is-enes
INFRASTRUCTURE FOR THE EUROPEAN NETWORK FOR EARTH SYSTEM MODELLING

CAS2K13
9-12 September 2013
Annecy, France

CAPACITIES

InfraStructure for the European Network for Earth System modelling

« IS-ENES »

Sylvie JOUSSAUME,
CNRS, Institut Pierre Simon Laplace, Coordinator

Sciences de l'environnement Institut Pierre Simon Laplace
Max-Planck-Institut für Meteorologie
CERFACS
DKRZ
National Centre for Atmospheric Science
NATURAL ENVIRONMENT RESEARCH COUNCIL
The University of Manchester
MANCHESTER 1824
DMI Vejr, klima og hav
UNIVERSITAS BERGENSIS
Science & Technology Facilities Council
cmcc Centro euro-Mediterraneo sui Cambiamenti Climatici
Met Office
Royal Netherlands Meteorological Institute
Ministry of Transport, Public Works and Water Management
METEO FRANCE Toujours un temps d'avance
IC3
UC UNIVERSIDAD DE CANTABRIA
SMHI
LINKÖPINGS UNIVERSITET
BSC
WAGENINGEN UR For quality of life
INSTITUTUL NATIONAL DE HIDROLOGIE SI GOSPODARIRE A APELOR INHGA
DLR
University of Cape Town
Meteorologisk institutt met.no

Earth System modelling in Europe

NCC	NorESM1-M NorESM1-ME
MPI-M	MPI-ESM-LR MPI-ESM-MR MPI-ESM-P
MOHC	HadCM3 HadGEM2-A HadGEM2-CC HadGEM2-ES
EC-EARTH	EC-EARTH
IPSL	IPSL-CM5A-LR IPSL-CM5A-MR IPSL-CM5B-LR
CNRM-CERFACS	CNRM-CM5
CMCC	CMCC-CESM CMCC-CM CMCC-CMS

CMIP5 in Europe

7 European modelling groups

17 models

CMIP5

Evaluate/Understand/Projections

3400 simul. yrs up to > 12000 yrs

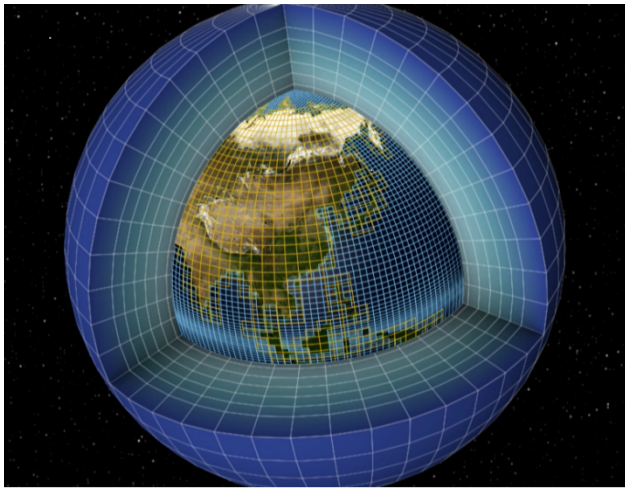
50 expts up to > 160 expts

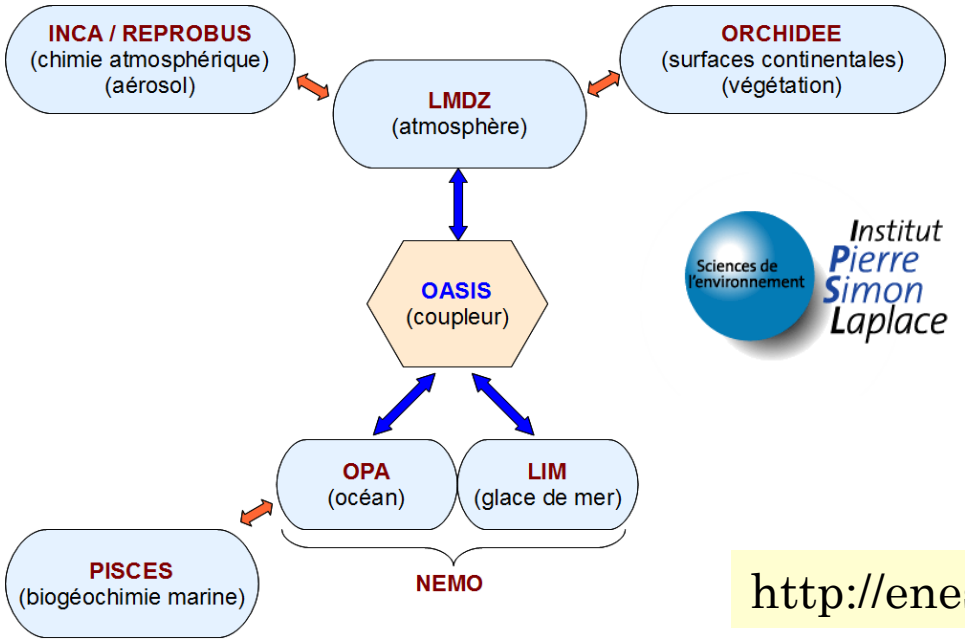
1000 – 3000 Tbytes (CMIP3: 36)

29 modelling groups

61 models

Earth System modelling in Europe





Institut Pierre Simon Laplace – Sciences de l'environnement

http://enes.org

Country	name of model (CMIP5)	Atmosphere	Ocean	Sea Ice	Coupler	Land Surface *Vegetation	Atmospheric Chemistry	Ocean Bio-geochemistry
Consortium	**EC-EARTH**	IFS	NEMO	LIM	OASIS	HTESSEL	TM5	
France	**IPSLCM5**	LMDz	NEMO	LIM	OASIS	ORCHIDEE	INCA	PISCES
France	**CNRM-Cerfacs**	ARPEGE	NEMO	GELATO	OASIS	SURFEX		
Germany	**MPI-ESM**	ECHAM5	MPIOM	MPIOM	OASIS	JSBACH*	HAM	HAMOCC
Italy	**C-ESM**	ECHAM5	NEMO	LIM	OASIS	SILVA		PELAGOS
UK	**HadGEM2**	UM	UM	CICE	OASIS	TRIFFID*	UKCA	diat-HADOCC
Norway	**NorESM**	NCAR	MICOM	CICE	CPL7	CLM	Chemistry	HAMOCC

EC-Earth Con Netherlands, Sweden, Ireland, Denmark, Spain, Portugal, Italy, Belgium

ENES

European Network for Earth System modelling

http://enes.org

A network of European groups in climate/Earth system modeling

Launched in 2001 (MOU)

Ca 50 groups from academic, public and industrial world

Main focus :

discuss strategy to accelerate progress in climate/Earth system modelling and understanding

Several EU projects

ENSEMBLES, COMBINE, EUCLIPSE, EMBRACE, SPECS

PRISM, METAFOR, IS-ENES

Collaboration with PRACE

IS-ENES
Infrastructure for ENES

European projects
2009-2013; 2013-2017

Infrastructure

Models & their environment
Model data (ESGF)
Interface with HPC ecosystem

Users :

Climate modelling community
Impact studies

enes
EUROPEAN NETWORK
FOR EARTH SYSTEM MODELLING

Infrastructure Strategy for the European Earth System Modelling Community 2012-2022

Drivers : Science & Society

From understanding to development of "Climate Services"

Key science questions

Q1. How predictable is climate on a range of timescales ?

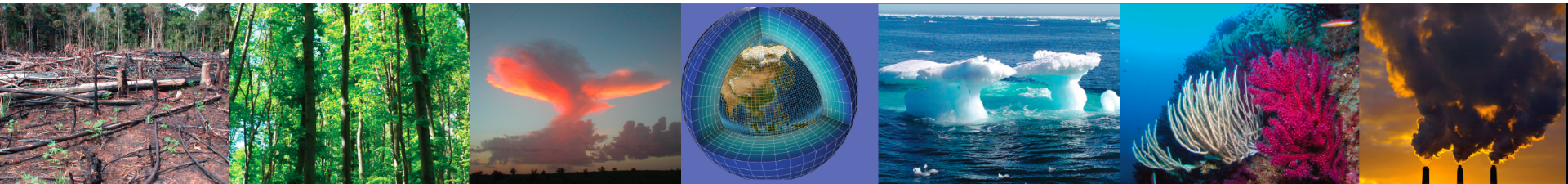
Q2. What is the sensitivity of climate and how can we reduce uncertainties ?

Q3. What is needed to provide reliable predictions of regional climate changes ?

Q4. Can we model and understand glacial-interglacial cycles ?

Q5. Can we attribute observed signals to understand processes ?

Writing team:
J. Mitchell, R. Budich, S. Joussaume, B. Lawrence & J. Marotzke
52 contributors from BE, CZ, DE, DK, FI, FR, IT, NO, SE, SP, UK



Infrastructure strategy for ENES for the next 10 years

Global & Regional climate models

Key role of infrastructure : models, data & computing

Recommandations:

1) Access to world-class HPC for climate

   at least «tailored » for climate up to « dedicated »

2) Develop the next generation of climate models

3) Set up data infrastructure (global and regional models) for large range of users from impact community

4) Improve physical network (e.g. link national archives)

5) Strengthen European expertise and networking

Input to IS-ENES2

ENES
Towards an European Climate Infrastructure Initiative :
a sustainable virtual laboratory

is-enes
INFRASTRUCTURE FOR THE EUROPEAN NETWORK FOR EARTH SYSTEM MODELLING

IS-ENES : Infrastructure for ENES

FP7 project « Integrating Activities »

CAPACITIES

http://is.enes.org/

1rst phase: March 2009- Feb 2013 (7.6 M€), 18 partners
2nd phase: April 2013- March 2017 (8 M€), 23 partners

Better understand and predict climate variability & changes

Foster:

- The integration of the European ESM community
- The development of ESMs and their environment
- High-end simulations
- The application of ESM simulations for climate change impacts

Support to international databases & metadata standards

WCRP World Climate Research Programme

IPCC AR5: CMIP5 & CORDEX (EuroCordex, Africa, Medcordex)

Foster the integration of the European ESM community

Foster interactions, synergies & common strategies

Common European strategy

ENES Infrastructure **Strategy in 2012**

Future steps:

Strategy on model evaluation infrastructure

Mid-term update of ENES strategy

Community building

ENES portal *http://enes.org*

Series of European training school on ESM

2012 Kos (Greece), **2014 Barcelona** (Spain), 2016 tbd

Enhance the development of ESMs

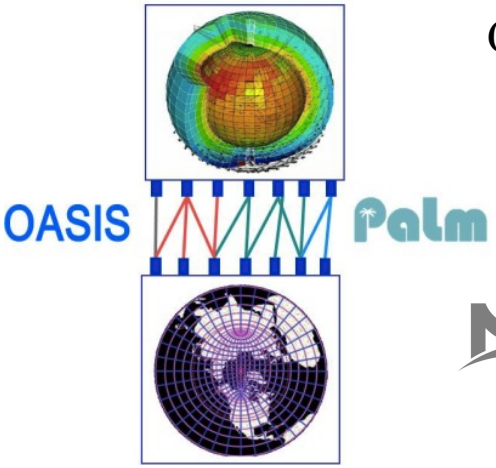
Foster common developments, sharing of expertise, accelerate developments

Service on models and model environment

OASIS coupler
CDO data processing
NEMO Ocean model

Support on ESMs:
Model documentation
Help users of model data (all)
+ and models (Hadgem & Ec-Earth)

Support to users
Development

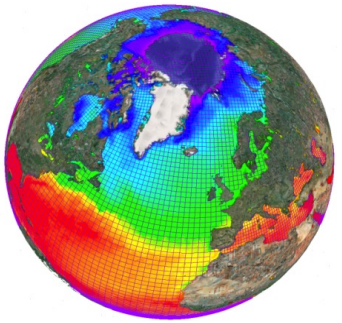


OASIS3-MCT
Sophie Valcke Talk

Max-Planck-Institut für Meteorologie CDO

CDO: Climate Data Operators
Tutorial, FAQ, developments

NEMO

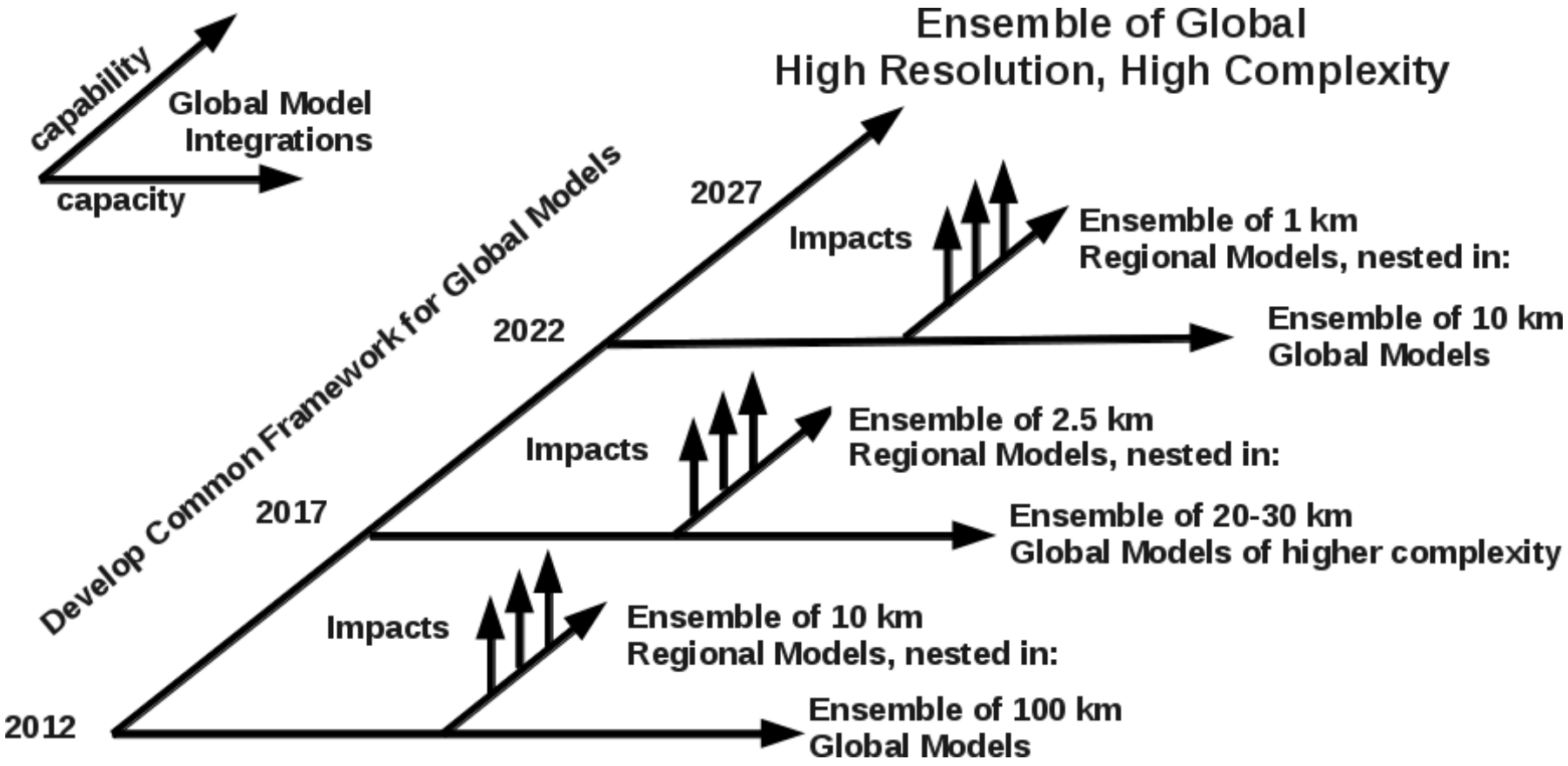


Standard configurations
User support

Sharing best practices for model environments
Workflows, configuration management, post-processing …

Infrastructure Strategy Roadmap

A grand Challenge :
towards 1 km scale global model
Resolving deep convective clouds, Avoiding regional model biases
Challenge for modelling & HPC



Enhance the development of ESMs

ENES Strategy
European climate modelling:
need to keep diversity but better organised,
reduce technological burden

Towards next generation models

Common radiation code
(MPIM, UKMO, IPSL)

Benchmark coupling approaches

Share information on key developments:
e.g. on new dynamical cores

Code structure / computational cores

Model evaluation portal

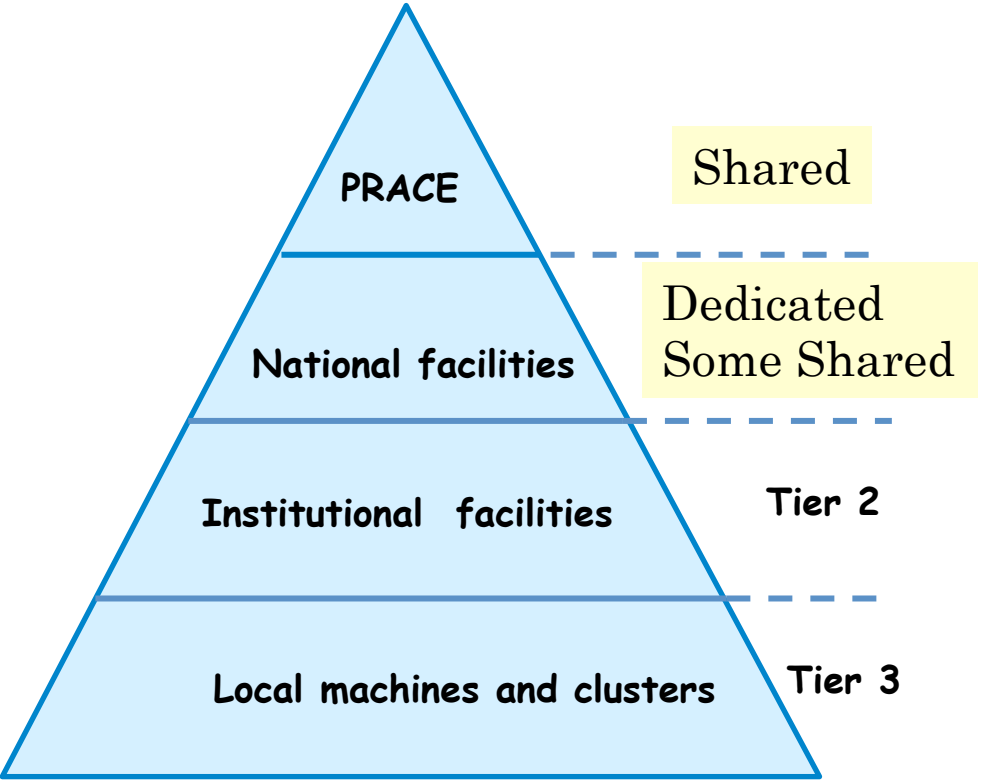
Datasets used for ESMs
Diagnostic tools

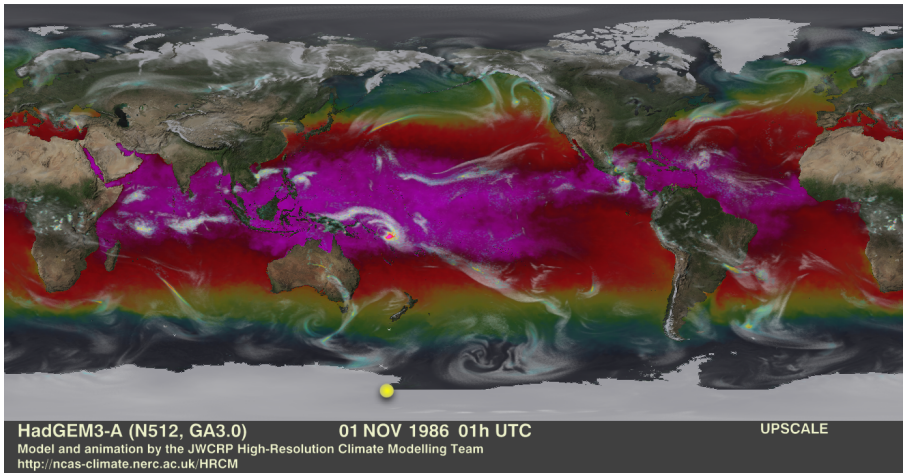
Further support cloud simulators (COSP)

Need Strategy on evaluation infrastructure

Foster high-end simulations

Ensure an efficient access and execution of ESMs on high-performance computing facilities





HADGEM3
UPSCALE Project, PRACE
PL Vidale & M. Roberts

Projects on Tier0 machines:

- UPSCALE	Pier Luigi Vidale (UK)	Hermit
- PULSATION	Sébastien Masson (FR)	Curie
- HIRESCLIM	Colin Jones (SE)	MareNostrum3
- SPRUCE	Eric Maisonnave (FR)	Curie

Foster high-end simulations

Ensure an efficient access and execution of ESMs
on high-performance computing facilities

Network on HPC
HPC Task Force, Common strategy
Interface with PRACE RI

Technology tracking (exascale)

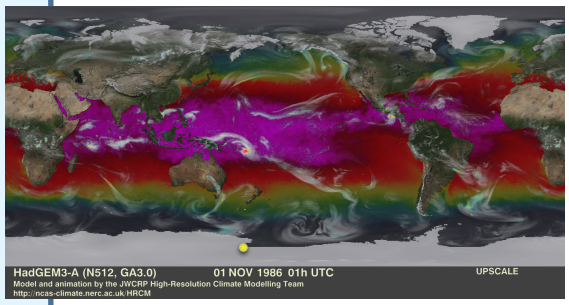
Improve model performance
Comparisons, coupler
Parallel I/O (XIOS, CDI-PIO)

Prepare high-end experiments
Multi-model High Resolution experiments

Develop coupled benchmarks

3rd IS-ENES HPC Workshop
Hamburg, mid-March 2014

2nd Workshop, Toulouse 2012
Andre et al., BAMS in press



Luis KornbluehTalk

Facilitate the dissemination of Earth system model simulation results

Use of model results for climate research and for climate impacts studies

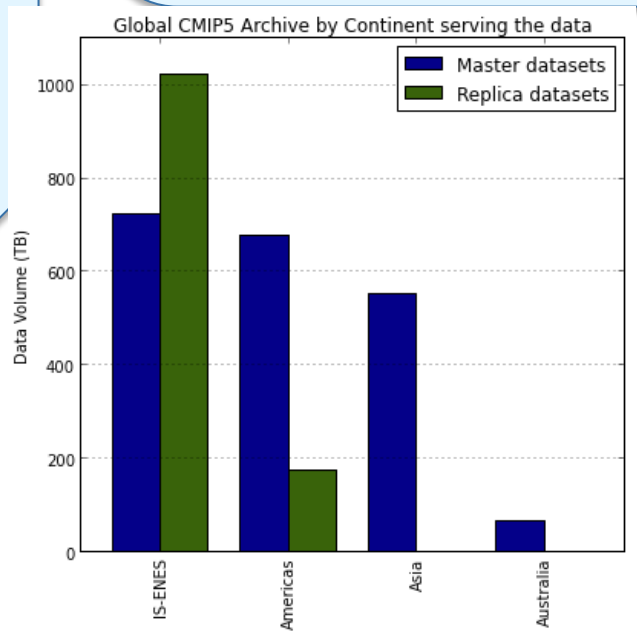
European contribution to
Earth System Grid Federation (ESGF)

Help to
Providers & users

CMIP5 & CORDEX
Data and metadata

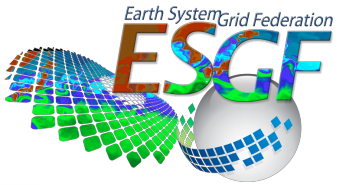
ESGF
SW development
e.g. Quality Control, Synchronisation

Metadata standards



CMIP5
Michael Lautenschlager Talk

Collaboration with PCMDI & NOAA



CMIP5
1.8 PB

PCMDI

ESGF
Earth System Grid federation

CMIP5

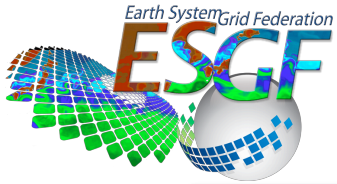
BADC
British Atmospheric Data Centre
DKRZ
DKRZ
IPSL
Institut Pierre Simon Laplace
CMCC
CMCC
Centro Euro-Mediterraneo per i Cambiamenti Climatici
CNRM-CERFACS
METEO FRANCE
ICHEC
ICHEC
Irish Centre for High-End Computing
Norwegian Climate Center

7 European datanodes

4 Index nodes
Index, Access
2 Core data
+ QC, Replicas

CIM
metafor
es-doc
Exarch

ENES collaboration with
PCMDI
ESGF and GO-EESP



PCMDI

ESGF
Earth System Grid federation

CMIP5

BADC British Atmospheric Data Centre
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BADC British Atmospheric Data Centre
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DMI SMHI
IPSL Institut Pierre Simon Laplace

European datanodes

Euro & Med

Climate Systems Analysis Group

Africa datanode

ENES collaboration with
PCMDI
ESGF and GO-EESP

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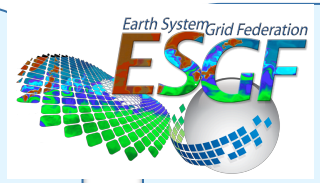
Data and metadata



ESGF
SW development
e.g. Quality Control, Synchronisation

Metadata standards

CMIP5
Michael Lautenschlager Talk

For climate impact research:
Climate4impact
Portal
Use cases, guidance

IS-ENES — e-Impact Portal

European ESGF Data Nodes (CM... | IS-ENES — e-Impact Portal

climate4impact.knmi.nl/impactportal/general/index.jsp

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ENES Portal Interface for the Climate Impact Communities (Prototype)

IS-ENES Website

Home | Data discovery | Documentation | Help | About us | Log in

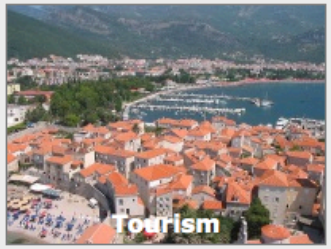
ENES Portal Interface for the Climate Impact Communities

Welcome to the ENES **Portal Interface for the Climate Impact Communities (EPICIC)**, oriented towards climate change impact modellers, impact and adaptation consultancy offices, as well as scientists using climate change data.

Here you will find **access to data** and *quick looks* of global climate models (GCM) scenarios, as well as some regional climate model (RCM) and downscaled higher resolution climate data. The portal provides data transformation tooling for **tailoring data** to your needs and **mapping & plotting** capabilities. All usin interfaces and common data processing tools to access and process described with standardised metadata.

climate4impact.eu

Guidance on how to use climate scenarios, **documentation** on the climate system, frequently asked questions (FAQ) and **examples** in several impact and adaptation themes (Use Cases) are presented and described, along with the steps required to go from the GCM data to the impact model input data (workflow).



Access
CMIP5
CORDEX

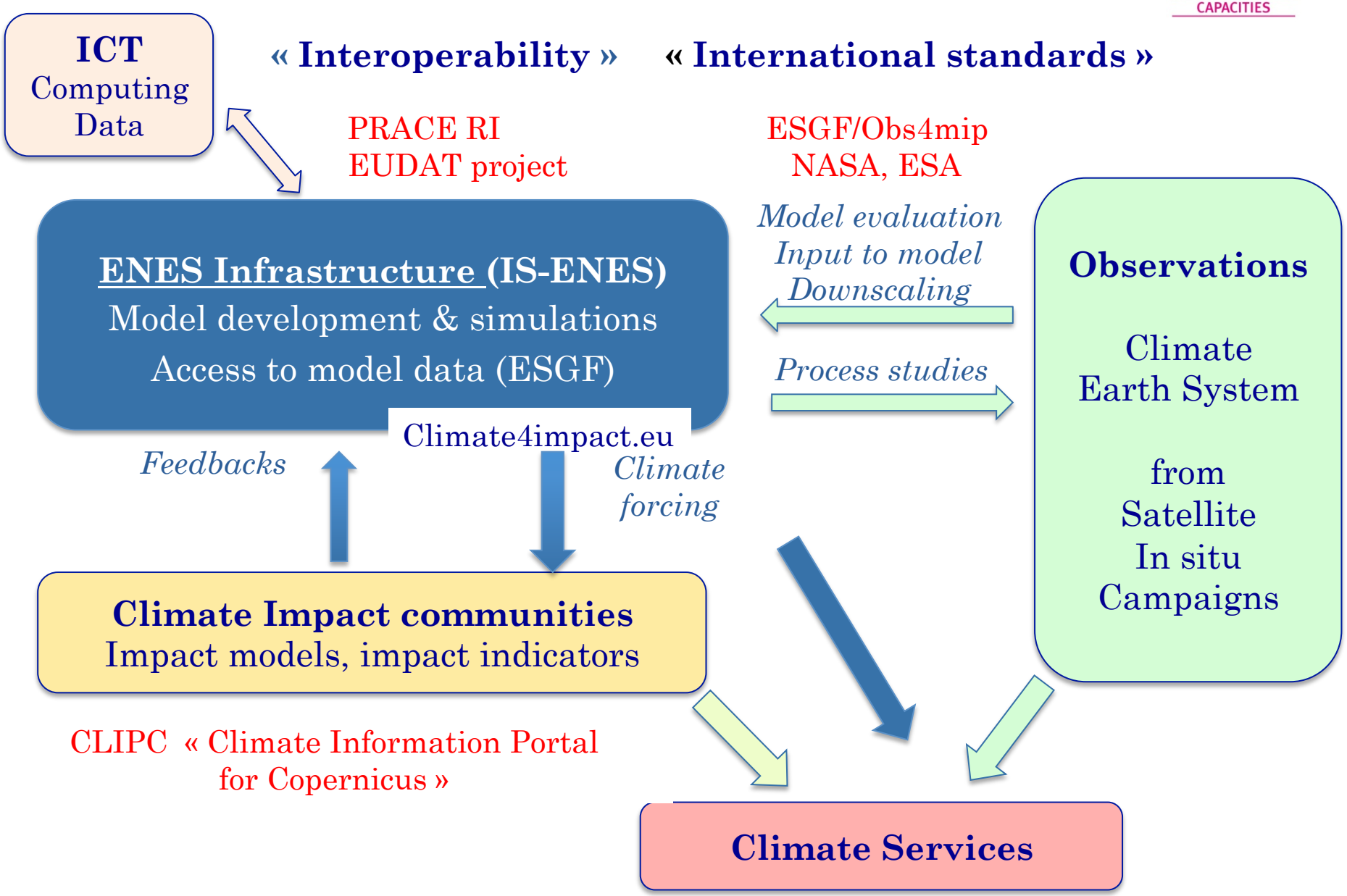
Web
Services
Extraction
visualisation

Use Cases

Guidance

Tools:
Dowscaling
Bias
corrections

IS-ENES : Infrastructure for ENES



Conclusions

With Climate Change:
growing need for more reliable climate models at regional scale
& better understanding

→ More data, More computing power

A challenge for the climate community

Towards a long-term research infrastructure for climate modelling

Models, Model data & metadata, HPC
Europe and world-wide

IS-ENES a first step


Thank you !
SeaWIFS Project (NASA/GSFC et Orbimage)