

## **An update on obs4MIPs**

### **WDAC Observations for Model Evaluation Task Team**

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Additional regular contributors: Otis Brown, Michel Rixen, Sophie Cloché (IPSL)

Tsengdar Lee (NASA) and Renu Joseph (DOE)

Luca Cinquini (JPL) – CoG technical support

Denis Nadeu (PCMDI) – CMOR development

Paul Durack (PCMDI) – Data specifications

Jim Biard (NCEI) and Matthias Tuma (WCRP) – beta testers

... and many others

## Presentation outline

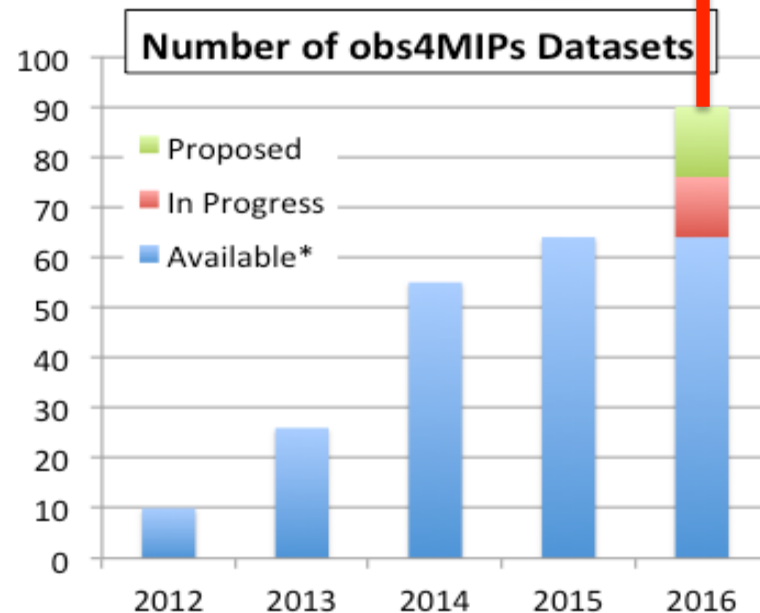
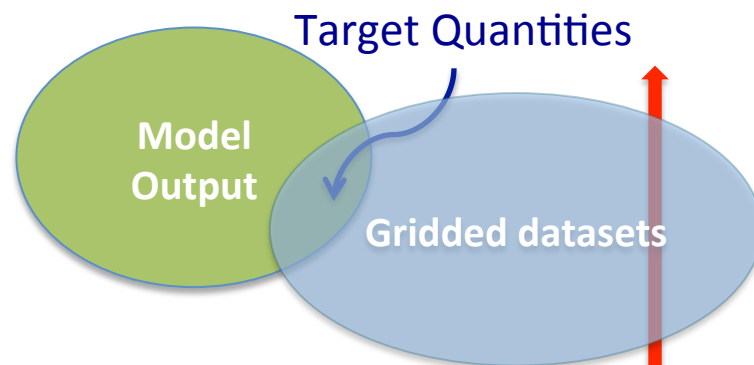
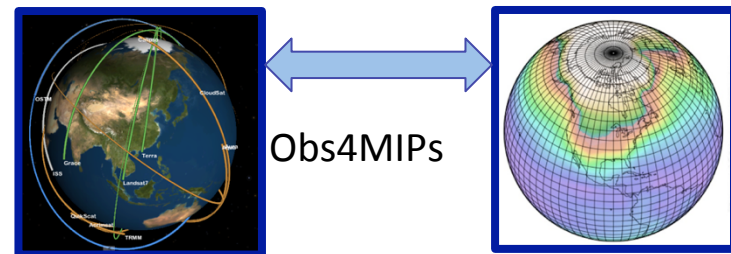
- Quick review, general status report
- Challenges, solutions in the works
- Strategic considerations for discussion

# obs4MIPs

<https://www.earthsystemcog.org/projects/obs4mips/>

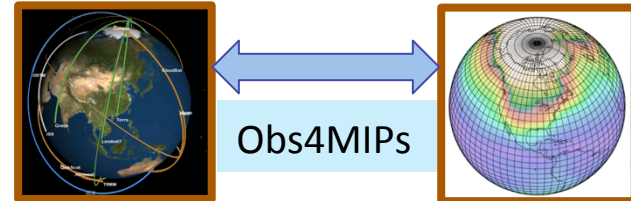
- A project for identifying, documenting and disseminating observations for climate model evaluation in WCRP model intercomparisons, notably CMIP.
- Data accessible with the distributed CMIP model output, adhering to same conventions
- Guided by the WCRP Data Advisory Council obs4MIPS Task Team

**Complete (~125\*)**  
**In Progress\* (~15)**  
**Proposals from Data Call (~90)**



.... and growing!

# obs4MIPs: The 4 Commandments

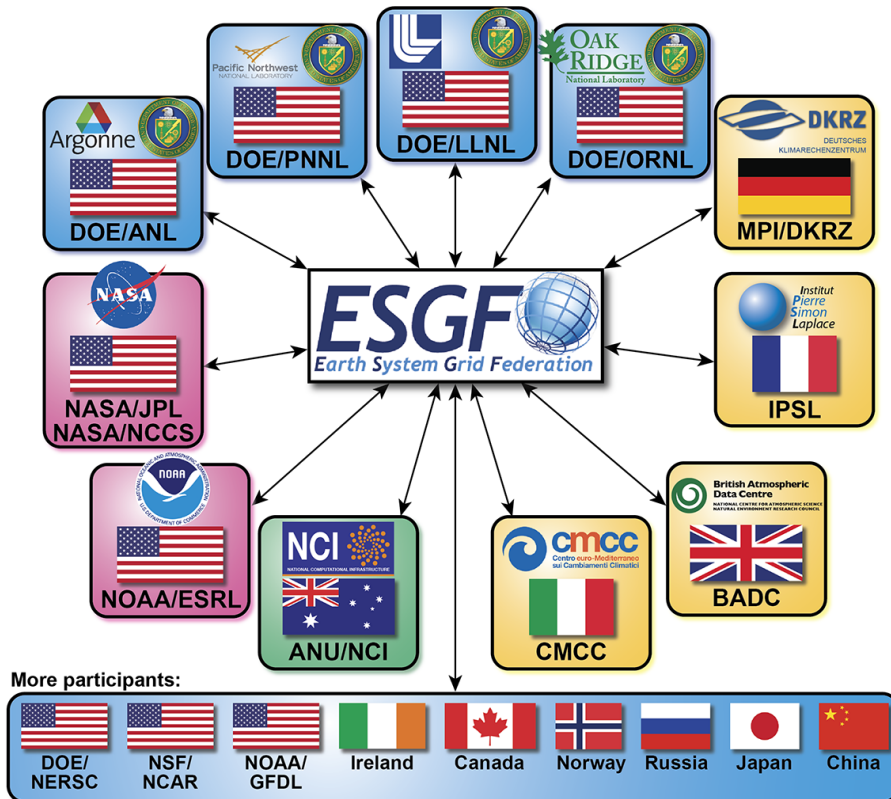


1. Use the CMIP<sup>\*</sup> Standard Model Output as guideline for selecting observations
2. Observations to be structured in coordination with the CMIP output (e.g. NetCDF, CF Convention, common vocabularies)
3. Hosted side by side on the ESGF with CMIP model output
4. Include a Technical Note for each variable describing observation and use for model evaluation (at graduate student level)

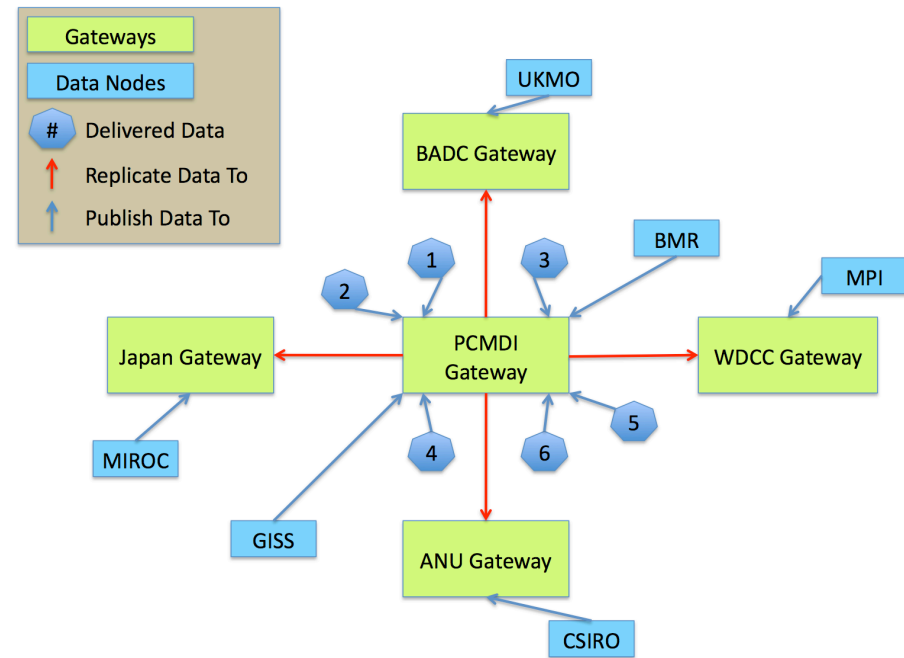
**\* obs4MIPs conventions are being updated to be consistent with CMIP6**

# Data accessibility for WCRP projects

The Earth System Grid Federation (**ESGF**) is being used for CMIP6 and other WCRP projects



*\*Additional participants could not be illustrated in this figure.*



[Check out ESGF Dec 2016 conference report \(Williams et al., 2017\)!](#)

# Data access and project connectedness

- Obs4MIPs data (and ana4MIPs) are available through the CoG
- CoG is directly integrated into the ESGF
- CMIP6 will be hosted on the CoG, as are many other projects



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### Observations for Climate Model Intercomparisons

Obs4MIPs (Observations for Model Intercomparisons) is an activity to make observational products more accessible for climate model intercomparisons.

*To Get Data - Please go to the "Search Data" box or "Advanced Data Search" link to the right.*

A wide variety of observationally-based datasets are used for climate model evaluation. Obs4MIPs refers to a limited collection of well-established and documented datasets that have been organized according to the [5th Coupled Model Intercomparison Project](#) (CMIP5) model output requirements and made available on the Earth System Grid Federation (ESGF). Each Obs4MIPs dataset corresponds to a field that is [output in one or more of the CMIP5 experiments](#). This technical alignment of observational products with climate model output can greatly facilitate model data comparisons. Guidelines have also been developed for Obs4MIPs product documentation that is of particular relevance for model evaluation. This effort was initiated with support from NASA and the U.S. Department of Energy (DOE) and has now expanded to include contributions from a broader community including [CFMIP-OBS](#) and products that rely on [ESA](#) satellites.

To summarize, products currently available via Obs4MIPs are:

1. Directly comparable to a model output field defined as part of CMIP5
2. Open to contributions from all data producers that meet the [Obs4MIPs requirements](#)
3. Well documented, with traceability to track product version changes
4. Served through ESGF (and directly available through this COG).

Efforts are underway to coordinate obs4MIPs with [CMIP6](#)

Last Update: Nov. 7, 2014, 4:57 p.m. by Robert Ferraro

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CoG version 2.10.0  
ESGF P2P Version 1.7.1-phoenix-release-master

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# Obs4MIPs leverages key protocols and infrastructure

- Experiment protocol and **CMIP standard output**
- **Climate Forecast (CF) Convention (as applied in CMIP)**
- **Additional data governance** led by WGCM Infrastructure panel (WIP)
- Utilities to ensure data complies to CMIP structure: **CMOR**
- Distribution: **ESGF**, technically aligned with CMIP data
- **CoG**: Project information, data search and interconnectedness with others

*Pros:* Pulling together key efforts that serve WCRP projects

*Cons:* Vulnerable to weak links

# obs4MIPs planning meeting for CMIP6

April 2014, NASA HQ but still relevant!

Selected consensus recommendations that applied to all of the meeting topic areas:

- **Expand the inventory** of included datasets
- **Include more higher frequency** data (a “golden period”?)
- Reliable and defensible **error characterization**/estimation of observations
- Include datasets in support of **off-line simulators** (prime example: COSP—Cloud Feedback Model Intercomparison Project [CFMIP] Observation Simulator Package)
- **Collocated observations, including sparser in-situ datasets**, are particularly valuable for diagnosing certain processes
- **Precise definitions of data products** (what’s actually being reported), including biases, and precise definitions of the model output variables are required

**Ferraro et al. (2015) BAMS and full meeting report on CoG website**



## Progress since WDAC5

- **Data call: ~100 new gridded datasets proposed, TT encouraging most to go forward**
- Online dataset proposal submission form has recently implemented
- Datasets span across 6 ESGF nodes, complete listing generated daily
- Task team expansion (C. A. Clayson)
- 6 TT telecons, multiple presentations at scientific meetings
- Two manuscripts in-prep (#1 strategy, #2 data description governance)
- CMIP6 data conventions released (Dec 2016)
- CMIP6-obs4MIPs data convention integration, in progress\*
- Software (CMOR) for preparing data released, examples being documented\*
- Development of a strategy to expand the project scope
- Exploring connections with ES-DOC to handle obs4MIPs tech notes, DOI's

\* Critical path for including new datasets

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**Instrument**

☐ AIRS (1)

☐ MLS (1)

**Time Frequency**

**Realm**

**Variable**

☒ ta (2)

☐ taNobs (2)

☐ taStderr (2)

**Variable Long Name**

**CF Standard Name**

**Datanode**

☒ esgf-data.jpl.nasa.gov (2)

Enter Text:



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**Search Constraints:** [✖ esgf-data.jpl.nasa.gov](#) | [✖ ta](#)

Total Number of Results: 2

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Please login to add search results to your Data Cart

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**1. obs4MIPs AIRS Air Temperature L3 Monthly Data**

Description: Obs-AIRS model output prepared for obs4MIPs NASA-JPL observation

Data Node: [esgf-data.jpl.nasa.gov](#)

Version: 20110608

Total Number of Files (for all variables): 3

[\[ Show Metadata \]](#) [\[ Show Files \]](#) [\[ THREDDS Catalog \]](#) [\[ WGET Script \]](#) [\[ LAS Visualization \]](#) [\[ Tech Note \]](#)

**2. obs4MIPs MLS Air Temperature L3 Monthly Data**

Description: Obs-MLS model output prepared for obs4MIPs NASA-JPL observation

Data Node: [esgf-data.jpl.nasa.gov](#)

Version: 20111025

Total Number of Files (for all variables): 3

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**Search facets**

**An example data search**

From IPSL CoG site, finding data on JPL data node  
Data & Tech Notes accessed together

# CMIP/obs4MIPs global attributes, controlled vocabulary and data reference syntax (under discussion)

**Example: Some predefined global attributes (there are others)**

**Variable ID** \* \*

**Source** \*

**Dataset version number** \*

**Institution\_id**

**Product**

**Frequency** \* \*

**Nominal\_resolution** \*

**License**

**\* obs4MIPs search facets**

**\* Controlled vocabulary with pre-defined options**

All Controlled vocabulary and other specifications managed publically on github

## CMOR 3

Overview
Getting started
CMOR API
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PrePARE
PDF
Installation
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Appendix
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## Getting started overview

### Table of Contents

- Design Considerations and Overview
- Preliminary notes

## Design Considerations and Overview

This document describes Version 3 of a software library called "Climate Model Output Rewriter" (CMOR3)[1], written in C with access also provided via Fortran 90 and through Python[2]. CMOR is used to produce CF-compliant[3] netCDF[4] files. The structure of the files created by CMOR and the metadata they contain fulfill the requirements of many of the climate community's standard model experiments (which are referred to here as "MIPs"[5] and include, for example, AMIP, PMIP, APE, and IPCC [DN1] scenario runs).

CMOR was not designed to serve as an all-purpose writer of CF-compliant netCDF files, but simply to reduce the effort required to prepare and manage MIP model output. Although MIPs encourage systematic analysis of results across models, this is only easy to do if the model output is written in a common format with files structured similarly and with sufficient metadata uniformly stored according to a common standard. Individual modeling groups store their data in different ways, but if a group can read its own data, then it should easily be able to transform the data, using CMOR, into the common format required by the MIPs. The adoption of CMOR as a standard code for exchanging climate data will facilitate participation in MIPs because after learning how to satisfy the output requirements of one MIP, it will be easy to prepare output for other MIPs.

CMOR output has the following characteristics:

- Each file contains a single primary output variable (along with coordinate/grid variables, attributes and other metadata) from a single model and a single simulation (i.e., from a single ensemble member of a single climate experiment). This method of structuring model output best serves the needs of most researchers who are typically interested in only a few of the many variables in the MIP databases. Data requests can be satisfied by simply sending the appropriate file(s) without first extracting the individual field(s) of interest.
- There is flexibility in specifying how many time slices (samples) are stored in a single file. A single file can contain all the time-samples for a given variable and climate experiment, or the samples can be distributed in a sequence of files.
- Much of the metadata written to the output files is defined in MIP-specific tables of information, which in this document are referred to simply as "MIP tables". These tables are JSON files that can be read by CMOR and are typically made available from MIP web sites. Because these tables contain much of the metadata that is useful in the MIP context, they are the key to reducing the programming burden imposed on the individual users contributing data to a MIP. Additional tables can be created as new MIPs are born.
- For metadata, different MIPs may have different requirements, but these are accommodated by CMOR, within the constraints of the CF convention and as specified in the MIP tables.
- CMOR can rely on NetCDF4 [See unidata web page](#) to write the output files and can take advantage of its compression and chunking capabilities. In that case, compression is controlled with the MIP tables using the shuffle, deflate and deflate\_level attributes, default values are respectively 0, 0 and 0(disable). It is worth noting that even when using NetCDF4, CMOR3 still produces NETCDF4 CLASSIC formatted output. This allows the file generated to be readable by any application that can read NetCDF3 provided they are re-linked against NetCDF4. When using the NetCDF4 library it is also still possible to write files that can be read through the NetCDF3 library by adding "\_3" to the appropriate cmor\_setup argument (see below). Note: CMOR3 **NOW** output NetCDF4 files by default. For CMIP6, the NetCDF4/NC\_CLASSIC\_Model mode is used (and chunking is **NOW** invoked... shuffle and deflation can be invoke on-demand by setting flags in the table. [example](#)).
- CMOR also must be linked against the udunits2 library [see http://www.unidata.ucar.edu/software/udunits/](http://www.unidata.ucar.edu/software/udunits/), which enables CMOR to check that the units attribute is correct[6]. Finally CMOR3 must also be linked against the uuid library [see http://www.ossdp.org/pkg/lib/uuid](http://www.ossdp.org/pkg/lib/uuid) in order to produce a unique tracking number for each file.

- **CMOR3** now supports observational data!
- Strongly recommended for obs4MIPs – it is the easiest way to ensure compliance
- Support for CMIP and obs4MIPs users
- Open source, can be adopted for other purposes
- Being used by most CMIP participating modeling groups
- Available via Anaconda with python, C and fortran interfaces

## Task team progress on strategic planning

1. Developing a concise set of Dataset Suitability and & Maturity Indicators
2. Accommodating a wide range of supplemental data and metadata beyond the “best estimate”
3. Interfacing with ESDOCs for handling Tech Notes and DOIs

## Technical Requirements

<b>Meets obs4MIPs data technical requirements</b>	Data suitably processed with CMOR and/or consistent with obs4MIPs standards	Largely complete with minor metadata inconsistencies	Non-compliant. Should be removed from database!
<b>Includes obs4MIPs technical note information</b>	Complete technical note information provided	Technical note information incomplete and/or could be improved	Technical note not provided

## Dataset Suitability and Maturity

<b>Closeness or robustness of measurement to observed reference quantity</b>	Firmly established and/or validated methodology	Indirect means of calculation or observations only providing partial constraint (e.g. ocean surface latent heat flux)	Largely model-derived quantity (e.g. LAI, root zone soil moisture, NPP)
<b>Maturity with respect to climate model evaluation</b>	Multiple peer-reviewed examples of application to CMIP climate model evaluation	One peer-reviewed example of application to CMIP climate and/or examples of other sorts of model evaluation.	As of DATE-TBS, no significant application to climate model evaluation
<b>Provision for robust uncertainty information</b>	Uncertainty information provided per retrieval/grid point	General uncertainty information given relative to the methodology and dataset as a whole - backed by actual field/in-situ validation exercises	No uncertainty information provided

## Comparison Complexity

<b>Complexity of Model Observation Comparison</b>	Comparison can be made directly with CMIP model output variable	Comparison requires some simple post processing of CMIP output variable(s) (e.g. vertical integral or ratio of two variables)	Comparison requires complex processing of CMIP output (e.g. "simulator", budget calculation)
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## obs4MIPs

### Dataset Suitability & Maturity Indicators (DRAFT)


Being finessed by TT, to be made public on obs4MIPs site

Indicators for all datasets will be determined by TT in consultation with dataset providers



# Prototyping Dataset Suitability And Maturity Indicators

*Based on typical obs4MIPs dataset search*

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Variable	+
Variable Long Name	+
CF Standard Name	+
Data Node	+

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Search Constraints: ✖TEMPERATURE

Total Number of Results: 8

-1-

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1. **obs4MIPs AMSRE Sea Surface Temperature L3 Monthly Data**

Description: Obs-AMSRE model output prepared for obs4MIPs NASA-JPL observation

Data Node: [esgf-data.jpl.nasa.gov](#)

Version: 20111031

Total Number of Files (for all variables): 3

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2. **obs4MIPs AIRS Air Temperature L3 Monthly Data**

Description: Obs-AIRS model output prepared for obs4MIPs NASA-JPL observation

Data Node: [esgf-data.jpl.nasa.gov](#)

Version: 20110608

Total Number of Files (for all variables): 3

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Entire symbol set linked as a single entity to explanatory page mentioned on previous page.

# Beyond the “best estimate” obs4MIPs dataset Supplemental Information

## Strategy currently in preparation by WDAC task team

A possible path forward to deal with multiple unresolved issues within obs4MIPs, e.g.:

- Additional documentation
- Uncertainty data
- Data flags, masks
- Supporting validation data
- Detailed Maturity matrices

Organization of supplemental data will initially be more heterogeneous than associated “best estimate”, and therefore not searchable from a higher level. It will be alongside best estimate as a zipped archive

locally - definition of p... x Temperature data (HadCR... x 5th Session of the WCRP Data Search... x obs4MIPs-IPSL Data Search... x

localhost:8080/node.ipsl.upmc.fr/search/obs4mips-ipsi/

obs4mips cog ipsi

hosted by Institut Pierre Simon Laplace is-enes

Powered by ESGF and GGG

The Earth System Grid Federation is currently in the process of redeployment. Although individual sites such as this one have been brought online you should consider the system at risk until integration testing between sites is completed. An update to this notice will be made once this is the case.

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WCRP obs4MIPs World Climate Research Programme

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Project Institute Instrument

Time Frequency Realm

Variable

Variable Long Name

CF Standard Name

Datanode

esgf-data.jpl.nasa.gov (2)

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Search Constraints: ☒ esgf-data.jpl.nasa.gov ☒ ta

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Expert Users: you may display the search URL and return results as XML or return results as JSON

1. obs4MIPs AIRS Air Temperature L3 Monthly Data  
Description: Obs-AIRS model output prepared for obs4MIPs NASA-JPL observation  
Data Node: esgf-data.jpl.nasa.gov  
Version: 20110608  
Total Number of Files (for all variables): 3  
[ Show Metadata ] [ Show Files ] [ THREDDS Catalog ] [ WGET Script ] [ LAS Visualization ] [ Tech Note ]

2. obs4MIPs MLS Air Temperature L3 Monthly Data  
Description: Obs-MLS model output prepared for obs4MIPs NASA-JPL observation  
Data Node: esgf-data.jpl.nasa.gov  
Version: 20110205  
Total Number of Files (for all variables): 3  
[ Show Metadata ] [ Show Files ] [ THREDDS Catalog ] [ WGET Script ] [ LAS Visualization ] [ Tech Note ]

Supplemental info

SGF sponsors and partners  
DoE Office of Science | IS-ENES | NASA | NOAA | NCI | NSF

CoG version 3.3.0  
ESGF P2P Version v2.2.3-master-release

Earth System CoG sponsors and partners  
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https://www.ipsl.fr

# Target Timelines

Winter'17	Spring'17	Summer'17	Fall'17	Winter'18
<i>Complete, Test and Release Tools/CMOR for Producing Compliant Datasets</i>				
	<i>Prepare datasets selected from "1st Dataset Call"</i>			
		<i>Refurbish and Extend Initial obs4MIPs Datasets</i>		
<i>Implement Dataset Suitability and Maturity Indicators</i>				
	<i>Develop &amp; Implement Dataset "Supplmental Info" Capability</i>			
	<i>Explore Use and Potentially Implement Use of EZ-Docs for obs4MIPs Technical Notes and DOIs</i>			
	<i>Generalize data specifications to accommodate non-gridded data</i>			
		<i>Submit 2 Papers: Project Overview &amp; Technical Update</i>		
			<i>Possible 2nd Dataset Call: Beyond Gridded</i>	

# Summary and Perspective

- Increasingly, obs4MIPs is serving as a direct connection between data providers and a large and diverse model evaluation community
- CMIP data specifications have been updated, and are being integrated with obs4MIPs
- Efforts are underway to expand the scope of the project by adding dataset maturity indicators and enabling additional data and metadata to be included
- With a dramatic increase in the number of simulations to analyze, model evaluation needs to become more systematic – we hope that obs4MIPs can facilitate this
- In addition to helping to advance climate model evaluation, obs4MIPs is providing some level of coordination across different classes and sources of observations

## Links to related material

- [ESGF Dec 2016 conference report \(pdf\)](#)
- [CMIP6 data specifications \(google docs\)](#)
- [Climate Model/obs Output Rewriter, CMOR \(website\)](#)
- [obs4MIPs draft data specification \(google docs\)](#)
- [Draft user guide for preparing obs4MIPs \(google docs\)](#)
- [obs4MIPs tables controlled vocabulary \(github\)](#)

EXTRAS

# Obs4MIPs: Status of Observation Holdings/ Submissions

April 2016

Water Vapor Path  
Fraction of Absorbed Photosynthetically Active Radiation  
Snow area fraction  
Ambient Aerosol Extinction Optical Thickness at 550 nm  
Sea Ice fraction  
Sea Ice fraction  
Sea Surface Temp  
Sea Surface Temp  
Sea Surface Temp  
TOA Outgoing Longwave Radiation  
TOA Outgoing Longwave Radiation  
TOA Outgoing Shortwave Radiation  
TOA Outgoing Longwave Radiation  
Mole Fraction of Ozone  
albedo; Ratio of two variables  
Ice Sheet Temperature?  
Ambient Aerosol Optical Thickness at 550 nm  
Surface Aqueous Partial Pressure of CO<sub>2</sub>  
dry\_atmosphere\_mole\_fraction\_of\_carbon\_dioxide  
Near-Surface Wind Speed

Near-Surface Air Temperature  
Air Temperature  
Geopotential Height  
Eastward Near-Surface Wind  
Northward Near-Surface Wind  
Near-Surface Wind Speed  
Near-Surface Specific Humidity  
Surface Downward Latent Heat Flux  
Surface Downward Sensible Heat Flux  
Near-Surface Air Temperature  
Precipitation  
Sea level pressure  
Sea Surface Temp  
Total Chlorophyll Mass Concentration  
Infrared brightness temperatures (11 μm, 0.6 μm, 6.7 μm)  
Leaf Area Index  
normalized difference vegetation index  
Fraction of Photosynthetically Active Radiation  
Sea Surface Temperature  
precipitation  
air temperature  
Burnt Area Fraction  
Surface Snow Amount  
Mid Tropospheric Humidity  
Upper Tropospheric Humidity  
Air Temperature  
geopotential height  
bending angle  
refractivity  
CLARA cloud\_area\_fraction; CFMIP 45  
surface albedo  
cloud\_area\_fraction  
cloud top phase; area\_fraction\_of\_liquid\_cloud\_water\_particles\_at\_cloud\_top  
cloud top pressure; air\_pressure\_at\_cloud\_top  
cloud optical thickness; atmosphere\_optical\_thickness\_due\_to\_cloud  
cloud ice water path; atmosphere\_cloud\_ice\_content  
surface\_downwelling\_shortwave\_flux\_in\_air  
surface\_downwelling\_clear\_sky\_shortwave\_flux  
surface\_downwelling\_shortwave\_flux\_in\_air  
cloud ice water path; atmosphere\_cloud\_ice\_content  
cloud liquid water path  
cci cloud area fraction (7x7 table); CFMIP 45 (tbd)  
cloud area fraction  
cloud top phase; area\_fraction\_of\_liquid\_cloud\_water\_particles\_at\_cloud\_top  
cloud top pressure; air\_pressure\_at\_cloud\_top  
cloud optical thickness; atmosphere\_optical\_thickness\_due\_to\_cloud  
Sea Ice Area Fraction  
Surface Temperature  
Sea Ice Area Fraction  
surface (2m) air temperature anomaly  
Near-Surface Specific Humidity  
Near-Surface Relative Humidity,  
Near-Surface Air Temperature

Complete (~125\*)  
In Progress\* (~15)  
Submissions From Data Call (~90)

\* A few technotes remain to be completed

Temperature  
Specific Humidity  
Air Temperature  
Specific Humidity  
Sea Surface Temperature  
TOA Outgoing Longwave Radiation  
TOA Outgoing Clear-Sky Longwave Radiation  
TOA Outgoing Shortwave Radiation  
TOA Outgoing Clear-Sky Shortwave Radiation  
TOA Incident Shortwave Radiation  
Surface Downwelling Longwave Radiation  
Surface Downwelling Clear-Sky Longwave Radiation  
Surface Upwelling Longwave Radiation  
Surface Downwelling Shortwave Radiation  
Surface Downwelling Clear-Sky Shortwave Radiation  
Surface Upwelling Shortwave Radiation  
Surface Upwelling Clear-Sky Shortwave Radiation  
Total Cloud Fraction  
Sea Surface Height Above Geoid  
Precipitation - monthly  
Precipitation - 3 hourly  
Precipitation - daily  
Precipitation - monthly  
Near-Surface Wind Speed  
Eastward Near-Surface Wind  
Northward Near-Surface Wind  
Leaf Area Index  
Mole Fraction of Ozone  
Ambient Aerosol Optical Thickness at 550 nm  
Ambient Aerosol Optical Thickness at 550 nm  
Water Vapor Path  
ISCCP Cloud albedo  
ISCCP Cloud albedo  
CALIPSO Scattering Ratio, srbox1  
CALIPSO Scattering Ratio, srbox2  
CloudSat Radar Reflectivity CFAD  
CALIPSO Cloud Fraction  
CALIPSO Clear Cloud Fraction  
CALIPSO High Level Cloud Fraction  
ISCCP Cloud Fraction  
CALIPSO Low Level Cloud Fraction  
CALIPSO Mid Level Cloud Fraction  
CALIPSO 3D Clear Fraction  
CALIPSO Total Cloud Fraction  
CLOUDSAT Total Cloud Fraction  
ISCCP Total Cloud Fraction  
ISCCP Cloud Top Temperature  
ISCCP Cloud Top Temperature  
Missing data fraction  
Overpasses  
PARASOL Reflectance  
Solar Zenith Angle  
ISCCP Cloud Top Pressure  
ISCCP Cloud Top Pressure  
MISR CTH-OD Cloud Fraction  
CALIPSO 3D Undefined fraction

# Task Team Efforts/Organization

- Regular TT telecons (~monthly)
- All project management data accessible to TT via Google Docs
- Much of the TT effort has been helping to better define strategic path, but increasingly...
- Moving toward helping to shepherd datasets from proposal to publication on ESGF



# Monitoring datasets across the distributed federation:

## A new capability scans all ESGF nodes and generates a catalog of available datasets

### Obs4MIPs

[Home](#) [About Us](#) [Governance](#) [Contact Us](#)

You are at the CoG-CU node

[Technical Support](#)

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### Obs4MIPs Data Table

The following table is automatically updated with Obs4MIPs datasets available throughout the Earth System Grid Federation.

Obs4MIPs Datasets			
Instrument	Dataset Name	Variables	Tech Note
AIRS	obs4MIPs AIRS Air Temperature L3 Monthly Data	Air Temperature Air Temperature Number of Observations Air Temperature Standard Error	<a href="#">Tech Note</a>
AIRS	obs4MIPs AIRS Specific Humidity L3 Monthly Data	Specific Humidity Specific Humidity Number of Observations Specific Humidity Standard Error	<a href="#">Tech Note</a>
AMSRE	obs4MIPs AMSRE Sea Surface Temperature L3 Monthly Data	Sea Surface Temperature Sea Surface Temperature Number of Observations Sea Surface Temperature Standard Error	<a href="#">Tech Note</a>
ARC-SST-1-1	obs4MIPs UOE ARC-SST-1-1 Monthly Data	sea surface temperature	
AVISO	obs4MIPs AVISO Sea Surface Height Above Geoid L4 Monthly Data	Sea Surface Height Above Geoid Sea Surface Height Above Geoid Number of Observations Sea Surface Height Above Geoid Standard Error	<a href="#">Tech Note</a>
CFMIP-Obs-CALIPSO	obs4MIPs CFMIP-Obs CALIPSO Low Level Cloud Fraction L3 Monthly Data	CALIPSO Low-Level Cloud Fraction	<a href="#">Tech Note</a>
CFMIP-Obs-CALIPSO	obs4MIPs CFMIP-Obs CALIPSO Low Level Cloud Fraction L3 Monthly(Day) Data	CALIPSO Low-Level Cloud Fraction	<a href="#">Tech Note</a>
MLS	obs4MIPs MLS Specific Humidity L3 Monthly Data	Specific Humidity Specific Humidity Number of Observations Specific Humidity Standard Error	<a href="#">Tech Note</a>
MLS	obs4MIPs MLS Air Temperature L3 Monthly Data	Air Temperature Air Temperature Number of Observations Air Temperature Standard Error	<a href="#">Tech Note</a>
MODIS	obs4MIPs MODIS Total Cloud Fraction L3 Monthly Data	Total Cloud Fraction Total Cloud Fraction Number of Observations Total Cloud Fraction Standard Deviation	<a href="#">Tech Note</a>
QuikSCAT	obs4MIPs QuikSCAT Northward Near-Surface Wind L2B Monthly Data	Northward Near-Surface Wind Northward Near-Surface Wind Number of Observations Northward Near-Surface Wind Standard Error	<a href="#">Tech Note</a>
QuikSCAT	obs4MIPs QuikSCAT Eastward Near-Surface Wind L2B Monthly Data	Eastward Near-Surface Wind Eastward Near-Surface Wind Number of Observations Eastward Near-Surface Wind Standard Error	<a href="#">Tech Note</a>
QuikSCAT	obs4MIPs QuikSCAT Near-Surface Wind Speed L2B Monthly Data	Near-Surface Wind Speed Near-Surface Wind Speed Number of Observations Near-Surface Wind Speed Standard Error	<a href="#">Tech Note</a>
SSMI-MERIS	project=obs4MIPs, institute=FUB-DWD, instrument=SSMI-MERIS, time_frequency=mon, variable=prw	Water Vapor Path	<a href="#">Tech Note</a>
TES	obs4MIPs TES Mole Fraction of O3 L3 Monthly Data	Mole Fraction of O3 Mole Fraction of O3 Number of Observations Mole Fraction of O3 Standard Error	<a href="#">Tech Note</a>

~125 DataSets