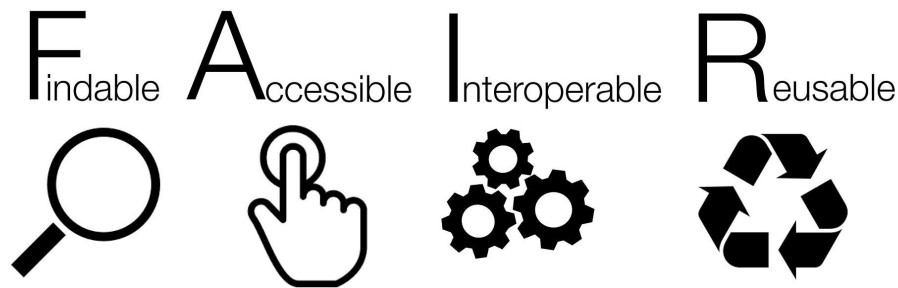


Collaborative frameworks and best practices

*Provenance and documentation, storing data underlying
figures and tables, data referencing*

*Martin Juckes, CEDA.
martin.juckes@stfc.ac.uk*

D_{iscoverable} A_{ccessible} R_e-usable K_{nowledgable}



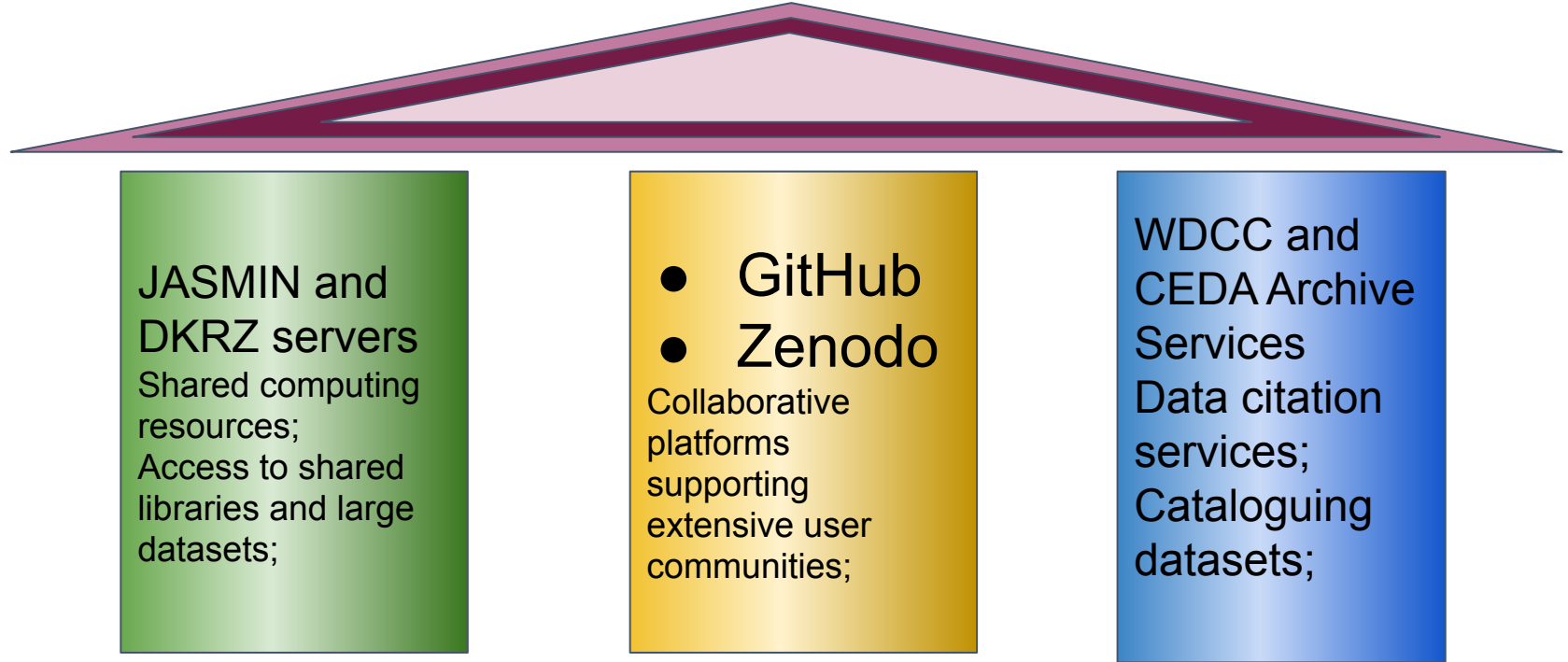
Work supported by IS-ENES3 with funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824084



FAIR data in action: Objectives

How do we get beyond the platitudes of wanting to be “FAIR”?

- Transparent and citable chain of documentation, code and data, giving accessibility for users and credit to contributors;
- Robust and efficient exchange among networks of science and IT teams;



Sponsors and Credits

BEIS fund CEDA and BMBF funds DKRZ to provide support for IPCC, under governance of TG-DATA



Department for
Business, Energy
& Industrial Strategy



Bundesministerium
für Bildung
und Forschung



europa.eu

With H2020 funding, IS-ENES supports many services for Earth System Modelling and related data services.

is-enes
INFRASTRUCTURE FOR THE EUROPEAN NETWORK
FOR EARTH SYSTEM MODELLING



Through the Working Group on Coupled Models (WGCM) and CMIP Panel, WCRP members deliver a suite of climate projections, predictions and reconstructions (CMIP6)



World Climate Research Programme

ESGF enables the efficient global dissemination of model output

ESGF
Earth System Grid Federation



Centre for Environmental
Data Analysis
SCIENCE AND TECHNOLOGY FACILITIES COUNCIL
NATURAL ENVIRONMENT RESEARCH COUNCIL



National Centre for
Atmospheric Science
NATURAL ENVIRONMENT RESEARCH COUNCIL



National Centre for
Earth Observation
NATURAL ENVIRONMENT RESEARCH COUNCIL

Github: one slide introduction

Software repositories:

- + forking and merging branches;
- + support for documentation;
- + issue tracking and task management;

Wikis;

Export to Zenodo;

Plus many more tools for collaboration.



github.com

Zenodo: one slide introduction

Built and developed by researchers,
to ensure that everyone can join in
Open Science.



zenodo.org

A catch-all repository for digital artefacts, including data,
software and other artefacts in support of publications,
also conference presentations, posters, etc;

Easy generation of DOIs; [Integration with GitHub](#); DOI
reservation

Data plotted vs. data used: an example

Example: Fig. 5.5 of FOD: Global anthropogenic CO₂ emissions.

Data plotted: 9 annual time series (with uncertainty).

Data used in the plot: national emissions inventories and model output.

The **data plotted** is not accessible to most readers if we do not save this IPCC product.

First Order Draft

Chapter 5

IPCC AR6 WGI

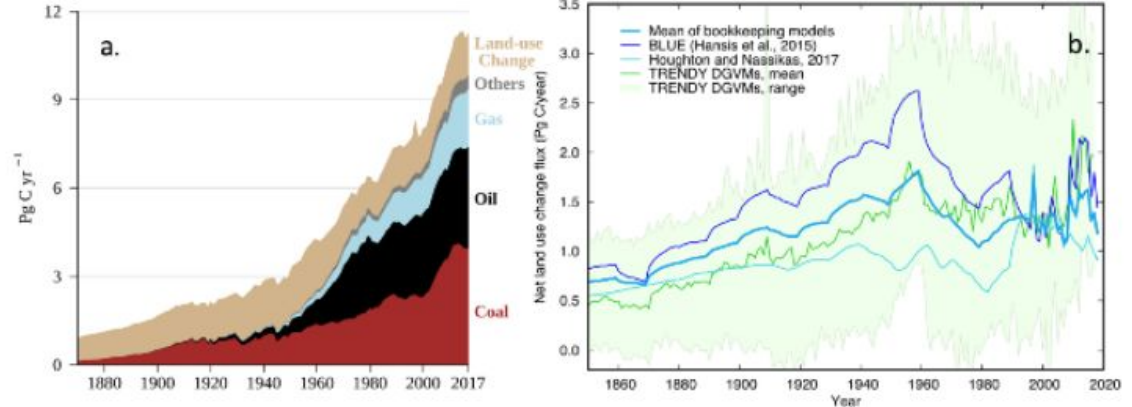


Figure 5.5: Global anthropogenic CO₂ emissions: A) Historical trends of anthropogenic CO₂ emission for the period 1870 to 2016. Data sources: (Andrew, 2018; BP, 2018; IEA, 2017; Marland et al.; Quéré et al., 2018). B) The net land use change CO₂ flux (Pg yr⁻¹) from two bookkeeping and 16 dynamic global vegetation models (Le Quéré et al., 2018a). Bookkeeping models are BLUE (Hansis et al., 2015; Houghton and Nassikas, 2017) both updated as described in (Le Quéré et al., 2018a). All estimates are unsmoothed annual data. Note that the estimates differ in process comprehensiveness of the models and in definition of flux components included in the net land use change flux.

Data and Software Citations

Enabling FAIR Data Project developed author guidelines on data and software citation in scholarly publications. The commitment is signed by publishers, repositories, organizations (www.copdess.org/enabling-fair-data-project).

Author Guidelines:

- Deposit data in a trusted repository (int. standard CoreTrustSeal): IPCC DDC
- ***Cite data in text body with a corresponding reference in the reference list***
- ***Similar instructions for software***
- Provide unrestricted access to all data and materials underlying reported findings

CMIP6 Data Citation Guidance example: <http://bit.ly/2gBCuqM>

Data Citation: Motivation

Why cite data?

- Give credit to data providers
- Improve traceability of research findings

CMIP6 Data: Three Steps for Data Citation

I. Find CMIP6 Data References

input4MIPs example:

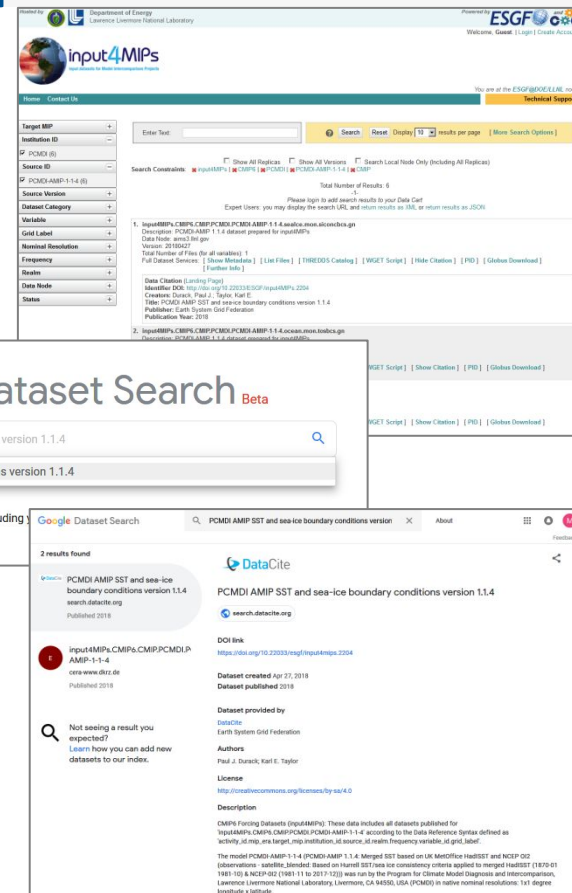
- ESGF CoG portal

<https://esgf-node.llnl.gov/search/input4mips/>

- Google Dataset Search

<https://toolbox.google.com/datasetsearch/>

- NetCDF file
- ES-DOC
- DOI landing page



The image displays three screenshots illustrating the steps to find and cite CMIP6 data:

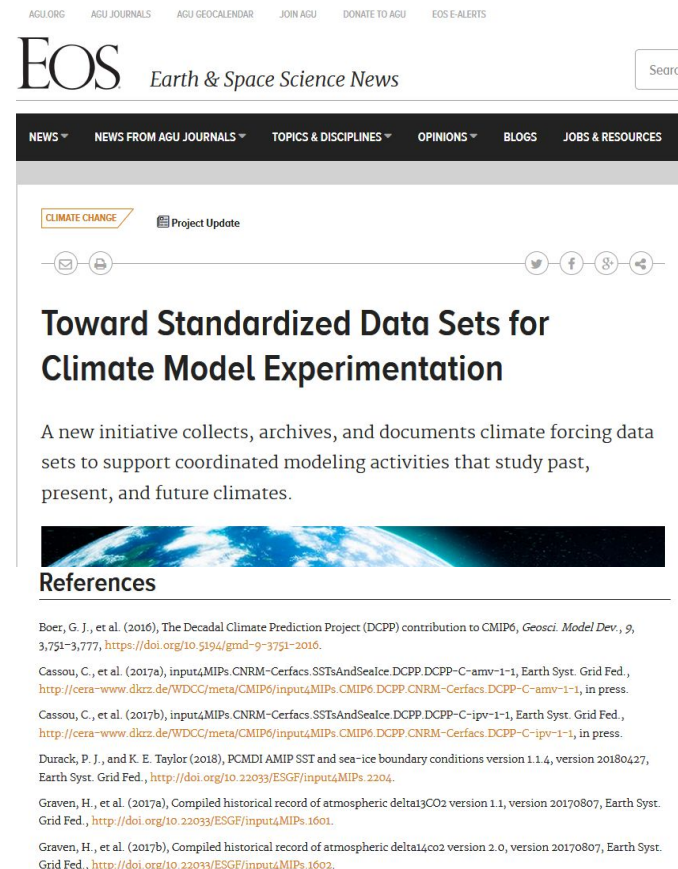
- ESGF CoG portal:** A screenshot of the ESGF CoG portal search results for 'input4MIPs'. The search criteria include 'Target MIP: PCMDI', 'Source ID: PCMDI', 'Source Version: PCMDI-1.1.4', and 'Variable: SST'. The results show two datasets: 'input4MIPs.CMIP6.CMIP.PCMDI-1.1.4.sst.nc' and 'input4MIPs.CMIP6.CMIP.PCMDI-1.1.4.sst.nc'.
- Google Dataset Search:** A screenshot of the Google Dataset Search results for 'PCMDI AMIP SST and sea-ice boundary conditions version 1.1.4'. The search results show two datasets: 'PCMDI AMIP SST and sea-ice boundary conditions version 1.1.4' and 'PCMDI AMIP SST and sea-ice boundary conditions version 1.1.4'.
- DataCite:** A screenshot of the DataCite landing page for the dataset 'PCMDI AMIP SST and sea-ice boundary conditions version 1.1.4'. The page provides the DOI link 'https://doi.org/10.22033/esgf/input4mips.2204', the dataset creation and publication dates (April 27, 2018), and the dataset provider 'Earth System Grid Federation'.

CMIP6 Data: Three Steps for Data Citation

I. Find CMIP6 Data References

II. Cite Data

Cite data in the text and include data references in reference lists of articles, e.g. <https://doi.org/10.1029/2018EO101751> (according to the recommendation of the “Enabling FAIR Data Project”)



AGU.ORG AGU JOURNALS AGU GEOCALENDAR JOIN AGU DONATE TO AGU EOS E-ALERTS

EOS Earth & Space Science News

NEWS NEWS FROM AGU JOURNALS TOPICS & DISCIPLINES OPINIONS BLOGS JOBS & RESOURCES

CLIMATE CHANGE Project Update

Toward Standardized Data Sets for Climate Model Experimentation

A new initiative collects, archives, and documents climate forcing data sets to support coordinated modeling activities that study past, present, and future climates.

References

Boer, G. J., et al. (2016), The Decadal Climate Prediction Project (DCPP) contribution to CMIP6, *Geosci. Model Dev.*, 9, 3,751–3,777, <https://doi.org/10.5194/gmd-9-3751-2016>.

Cassou, C., et al. (2017a), input4MIPs CNRM-Cerfacs SSTsAndSeaIce.DC.PP.DC.PP-C-armv-1-1, Earth Syst. Grid Fed., <http://cera-www.dkrz.de/WDCC/meta/CMIP6/input4MIPs.CMIP6.DC.PP.CNRM-Cerfacs.DC.PP-C-armv-1-1>, in press.

Cassou, C., et al. (2017b), input4MIPs CNRM-Cerfacs SSTsAndSeaIce.DC.PP.DC.PP-C-ipv-1-1, Earth Syst. Grid Fed., <http://cera-www.dkrz.de/WDCC/meta/CMIP6/input4MIPs.CMIP6.DC.PP.CNRM-Cerfacs.DC.PP-C-ipv-1-1>, in press.

Durack, P. J., and K. E. Taylor (2018), PCMDI AMIP SST and sea-ice boundary conditions version 1.1.4, version 20180427, Earth Syst. Grid Fed., <http://doi.org/10.22033/ESGF/input4MIPs.2204>.

Graven, H., et al. (2017a), Compiled historical record of atmospheric delta13CO2 version 1.1, version 20170807, Earth Syst. Grid Fed., <http://doi.org/10.22033/ESGF/input4MIPs.1601>.

Graven, H., et al. (2017b), Compiled historical record of atmospheric delta14co2 version 2.0, version 20170807, Earth Syst. Grid Fed., <http://doi.org/10.22033/ESGF/input4MIPs.1602>.

CMIP6 Data: Three Steps for Data Citation

I. Find CMIP6 Data References

II. Cite Data

III. Credit and Reuse

- Impact of CMIP6 data reaches the data providers via services of the publishers (e.g. WoS) or via Scholix and data publisher services
- Article readers can reuse the data by resolving the DataCite DOI (part of the data reference), e.g. <https://doi.org/10.22033/ESGF/input4MIPs.2204>



The screenshot shows the Data Reference page for 'input4MIPs.2204' on the ESGF website. The page includes logos for WCRP, PCMDI, British Atmospheric Data Centre, and WDC Climate. The DOI is 10.22033/ESGF/input4MIPs.2204. The 'General Information' tab is selected, showing details about the dataset, including its name, abstract, subjects, rights, and contacts. The 'Cite this data' section provides the citation text and a link to the dataset. The 'Data Access' section provides a URL to the dataset. The 'Metadata Export' section provides links to XML and JSON formats.

WCRP World Climate Research Programme

PCMDI

British Atmospheric Data Centre NATIONAL CENTRE FOR ATMOSPHERIC SCIENCE NATURAL ENVIRONMENT RESEARCH COUNCIL

WDC CLIMATE

DOI for 'input4MIPs.CMIP6.CMIP.PCMDI.PCMDI-AMIP-1-1-4'
doi:10.22033/ESGF/input4MIPs.2204

General Information **Creators**

General Information

Name input4MIPs.CMIP6.CMIP.PCMDI.PCMDI-AMIP-1-1-4
Abstract CMIP6 Forcing Datasets (input4MIPs).
These data includes all datasets published for 'input4MIPs.CMIP6.CMIP.PCMDI.PCMDI-AMIP-1-1-4' according to the Data Reference Syntax defined as 'activity_id.mip_era.target_mip.institution_id.source_id.realm.frequency.variable_id.grid_label'.
The model PCMDI-AMIP-1-1-4 (PCMDI-AMIP 1.1.4): Merged SST based on UK MetOffice HadISST and NCEP OI2 (observations - satellite, blended). Based on Hurrell SST/sea ice consistency criteria applied to merged HadISST (1870-01 to 1981-10) & NCEP-OI2 (1981-11 to 2017-12)) was run by the Program for Climate Model Diagnosis and Intercomparison, Lawrence Livermore National Laboratory, Livermore, CA 94550, USA (PCMDI) in native nominal resolutions: 1x1 degree longitude x latitude.
Project: The forcing datasets (and boundary conditions) needed for CMIP6 experiments are being prepared by a number of different experts. Initially many of these datasets may only be available from those experts, but over time as part of the 'input4MIPs' activity most of them will be archived by PCMDI and served by the Earth System Grid Federation (<https://esgf-node.lnl.gov/search/input4mips/>). More information is available in the living document: <http://pcoi.github.io/rbup31>.
Subjects input4MIPs.CMIP6.CMIP.PCMDI.PCMDI-AMIP-1-1-4
forcing data
climate
CMIP6
Rights Creative Commons Attribution 4.0 International License (CC BY-SA 4.0)
License input4MIPs forcing data for CMIP6 is evolving in the sense that altered datasets might be added as new versions. The author list and the title are not final, either. Cite this data collection including the latest dataset version according to the Data Citation Guidelines (<http://bit.ly/2@CuqH>). Individuals using the data must abide to the terms of use for CMIP6 data (<https://pcmdi.lnl.gov/CMIP6/TermsOfUse>). Details on any license restrictions are recorded as global attributes in the files.
Contacts Durack, Paul J.

Cite this data

Citation Durack, Paul J.; Taylor, Karl E. (2018). PCMDI AMIP SST and sea-ice boundary conditions version 1.1.4. Version YYYYMMDD¹. Earth System Grid Federation. <https://doi.org/10.22033/ESGF/input4MIPs.2204>

[1] Please use the latest dataset version or if not available the latest data download date as version in your data citation.

Data Access

http://esgf-data.dkrz.de/search/esgf-dkrz?mip_era=CMIP6&activity_id=input4MIPs&institution_id=PCMDI&target_mip=CMIP&source_id=PCMDI-AMIP-1-1-4
http://esgf-node.lnl.gov/search/input4mips?mip_era=CMIP6&activity_id=input4MIPs&institution_id=PCMDI&target_mip=CMIP&source_id=PCMDI-AMIP-1-1-4

Metadata Export

[XML](#) [JSON](#)

Data Provenance

Data provenance describes how the dataset (e.g. figure) was created, including information on used source data and applied analysis. The international standard is W3C PROV.



Provenance Documentation (e.g. a figure) - Best Practice:

- Add relations (references) for persistent (e.g. DOI) resources: applied software DOI, source data DOI
- Store resources without DOIs: W3C PROV record, source data...
- Brief human-readable provenance description in abstract

Proposed Framework (for discussion)

- Create a repository for each figure of family of related figures;
- After submission of SOD, create a Zenodo entry and reserve a DOI for the software (embargoed) and a catalogue entry (embargoed) for any data files created in support of the assessment; add relations to source data, software and provenance information to data file entries.
- The catalogue will provide links to underlying data sources (including links to data holdings, not just the relevant publications -- but for CMIP6, see Martina's talk);

Proposed Framework (for discussion)

- Add information for figure reproducibility to figure caption:
 - Place figure data DOIs in the report figure captions for direct access to the plotted data
 - Add citations for used data and software to captions (for multiple data citations these could be put into a separate table referenced in the figure's caption - example: FOD Fig. 5.13)
- Add data and software references in a dedicated section of the chapter's reference list

THE END