Progress and Plans for obs4MIP

WDAC Observations for Model Evaluation Task Team

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… and many others

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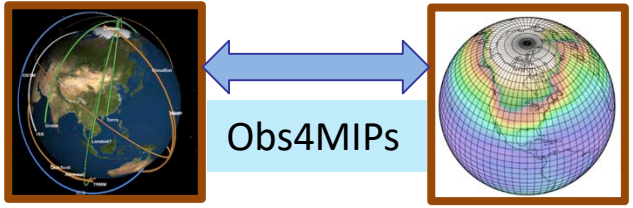
Briefing outline

- Quick review, general status report
- Challenges, possible solutions
- Atmospheric reanalysis: ana4MIPs
- Strategic considerations

obs4MIPs: The 4 Commandments

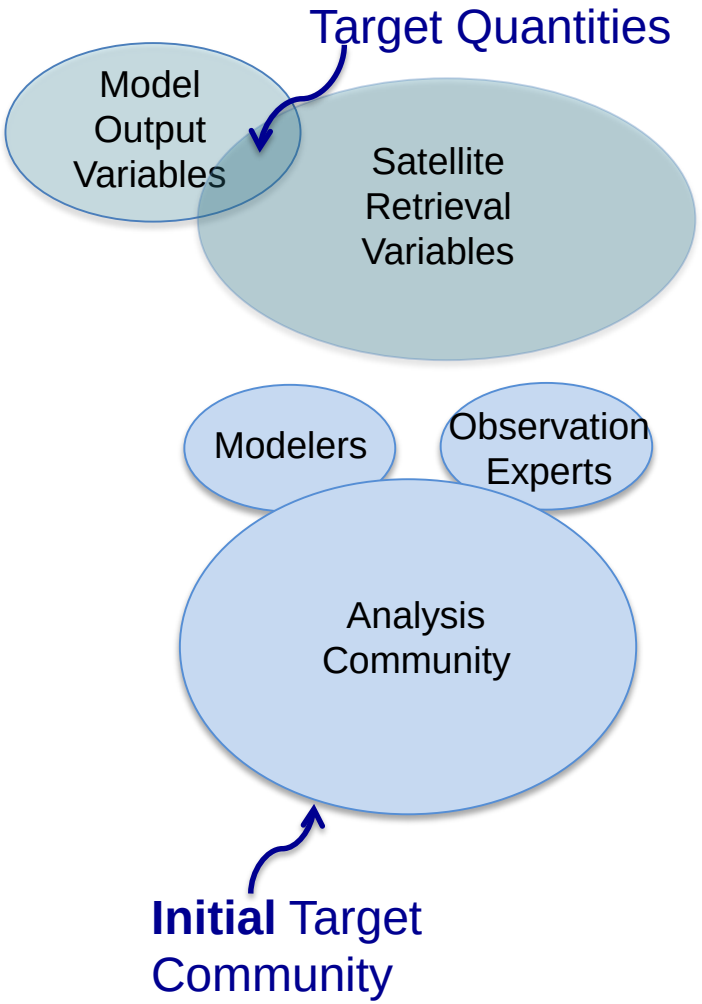


1. Use the CMIP5/6 Standard Model Output as guideline for selecting observations

1. Observations to be formatted the same as CMIP Model output (e.g. NetCDF files, CF Convention)

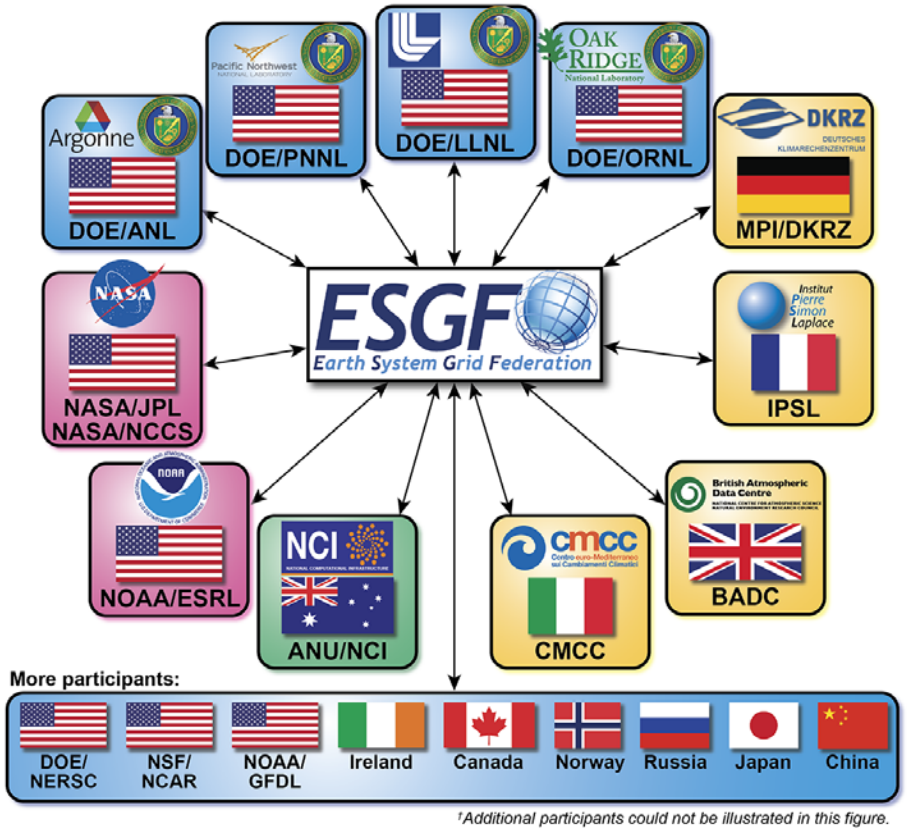
1. Hosted side by side on the ESGF with CMIP model output

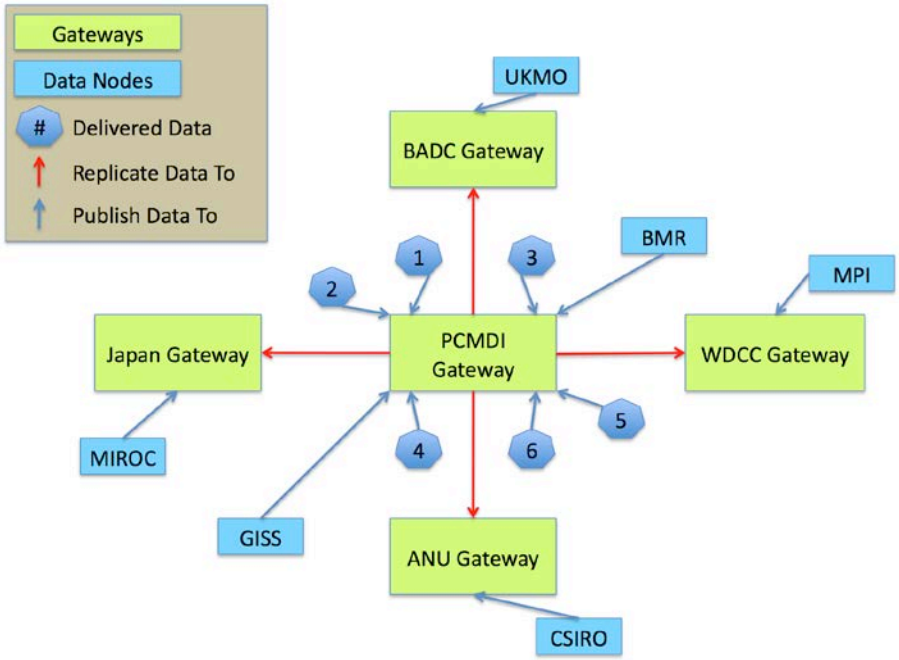
1. Include a Technical Note for each variable describing observation and use for model evaluation (at graduate student level).



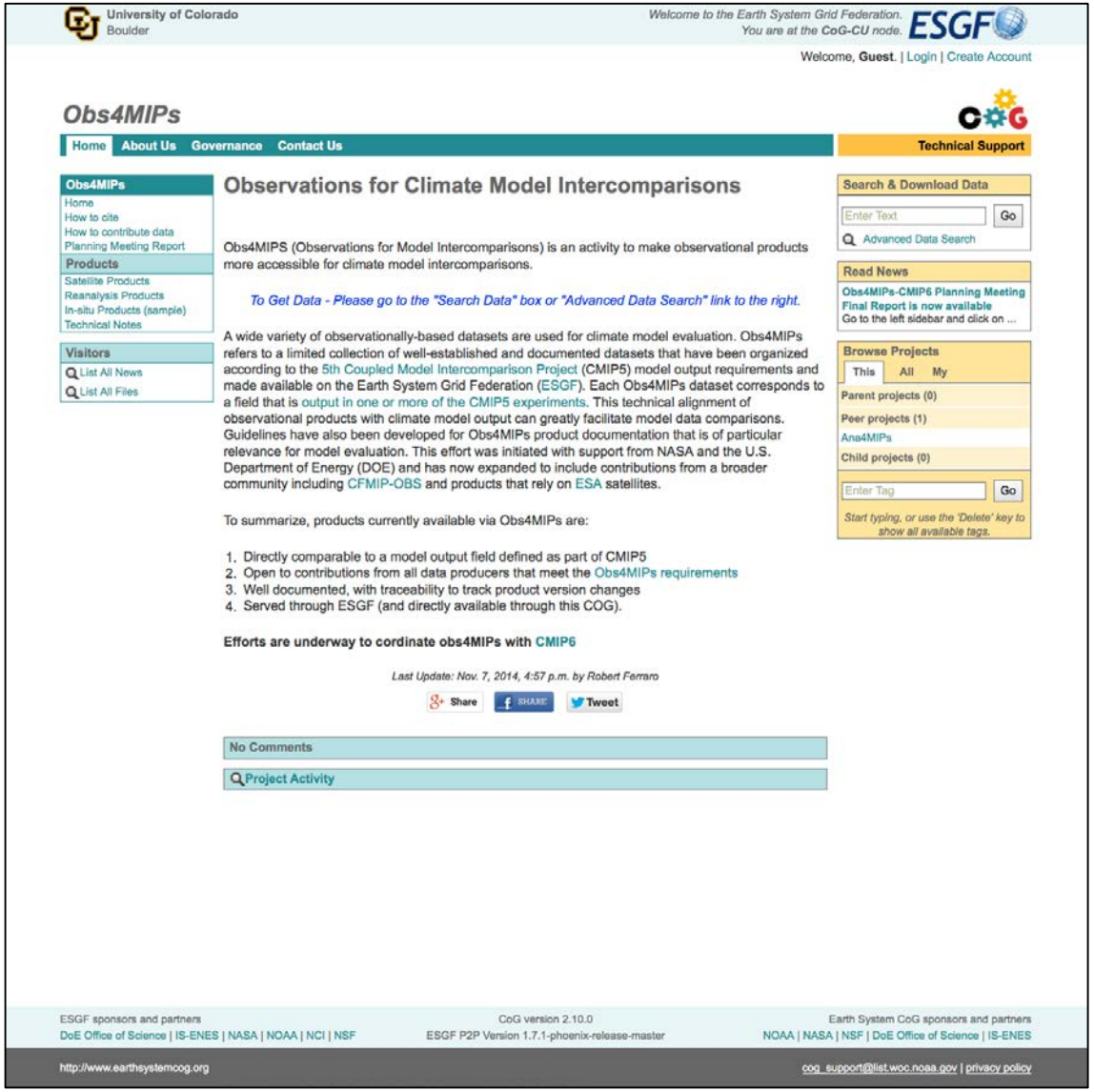
Review: Data accessibility for WCRP projects

Earth System Grid Federation (**ESGF**) will be used for CMIP6 (and, increasingly, many other projects)





Data access and project connectedness

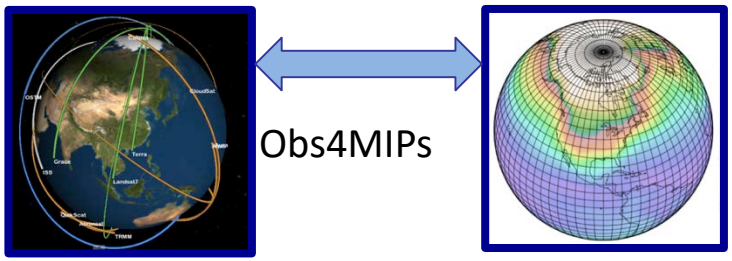


- Obs4MIPs data (and ana4MIPs) are available through the CoG
- CoG is directly connected to ESGF
- CMIP6 is will be hosted on the CoG, as are many other projects

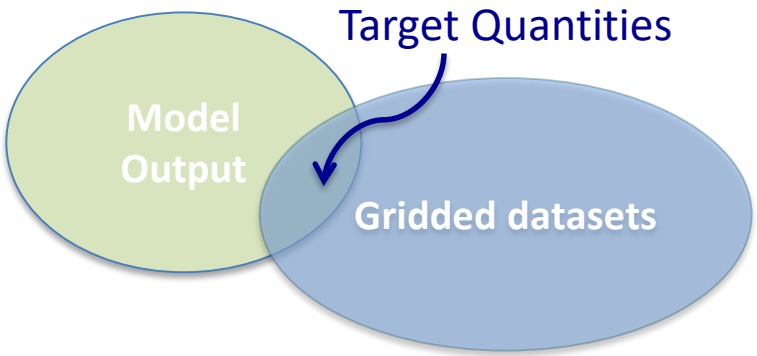
obs4MIPs

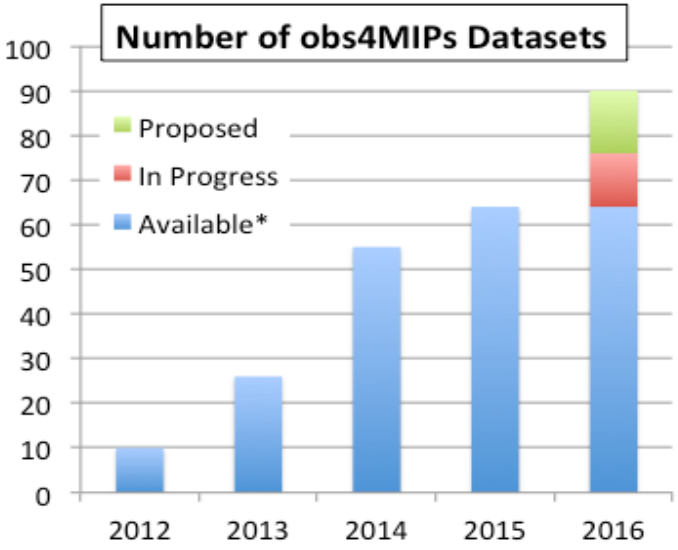
Single Slide Project Flyer

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



- A Project for identifying, documenting and disseminating observations for climate model evaluation.
- Data sets accessible on the Earth System Grid Federation (ESGF) alongside the Coupled Model Intercomparison Projection (CMIP) model output, adhering to the same data conventions, greatly facilitating research
- Guided by the World Climate Research Program (WCRP) Data Advisory Council obs4MIPS Task Team





.... and growing!

obs4MIPs planning meeting for CMIP6

(April 2014, NASA HQ)

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

- Expand the inventory
- Include more higher frequency data (a “golden period”?)
- Reliable and defendable error characterization of observations is a high priority
- 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 and their inclusion in obs4MIPs should therefore be encouraged
- 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

Obs4MIPs: Status of Observation Holdings/Submissions

April 2016

Air 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 Fraciont of Ozone
Ambient Aerosol Opitical Thickness at 550 nm
Ambient Aerosol Opitical 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

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 Opitical Thickness at 550 nm
Surface Aqueous Partial Pressure of CO2
dry_atmosphere_mole_fraction_of_carbon_dioxide
Near-Surface Wind Speed

Complete* (~57)

In Progress* (~20)

Submissions After Data Call (~50)

*some tech notes remain and ESGF re-loading

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

Task Team Efforts/Organization since WDAC4

- Regular TT telecons (~monthly)
- All project management data accessible to TT via Google Docs
- Much of TT effort has been helping to better define strategic path, but increasingly, moving toward helping to shepherd datasets from proposal to publication on ESGF
- A “call for datasets”, coordinated with NASA & ESA (Dec 2015-April 2016)
- Technical team meeting at PCMDI (March 2016)
- Engaged with lots of technical infrastructure (CMOR, CoG, ESGF)
- Next obs4MIPs publication planned in support of CMIP6

Task team considers many topics

Lingering issues (examples):

- Improved presentation/organization of CoG site
- Tech note: PDF -> XML
- DOI's on tech note *and* data. A tech note report series?*
- Possible adoption of a "maturity matrix"
- A "completeness table"?

In progress:

- Advertising a "dataset call" including gridded in-situ products, review new proposals ✓

* Could require a moderate amount of effort to do properly

Some overarching challenges

- Connecting, but also reliant on multiple efforts (CMIP, ESGF, COG) … ESGF was down for ~6 months to address security vulnerabilities
- Every step requires work/resources (for data providers and/or TT host nodes, etc.)
- Improving *the process* of data preparation and ESGF publication
  (primarily technical)
- Better defining *the process* of what datasets get included and how it is catalogued
- Expansion (e.g., high frequency, in-situ)

(More on this in a few minutes)

New capability to generate catalog of existing obs4MIPs datasets across nodes

TT co-chairs no longer have to do this manually!

Obs4MIPs

You are at the CoG-CU node

Home | About Us | Governance | Contact Us | Technical Support

Last Search | My Data Cart (1)

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	Tech Note
AIRS	obs4MIPs AIRS Specific Humidity L3 Monthly Data	Specific Humidity Specific Humidity Number of Observations Specific Humidity Standard Error	Tech Note
AMSRE	obs4MIPs AMSRE Sea Surface Temperature L3 Monthly Data	Sea Surface Temperature Sea Surface Temperature Number of Observations Sea Surface Temperature Standard Error	Tech Note
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	Tech Note
CFMIP-Obs-CALIPSO	obs4MIPs CFMIP-Obs CALIPSO Low Level Cloud Fraction L3 Monthly Data	CALIPSO Low-Level Cloud Fraction	Tech Note
CFMIP-Obs-CALIPSO	obs4MIPs CFMIP-Obs CALIPSO Low Level Cloud Fraction L3 Monthly(Day) Data	CALIPSO Low-Level Cloud Fraction	Tech Note
MLS	obs4MIPs MLS Specific Humidity L3 Monthly Data	Specific Humidity Specific Humidity Number of Observations Specific Humidity Standard Error	Tech Note
MLS	obs4MIPs MLS Air Temperature L3 Monthly Data	Air Temperature Air Temperature Number of Observations Air Temperature Standard Error	Tech Note
MODIS	obs4MIPs MODIS Total Cloud Fraction L3 Monthly Data	Total Cloud Fraction Total Cloud Fraction Number of Observations Total Cloud Fraction Standard Deviation	Tech Note
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	Tech Note
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	Tech Note
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	Tech Note
SSMI-MERIS	project=obs4MIPs, institute=FUB-DWD, instrument=SSMI-MERIS, time_frequency=mon, variable=prw	Water Vapor Path	Tech Note
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	Tech Note

Courtesy Luca Cinquini

Making observational data consistent with CMIP model output

- CMIP6 data conventions soon to be finalized
- Climate Model Output Rewriter (CMOR) is used by modeling groups to ensure their data is CF compliant and adheres to CMIP guidelines
- CMOR3 currently being tested and (*new*) now can accommodate gridded observation

Rough slide to be improved before WDAC

An example data search

From IPSL CoG site, finding data on JPL data node

Data & Tech Notes accessed together

Obs4MIPs/WCRP logo needed?

An example data search

From IPSL CoG site, finding data on JPL data node

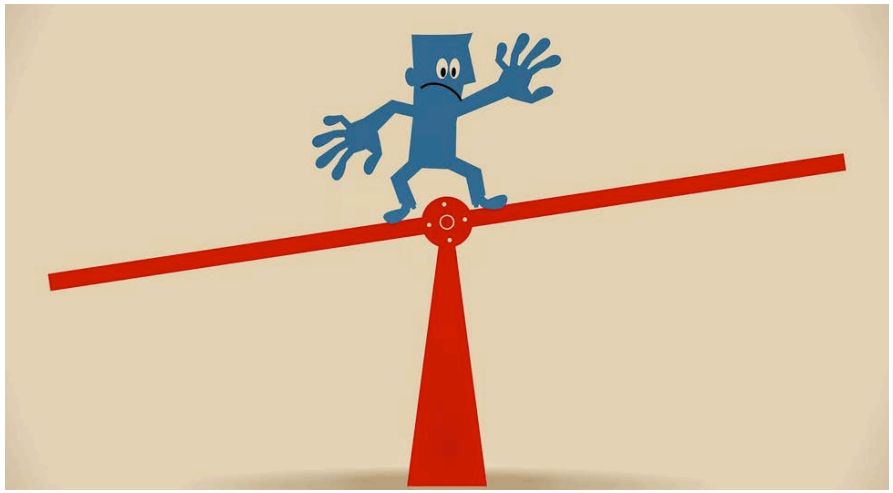
Data & Tech Notes accessed together

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

- Uncertainty data
- Data flags
- Land-sea masks
- Supporting validation data
- Pointers to data project site

Organization of ancillary data likely more heterogeneous than “best estimate” and therefore not as searchable from a higher level

Still a balancing act for the task team



Enabling data providers to make their products for accessible for climate modeling evaluation and research

Making judgments about whether or not a dataset is suitable for evaluating climate models…
Examples: LAI, FPAR?
How many SST products?

Purpose of ana4MIPs

Jerry Potter, Laura Carriere, Mike Bosilovich, Tsengdar Lee

- Provide data for CMIP evaluation that is not directly observable
- Selected variables with high potential for model evaluation
  - Including, but not limited to monthly mean:
    - Standard CMIP5/6 pressure level Temperature, winds and geopotential height
    - 2m surface temperature and specific humidity
    - Mean sea level pressure and surface winds
  - Possibly some higher frequency data

Strategic considerations

- Interest in obs4MIPs continues to grow
- Potential to diversify and accommodate more data/information

- Additional “champions” would be very helpful (e.g., establish Tech note report series with DOIs, etc.)
- Long term viability for supporting the project infrastructure needs to be monitored

Scrap

Collaborative REAnalysis Technical Environment – Intercomparison Project (CREATE-IP)

- Expanded reanalysis intercomparison
  - Up-to-date (annually if not monthly)
  - Monthly data
  - High frequency (1hr, 3hr, 6hr) for limited number of variables
  - All available levels
  - Include increments (O-A and O-F)
  - Include observations as available
  - Part of a total environment – science cloud, analytics, ontology, visualization, API
  - Interaction with reanalysis and outside user communities

Goals to be met before WDAC-5

- Advancements on all “tractable” improvements
- Define and document a process of data preparation/ESGF
- Better defining *the process* of what datasets get included and how it is catalogued

Obs4MIPs progress

- Contributions accumulating steadily
  - NASA, NOAA, ESA, EUMETSAT, DLR committing contributions
- ESGF will be used for CMIP6
- CoG environment is strengthening, expanding; e.g., will serve CMIP6, . . .
- Task team:
  - Healthy and productive interactions
  - Gradually grappling with key issues
  - Lots to do and think about!

.... and growing!