

# From climate models to informing policy decisions: the end-to-end importance of a sustained research infrastructure

## *The IS-ENES3 Sustainability Working Group*

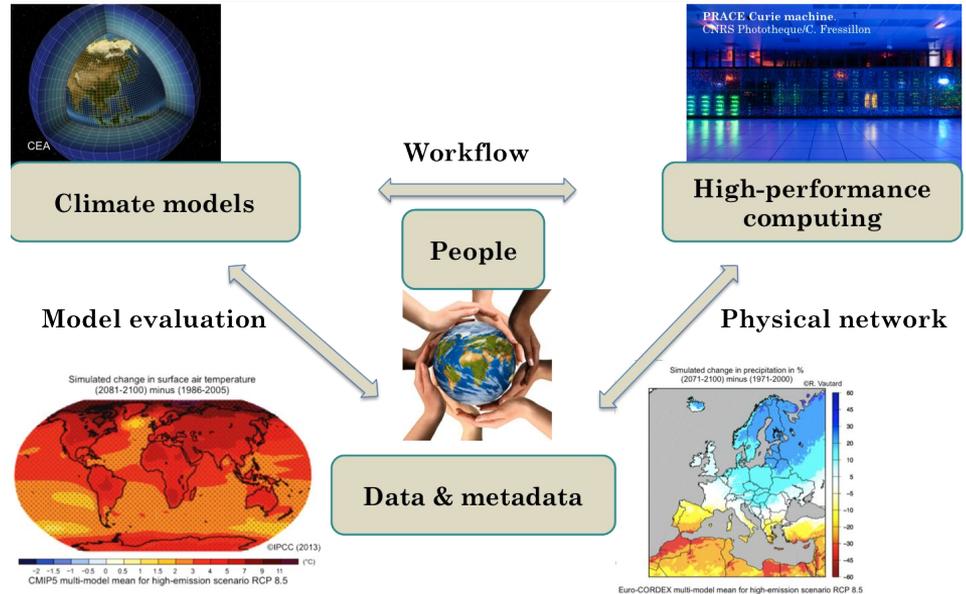
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- 0 - The ENES research infrastructure and its mission
- 1 - Contributions to advances in policy-relevant science
- 2 - Positioning ENES-RI in the international landscape
- 3 - Steps towards a sustained infrastructure
- 4 - Summary

## Primary focus: the climate modelling research community

- Foster common model development and efficient use of HPC.
- Sharing of expertise, training
- Support exploitation of model data
- Support **WCRP** coordinated experiments (**CMIP & CORDEX**)
- Prepare for exascale



### Two EC project streams:

- **IS-ENESx**: Infrastructure for the European Network for Earth System Modelling (since 2009).
- **ESIWACEx**: Centre of Excellence in Simulation of Weather and Climate in Europe (since 2015).

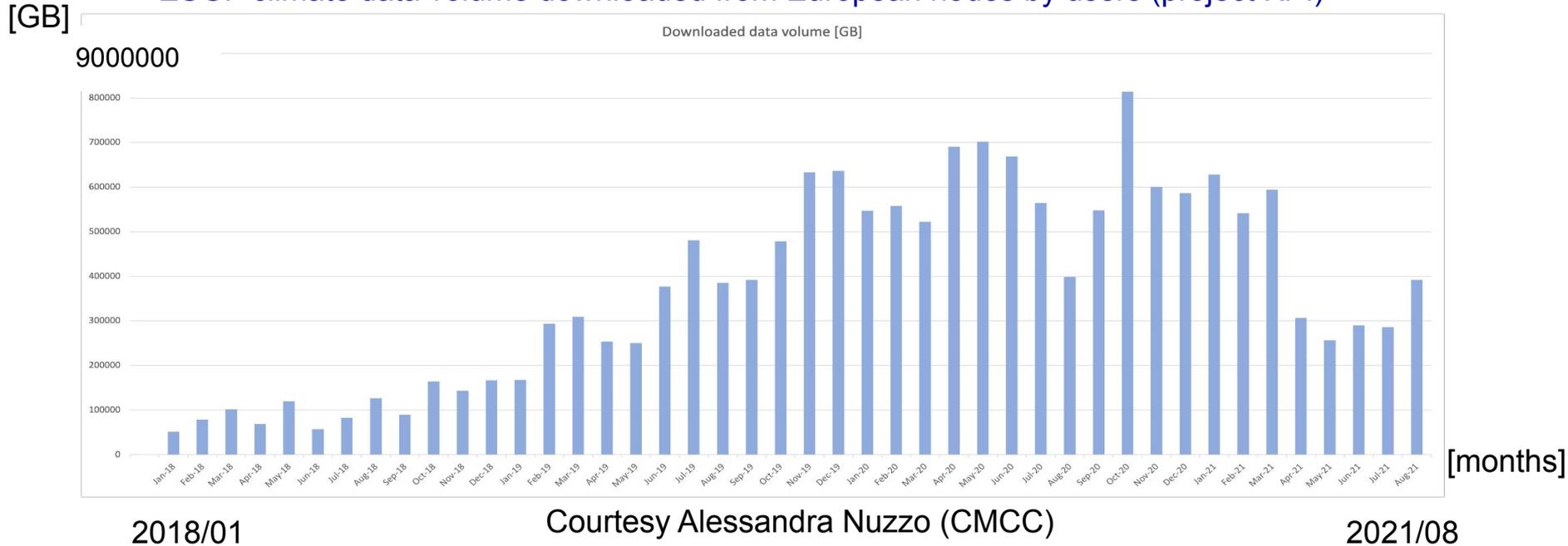
## Services and expertise enabling the Exploitation of Climate Model Data

- **Data Access** (Provide a range of data access services)
- **Metadata and Data Standards** (contribute to the infrastructure and governance of key metadata and data standards, e.g. Climate Forecast conventions for NetCDF, documentation of models and simulations, CMIP data protocols)
- **Represent Needs of Climate Modelling** ( European contributions to international partnerships, such as the European Open Science Cloud, the Earth System Grid Federation and the IPCC Data Distribution Centre)
- **Support and Enhance Model Diagnostic Capability** (primarily to support model evaluation and intercomparison ) including **Deploying Services, Gathering Requirements, Promoting Standards, Developing Software**
- **Support Climate Impacts Community** (invest in the operation and development of targeted services)

## Supporting the development, operation, optimisation and evaluation of climate models

- **Support common development and use** of models, components, and tools
- **Improve the toolchain to manage data** from climate and weather simulations **at scale**
- **Accelerate preparation to (pre-)exascale systems** (foster co-design between model developers, HPC manufacturers and HPC centres)
- **Provide a platform for expertise exchange** to create a fitter and sustainable community
- **Promote the use of new metrics for evaluating model computational performance** and how best to use available HPC
- **Enhance HPC capacity**
- **Explore** new avenues and tools, such as **Machine Learning** and **Artificial Intelligence**

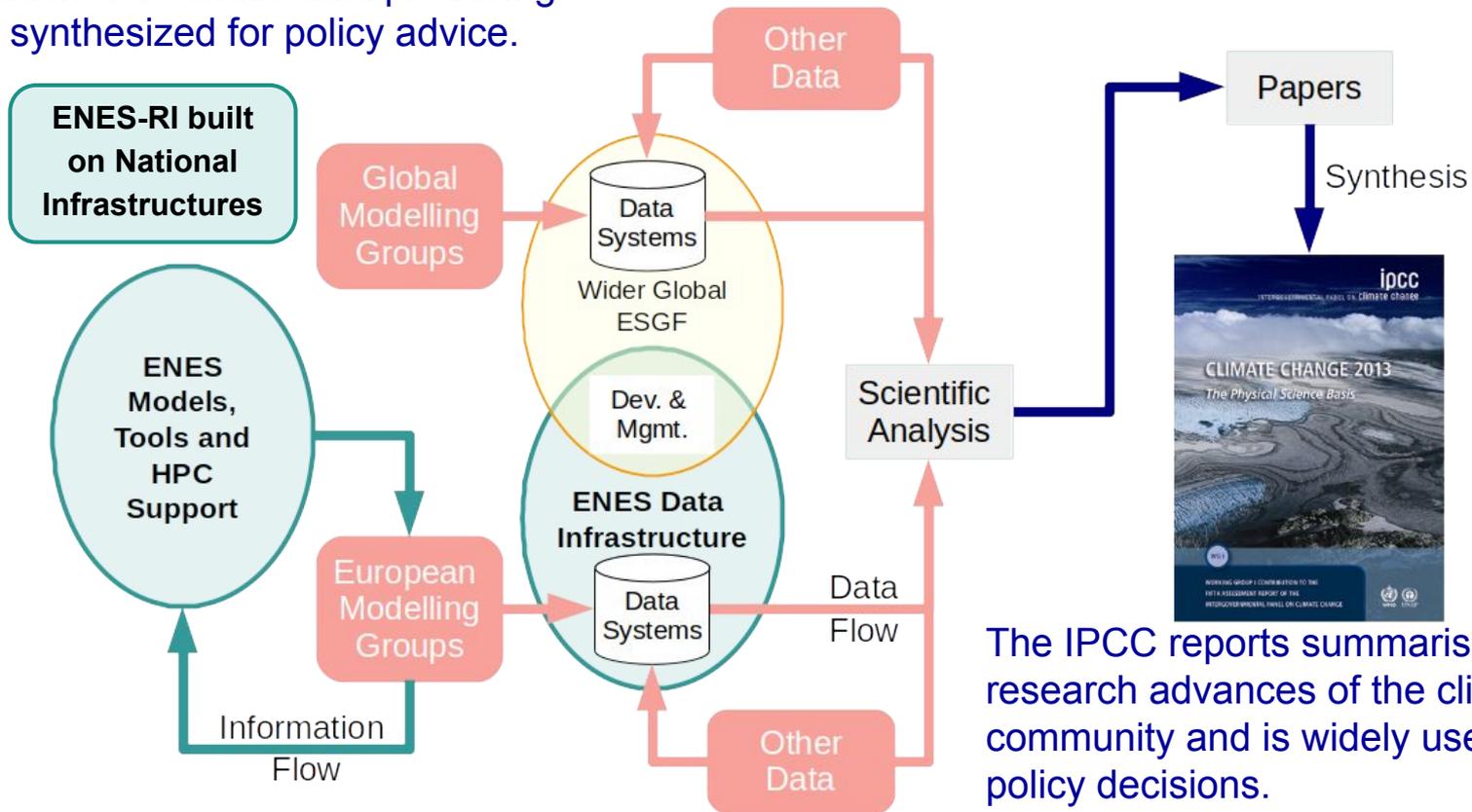
ESGF climate data volume downloaded from European nodes by users (project KPI)



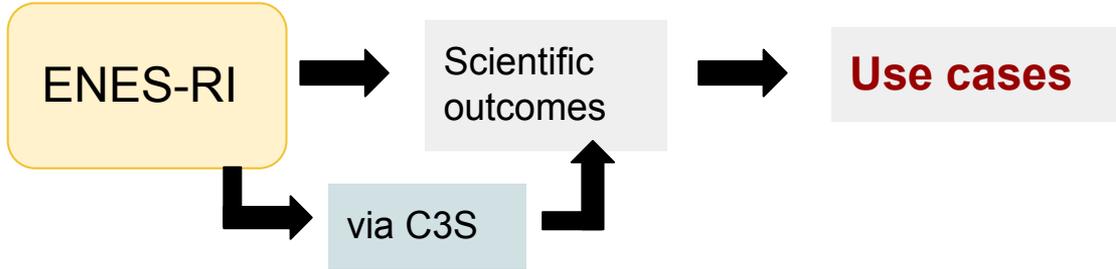
Growing use of climate model data from the ENES-RI highlights the relevance of of our database beyond the pure research usage.  
 Administrations and climate services are important users of the database.

## Feeding IPCC

Results from climate modelling are a major contribution to scientific data producing papers synthesized for policy advice.



The IPCC reports summarises the latest research advances of the climate community and is widely used to inform policy decisions.



### Examples:

- Management and conservation planning
- Development of tool to help local adaptation to regional climate change
- Evaluation of cost-risk trade-off of mitigation and geoengineering

SpringerLink

Published: 06 June 2018

Cost-Risk Trade-Off of Mitigation and Solar Geoengineering: Considering Regional Disparities Under Probabilistic Climate Sensitivity

Elnaz Boshan, Mohammad M. Khabbazaan & Hermann Held

*Environmental and Resource Economics* 72, 263–279(2019) | [Cite this article](#)

617 Accesses | 5 Citations | 16 Altmetric | [Metrics](#)

1. Available at <https://esgf-data.dkrz.de/search/esgf-dkrz/>.

Environmental Research Letters

LETTER

Maximising climate mitigation potential by carbon and radiative agricultural land management with cover crops

Emanuele Lugato, Alessandro Cescatti, Arwyn Jones, Guido Ceccherini and Gregory Duveiller

European Commission, Joint Research Centre (JRC), Ispra (VA), Italy

ically downscaled with the Regional Climate Model CCLM4-8-17, available from the WCR-CORDEX portal (<https://esgf-node.ipsl.upmc.fr/search/cordex-ipsl/>), was used. Average annual atmospheric N



PROJECTIONS OF FUTURE CORAL BLEACHING CONDITIONS USING IPCC CMIP6 MODELS:

Climate policy implications, management applications, and Regional Seas summaries

Climate model data: Values for the variable 'tos' (sea surface temperature) at the model native grid resolution was downloaded from <https://esgf-node.inl.gov/> on January 17th 2020, for all available models in SSP5-8.5 and SSP2-4.5 (see Appendix 1 for models lists for each scenario).

Results from climate modelling data analyses have largely contributed to local / regional decisions on adaptation, mitigation or conservation planning ; as well as development of tools for adaptation.

### ESiWACE2 (& 3?)

Enables very high resolution modelling of weather and climate on the upcoming (pre-)Exascale supercomputers.

Improved weather forecasts and climate projections are crucial for informing decisions on emission reductions as well as adaptation strategies for housing, cities, farming, coastal defenses and other parts of society.

### Models, Tools & HPC

### IS-ENES (& future ENES-RI)

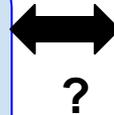
Contribute to developing a better understanding of past and present-day climate and to project future variability and changes through the development and sharing of model components, modelling tools and data infrastructure.

Delivering CMIP and CORDEX data to the community.

### DestinE

Development a very high precision digital model of the Earth (Digital Twin) [...] to develop and test scenarios for:

- more sustainable development and achievement of the EU green deal objectives
- saving lives
- avoiding large economic downturns
- support EU policy

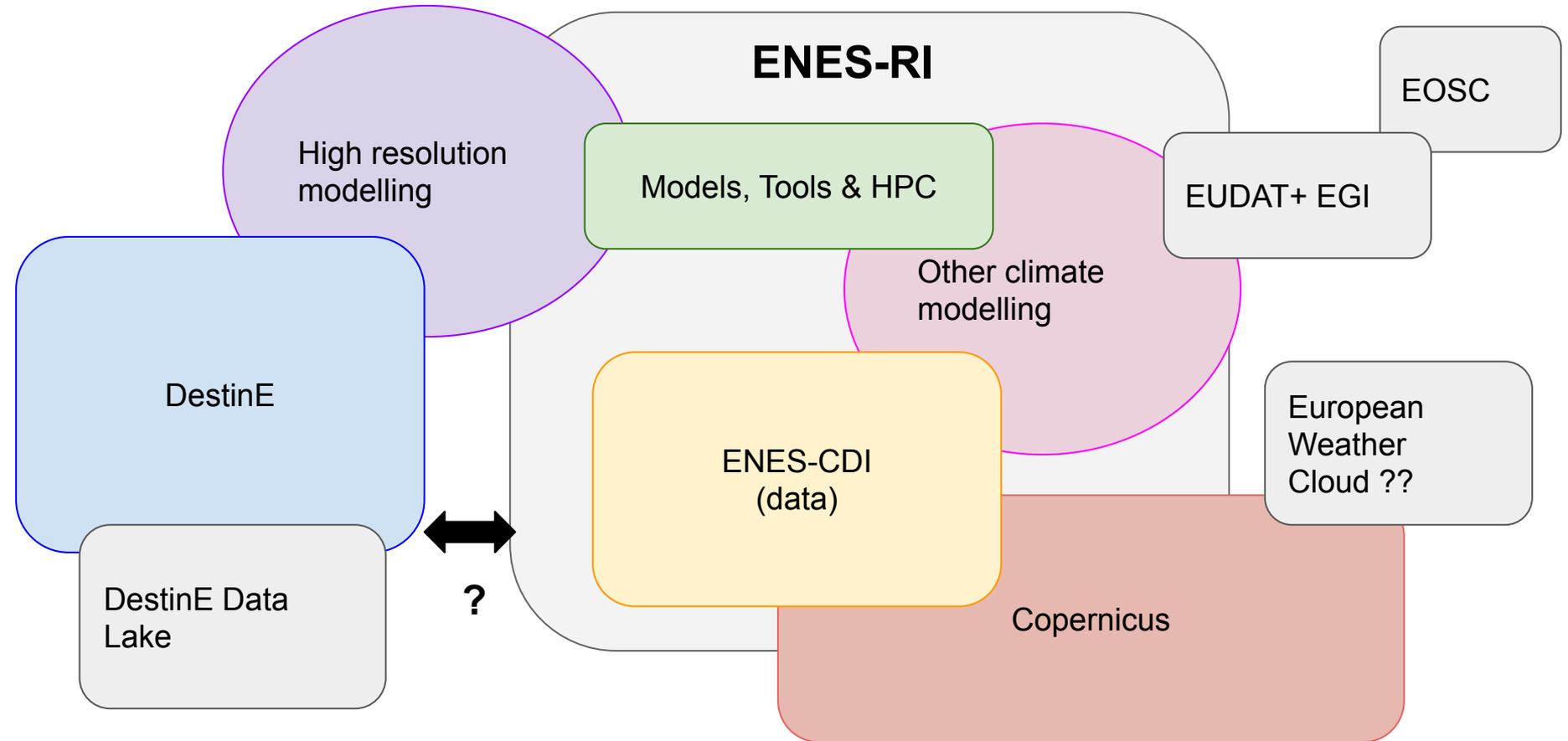


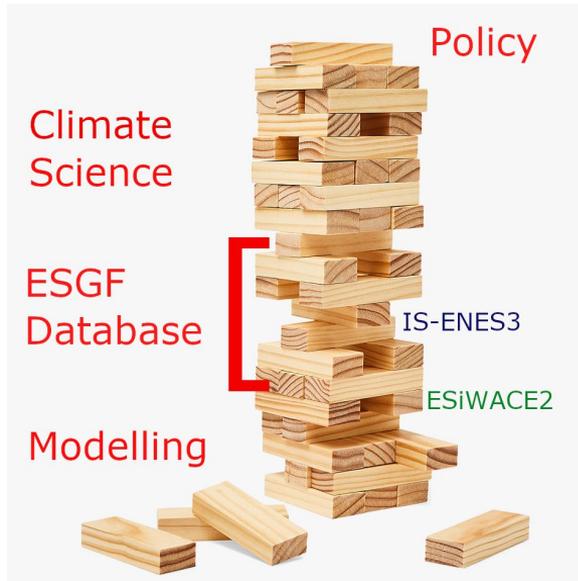
EUMETSAT  
(data lake)

### ENES-CDI (data)

### Copernicus - C3S

Provide authoritative information about the past, present and future climate, as well as tools to enable climate change mitigation and adaptation strategies by policy makers and businesses.





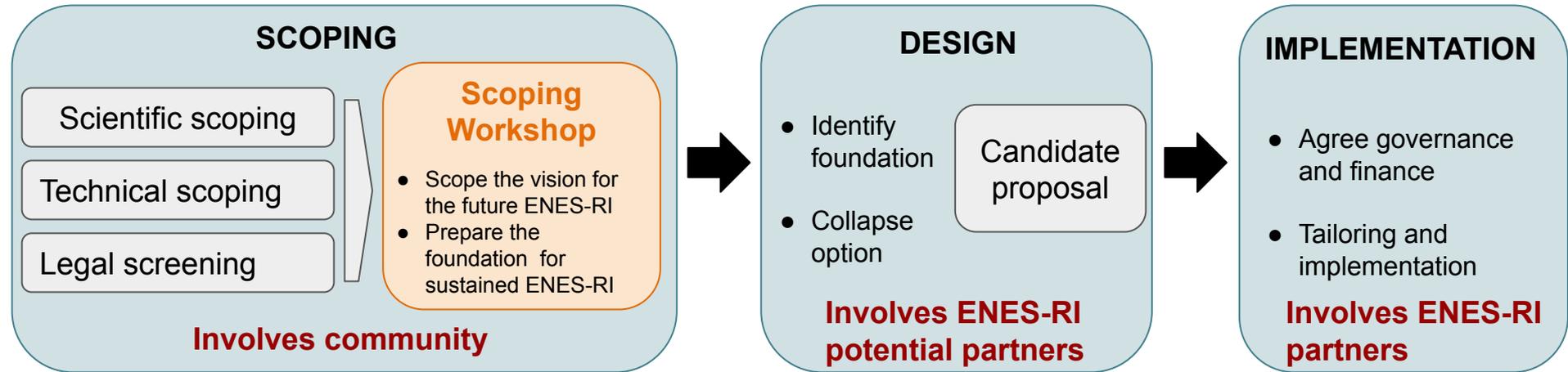
The ENES-RI provides essential infrastructure which underpins the production of synthesized research informing climate policy.

The ENES-RI currently largely relies on EU funding from both IS-ENES3 and ESIWACE2 projects.

**EU funding ends Dec 2022.**

**=> Underfunding of RI will slow down science outcomes and prejudice adequate policy advice.**

**We are working toward sustaining our ENES-RI.**



## M2.3 - Sustainability Scoping Report

- The **scoping phase** assesses the needs of the community and scope the vision for the future RI.
- The **design phase**: prepares a candidate proposal.
- The **implementation phase**: finalises the governance, and the legal and financial organisation of the structure.

## The European Network for Earth System Modelling (ENES)

➤ An umbrella of services and venue to support the climate modelling community

ENES-RI entity coordination office:

- Primary contact point / triage
- Communication channels
- Coordination of boards
- Organisation of training / workshops
- Communication between running projects to foster synergy
- Coordination of funding opportunities

### ENES Climate Data Infrastructure (ENES-CDI)

➤ Service and expertise enabling the exploitation of climate model data

Core architectural RSE team for data sharing:

- Security upgrades
- Architecture maintenance and upgrade
- WPS integration and maintenance

### ENES strategy board (representative of ESM institutions)

➤ A lobby coordination platform to discuss the European ESM strategy / objectives

- Decision on future directions of ENES-RI
- Decision on priorities

Previous recommendations (ENES Infrastructure strategy 2012-2022, update in 2017):

- Models: Accelerate preparation of exascale
- HPC: Exploit blend of facilities & Access to world-class HPC
- Big data challenge: Access, documentation, analyses
- Physical network: Maximize bandwidth
- People: Training at all levels for researchers & engineers
- (from update) Model evaluation: supporting the infrastructure
- (from update) Sustainable infrastructure

**We will now start working on the foresight strategy 2023-2033:**

- (1) Contact with modelling institutions to get their views
- (2) Draft a strategy based on the feedback
- (3) Have a ENES strategy workshop to finalise

- The ENES-RI provides essential infrastructure which underpins the production of synthesized research informing climate policy.
- Underfunding of RI might slow down science outcomes and prejudice adequate policy advice.
- We are currently taking steps towards making the ENES-RI sustainable with the support from European climate modelling research institutions.
- An ENES foresight strategy for 2023-2033 will be prepared.