Making Reanalysis Data Available through the Earth System Grid Federation

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Reanalysis Monthly Data That is Matched by CMIP5 Contributors

CF Variable Name	CMIP Name	Units
Total Cloud Fraction	clt	%
Evaporation	evspsbl	kg m^{-2} s^{-1}
Surface Upward Latent Heat Flux	hfls	W m^{-2}
Surface Upward Sensible Heat Flux	hfss	W m^{-2}
Specific Humidity	hus	kg kg^{-1}
Surface Air Pressure	ps	Pa
Sea Level Pressure	psl	Pa
Surface Downwelling Longwave Radiation	rlds	W m^{-2}
Surface Downwelling Clear-Sky Longwave Radiation	rldscs	W m^{-2}
Surface Upwelling Longwave Radiation	rlus	W m^{-2}
TOA Outgoing Longwave Radiation	rlut	W m^{-2}
TOA Outgoing Clear-Sky Longwave Radiation	rlutcs	W m^{-2}
Surface Downwelling Shortwave Radiation	rsds	W m^{-2}
TOA Incident Shortwave Radiation	rsdt	W m^{-2}
TOA Outgoing Shortwave Radiation	rsut	W m^{-2}
TOA Outgoing Clear-Sky Shortwave Radiation	rsutcs	W m^{-2}
Air Temperature	ta	K
Near-Surface Air Temperature	tas	K
Surface Downward Eastward Wind Stress	tauu	N m^{-2}
Surface Downward Northward Wind Stress	tauv	N m^{-2}
Surface Temperature	ts	K
Eastward Wind	ua	m s^{-1}
Eastward Near-Surface Wind	uas	m s^{-1}
Northward Wind	va	m s^{-1}
Northward Near-Surface Wind	vas	m s^{-1}
omega (=dp/dt)	wap	Pa s^{-1}
Geopotential Height	zg	m

Converting Formats to Adhere to CMIP5 Standards

The Climate Model Output Rewriter (CMOR, pronounced "Seymour") comprises a set of C-based functions, with bindings to both Python and FORTRAN 90, that can be used to produce CF-compliant netCDF files that fulfill the requirements of many of the climate community's standard model experiments. These experiments are collectively referred to as Model Intercomparison Projects (MIPs) and include, for example, AMIP, CMIP, CFMIP, PMIP, APE, and IPCC scenario runs. The output resulting from CMOR is "self-describing" and facilitates analysis of results across models.

For example, MERRA data is COARDS-compliant netCDF4 with non-standard latitude and longitude designations. The data must also be standardized to provide the same file and variable name conventions used by the CMIP5 models.

NCCS Data Management System

The NASA Center for Climate Simulation (NCCS) provides computing and data services to NASA's climate research community. The Earth System Grid is a federation of climate modeling centers created to provide access to the climate model data produced for the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (AR5). NCCS currently supplies access to simulated data produced by NASA's Global Modeling and Assimilation Office (GMAO)—including the MERRA datasets—and the Goddard Institute for Space Studies (GISS).

Abstract

We propose that the available reanalysis products (CFSR, MERRA, ECMWF Interim, etc.) be formatted and organized in a similar way and distributed throughout the climate research community by means of the Earth System Grid Federation (ESGF). By using the ESGF, the various reanalysis products would be presented in the same way as the Coupled Model Intercomparison Project phase 3 (CMIP3) and the subsequent CMIP5 effort.

ESGF at NCCS

There are several benefits of making the availability of these data uniform:

- Researchers will easily be able to pick any combination of the reanalysis products available from different centers.
- The common access will allow researchers to compare reanalysis products and/or prepare ensembles of various fields.
- Although various reanalysis products have been used by the climate research community for years, providing researchers with access identical to CMIP3 and CMIP5 will invite new users that have not previously been accustomed to using reanalysis in their research.

The advantages of the NASA Center for Climate Simulation (NCCS) ESGF Data Node include:

- Use of grid technology to provide reliable and efficient access to massive datasets that are stored in geographically diverse locations, eliminating the need to transfer data to a central repository.
- Maintenance of strict data standards and high quality control to allow researchers to identify and compare datasets from multiple climate models.
- Access to server-side analysis tools such as Live Access Server and Ultrascale Visualization Climate Data Analysis Tools (UV-CDAT) to provide analysis functionality locally, thereby reducing network requirements.

New Tools for Analysis

Ultrascale Visualization Climate Data Analysis Tools (UV-CDAT)
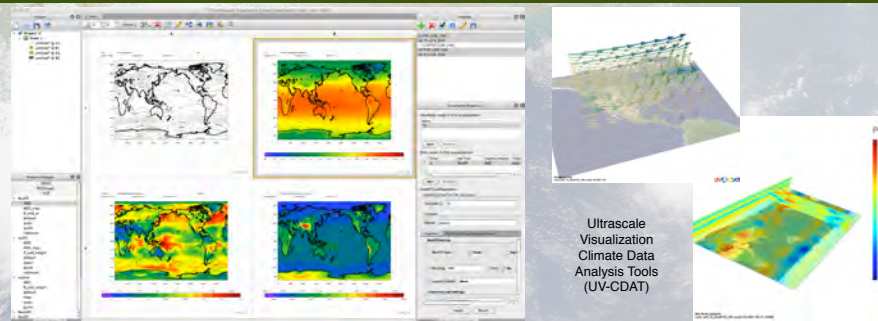
Earth System Grid Federation Concept

More than 25,000 registered users worldwide

Summary

- **Provides standard access to reanalysis data**
  Scientists engaged in research for the next IPCC and beyond will use all available reanalysis products for validation.
- **Provides common data format**
  Data will be distributed in standard CF-compliant netCDF.
- **Will enable users who previously have not used modern reanalysis products to access reanalysis data**
  ESGF will provide access to thousands of users worldwide.
- **Will allow access to server-side analysis tools**
  Use of such tools as UV-CDAT and LAS adds local functionality, reducing network requirements.

For Additional Information

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