

CMIP6 Overview and Status

Karl E. Taylor

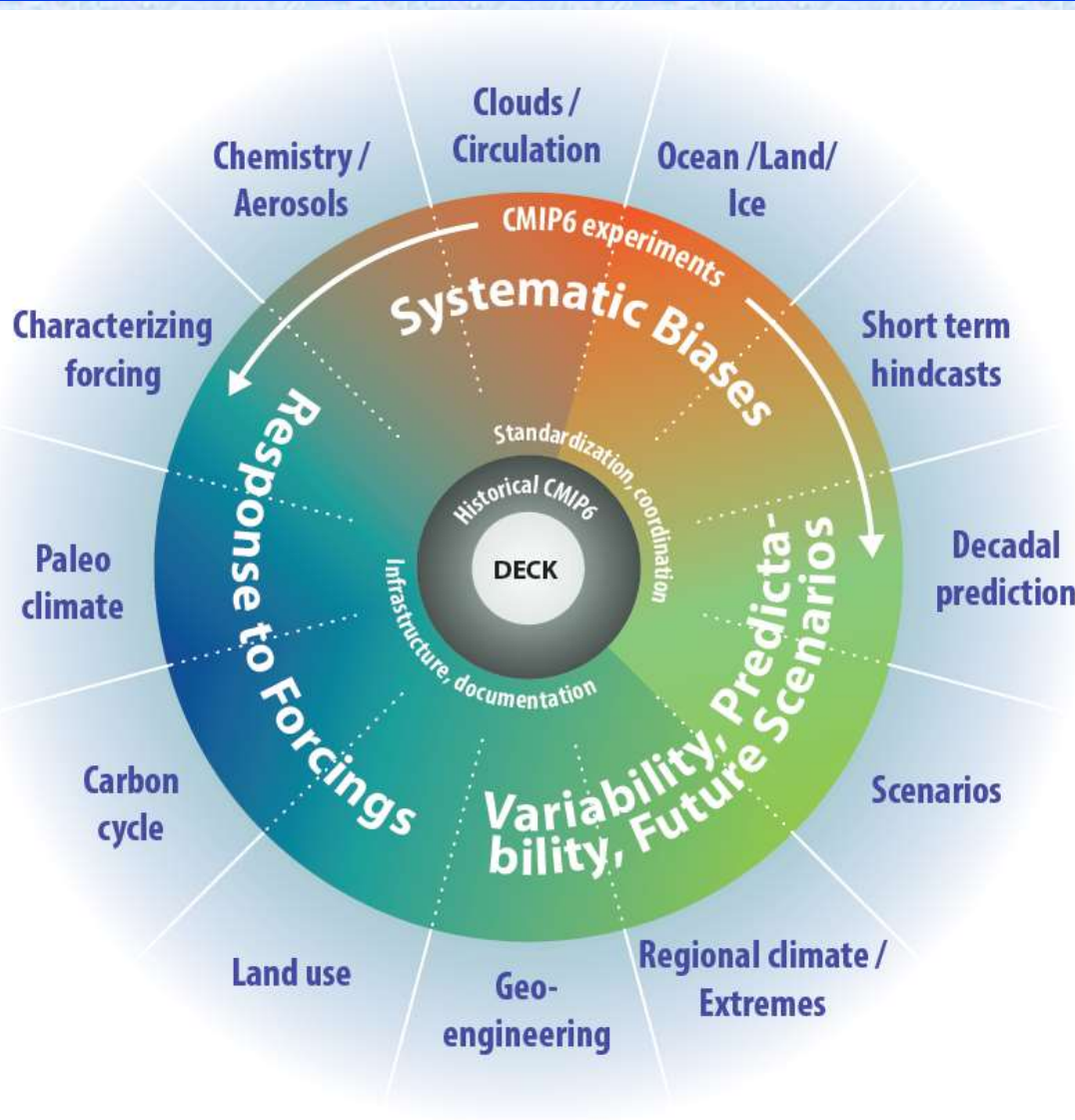
Presented to WGNE

11 October 2018

Purpose:

- Provide a status report
- Make you aware of *CMIP* resources that you might find useful

CMIP6 design overview:



DECK

- Small set of benchmark runs
- To evolve only slowly (e.g. OMIP, LMIP)

Historical CMIPX

- Forcing to be updated for each new phase

CMIP6-endorsed MIPs

- An evolving collection to address specific scientific issues

CMIP5/6 evolution: More institutions, more models, more experiments, more data

- 44 institutions/consortia have officially registered for CMIP6
- 100 models are registered
- 287 experiments defined
- order 20 PB of model output expected

CMIP6_CVs

https://github.com/WCRP-CMIP/CMIP6_CVs

Core Controlled Vocabularies (CVs) for use in CMIP6

Registering Institutions, Models, or requesting changes to CVs:

To register your institution or model or to request changes to a CV, please submit an issue/ticket following the instructions on the [CMIP6_CVs issue page](#).

Some support for CMIP participating modeling groups is available: pcmdi-cmip@lnl.gov

To view the current **Experiment** entries point your browser to [CMIP6_experiment_id.html](#)

To view the current **Institution** entries point your browser to [CMIP6_institution_id.html](#)

To view the current **Source** entries point your browser to [CMIP6_source_id.html](#)

The CVs build on logic that is described in the [CMIP6 Global Attributes, DRS, Filenames, Directory Structure, and CV's document](#)

CMIP6 data availability and IPCC timeline

- Model output from a few models and a few experiments now available
- Much output to be made available over the next year
- Seems unlikely to me that very many multi-model CMIP6 results will be published in time for the IPCC's AR6.

2019	
January 7	Second Lead Author Meeting
April 29	First order draft expert review
August 26	Third Lead Author Meeting
2020	
March 2	Second order draft expert review
June 1	Fourth Lead Author Meeting
October 18	Submission of final draft
2021	
April 16	IPCC acceptance/adoption/approval

← 31 December 2019:
Journal articles submitted

← 30 September 2020:
Journal articles accepted

CMIP infrastructure improvements (1)

- Infrastructure specifications were developed and documented in a series of WIP position papers (see the summary by Balaji et al. (2018, doi.org/10.5194/gmd-9-1937-2016 and <https://www.earthsystemcog.org/projects/wip>)
- A reference set of controlled vocabularies was defined to enable independently-developed components of the infrastructure to smoothly interact (https://github.com/WCRP-CMIP/CMIP6_CVs).

Controlled vocabularies are specified in JSON files hosted by github

https://github.com/WCRP-CMIP/CMIP6_CVs

WCRP-CMIP / CMIP6_CVs

Controlled Vocabularies (CVs) for use in CMIP6 — Edit

828 commits 1 branch 1 release 5 contributors

Branch: master New pull request Create new file Upload files Find file Clone or download

durack1 committed on GitHub Issue156 durack1 revise source_id NorESM various (#167) Latest commit bef52de 6 days ago

.github	Source_id format reorder	a month ago
src	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
.gitignore	Further formatting - deal with xlsx quirks	5 months ago
CMIP6_activity_id.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_experiment_id.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_frequency.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_grid_label.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_institution_id.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_license.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_nominal_resolution.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_realm.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_required_global_attributes.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_source_id.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_source_type.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
CMIP6_table_id.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
README.md	Added source_id html	15 days ago
mip_era.json	Issue156 durack1 revise source_id NorESM various (#167)	6 days ago
README.md		

CMIP6_activity_id.json

CMIP6_institution_id.json

CMIP infrastructure improvements (2)

- QC code now run as part of the publication procedure to ensure metadata is consistent with controlled vocabulary (PrePARE).
- input4MIPs hosts a well-documented repository for CMIP6 forcing data sets (<https://esgf-node.llnl.gov/projects/input4mips/>)

Forcing datasets for CMIP6: Input4MIPs status

- Project initiated April 2016
- Purpose
 - To collect, version-control, and archive CMIP6 forcing data sets
 - To impose data and metadata standards facilitating use
- Forcing datasets description/status
 - <https://esgf-node.llnl.gov/projects/input4mips/>
- input4MIPs holdings to-date
 - 5620 files & 1.5 Tb of data
- input4MIPs project has adopted the CMIP infrastructure

Input4MIPs DECK/historical forcing data status

Forcing Dataset	input4MIPs Status	Temporal Coverage	Latest Data Version(s)	Contact
SLCF Emissions	Available	1750-01 to 2014-12	2017-05-18, 2017-08-30 (Aircraft; updated)	Steven Smith
Biomass Burning	Available	1750-01 to 2015-12	1.2 (2016-12-13; updated)	Margreet van Marle
CO2 and CH4 Emissions	Available	1750-01 to 2014-12	2017-05-18, 2017-08-30 (Aircraft; updated)	Steven Smith
Land-use	Available	850 to 2015	2.1h (2017-01-26)	George Hurtt
GHG concentrations	Available	0-01 to 2015-12	1.2.0 (2016-07-01)	Malte Meinshausen
Ozone concentrations	Available	1850-01 to 2014-12	1.0 (2016-07-11)	Michaela Hegglin
Nitrogen deposition	Available	1850-01 to 2014-12	2.0 (2016-12-07; updated)	Michaela Hegglin
Simple plume aerosol	Available	1850 to 2100	1.0 (2017-02-01)	Bjorn Stevens
Solar	Available	1850-01 to 2299-12	3.2 (2017-01-03; updated)	Katja Matthes
Stratospheric aerosol	Available	1850-01 to 2014-12	3.0 (2017-10-04; updated)	Beiping Luo
AMIP SST and SIC	Available	1870-01 to 2016-06	1.1.2 (2017-04-19; updated)	PCMDI

Download links, input4MIPs website: <https://esgf-node.llnl.gov/search/input4mips>

Also see the live google doc at <https://goo.gl/r8up31>

Endorsed-MIP forcing status

Satellite MIP	Status	Host(s); Version	Contact
CFMIP	Host site	http://doi.org/10.5194/gmd-2016-70 ; 1.0	Mark Webb
DAMIP	input4MIPs	1.0 (2017-08-14)	David Plummer
DCPP	input4MIPs	1.1 (2017-01-23)	Christophe Cassou
FAFMIP	input4MIPs	http://www.met.reading.ac.uk/~jonathan/FAFMIP/ ; (2015-08-21)	Jonathan Gregory
HighResMIP	input4MIPs	2.2.0.0-r1 (2017-05-05)	Malcolm Roberts
LS3MIP	In prep.	Data is yet to be contributed	Sonia Seneviratne
OMIP	input4MIPs	http://data1.gfdl.noaa.gov/nomads/forms/core/COREv2.html http://amaterasu.ees.hokudai.ac.jp/~tsujino/JRA55-do-v1.2/ CORE (Ready); JRA55-do v1.2 (Ready)	Gokhan Danabasoglu
PMIP	Host site	https://pmip4.lscce.ipsl.fr/doku.php ; ?	Masa Kageyama
RFMIP	Ready	0.4 (2017-01-18)	Robert Pincus
ScenarioMIP	In prep.	Land-use – 2.1f (2017-10-05); emissions (in prep.)	Detlef van Vuuren
VolMIP	Ready	3.0 (2017-10-04); EVA module (Ready – GMD below) https://doi.org/10.5194/gmd-9-4049-2016	Davide Zanchettin

Infrastructure improvements: CMIP6 Guide now available

This is the place to go first if you need CMIP6 help!

<https://pcmdi.llnl.gov/CMIP6/Guide/dataUsers.html>

- Experiment design
- Model output specifications
- Accessing model output
- Terms of use and citation requirements
- Model and experiment documentation
- Reporting suspected errors
- Registering published work based on CMIP6
- CMIP6 organization and governance

CMIP infrastructure improvements (4)

- Advanced planning and extensive testing have resulted in a smooth launch of the ESGF CMIP6 archive.
- A data citation service is in place to facilitate proper acknowledgment in scientific publications.
- Central documentation will be provided via ES-DOC's, which is undergoing testing and should be ready in spring 2019.

Data now available via ESGF data portals

- All available CMIP6 data obtainable from:
 - IPSL (France) <https://esgf-node.ipsl.upmc.fr/search/cmip6-ipsl/>
 - PCMDI/LLNL (USA) <https://esgf-node.llnl.gov/search/cmip6/>
- 4 models and 12 experiments
- Download options:
 - Point and click (http)
 - WGET script (http)
 - Globus (grid ftp)

The screenshot shows the WCRP CMIP6 data portal search results page. The header includes the WCRP logo and 'World Climate Research Programme CMIP6'. A navigation bar contains 'Home', 'Technical Support', and 'Last Search | My Data Cart (1)'. A search bar is present with a search button and options for 'Reset', 'Display 10 results per page', and 'More Search Options'. Below the search bar, there are checkboxes for 'Show All Replicas', 'Show All Versions', and 'Search Local Node Only (Including All Replicas)'. The search constraints are set to 'CFMIP'. The total number of results is 663. The results are displayed in a list with columns for 'Experiment ID', 'Sub-Experiment', 'Variant Label', and 'Grid Label'. The first four results are shown, each with a 'Data Node', 'Version', 'Total Number of Files (for all variables)', and 'Full Dataset Services' (including 'Show Metadata', 'List Files', 'THREDDS Catalog', 'WGET Script', 'LAS', 'Show Citation', 'PID', and 'Globus Download').

Data now available via ESGF data portals

1. CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2.r11p1f1.CFmon.albisccp.gr

Data Node: vesg.ipsl.upmc.fr

Version: 20180605

Total Number of Files (for all variables): 1

Full Dataset Services: [[Show Metadata](#)] [[List Files](#)] [[THREDDS Catalog](#)] [[WGET Script](#)] [[LAS](#)] [[Show Citation](#)] [[PID](#)] [[Globus Download](#)] [[Further Info](#)]


 Add to Data Cart

Show Citation



WCRP CMIP6
World Climate Research Programme

Home You are at the ESGF@OIE/LLNL node


Technical Support
Last Search:  My Data Cart (1)

Enter Text: Search Reset Display 10 results per page More Search Options

Search Constraints: CFMIP Show All Replicas Show All Versions Search Local Node Only (Including All Replicas)

Number of Results: 663
1 2 3 4 5 Next >>

Add all displayed results to Data Cart Remove all displayed results from Data Cart
Expert Users: you may display the search results and return results as XML or return results as JSON

- 1. CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2.r11p1f1.CFmon.albisccp.gr**
Data Node: vesg.ipsl.upmc.fr
Version: 20180605
Total Number of Files (for all variables): 1
Full Dataset Services: [[Show Metadata](#)] [[List Files](#)] [[THREDDS Catalog](#)] [[WGET Script](#)] [[LAS](#)] [[Show Citation](#)] [[PID](#)] [[Globus Download](#)] [[Further Info](#)]
 Add to Data Cart
- 2. CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2.r11p1f1.CFmon.chcaltjes.gr**
Data Node: vesg.ipsl.upmc.fr
Version: 20180605
Total Number of Files (for all variables): 5
Full Dataset Services: [[Show Metadata](#)] [[List Files](#)] [[THREDDS Catalog](#)] [[WGET Script](#)] [[LAS](#)] [[Show Citation](#)] [[PID](#)] [[Globus Download](#)] [[Further Info](#)]
 Add to Data Cart
- 3. CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2.r11p1f1.CFmon.rhccp.gr**
Data Node: vesg.ipsl.upmc.fr
Version: 20180605
Total Number of Files (for all variables): 1
Full Dataset Services: [[Show Metadata](#)] [[List Files](#)] [[THREDDS Catalog](#)] [[WGET Script](#)] [[LAS](#)] [[Show Citation](#)] [[PID](#)] [[Globus Download](#)] [[Further Info](#)]
 Add to Data Cart
- 4. CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2.r11p1f1.3hr.ncs.gr**
Data Node: vesg.ipsl.upmc.fr
Version: 20180605

Citation page



Metadata for 'CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2'

General Information

General Information

Name CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2

Abstract Coupled Model Intercomparison Project Phase 6 (CMIP6) data sets. These data includes all datasets published for 'CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2' according to the Data Reference Syntax defined as 'mip_era.activity_id.institution_id.source_id.experiment_id.member_id.table_id.variable_id.grid_label.version'.

The Earth System Model IPSL-CM6A-LR, released in 2017, includes the components: atmos: LMDZ (NPv6, N96; 144 x 143 longitude/latitude; 79 levels; top level 40000 m), land: ORCHIDEE (v2.0, Water/Carbon/Energy mode), ocean: NEMO-OPA (eORCA1.3, tripolar primarily 1deg; 362 x 332 longitude/latitude; 75 levels; top grid cell 0-2 m), ocnBgchem: NEMO-PISCES, seaIce: NEMO-LIM3.

The model was run by the Institut Pierre Simon Laplace, Paris 75252, France (IPSL) in native nominal resolutions: atmos: 250 km, land: 250 km, ocean: 100 km, ocnBgchem: 100 km, seaIce: 100 km.

Project: These data have been generated as part of the internationally-coordinated Coupled Model Intercomparison Project Phase 6 (CMIP6); see also CMD Special Issue: <http://www.geoscientific-model-data.net/cmip6/issue500.html>. The

Cite this data

Citation (2018). *IPSL IPSL-CM6A-LR model output prepared for CMIP6 CFMIP abrupt-0p5xCO2*. Earth System Grid Federation. <http://cera-www.dkrz.de/WDCC/meta/CMIP6/CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2>



Data now available via ESGF data portals

1. CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2.r1i1p1f1.CFmon.albisccp.gr

Data Node: vesg.ipsl.upmc.fr

Version: 20180605

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 Add to Data Cart

Further Info



WCRP CMIP6
World Climate Research Programme

Home You are at the ESGF@OIEILLNL node

Technical Support
Last Search | My Data Cart (1)

Enter Text: Search Reset Display 10 results per page More Search Options

Search Constraints: CFMIP Show All Replicas Show All Versions Search Local Node Only (Including All Replicas)

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[[Further Info](#)]
 Add to Data Cart
- 4. CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2.r1i1p1f1.3hr.zeds.gr**
Data Node: vesg.ipsl.upmc.fr
Version: 20180605

Model and experiment documentation by es-doc



CMIP6 Further Information vo.5.0.0

Support

Help

Further Info URL: <https://furtherinfo.es-doc.org/CMIP6.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2.none.r1i1p1f1>

ES-DOC Documentation

MIP Era	CMIP6
Institution	IPSL
Model	IPSL-CM6A-LR
Experiment	abrupt-0p5xCO2
Ensemble Description	N/A
Machine Performance	N/A

Dataset Documentation

Dataset ESGF Search	N/A
Dataset Errata	N/A
Dataset Citation(s)	https://cera-www.dkrz.de/WDCC/meta/CMIP6/CMIP6.CFMIP.IPSL.IPSL-CM6A-LR.abrupt-0p5xCO2

Other Documentation

WCRP CMIP6 Homepage	https://www.wcrp-climate.org/wgcm-cmip/wgcm-cmip6
ES-DOC CMIP6 Homepage	https://es-doc.org/cmip6

Obs4MIPs status

- Data specifications are now more closely aligned with CMIP6
- CMOR software has been adapted for use with obs4MIPs
- Existing data is being rewritten to conform
- Many new datasets expected soon.
- New obs4MIPs site: <https://esgf-node.llnl.gov/projects/obs4mips/>

First workshop to share preliminary CMIP6 results

- Acceptable to report on CMIP6 results from a single model
- Submit abstracts October 15- November 30

CMIP6 Model Analysis Workshop

Barcelona, Spain

25-28 March 2019

(<https://www.wcrp-climate.org/news/wcrp-news/1360-cmip6-ma-workshop>)

HighResMIP

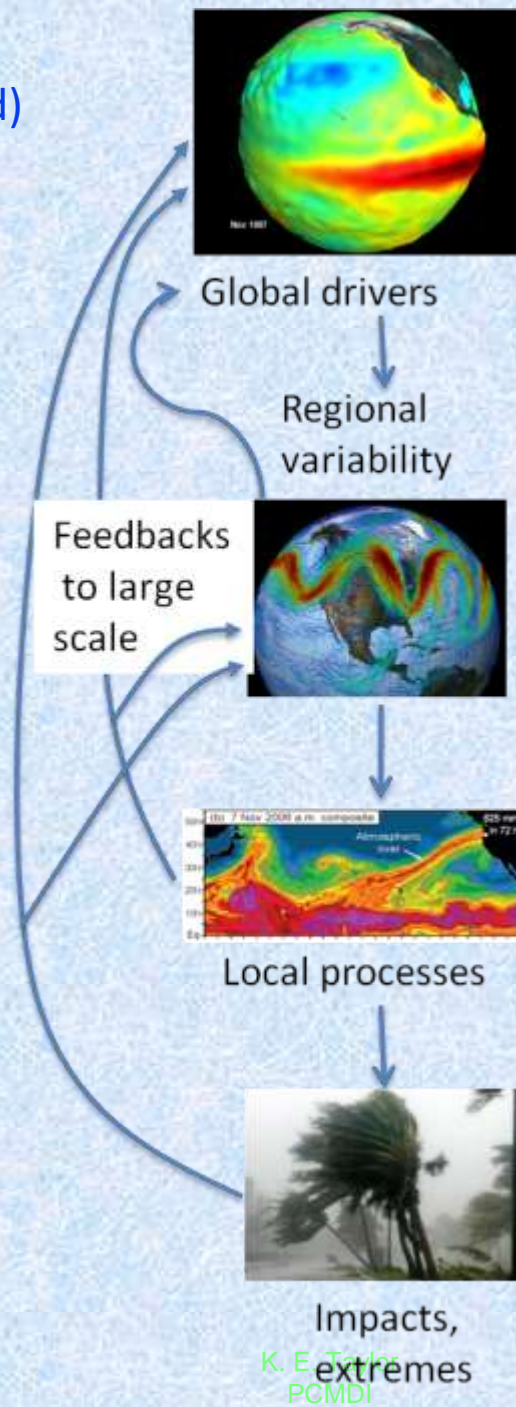
Rein Haarsma KNMI (co-lead)

Malcolm Roberts Met Office (co-lead)

Goal of HighResMIP:

- to investigate the robustness across a multi-model ensemble of changes to the representation of climate processes as model horizontal resolution is increased
- To find out if there is any convergence with resolution across models
- Use coordinated, simple experimental protocol, each simulation using at least two model resolutions - Haarsma et al 2016
 - Tier 1: atmosphere-only, 1950-2014
 - Tier 2: 30-50 year spin-up, then pairs of coupled simulations, constant 1950's forcing and transient 1950-2014
 - Tier 3: 2015-2050 future forced simulations with both atmosphere-only and coupled models

CMIP6 main science question: What are the origins and consequences of systematic model biases



HighResMIP modelling groups (1)

Model name	Contact Institute	Tier	Atmos resolution (STD/Hi) mid-latitude (km)	Ocean resolution (Hi)
AWI-CM	Alfred Wegener Institute (Germany)	2,3	T63 (~200 km) T127 (~100 km) T255 (~50 km)	50 km (variable) 25 km (variable) 10 km (variable)
BCC-CSM2-HR	Beijing Climate Center (China)	1,2	TBD	
BESM	CPTEC/INPE (Brazil)	1	TBD	
CAM6-CSM1.0	NCAR/UCAR (USA)	1	100 km 28 km	
CAMS-CSM1.0	Chinese Academy of Meteorological Sciences (China)	1	T106 (~120 km) T255 (~50 km)	1 degree
CAS-ESM	IAP, CAS (China)	1	1.4x1.4 degree 0.5x0.5 degree	
CIESM	Tsinghua University (China)	1,3	100 km 25 km	
CMCC-CM2	Centro Euro-Mediterraneo sui Cambiamenti Climatici (Italy)	1,2,3	100 km 25 km	0.25 degree
CNRM-CM6	CNRM-CERFACS (France)	1,2,3	T127 (~100 km) T359 (~35 km)	1 degree 0.25 degree
EC-Earth3	SMHI, KNMI, BSC and 26 other institutes (Europe)	1,2,3	T255 (~50 km) T511 (~25 km)	1 degree 0.25 degree
ECMWF-IFS	ECMWF (Europe)	1,2	Tco199 (~50 km) Tco399 (~25 km)	1 degree 0.25 degree
FGOALS-f3-H (L)	LASG, IAP, CAS (China)	1,2	1 degree 0.25 degree	10 km

HighResMIP modelling groups (2)

Model name	Contact Institute	Tier	Atmos resolution (STD/Hi) mid-latitude (km)	Ocean resolution (Hi)
GFDL AM4	GFDL (USA)	1,2	50 km	
HadGEM3-GC3.1	Met Office Hadley Centre (UK)	1,2,3	130 km 60 km 25 km	1 degree 0.25 degree 1/12 degree
HIRAM-SIT	RCEC, Academia Sinica, (Taiwan, China)	2	50 km 25 km	25 km
INMCM5H	Institute of Numerical Mathematics (Russia)	1,2,3	1.5 x 2 degree 0.5 x 0.66 degree	0.25 x 0.5 degree 1/8 x 1/6 degree
MIROC6-CGCM	AORI, Univ. Of Tokyo/JAMSTEC/National Institute for Environmental Studies (NIES) (Japan)	1,2	T213 (~60 km)	0.25 degree
MPAS-A	Pacific Northwest National Laboratory (USA)	1,3	120 km 30 km	18-6 km (variable)
MPI-ESM-1-2	Max Planck Institute for Meteorology (Germany)	1,2,3	T127 (~100 km) T255 (~50 km)	0.4 degree
MRI-AGCM3.xS	Meteorological Research Institute (Japan)	1	-- TL959 (~20 km)	
NICAM glevel-7/8/9	JAMSTEC, AORI, Univ. Of Tokyo//RIKEN AICS (Japan)	1	56 km 28 km 14km (short term)	
NorESM2-H	Norwegian Climate Service Centre (Norway)		-- 0.25 degree	0.25 degree
E3SM	DOE National Laboratories (USA)	1		

Simulation progress

- Tier 1 (atmosphere-only):
 - 6 European groups have completed simulations as part of EU-PRIMAVERA project, and analysis ongoing
 - Several other groups active (FGOALS-f3-H, NICAM, MPAS-A), GFDL finished (colours indicate known activity)
- Tier 2 (coupled control-1950 & hist-1950):
 - 7 European groups have finished simulations
 - GFDL also completed
- Tier 3 (future to 2050, atmos-only + coupled):
 - Awaiting future scenario CMIP6 forcing datasets
 - Hoping to start simulations Oct/Nov 2018

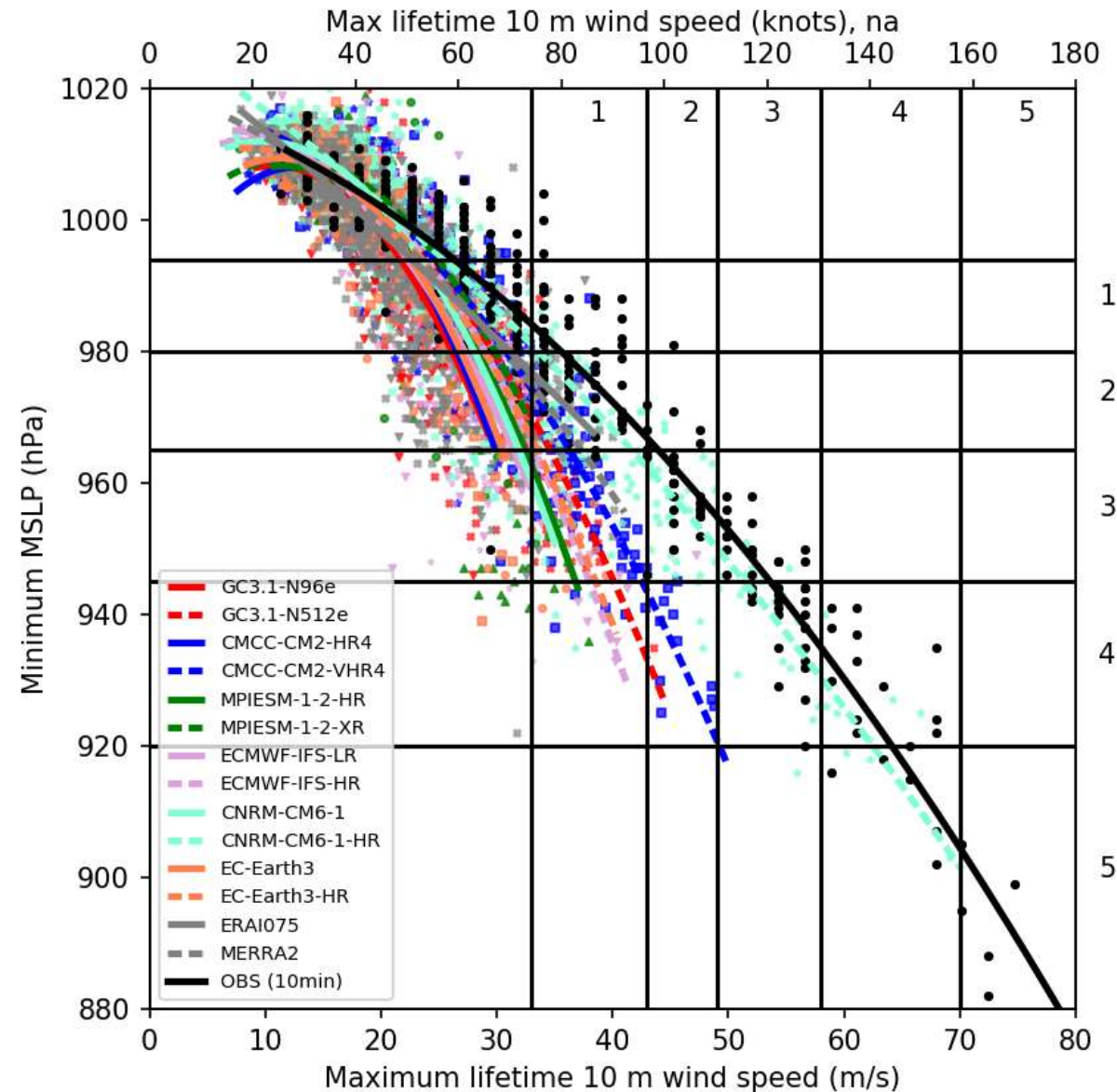
Results/analysis so far

- Initial analysis is being coordinated between EU-PRIMAVERA and other groups
 - documented at collab.knmi.nl/project/highresmip
 - CLIVAR panels (including Dynamics, Atlantic, Southern Ocean, etc)
 - International Tropical Cyclone groups
 - various other individual groups
- Model data available (~3PB) on single CEDA-JASMIN platform with analysis and processing tools and compute cluster
 - This will enable coordinated analysis without need to download data elsewhere
 - Suggest this is the way forward for other CMIP6 analyses

Data upload to ESGF and sharing

- Model data currently being validated on CEDA-JASMIN
- Hope to start upload to ESGF in ~2 months time
- Tropical cyclone tracks (using two algorithms) to be published to CEDA catalogue
 - And hence available to the community
- Climate extremes indices
 - Currently being calculated for all models, to be made available to community ASAP

Tropical cyclone intensities in North Atlantic



Tropical cyclones at peak intensity from highresSST-present simulations (atmos-only)

Solid lines – lower resolution
Dashed lines – higher resolution

Coupled models - SST bias at end of 30/50 year spinup using 1950's forcing

Pairs of models – bias at higher resolution, and difference higher – lower resolution (atmosphere and/or ocean)

