EC FP7 I3 funding rules into: networking (WP5/NA4), trans national services (WP8/SA2) and joint research activities (WP11/JRA3), a key aspect of our delivery is also a thematic split within each work package, into three cross-cutting themes:

- Core data services, including quality control, publication and access services;
- Documentation services;
- Serving the user communities working on the impacts of climate variability and change.

The three work packages and the three cross-cutting themes interact with other European projects and institutions in a number of ways. For the climate impacts theme, the global networks are less dominant and these communications with the huge diversity of the European climate impacts community is a major focus. There has been strong engagement with the [CIRCLE-2](#) network and there will be continuing engagement with that community even though the project has finished.

Key external project relationships fall into three areas: with climate science projects, with impacts and climate service projects, and with infrastructure projects. Here we list only those which have direct infrastructural implementations:

- SPECS: establishing technology requirements for seasonal predictions, which will enter into the CMIP6 framework.
- CLIPC: providing a link to the Copernicus programme. In co-operation with IS-ENES2, CLIPC is aiming to establish a transparent data service framework linking Earth observation, in-situ observations, re-analyses and climate model data archives.
- CHARMe: developing tools to support annotation of data products in the data archives. This topic was discussed at the joint IS-ENES2/CLIPC workshop at KNMI, Nov. 17th-19th, 2014.
- EUPORIAS: establishing user requirements and demonstration use cases for climate projections (near term).
- EUDAT: address Big Data problems with other sciences, especially on cross-scientific communities Metadata, Data Annotation and Provenance, Persistent Identifiers, Data Sharing, Data Processing and Scientific Workflows. The co-operation with IS-ENES2 will

notably include work on data processing close to the data storage, in tight collaboration with the ESGF Compute Working Team.

- VALUE: Validating and Integrating Downscaling Methods for Climate Change (an EU COST action).

Key institutional relationships are primarily those with

- National e-infrastructures, including network providers.
- Copernicus – the European Climate Services Initiative, where the lead institute for [Climate Change Services](#) is the European Centre for Medium Range Forecasting (ECMWF).
- The European Space Agency in the context of the [Climate Change Initiative](#), and their portal project.

1.2 Global Relationships

The project interacts with the **global** community through five primary channels discussed below which effectively reflect aspects of science governance, the data science community, infrastructure development and delivery, and user communities.

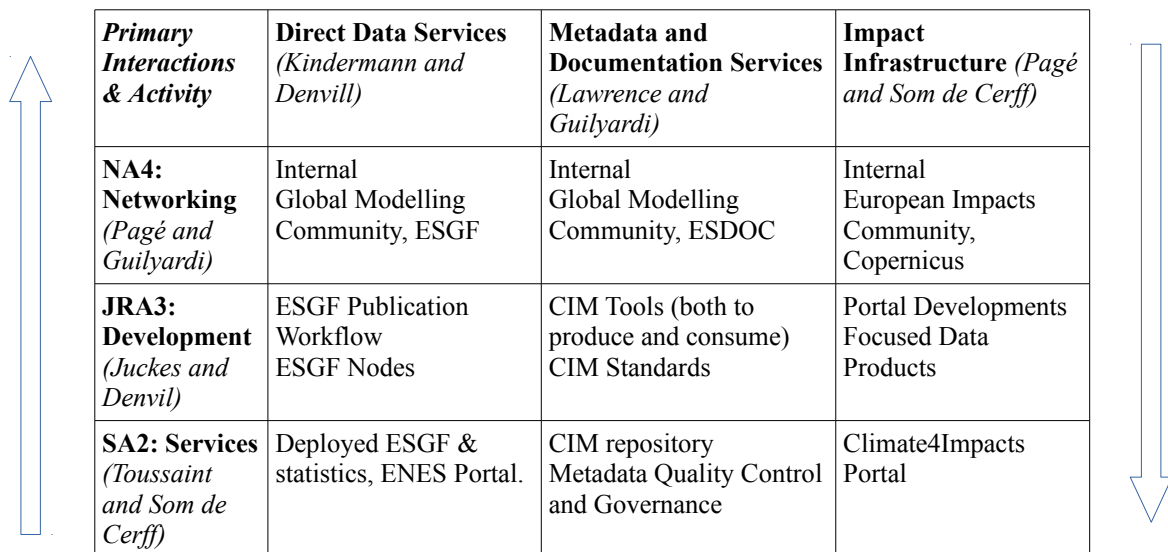
- **Climate Science Governance:** The World Climate Research Programme (WCRP) provides the route to science governance. The mission of the WCRP is “to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society”. In this context, the WCRP provides the over-arching scientific and policy requirements which IS-ENES2 needs to support – at least from supporting the data producers and primary data simulation.
- **Data Science Community:** The Global Organisation of Earth System Science Portals ([GO-ESSP](#)) is a community network which exists to promote discussion of systems and standards to support the dissemination and exploitation of Earth System Science data. GO-ESSP organises science meetings and a number of on-line discussions, including the NetCDF CF conventions governance which is critical to the efficient dissemination of climate model data and is now being adopted in the broader climate science and meteorological communities. GO-ESSP provided the organisational impetus to establishing the ESGF discussed next, and provides the route both for IS-ENES2 to understand and influence earth science data technology trends. In terms of wider data science trends, IS-ENES2 needs to engage with the Research Data Alliance ([RDA](#)).
- **Infrastructure Development and Delivery:** Here there are two major engagements, with the Earth System Grid Federation (ESGF) for data delivery and the Earth System Documentation community (ESDOC) for metadata. There is also a project relationship under the auspices of the G8.
 - The ESGF formed around the institutions responsible for delivering the archive infrastructure for the Coupled Model Intercomparison Project, Phase 5. ESGF is responsible for the maintenance and development of a software stack which is run at dozens of institutions and provides users access to a single petascale virtual archive distributed over 4 continents. ESGF holds one meeting each year and regular tele-conferences. IS-ENES2 provides the European component of ESGF, leads on many aspects of ESGF software development, and contributes to ESGF governance as discussed below.
 - The ES-DOC activity is an international umbrella activity which encompasses mainly the effort of IS-ENES2 and the US National Climate Predictions and Projections (NCPP) project. It has grown out of the collaboration between the EC FP7 METAFOR and US NSF CURATOR projects which delivered the Common Information Model (CIM) used to document the CMIP5 archive. ES-DOC communicates through regular tele-conferences. NCPP has been recently established as a joint venture between the US Department of the Interior and NOAA to promote dissemination and use of regional climate information. It is playing a significant role in the statistical downscaling element of CORDEX. IS-ENES2 provides both scientific and software leadership.
 - ExArch (G8 research initiative funding): Improved tools for managing model documentation, supporting data transformations through OGC WPS services and NOAA

Live Access Service, progress in structuring QC results, linking ESGF to tools for evaluation of regional climate models.

- User Communities: There are two major user communities for the data activities within IS-ENES2: the modelling community itself, and users of modelling data (who are often not themselves physical scientists).
 - The modelling community itself: modern climate science is totally dependent on model inter-comparison, and so the primary infrastructure for managing and providing distributed access to model data is integral to that science. For global climate modelling IS-ENES2 interacts with this community at the international level via the Infrastructure Panel of the Working Group on Coupled Climate Modelling (WGCM) (so the Infrastructure Panel is the WIP). The link to regional climate modelling is direct with WCRP.
 - The “impacts” community: those who use climate data. At the global scale IS-ENES2 interacts with the Intergovernmental Panel for Climate Change (IPCC) Task Group on Scenarios for Climate and Impact Assessment (TGCIA) who provide a venue to discuss the issues and requirements of the non-physical scientists. This interaction is primarily via the intersection between IS-ENES2 activities and the IPCC Data Distribution Centres which occurs at DKRZ and BADC. (However, as noted earlier, the primary interaction with the Impacts community is via European relationships.)

2 Delivery Plan

The major requirement of this delivery plan is to layout the links between the various activities within the project, and external activity. With these links exposed we can describe the ways of working and the ways of managing timelines – many of which depend on external projects and are not directly under the control of IS-ENES2.



Primary Interactions & Activity	Direct Data Services <i>(Kindermann and Denvil)</i>	Metadata and Documentation Services <i>(Lawrence and Guilyardi)</i>	Impact Infrastructure <i>(Pagé and Som de Cerff)</i>
NA4: Networking <i>(Pagé and Guilyardi)</i>	Internal Global Modelling Community, ESGF	Internal Global Modelling Community, ESDOC	Internal European Impacts Community, Copernicus
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SA2: Services <i>(Toussaint and Som de Cerff)</i>	Deployed ESGF & statistics, ENES Portal.	CIM repository Metadata Quality Control and Governance	Climate4Impacts Portal

Table 2: Key Interactions and cross cutting activities in terms of delivery themes, with responsible parties. Requirements feed down from networking to services, and experience feeds back from services to networking.

Although the data aspects of the project are being delivered in three work packages which reflect the formal funding mechanisms, the delivery is organised according to the three internal themes: (raw) data, metadata, and impact. In what follows we discuss each of the three themes and then present their interactions.

2.1 Data Theme Delivery

The cross-cutting data activity is co-led by Sebastien Denvil and Stephan Kindermann. The main aspects are shown in Figure 1 (alongside the impacts activities).



Figure 1: Relationship between different activities in the different work packages in the data and impacts themes and key external activities (e.g. the ENES portal, the IPCC DDC etc). The figure does not show the metadata services as these will appear in a future document.

All three aspects of the data services (networking, development, and service) are intimately related to international activities: much of the networking involves working with requirements capture and governance in international projects, the development work is being done in partnership with groups in ESGF, and the delivery of services is primarily around the deployment of ESGF.

The data access services will rely on the high degree of interoperability with data providers in the US, Asia and Australia which is provided by the Earth System Grid Federation. Planning is thus strongly influenced by external factors, as federation partners deliver new resources to be exploited or need to change direction. The data delivery theme will have a timeline which is primarily driven by CMIP6 (Meehl et al, 2014) – although it will provide ongoing support for CORDEX and existing CMIP5 data.

Governance arrangements for the ESGF were initially complicated by some misunderstanding as to exactly what is being governed, and by whom. As of March 2015, clarity was established (Figure 2). ENES is providing three European members representing not only themselves but the wider

European initiatives on the software development committee, one ENES member on the inter-sponsor “steering committee.

Currently (March 2015) the software development itself is further organised into working teams, details of which appear in the appendix – but these are expected to change.

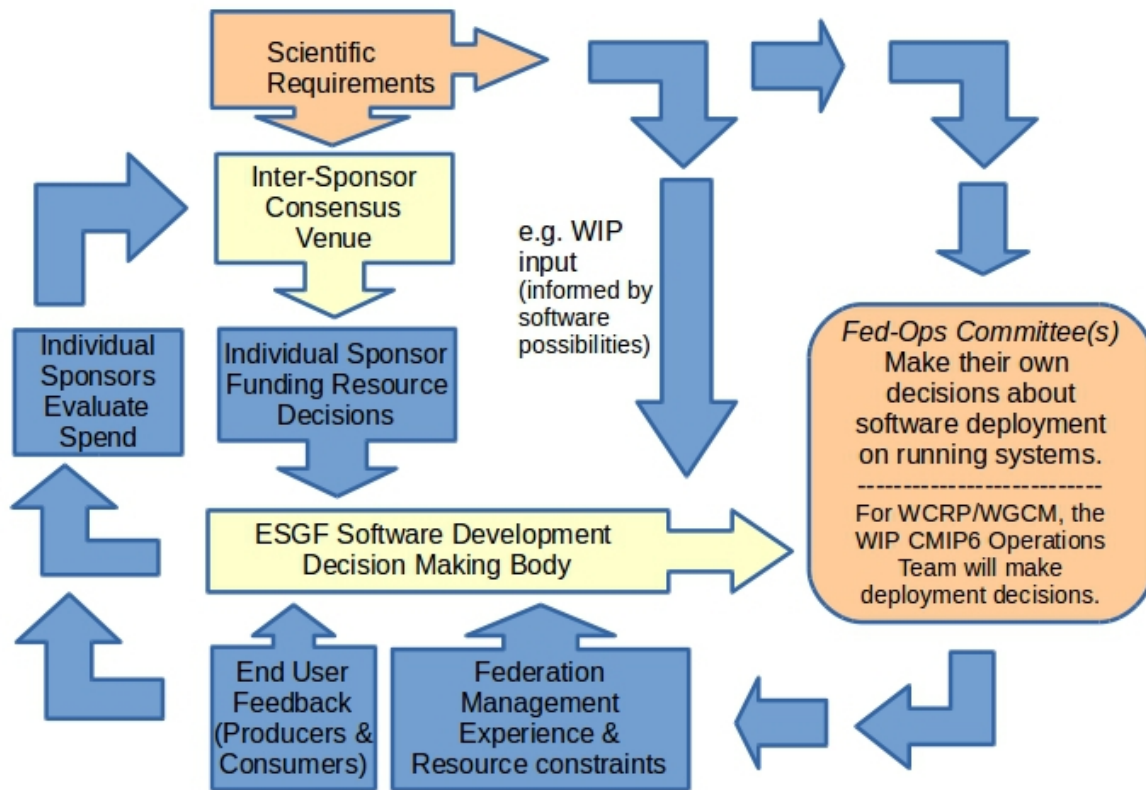


Figure 2: ESGF Governance: Software governance is expected to be dealt with by two international committees focusing on funding agreements and software agreements respectively (yellow boxes); while operational governance will be dealt with by actual interoperating federations using ESGF software. For IS-ENES2 the key federation operations committee will be the CMIP6 Operations Committee, which will coordinate primarily the CMIP6 requirements, but also take wider responsibility for a working WCRP federation.

Operational matters will be dealt with by a new committee set up under the auspices of the WGCM Information Panel (WIP): the CMIP6 Data Node Operations Team (CDNOT) – although of necessity this committee will need to look after key WCRP programmes, including CORDEX. It is led by Sébastien Denvil from ENES.

The European Space Agency will also be exploiting ESGF to make their Climate Change Initiative data available – CEDA¹ has recently obtained the contract to deliver the portal for his work, and will establish an appropriate governance arrangement with IS-ENES2 and the CDNOT once the issues are clear.

Another relationship that will need managing is with EUDAT. DKRZ, STFC and CERFACS are partners in EUDAT, so it is expected that a formal arrangement will be established once EUDAT2 is up and running.

2.2 Metadata Theme Delivery

The cross-cutting metadata activity is co-led by Bryan Lawrence and Eric Guilyardi. The main aspects are shown in Figure 3. The key activities can be summarised as consisting of developing and maintaining tools for creating and exploiting metadata, extending the structure and vocabularies

1 The Centre For Environmental Data Analysis: the unit at STFC taking part in IS-ENES2.

of the Common Information Model used for capturing the metadata, and working with science communities to ensure that the systems and vocabularies are fit for purpose.

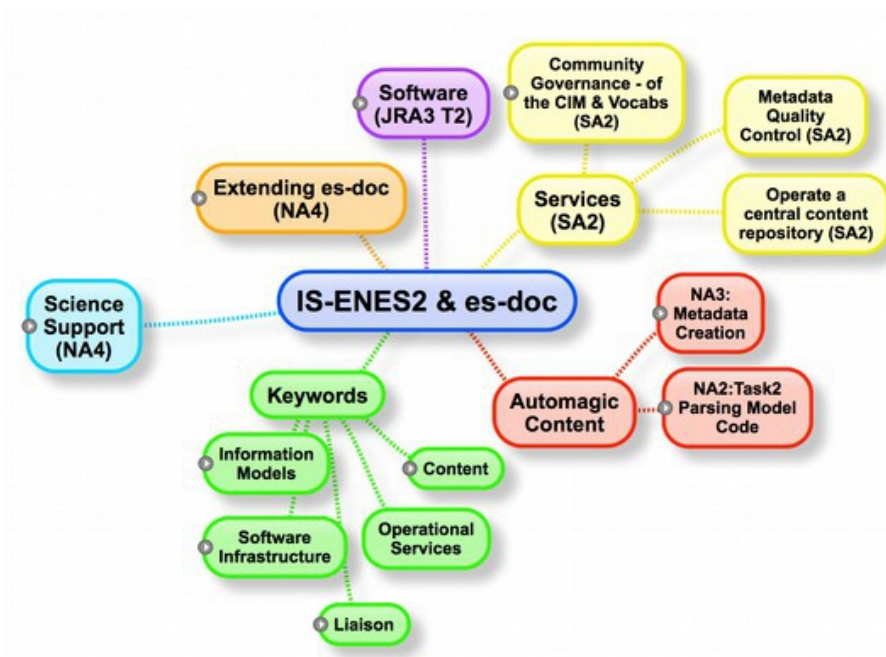


Figure 3: Key relationships within the metadata theme (not including detail for NA4). Note that there are aspects related to metadata outside the three core data work packages.

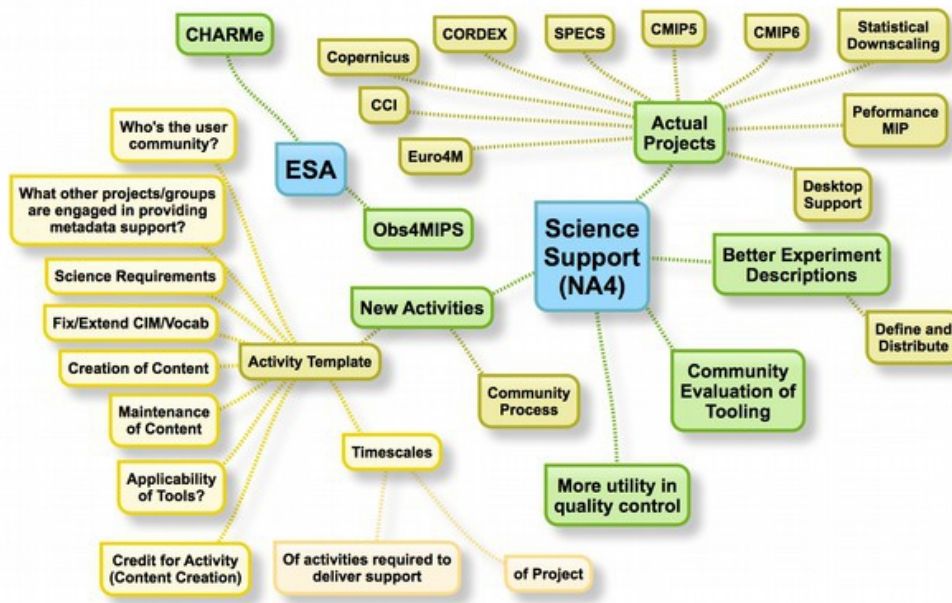


Figure 4: Main focus of the various external facing science support activities that are associated with metadata. Note the activity template for new (and existing) activities (outside IS-ENES2) as linked from “Actual Projects”.

The key classes of metadata which are expected to be captured are shown Figure 5. The most noteworthy issue from the point of view of IS-ENES2 delivery is that there needs to be a concrete point of linkage between the “file” metadata held in the ESGF repositories (both in the files, and in the layout and file nomenclature as defined by the Directory Reference Syntax) and the metadata held in the CIM.

This linkage will have to be managed via identifiers which will be established within the IS-ENES2 project in accordance with the WGCM Information Panel principles – and the WIP will also control many aspects of (at least) the CMIP6 vocabularies. In particular, the WIP will be relying on IS-ENES2 to construct and manage many of the vocabularies integral to CMIP6 – beginning with the formal definitions of the CMIP6 experiments which will be managed in the CIM. However, it is clear that the existing CIM will not be fit for purpose for these requirements, so CMIP6 will be the driver of key modifications to the CIM.

The CIM is not managed by one project: an international project has been established to provide that governance: <http://es-doc.org>. All changes to the CIM will need to be dealt with in the context of shared international objectives and priorities. While CMIP6 is a shared priority, it is not the only one. While IS-ENES2 was bid with resource to engage in shared community governance, exactly how to use that resource will need to be examined in the context of the resources available from other ESDOC partners, and the priority goals of the project – which are listed in Figure 4.

Like the data delivery theme, the metadata theme will be governed primarily by the CMIP6 timeline, although other projects will be important too – particularly CORDEX and other downscaling projects. IS-ENES2 will attempt to support CORDEX in accordance with an MoU to be drawn up with WCRP.

The Metadata Controlled Vocabulary for Statistical Downscaling development is also lead by NCAR/NCPP and several regular teleconferences have and will be held between US and European representatives, which included people from IS-ENES2 project and the EU COST VALUE Action.

A more detailed Metadata Delivery Plan will be drawn up during late 2015 and early 2016 as the CMIP6 timeline is finalised. It will cover how the CIM will produced and used by the community.

2.3 Impact Theme Delivery

The cross-cutting impact activity is co-led by Christian Pagé and Wim Som de Cerff.

The support to impacts communities needs input from different categories of users, hence there are strong connections with other FP7 projects which will also deliver data to these communities,

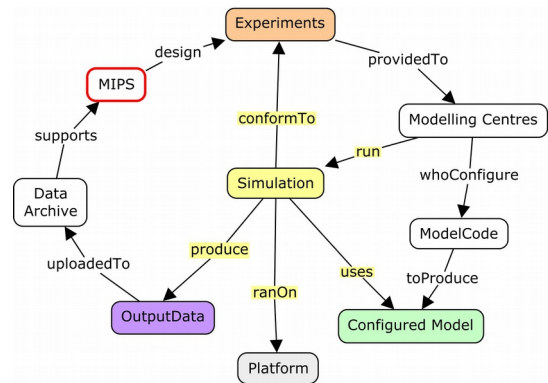


Figure 5 Key classes of metadata to be managed by IS-ENES2: Experiment descriptions, simulation descriptions, code descriptions, platform descriptions, and data descriptors. Other important concepts will be managed in vocabularies and relationships.

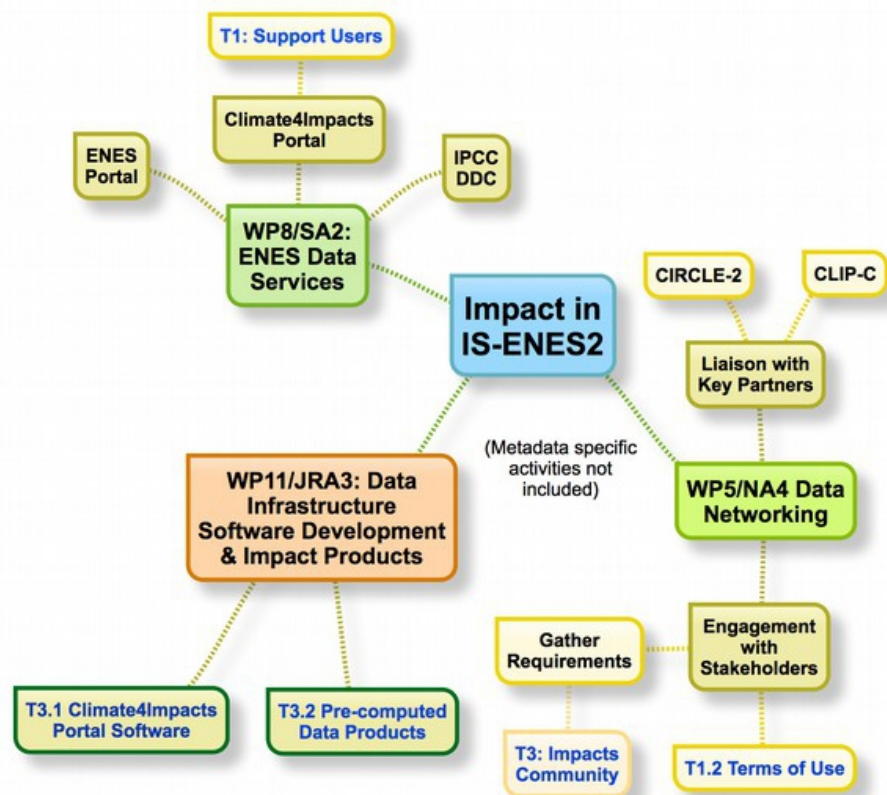


Figure 6: Summary of the key impacts activities and relationships. The main product is the climate4impacts portal and the content therein.

notably via [CLIPC](#), where there is considerable overlap between aims and user communities. This overlap will be beneficial since the two projects will be able to deliver more than the sum of the two parts.

It is expected that services offered by the climate4impact portal should also be usable within ESGF. It will no longer just be a client of ESGF services but will also contribute to them. Climate4Impact would also like to use ESGF monitoring S/W to improve error messages and to monitor the climate4impact usage of ESGF (data downloads initiated through climate4impact).

2.4 Cross-Cutting Thematic Activity

The key cross-cutting activity revolves around establishing appropriate identifiers for information entities and the relationships between them.

Processing APIs and tools will be very important in ongoing work for both the data delivery and impact work. The Web Processing Service API currently lies underneath both the impact portal and the planned ESGF server-side computing.

There will be semantic work necessary to make mapping between metadata held in NetCDF and in other formats, particularly GRIB which is still used in some communities.

3 Managing Relationships and Timelines

Most delivery issues revolve around inter-work package dependencies, and dependencies on external timelines.

Internal dependencies have been, and will continue to be managed by regular work-package leader telcos, and ad-hoc meetings as necessary. The theme leaders will provide the necessary leadership.

A complete set of data milestones and deliverables appears in Appendix 3.

A key focus will be on the new ENES Data Task Force, established under the auspices of IS-ENES2 WP1, to provide a European venue for data infrastructure discussions that go beyond what can be achieved during and within IS-ENES2. However, while the DTF scope is much greater than IS-ENES2, it could also be used as venue for pulling “top-down” requirements into or out of the IS-ENES2 scope (alongside “bottom-up” requirements gathering in the networking packages). In this context, we anticipate such “top-down” requirement changing to arise from changing external factors such as the influence of PRACE2 or new ENES scientific endeavours.

4 Final Recommendation

IS-ENES2 does not exist in a vacuum, both activities and products need to be responsive to external events and developments. To that end, as well as the new data task force, IS-ENES2 needs to react with, and to, the drivers from the modelling and impact science programmes: Timelines and deliverables need to meet the science drivers.

5 References

Meehl, G. A., Moss, R., Taylor, K. E., Eyring, V., Stouffer, R. J., Bony, S., & Stevens, B. (2014). Climate Model Intercomparisons: Preparing for the Next Phase. *Eos, Transactions American Geophysical Union*, 95(9), 77–78.

6 Appendix 1: ESGF Working Groups

Team	Abbrev	Team leaders
Installation Working Team	esgf-iwt	<i>Nicolas Carenton and Prashanth Dwarakanath</i>
Compute Working Team	esgf-pwt	Dan Duffy and Charles Doutriaux
(International) Network Working Group	ICNWG	Eli Dart and Mary Hester
Identity/Entitle/Access	esgf-IdEA	<i>Philip Kershaw</i> and Rachana Ananthakrishnan
Support Working Team	esgf-swt	<i>Torsten Rathman</i> and Matthew Harris
Data Transfer Working Team	esgf-dtw	Rachana Ananthakrishnan and Eric Blau
Dashboard Working Team	esgf-dwt	<i>Sandro Fiore</i>
Node Manager Working Team	esgf-nmwt	<i>Prashanth Dwarakanath</i> and Sasha Ames
Quality Control Working Team	esgf-qcwt	<i>Martina Stockhause</i> and <i>Katharina Berger</i>
Tracking and Feedback Notification Working Team	esgf-tfnwt	TBD (IPSL?)
Workflow and Provenance Working Team	esgf-wpwt	TBD
Metadata and Search Working Team	esgf-mswt	Luca Cinquini

Table 3: ESGF Working Teams and their leadership (March 2015). Where ENES has leadership, names are indicated in bold and italic fonts.

Appendix 2: CMIP6 Timeline

Much of the timing and detail was not possible to construct until early 2015, one of the reasons for the delay in finalising this document. CMIP6 is expected to be fully defined in a WGCM meeting in October 2015, and run through to approximately 2020, with extra MIPs to be added as necessary.

A2.1 CMIP6 Timetable²

- May 2015: Endorsed MIPs established
- June 2015: First draft of CMIP6 Data Request
- October 2015: Final approval from WGCM for details (including Data Request).
- January 2016: Pre-Industrial Forcing Datasets ready.
- July 2016: Historical Forcings Ready
- October 2016: Future Scenario Forcings Ready.
- (Expected AR6 deadline 2019?)

A2.2 WIP and ENES timetable

- Expecting simulations to start flowing in earnest once the historical forcings are ready; data to start coming soon thereafter.
- Need most of the controlled vocabularies in place by end of 2015.
- A timeline for ESGF modifications has yet to be established.
- A timeline for the publication and quality control activities has yet to be established.

² http://www.wcrp-climate.org/images/modelling/WGCM/CMIP/CMIP6FinalDesign_WGCMMeeting_150116_Sent.pdf

A2.3 IS-ENES2 Metadata Timetable

Second Quarter 2015

- Complete CMIP5 simulations via DRS parsing (UREAD)
- Draft CMIP6 Data Reference Vocabularies (STFC)
- Organise existing standard vocabulary mindmaps into tables for community review (UREAD)
- Actively publicise existing CMIP5 tools and quality controlled metadata (IPSL)
- WGCM Statement of Purpose (IPSL)
- Sea Ice Proof of Concept for new Standard Vocabulary method (UREAD).
- Forcings Protocol

Third Quarter 2015

- CMIP6 Experiment Protocol Agreed (UKMO)
- Modify semantic structure of Model Standard Vocabularies to use “Process/Algorithm” method
- Who: Ocean (Eric), Atmosphere (Charlotte), Atm Chem/Aerosol (Charlotte), Land Surface (Ksenya), OBG (Eric), Land Ice (UoR: David tbd)
- Community Review (WGCM Lead with IPSL)
- Draft Standard Vocabularies for Experiments, Variables and Forcings (STFC)
- CIM2 Specification Complete (UREAD/STFC) (including Grid)

Fourth Quarter 2015

- Formal Specification (using CIM) of Key MIP Experiments Complete

First Quarter 2016

- Complete Standard Vocabularies for Models

Second Quarter 2016

- Historical Forcings

Appendix 3: Data Milestones and Deliverables

In this table:

- Month 12: March 2014
- Month 24: March 2015
- Month 36: March 2016
- Month 48: March 2017.

Name	Activity	Due	WP	D	M	I
D11.1	Delivery Plan (this document)	7	JRA3	X		
MS 51	Draft archive governance and requirements circulated for feedback	12	NA4	X	X	
MS 52	Consultation on data access protocols	12	NA4	X		
MS 81	ENES Climate Data Infrastructure Help Desk	12	SA2	X	X	X
MS 82	Set up of Data Service Review Committee	12	SA2	X	X	X
MS111	Monitoring system and dashboard design document (for D 11.3)	12	JRA3	X		
D11.2	Report on climate4impacts V1	12	JRA3			X
MS 112	Web processing services report on cross-cutting synergies between data and impacts tasks.	12	JRA3	X		X
MS 113	Revised generic questionnaire s/w package available	15	JRA3		X	
MS 114	Core services package, version 1, commissioned	18	JRA3	X		
MS 115	Review requirements and resources for pre-computed products	18	JRA3			X
D 5.1	Data archive governance and requirements document	18	NA4	X	X	
MS 116	MetO Metadata tool evaluation	21	JRA3		X	
MS 53	Consultation on quality control requirements	24	NA4	X	X	
MS 83	Integration of CIM model and experiment repository into ENES CDI	24	SA2		X	
MS 84	1 st Review report on the ENES climate data infrastructure	24	SA2	X	X	X
MS 117	Report on integration of services for indices and averaging	24	JRA3			X
MS 85	JRA4 developed climate services deployed in climate4impacts	32	SA2			X
MS 86	2 nd Review report on ENES climate data infrastructure	36	SA2			X
D 5.2	Assessment of impact communities requirements	36	NA4			X
D 11.3	Report on service monitoring and dashboard	36	JRA3	X		
MS118	Review climate4impacts services and objectives	36	JRA3			X
D11.4	Report on metadata services	39	JRA3		X	
MS 54	Synthesis report on metadata requirements regarding relevant data archives	42	NA4		X	
D 5.3	Report on basic data access protocols and data quality control	42	NA4	X		
D11.5	Report on core services package, V2	42	JRA3	X	X	X
D11.6	Report on derived products in climate4impacts	44	JRA3			X
D 5.4	Report on metadata controlled vocabulary extensions	45	NA4		X	
MS 88	Climate4impacts components available for use in tailored impact portals	46	SA2			X
MS 89	Improved data access available from ENES climate data infrastructure	48	SA2	X	X	X