

Reading

**European climate modelling infrastructure:
Accessing climate projections**

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Max-Planck-Institut
für Meteorologie



DMI
Vejr, klima og hav



<http://enes.org/>

<http://is.enes.org/>

1st phase: March 2009- Feb 2013, 18 partners

2nd phase: Apr 2013- March 2017, 23 partners

Infrastructure

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

Users :

Climate modelling community
(Global & regional)
Impact studies

**Support to international databases : for IPCC AR5
CMIP5 & CORDEX (EuroCordex, Africa)**

Support to JPI Climate research agenda



Networking, Service & Joint Research Activities

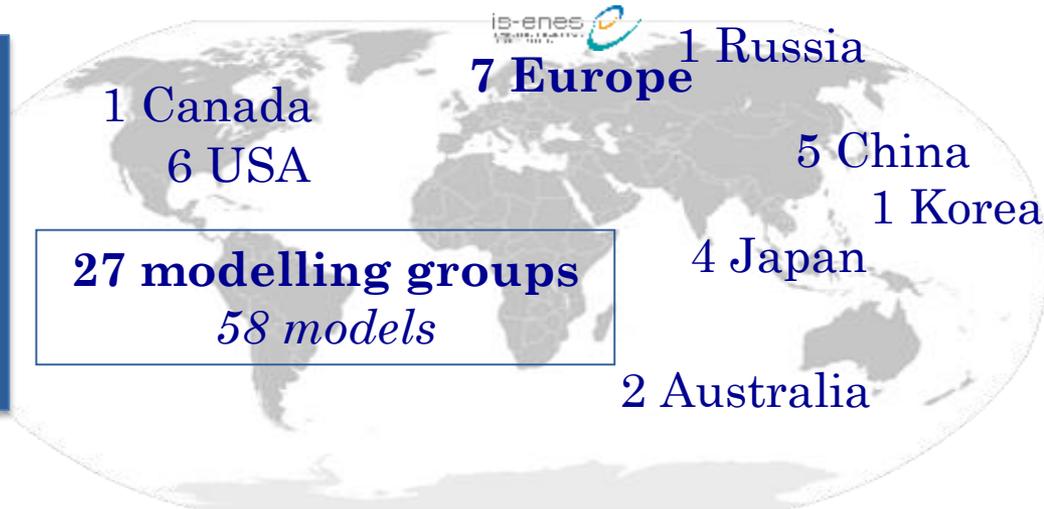
Support to international coordinated experiments CMIP5

Evaluate/Understand/Projections

3400 simul. yrs up to > 12000 yrs

50 expts up to > 160 expts

CMIP5: 1000 – 3000 Tbytes
(CMIP3: 36)

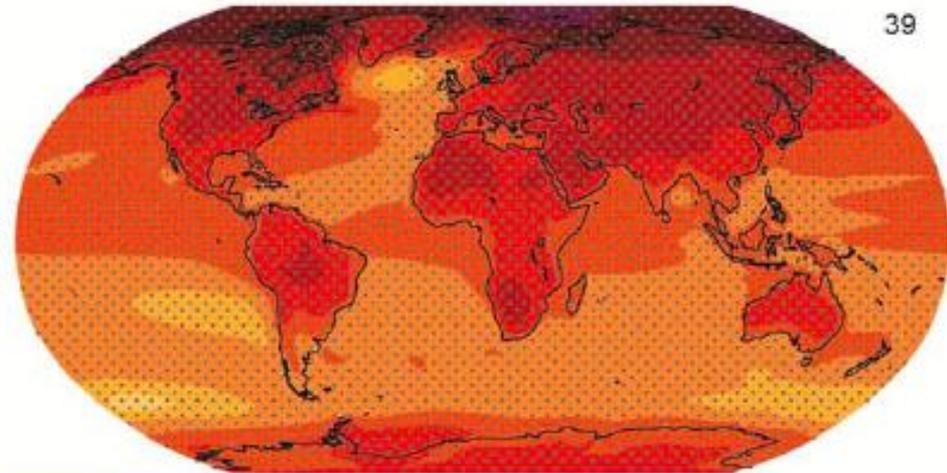
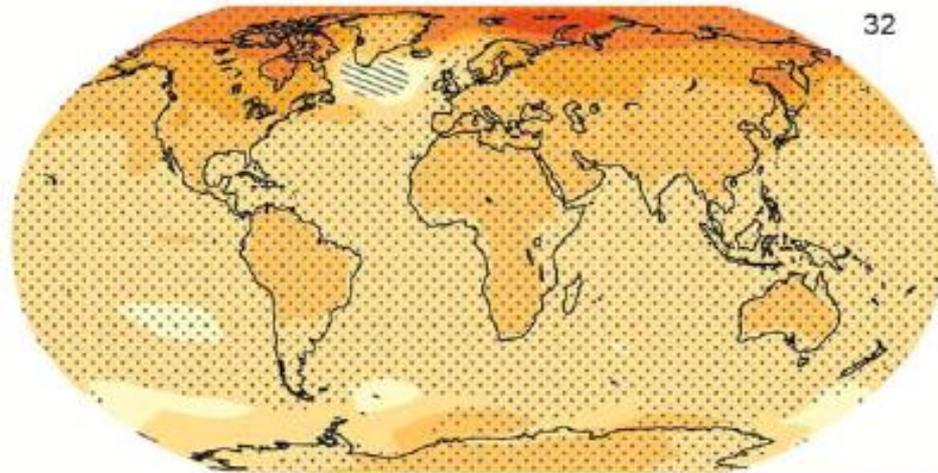


RCP 2.6

IPCC AR5 SPM (2013)

RCP 8.5

(a) Change in average surface temperature (1986–2005 to 2081–2100)



CMIP international data bases

Ease access for model analysis and impact studies

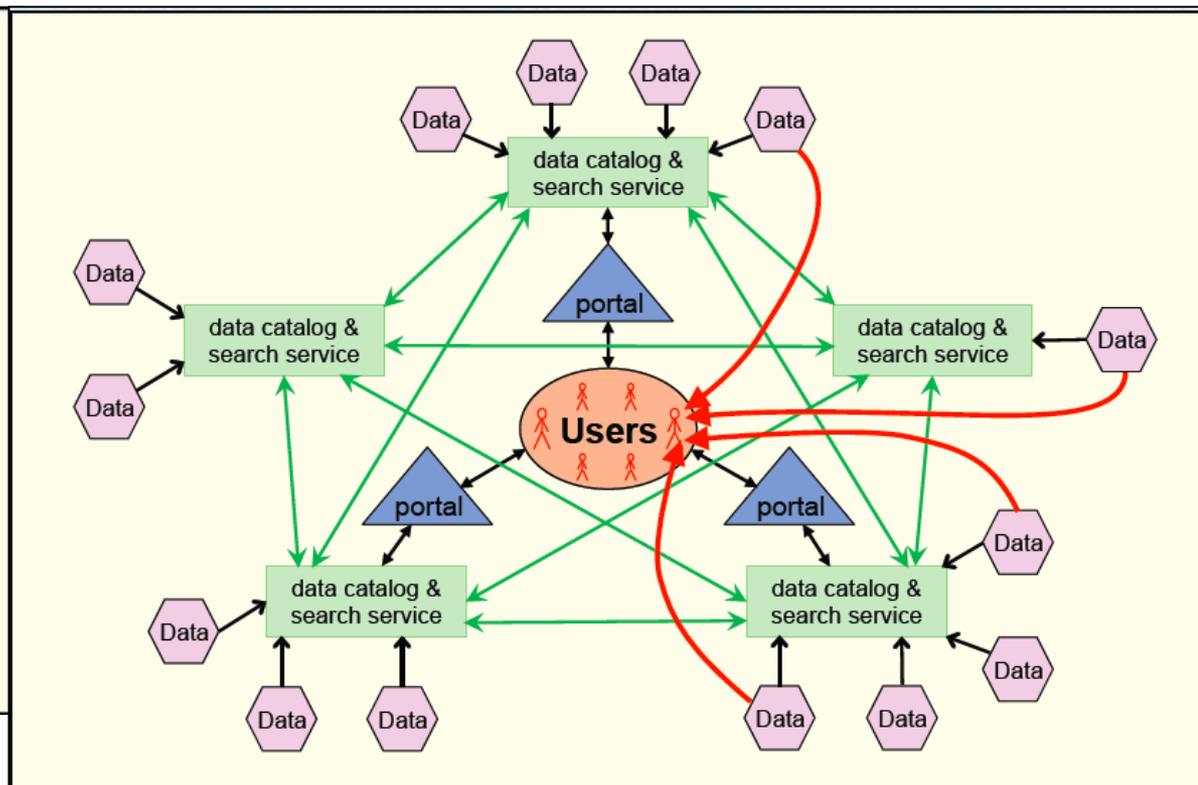
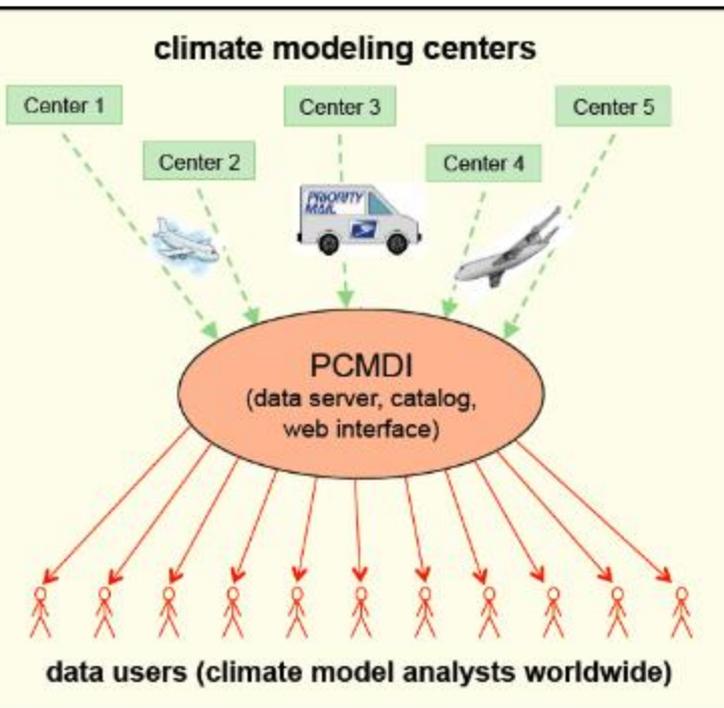
CMIP3
36 TB

Central archive at PCMDI (LLNL)
Earth System Grid

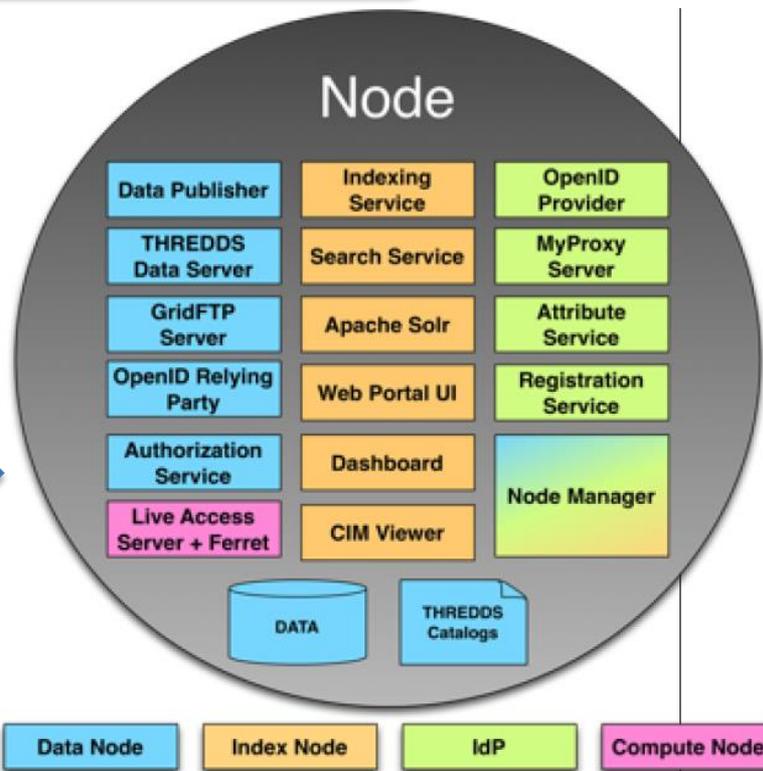
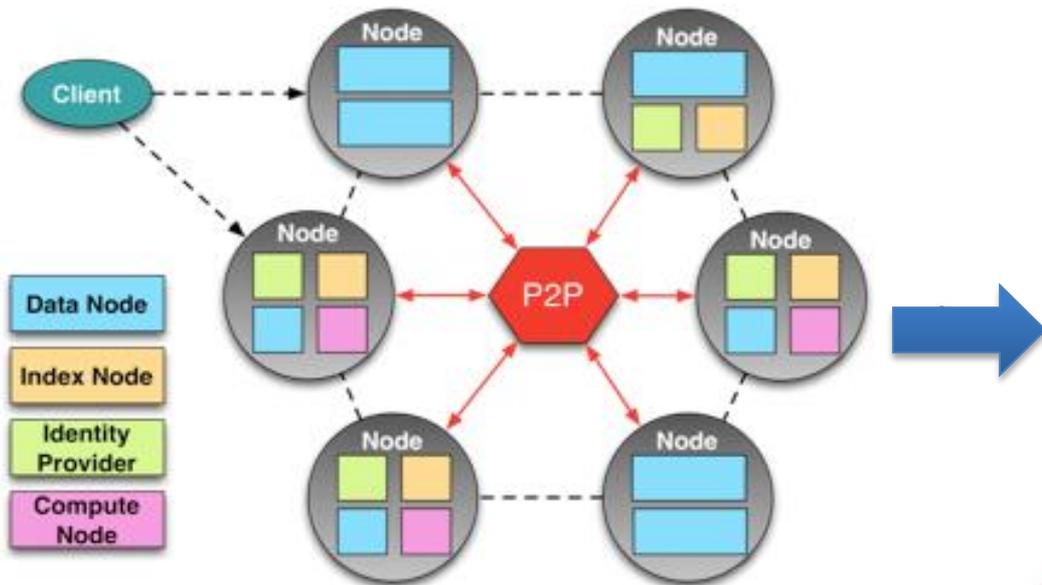
CMIP5

1.8PB (up to 3 PB)

Distributed data infrastructure
Earth System Grid Federation



Earth System Grid Federation



Open source software
International
Community led : GO-ESSP, WIP
Multi-agencies support
DOE, NOAA, NASA, IS-ENES, NCI

ESGF worldwide system



Data nodes
up / down

Replicas allow
full time access



ESGF Dashboard (CMCC)

ESGF Users
eg IPSL data node

ca 10 000 registered users
ca 30 TB/mth/node transfer

Ref: from Doutriaux and Taylor, 4th ESGF meeting, 12/2014

Adoption of common standards/conventions for the:

Structure and format of climate data
Metadata used to describe climate data
Vocabulary used for categorizing the diversity of model output

Standardization enables/facilitates

Automation in the preparation of model output
Analysis by researchers using uniform methods for reading and interpreting data
Unique identification of files
Sharing of data across the ESGF network

netCDF

CF Conventions – provides for standardized description of data contained in a file

Data Reference Syntax (DRS) – defines vocabulary used in uniquely identifying MIP datasets and specifying file and directory names

CMIP output requirements – specify the data structure and metadata requirements for CMIP data

**CMOR (Climate Model Output Rewriter) developed at PCMDI (from CMIP3)
translation into the standard form**

IPCC AR5 variable counts

	1 hour	3 hour	6 hour	daily	month	annual	totals
aerosol	0	0	0	0	81	0	81
atmosphere	75	101	9	86	184	0	455
land	0	3	0	2	59	0	64
land ice	0	0	0	2	13	0	15
ocean	0	1	0	3	116	0	120
biogeochemistry	0	0	0	0	88	71	159
sea ice	0	0	0	4	47	0	51
totals	75	105	9	97	588	71	945

CMIP5 – Browse Metadata on models and experiments

Earth System Documentation - Viewer | CMIP5 Model - gfdl-hiram-c180 (v2)

CMIP5 Model - gfdl-hiram-c180 Model Experiment

Overview Citations Contacts **Components**

Atmosphere
Convection Cloud Turbulence
Cloud Scheme
Dynamical Core
Advection
Orography & Waves
Radiation

Land Surface
Albedo
Energy Balance
Lakes
RiverRouting
Snow
Soil

Land Surface

Properties

- Basic Approximations : Physics - Full 1D Vertical Soil And Heat With Parameterized Ground Water,rivers And Lakes; Vegetation - Princeton Scheme
- Conservation Of Properties > Water Storage Method : Other
- Conservation Of Properties > Water Treatment : Storage
- Coupling With Atmosphere : Implicit
- Genealogy : Other
- Land Cover Types : Bare Soil
- Land Cover Types : Ice
- Land Cover Types : Lake
- Land Cover Types : Other
- Land Cover Types : Vegetated
- List Of Prognostic Variables : Canopy Skin Temperature
- List Of Prognostic Variables : Canopy Snow Content
- List Of Prognostic Variables : Canopy Water Content
- List Of Prognostic Variables : Other
- List Of Prognostic Variables : River Water Storage
- List Of Prognostic Variables : Snow Mass
- List Of Prognostic Variables : Snow Water Content
- List Of Prognostic Variables : Soil Ice Content
- List Of Prognostic Variables : Soil Moisture
- List Of Prognostic Variables : Soil Temperature
- List Of Prognostic Variables : Surface Skin Temperature
- Tiling : Common To All LS Subcomponents
- Tiling Method : Dynamic
- Time Stepping Framework > Method : Use Atmosphere Time Step

Earth System Documentation - Viewer (v0.6.7.1) CMIP5 Model - gfdl-hiram-c180 (v2)



“Common Information Model”

Javascript plugin linking data to remote documentation

CMIP5 - Comparing and contrasting

The screenshot displays the es-doc (Earth System Documentation) v0.9.0.0 interface. At the top, the 'Project' is set to 'CMIP5' and the 'Comparator' is 'Model Component Properties'. A blue 'Open' button is visible. Below this, a navigation bar includes 'Help', 'Reset', and 'Next' buttons.

The main content area is titled 'Step 1 : Select Model Component Properties' and is divided into three columns:

- 1. Select Models:** A list of model identifiers with 'view' buttons. The selected model is 'GFDL-CM3'.
- 2. Select Components:** A hierarchical tree of components. The selected component is 'Model' under the 'Aerosols' category.
- 3. Select Properties:** A list of properties for the selected model and component. The selected property is 'Aerosol Scheme'.

The 'Aerosol Scheme' property list includes: Bin Framework, Bin Species, Bulk Species, Framework, Modal Framework, Modal Species, Scheme Characteritice, Scheme Type, Species, Coupling With, Gas Phase Precursors, ocean biogeochemical coupling, Processes, Standard Properties (Citations, Location, Title, Description, Long Name, PI Email Address, PI Name, Short Name), and vegetation model coupling.

Various user interfaces 1/2



Home Search Tools Login Help

Current Selections

remove all
 (x) project:CMIP5
 (x) model:HadGEM2-ES
 (x) variables:
 (x) time_frequency:mon
 (x) experiment_family:RCP

Examples: temperature, "surface temperature", climate AND project:CMIP5 AND variable:tas
 To download data: add datasets to your Data Cart, then click on "Display" or "wget".

Search All Sites Show All Replicas Show All Versions

< 1 2 > displaying 1 to 10 of 17 search results

Display 10 datasets per page

Add All Displayed to Data Cart Remove All Displayed from Data Cart

Search Categories

Project
 Institute
 Model
 Instrument

Results: Data Cart

ESGF LAS

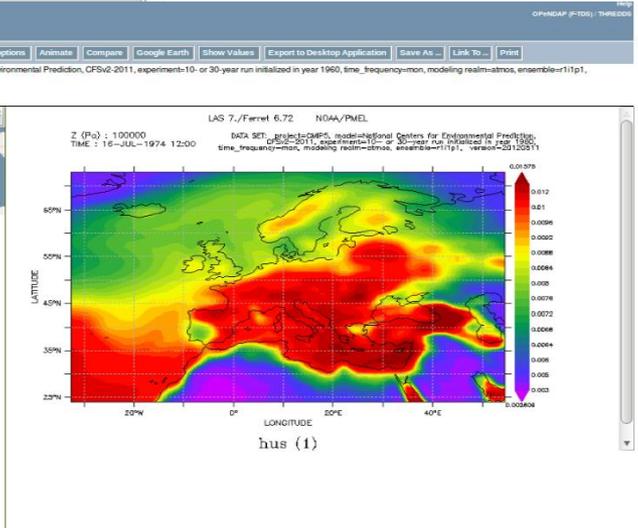
Choose dataset Update Plot Set plot options Animate Compare Google Earth Show Values Export to Desktop Application Save As Link To Print

project=CMIP5,model=National Centers for Environmental Prediction,CFR2.2011,experiment=10-or-30-year run initialized in year 1960,time_frequency=mon,modeling_realm=atmos,ensemble=11p1,version=20120511

hus

Latitude: 73.13 N Longitude: 32.64 W
 Latitude: 23.91 N Longitude: 54.55 E

MAPS
 Latitude-Longitude
DEPTH PROFILES
 Longitude-Depth
 Latitude-Depth
HOVMOLLER PLOTS
 Longitude-Time
 Latitude-Time
 Depth-Time
LINE PLOTS
 Time Series
 Longitude
 Latitude
 Depth
SCATTER PLOTS



Antilope Pierre Simon Laplace Prodiguer Portal v1.0.b5
 Diffusion internationale des données scientifiques

User: Internal Language: English Activity: CMIP5

Experiments Models Simulations Output

CMIP5 - EXPERIMENTS Atmosphere Decadal Long-Term

1 to 12 of 12 entries

Name	Description	Number	Tier	Years / run	Ensembles	CIM
amp	AMIP	3.3	CORE	>=30	>=1	
amp4K	AMIP plus 4K anomaly	6.8	TIER 1	30	1	
amp4xCO2	4xCO2 AMIP	6.6	TIER 1	30	1	
ampFuture	AMIP plus patterned anomaly	6.6	TIER 1	30	1	
aqm4K	aqua planet plus 4K anomaly	6.7c	TIER 1	5	1	
aqm4xCO2	4xCO2 aqua planet	6.7b	TIER 1	5	1	
aquaControl	aqua planet control	6.7a	TIER 1	5	1	
set2C3D	2030 time-slice	2.1	TIER 1	10	>=1	
setClim	control SST climatology	6.2a	CORE	30	1	
setClim4xCO2	CO2 forcing	6.2b	CORE	30	1	
setClimAeroccl	all aerosol forcing	6.4a	TIER 1	30	1	
setClimSulph	sulphate aerosol forcing	6.4b	TIER 1	30	1	

25 per page

First Previous 1 Next Last

ESGF Earth System Grid Federation metafor Earth System Grid

Forge Contact Terms © IPLS

IS-ENES climate4impact portal

Welcome to the IS-ENES climate4impact portal, oriented towards climate change impact modellers, impact and adaptation consultants, as well as other experts using climate change data.

Here you will find [access to data](#) and [quick looks](#) of global climate models (GCM) scenarios, as well as 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](#).

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

Latest

- Workshop held on design of scientific portals (Nov 2014, KNMI (NL)) [download the presentations](#)
- The climate4impact portal is operational since 15 April 2014: [read more](#).

<http://climate4impact.eu>



Click on one of these images to go to a specific climate change impact and adaptation theme.



The IS-ENES project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration.

[Disclaimer](#)

Use Cases

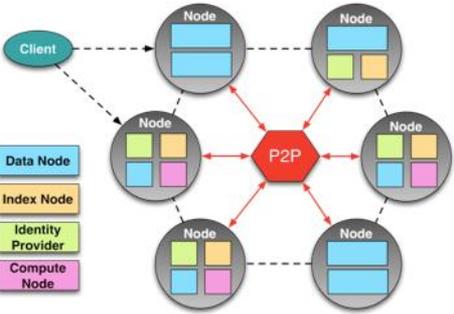
Access
CMIP5
CORDEX

Web
Services
Extraction
visualisation

Guidance

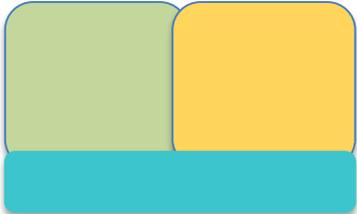
Tools:
Downscaling
Bias
corrections
Indices

Talk by
Wim
Som de Cerff



IS-ENES
services & development

Users



Modelling groups
Provide model data
Check data/correct bugs
Manage versions
Provide metadata



Ease access to model data
Processing tools
KNMI/CERFACS

CMIP5 European Index nodes
BADC / DKRZ / IPSL / CMCC
Euro-cordex index nodes
BADC/DKRZ/IPSL/DMI/LIU
Security SW *BADC*
Monitoring *CMCC*
Replication SW *IPSL*
Replication sites *BADC/DKRZ*
Access to metadata *IPSL/DKRZ/BADC*

Installation SW *IPSL/DKRZ/BADC*
Help/FAQ *DKRZ/BADC/PCMDI*

USA
Search APIs *NASA/JPL*
Computing *PCMDI*
Network/Globus *PCMDI*
Visualisation *PCMDI*

Joint Research Activity
Data citation *DKRZ*
Controlled vocabularies
NCAS/BADC/NOAA

« Interoperability »

« International standards »

ICT
Computing
Data

PRACE RI
EUDAT project

ESGF/Obs4mip
NASA, ESA

ENES Infrastructure (IS-ENES)
Model development & simulations
Access to model data (ESGF)

Climate4impact.eu

Model evaluation
Input to model
Downscaling

Observations

Climate
Earth System

from
Satellite
In situ
Campaigns
Reanalyses

Process studies

ESGF/Reanalyses
ana4MIP

Feedbacks

Climate
forcing

Climate Impact communities
Impact models, impact indicators

**Climate Information
Portal
for Copernicus**

CLIPC

Climate Services

WCRP model data base using ESGF:

Success but also challenging for CMIP5

Still needs some improvements – CMIP6 under preparation

Metadata : new

WCRP: more largely use ESGF (Obs4MIP, Ana4MIP)

IS-ENES projects :

instrumental to support European contribution to ESGF

For CMIP5 but also Cordex

IS-ENES part of ESGF international governance:

A strong expertise & contribution to ESGF

Towards a long-term research infrastructure for climate modelling

CLiM-ERI “Earth’s CLiMate system Modelling European Research Infrastructure”

Infrastructure supporting CMIP cycles (models, data, metadata, computing)

IS-ENES a first step

A service for climate and climate impact research

An asset for Copernicus C3S to access climate projections

CLIPC as an extension of IS-ENES2



Thank you !

SeaWiFS Project (NASA/GSFC et Orbimage)