ECMWF COPERNICUS REPORT

Copernicus Climate Change Service

D381.1.1.1. Consolidation of the Atlas Monthly Dataset (v1; IPCC Interactive Atlas version) in the CDS

Issued by: CSIC

Date: 29/9/2022

Ref: C3S2_D381.1.1.1_202208_dataset-v1_v4

Official reference number service contract: 2022/C3S2_381 _CSIC/SC1

PROGRAMME OF THE EUROPEAN UNION

IMPLEMENTED BY ECMWF

Contributors

CSIC
José Manuel Gutiérrez
Antonio Cofiño
Javier Díez

Predictia
Daniel San Martín
Sergio Natal
Max Tuni

Table of Contents

1. Introduction

The IPCC Interactive Atlas (IPCC-IA, http://interactive-atlas.ipcc.ch) is an innovation of the Working Group I contribution to the Sixth Assessment Report (AR6) supporting the assessment done in the chapters, the Technical Summary (TS) and the Summary for Policy Makers (SPM)[1]. The IPCC-IA allows flexible (but limited) spatial and temporal analyses of key authoritative climate change products used in IPCC the report (such as maps, time series, annual cycle plots, or global warming level plots, including uncertainty information) for a number of key atmospheric and oceanic variables and indices[2]. These products were computed from both global (CMIP5 and CMIP6) and regional (CORDEX) projections –used as complementary lines of evidence in the AR6 report– for a range of emissions scenarios across predefined historical and future (near-, medium-, or long-term) periods and warming levels (1.5, 2, 3 and 4 °C). These products and options were carefully designed during the preparation of the IPCC report to convey relevant information along different climate dimensions for a wide range of users, from policymakers to practitioners. However, the spatial and temporal scales of analysis used in the IPCC-IA are limited to those scales assessed in the report; for instance, regional analysis is limited to the pre-defined regions used in the AR6-WGI report[3] (in particular the subcontinental IPCC reference regions). This prevents the use of the IPCC-IA for the calculation of customised regional information (e.g. at country level) that is highly demanded by users. The calculation of fully customised products is facilitated by making publicly available the intermediate dataset post-processed from the original CMIP and CORDEX data and used to calculate the IPCC-IA products. This is ongoing work as part of the IPCC activities for the adoption of FAIR (findability, accessibility, Interoperability and reproducibility) data principles in the AR6 report[4].

FAIR data principles[5] aim to facilitate open science by ensuring that the data and code are findable and accessible and can be reused for reproducibility and for further developments. The novel implementation of these principles in the AR6 report is done in collaboration with the IPCC Data Distribution Center (IPCC-DDC; http://ipcc-data.org), under the supervision of the IPCC Task Group on Data Support for Climate Change Assessments (TG-Data, https://www.ipcc.ch/data), and includes the archival and data access services for key intermediate datasets created by IPCC authors during the preparation of the AR6 report. One of these intermediate datasets is the "IPCC-IA Monthly Dataset" and consists of the curated and harmonized (common calendars, common grids and monthly temporal frequency) CMIP and CORDEX projection data underpinning the IPCC-IA, allowing for flexible customization and expansion of the products provided by the IPCC-IA.

This document presents the work done within the contract WP1 (Task C3S2_381_11: Interactive Atlas Monthly Dataset) to consolidate the "IPCC-IA Monthly Dataset" using the data developed for the IPCC-IA. This process included the definition of an appropriate data model (aligned with CMIP

[1] https://www.ipcc.ch/report/ar6/wg1
[2] https://interactive-atlas.ipcc.ch/regional-information/about
[3] https://github.com/IPCC-WG1/Atlas/tree/main/reference-regions
[4] https://doi.org/10.5281/zenodo.6504468
[5] https://www.nature.com/articles/sdata201618

and CORDEX specifications) and the generation of CF-compliant NetCDF archives with comprehensive and curated metadata (e.g. fixing problems with temporal and geospatial attributes). The document describes the main characteristics of the resulting dataset and the details required for planning its archival in the CDS (this document will be circulated to CDS representatives to coordinate data transferal and publication/documentation in the CDS). Further technical information is provided in the complementary deliverable D3.1.1 "Documentation and metadata produced for the Atlas Monthly Dataset (v1)".

This dataset will be used as the first version of the "C3S Atlas Dataset" and the work done will pave the way for archiving forthcoming datasets in the CDS (future versions building on CDS data with expanded datasets and variables/indices). Moreover, this work has contributed to support the activities of the IPCC-DDC[6] and to align IPCC and C3S products (the long-term version archived in IPCC-DDC for AR6 traceability will be the same as the one provided by the CDS). This will attract user's interest to the C3S Interactive Climate Atlas initiative which will develop expanded datasets (WP1), an Interactive Atlas with further functionalities (WP2) and also user tools to operate with the data (via the Toolbox, WP3).

2. The C3S Interactive Climate Atlas Datasets

The C3S Interactive Climate Atlas will provide access to a variety of products (developed in Task C3S2_381_11 using the software produced in Task C3S2_381_13) for a number of variables and indices from different data sources, computed using the available C3S infrastructure as illustrated in Figure 1. This involves the calculation of an intermediate dataset (the Atlas Monthly Dataset) with monthly aggregated values of the variables/indices curated and harmonized spatially (regular grids) and temporally (e.g. leap years, different calendars). This involves index calculation and/or bias adjustment (when needed) and curation and harmonization (in all cases). This activity will produce three versions of the intermediate dataset that will be stored and make accessible from the CDS and the Toolbox. The first version of this dataset (discussed in this report) will be the one used to produce the IPCC Interactive Atlas Monthly Dataset, so afterwards C3S will be an evolution from the frozen IPCC Interactive Atlas.

The development of the web application (frontend and backend) will require precomputing some products (temporal aggregations, spatial aggregations, auxiliary values for uncertainty, global warming levels, etc.) from this intermediate monthly dataset, so it is a fundamental part for the development of the C3S Interactive Climate Atlas, providing transparency and allowing for reproducibility and reusability.

[6] CSIC is one of the four partners providing in-kind support to the IPCC-DDC, and is responsible for the curation, standardization and long-term archiving of IPCC-IA relevant datasets.

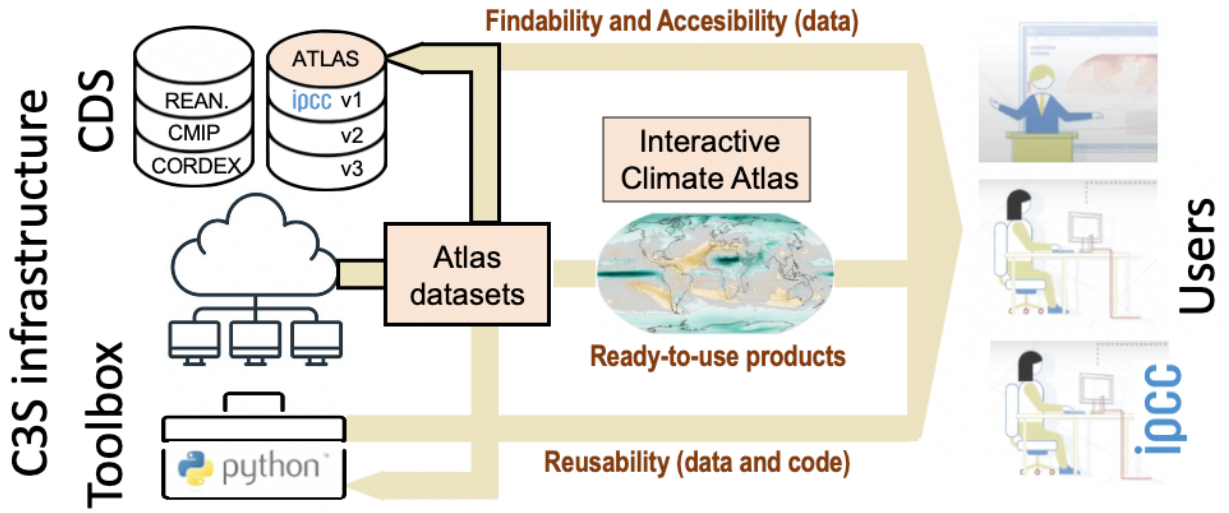

Figure 1. Schematic illustration of the C3S components involved in the development of the C3S Interactive Climate Atlas (left) and the key activities using these components (yellow arrows), including the preparation of the Atlas data and its storage in the CDS (indicated by the yellow arrow with black border).

3. Description of the Atlas Monthly Dataset version 1 (v1)

The first version of the Atlas Monthly Dataset (v1) corresponds to the dataset used in the preparation of the IPCC WGI Interactive Atlas and is listed as one of the key intermediate IPCC WGI products in the IPCC Data Distribution Center[7]. This will be extended in future C3S versions with new variables/indices and updated datasets from the CDS. The inclusion of this dataset in the CDS is twofold. On the one hand, this first version will serve to establish a connection with the IPCC Interactive Atlas and will allow CDS users to compare future C3S versions with the original IPCC frozen version, keeping track of differences and changes; this will also promote the role of the C3S as a contributor to IPCC activities, facilitating the access to key IPCC datasets. On the other hand, this dataset is highly demanded by users/practitioners who want to develop customized products not available in the IPCC Interactive Atlas (e.g. regional information at subnational or national scales); note that this dataset is not available for download from the IPCC Interactive Atlas and, therefore, the CDS could facilitate this task to C3S users, providing easy access to data (via the CDS) and virtual resources (via the Toolbox) for product customization.

This initial version cannot be reproduced with a CDS workflow, because some of the data sources used in the IPCC report are different from those currently stored in the CDS (different versions for some datasets) and some of the tools (like regridding and bias correction) are not available. Future versions of the dataset will be produced with a CDS workflow in Task C3S2_381_13.

The main characteristics of this initial version (v1) of the dataset are described in the following sections.

[7] https://www.ipcc-data.org/ar6landing.html

3.1 Variables and Indices

Table 1 shows the variables (in bold) and derived indices included in the dataset as well as their description. Atmospheric and oceanic variables are shown in black and blue, respectively. Note that for two illustrative threshold-dependent indices (TX35 and TX40), the dataset includes results obtained using both the raw and the bias adjusted values (using the ISIMIP3 trend-preserving bias adjustment method; see Section Atlas.1.4.5[8]). Note that all variables and indices are aggregated at monthly or annual temporal resolution.

The indices included in this dataset are generic indices for extremes (used in Chapter 11[9]; see Annex VI[10]) and climatic impact-drivers (used in Chapter 12[11]; see Annex VI), selected to support the assessment made in these chapters.

#	Code	IPCC-IA Label	Description
1	**t**	**Monthly mean of daily mean temperature**	**Monthly mean of daily mean near-surface (2 meters) air temperature**
2	**tn**	**Monthly mean of daily minimum temperature**	**Monthly mean of daily minimum near-surface (2 meters) air temperature**
3	**tx**	**Monthly mean of daily maximum temperature**	**Monthly mean of daily maximum near-surface (2 meters) air temperature**
4	tnn	Monthly minimum of daily minimum temperature	Monthly minimum of daily minimum near-surface (2 meters) air temperature
5	txx	Monthly maximum of daily maximum temperature	Monthly maximum of daily maximum near-surface (2 meters) air temperature
6	tx35	Monthly count of days with maximum temperature above 35 °C	Monthly count of days with maximum near-surface (2 meters) temperature above 35 °C
7	tx35ba	Bias adjusted monthly count of days with maximum temperature above 35 °C	Bias adjusted (ISIMIP3 trend preserving method) monthly count of days with maximum near-surface (2 meters) temperature above 35 °C
8	tx40	Monthly count of days with maximum temperature above 40 °C	Monthly count of days with maximum near-surface (2 meters) temperature above 40 °C
9	tx40ba	Bias adjusted monthly count of days with maximum temperature above 40 °C	Bias adjusted (ISIMIP3 trend preserving method) monthly count of days with maximum near-surface temperature above 40 °C
10	fd	Monthly count of frost days	Monthly count of days with minimum near-surface (2 meters) temperature below 0 °C
11	hd	Heating degree-days	Annual energy consumption to heat the deficit of temperature below 15.5 °C
12	cd	Cooling degree-days	Annual energy consumption to cool the excess of temperature above 22 °C

[8] https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Atlas.pdf
[9] https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter11.pdf
[10] https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_AnnexVI.pdf
[11] https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter12.pdf

13	**pr**	**Monthly mean of daily accumulated precipitation**	**Monthly mean of daily accumulated precipitation of liquid water equivalent from all phases**
14	**prsn**	**Monthly mean of daily accumulated snowfall precipitation**	**Monthly mean of daily accumulated liquid water equivalent thickness snowfall**
15	rx1day	Monthly maximum of 1-day accumulated precipitation	Monthly maximum of 1-day accumulated precipitation of liquid water equivalent from all phases
16	rx5day	Monthly maximum of 5-day accumulated precipitation	Monthly maximum of 5-day accumulated precipitation of liquid water equivalent from all phases
17	cdd	Annual consecutive dry days	Annual maximum of consecutive days when daily accumulated precipitation amount is below 1 mm
18	spi6	Standardized precipitation index for 6 months cumulation period	Monthly index that compares accumulated precipitation for 6 months with the long-term precipitation distribution for the same location and accumulation period
19	**sfcwind**	**Monthly mean of daily mean wind speed**	**Monthly mean of daily mean near-surface (10 meters) wind speed**
20	**sst**	**Monthly mean of sea surface temperature**	**Monthly mean temperature of sea water near the surface**
21	**ph**	**Monthly mean of acidity (pH) of seawater**	**Monthly mean of negative log of hydrogen ion concentration with the concentration expressed as mol H kg-1**
22	**siconc**	**Monthly mean of sea-ice area percentage**	**Monthly mean percentage of sea grid cell area covered by ice**

Table 1. Description of the variables (in bold) and indices for the Atlas Monthly Dataset. The oceanic variables are shown in blue.

3.2 Experiments and GCM/RCM simulations

The dataset contains simulations from three experiments: **CMIP6** (global, with 1° horizontal resolution), **CMIP5** (global, with 2° horizontal resolution), and CORDEX (regional, with 0.5° horizontal resolution, with the exception of Europe, with 0.25° horizontal resolution). Note that all models from the same experiment are regridded to the common grids with predefined resolution. CORDEX includes different regional domains which are indicated in the dataset as different experiments (CORDEX-AFR, or just AFR, etc.) as follows:

CORDEX Africa (**AFR**)
CORDEX Antarctica (**ANT**)
CORDEX Arctic (**ARC**)
CORDEX Australasia (**AUS**)
CORDEX Central America (**CAM**)
CORDEX East Asia (**EAS**)
CORDEX Europe (**EUR**)
CORDEX North America (**NAM**)
CORDEX South America (**SAM**)

CORDEX South Asia (**WAS**)
CORDEX South East Asia (**SEA**)

Table A1.1 (in Annex 1 "Simulations") provides information about the simulations or members provided by the dataset for the different domains (last column).

3.3 Scenarios and time periods

Model simulations are available for recent-past (historical scenario) and future periods (RCP2.6, RCP4.5 and RCP8.5 scenarios for CMIP5 and CORDEX, and SSP1-2.6, SSP 2-4.5, SSP 3-7.0 and SSP 5-8.5 for CMIP6) with monthly temporal frequency. The historical scenario provides data for a pre-industrial period (1850-1900 for CMIP5 and CMIP6) and a modern period (1970-2005 / 1950-2005 / 1950-2014 for CORDEX / CMIP5 / CMIP6, according to data availability). The future scenarios provide data for 2006-2100 / 2015-2100 for CORDEX and CMIP5 / CMIP6.

3.4 File format and archiving

Files have been generated using netcdf-c verion 4.4.1.1 and hdf5 version 1.8.18 libraries using NETCDF4 data model. The resulting files are NetCFD format and metadata is CF1.9[12] compliant allowing for string type NetCDF variables (used to define some attributes in the files, such as members). The attribute convention for data discovery is ACDD-1.3[13] compliant (including reference, geospatial, etc.).

Data is stored in different files for different experiments, scenarios and variables/indices (using the naming convention *experiment_ scenario_index.nc*), including all members (see Table A1.1) in the same file using the member attribute and the full time periods described in Section 2.3; this was done to facilitate long-term data archival in the IPCC-DDC and the resulting dataset contains 806 files with a total volume of 400 GB (high compression rate is used), with file sizes ranging from 5GB to 600 KB. The archiving convention can be adapted to facilitate CDS archiving, adopting other convention and/or splitting the files for different members and/or years.

Data transfer can be done though either push or pull approaches at the CDS convenience. This will be agreed in the next coordination meeting with CDS representatives, scheduled for 12 September, during the C3S General Assembly.

3.5 License

4. Conclusions

[12] https://cfconventions.org/Data/cf-conventions/cf-conventions-1.9/cf-conventions.html
[13] https://wiki.esipfed.org/Attribute_Convention_for_Data_Discovery_1-3

The IPCC Interactive Atlas (IPCC-IA, http://interactive-atlas.ipcc.ch) allows flexible (but limited) analysis of authoritative climate change products from global and regional climate projections. For instance, it allows to obtain regional climate change information only for the pre-defined regions used in the AR6-WGI report (in particular the subcontinental IPCC reference regions), preventing the calculation of customized regional information (e.g. at a country level), which is highly demanded by users. The "IPCC-IA Monthly Dataset" consists of the curated and harmonized (common calendars, common grids and monthly temporal frequency) CMIP and CORDEX projection data underpinning the IPCC-IA and facilitating the expansion of the results producing customized products.

The C3S Interactive Climate Atlas will develop an evolution of the IPCC-IA, building on C3S datasets to expand the Atlas Dataset (new datasets, variables and indices) and the functionalities of the IPCC-IA, including also user tools for data processing on the resulting datasets.

This document presents the work done within WP1 (Task C3S2_381_11: Interactive Atlas Monthly Dataset) to consolidate the "IPCC-IA Monthly Dataset", which will be the first version of the C3S Climate Atlas dataset after publication in the CDS. This process included the definition of an appropriate data model and the generation of standard archives with comprehensive curated metadata. The document describes the main characteristics of the resulting dataset and the details required for planning its archival in the CDS. This document will be circulated to CDS representatives to coordinate data transferal and documentation for publication in the CDS. Further technical information is provided in the complementary deliverable D3.1.1 "Documentation and metadata produced for the Atlas Monthly Dataset (v1)".

5. Annex 1. Simulations for different experiments / domains

#	MEMBER LABEL	GCM	RCM	EXPERIMENTS
0	AS-RCEC_TaiESM1_r1i1p1f1	TaiESM1		[CMIP6]
1	AWI_AWI-CM-1-1-MR_r1i1p1f1	AWI-CM-1-1-MR		[CMIP6]
2	BCC_BCC-CSM2-MR_r1i1p1f1	BCC-CSM2-MR		[CMIP6]
3	BCC_bcc-csm1-1-m_r1i1p1	bcc-csm1-1-m		[CMIP5]
4	BCC_bcc-csm1-1_r1i1p1	bcc-csm1-1		[CMIP5]
5	BNU_BNU-ESM_r1i1p1	BNU-ESM		[CMIP5]
6	CAMS_CAMS-CSM1-0_r2i1p1f1	CAMS-CSM1-0		[CMIP6]
7	CAS_FGOALS-g3_r1i1p1f1	FGOALS-g3		[CMIP6]
8	CCCR-IITM_IITM-ESM_r1i1p1f1	IITM-ESM		[CMIP6]
9	CCCma_CanESM2_r1i1p1	CanESM2		[CMIP5]
10	CCCma_CanESM5_r1i1p1f1	CanESM5		[CMIP6]
11	CMCC_CMCC-CM2-SR5_r1i1p1f1	CMCC-CM2-SR5		[CMIP6]
12	CMCC_CMCC-CMS_r1i1p1	CMCC-CMS		[CMIP5]
13	CMCC_CMCC-CM_r1i1p1	CMCC-CM		[CMIP5]
14	CNRM-CERFACS_CNRM-CM5_r1i1p1	CNRM-CM5		[CMIP5]
15	CNRM-CERFACS_CNRM-CM6-1-HR_r1i1p1f2	CNRM-CM6-1-HR		[CMIP6]
16	CNRM-CERFACS_CNRM-CM6-1_r1i1p1f2	CNRM-CM6-1		[CMIP6]
17	CNRM-CERFACS_CNRM-ESM2-1_r1i1p1f2	CNRM-ESM2-1		[CMIP6]

18	CSIRO-ARCCSS_ACCESS-CM2_r1i1p1f1	ACCESS-CM2		[CMIP6]
19	CSIRO-BOM_ACCESS1-0_r1i1p1	ACCESS1-0		[CMIP5]
20	CSIRO-BOM_ACCESS1-3_r1i1p1	ACCESS1-3		[CMIP5]
21	CSIRO-QCCCE_CSIRO-Mk3-6-0_r1i1p1	CSIRO-Mk3-6-0		[CMIP5]
22	CSIRO_ACCESS-ESM1-5_r1i1p1f1	ACCESS-ESM1-5		[CMIP6]
23	EC-Earth-Consortium_EC-Earth3-Veg-LR_r1i1p1f1	EC-Earth3-Veg-LR		[CMIP6]
24	EC-Earth-Consortium_EC-Earth3-Veg_r1i1p1f1	EC-Earth3-Veg		[CMIP6]
25	EC-Earth-Consortium_EC-Earth3_r1i1p1f1	EC-Earth3		[CMIP6]
26	ICHEC_EC-EARTH_r12i1p1	EC-EARTH		[CMIP5]
27	INM_INM-CM4-8_r1i1p1f1	INM-CM4-8		[CMIP6]
28	INM_INM-CM5-0_r1i1p1f1	INM-CM5-0		[CMIP6]
29	INM_inmcm4_r1i1p1	inmcm4		[CMIP5]
30	IPSL_IPSL-CM5A-LR_r1i1p1	IPSL-CM5A-LR		[CMIP5]
31	IPSL_IPSL-CM5A-MR_r1i1p1	IPSL-CM5A-MR		[CMIP5]
32	IPSL_IPSL-CM5B-LR_r1i1p1	IPSL-CM5B-LR		[CMIP5]
33	IPSL_IPSL-CM6A-LR_r1i1p1f1	IPSL-CM6A-LR		[CMIP6]
34	KIOST_KIOST-ESM_r1i1p1f1	KIOST-ESM		[CMIP6]
35	MIROC_MIROC-ES2L_r1i1p1f2	MIROC-ES2L		[CMIP6]
36	MIROC_MIROC-ESM-CHEM_r1i1p1	MIROC-ESM-CHEM		[CMIP5]
37	MIROC_MIROC-ESM_r1i1p1	MIROC-ESM		[CMIP5]
38	MIROC_MIROC5_r1i1p1	MIROC5		[CMIP5]
39	MIROC_MIROC6_r1i1p1f1	MIROC6		[CMIP6]

40	MOHC_HadGEM2-CC_r1i1p1	HadGEM2-CC		[CMIP5]
41	MOHC_HadGEM2-ES_r1i1p1	HadGEM2-ES		[CMIP5]
42	MOHC_HadGEM3-GC31-LL_r1i1p1f3	HadGEM3-GC31-LL		[CMIP6]
43	MOHC_UKESM1-0-LL_r1i1p1f2	UKESM1-0-LL		[CMIP6]
44	MPI-M_MPI-ESM-LR_r1i1p1	MPI-ESM-LR		[CMIP5]
45	MPI-M_MPI-ESM-MR_r1i1p1	MPI-ESM-MR		[CMIP5]
46	MPI-M_MPI-ESM1-2-HR_r1i1p1f1	MPI-ESM1-2-HR		[CMIP6]
47	MPI-M_MPI-ESM1-2-LR_r1i1p1f1	MPI-ESM1-2-LR		[CMIP6]
48	MRI_MRI-CGCM3_r1i1p1	MRI-CGCM3		[CMIP5]
49	MRI_MRI-ESM2-0_r1i1p1f1	MRI-ESM2-0		[CMIP6]
50	NCAR_CCSM4_r1i1p1	CCSM4		[CMIP5]
51	NCAR_CESM2-WACCM_r1i1p1f1	CESM2-WACCM		[CMIP6]
52	NCAR_CESM2_r4i1p1f1	CESM2		[CMIP6]
53	NCC_NorESM1-M_r1i1p1	NorESM1-M		[CMIP5]
54	NCC_NorESM2-LM_r1i1p1f1	NorESM2-LM		[CMIP6]
55	NCC_NorESM2-MM_r1i1p1f1	NorESM2-MM		[CMIP6]
56	NIMS-KMA_KACE-1-0-G_r2i1p1f1	KACE-1-0-G		[CMIP6]
57	NOAA-GFDL_GFDL-CM3_r1i1p1	GFDL-CM3		[CMIP5]
58	NOAA-GFDL_GFDL-CM4_r1i1p1f1	GFDL-CM4		[CMIP6]
59	NOAA-GFDL_GFDL-ESM2G_r1i1p1	GFDL-ESM2G		[CMIP5]
60	NOAA-GFDL_GFDL-ESM2M_r1i1p1	GFDL-ESM2M		[CMIP5]
61	NOAA-GFDL_GFDL-ESM4_r1i1p1f1	GFDL-ESM4		[CMIP6]

62	NSF-DOE-NCAR_CESM1-BGC_r1i1p1	CESM1-BGC		[CMIP5]
63	NUIST_NESM3_r1i1p1f1	NESM3		[CMIP6]
64	CCCma_CanESM2_r1i1p1_CCCma_CanRCM4_r2	CanESM2	CanRCM4	[NAM, ARC, AFR]
65	CCCma_CanESM2_r1i1p1_CSIRO_CCAM-2008_v1	CanESM2	CCAM-2008	[AUS]
66	CCCma_CanESM2_r1i1p1_IITM_RegCM4-4_v5	CanESM2	RegCM4-4	[WAS]
67	CCCma_CanESM2_r1i1p1_OURANOS_CRCM5_v1	CanESM2	CRCM5	[NAM, CAM]
68	CCCma_CanESM2_r1i1p1_SMHI_RCA4_v1	CanESM2	RCA4	[NAM, ARC, AFR, CAM]
69	CCCma_CanESM2_r1i1p1_SMHI_RCA4_v2	CanESM2	RCA4	[WAS]
70	CCCma_CanESM2_r1i1p1_SMHI_RCA4_v3	CanESM2	RCA4	[SAM]
71	CCCma_CanESM2_r1i1p1_UCAN_WRF341I_v2	CanESM2	WRF341I	[SAM]
72	CCCma_CanESM2_r1i1p1_UNSW_WRF360J_v1	CanESM2	WRF360J	[AUS]
73	CCCma_CanESM2_r1i1p1_UNSW_WRF360K_v1	CanESM2	WRF360K	[AUS]
74	CCCma_CanESM2_r1i1p1_UQAM_CRCM5_v1	CanESM2	CRCM5	[NAM, ARC, AFR]
75	CNRM-CERFACS_CNRM-CM5_r1i1p1_CLMcom_CCLM4-8-17_v1	CNRM-CM5	CCLM4-8-17	[EUR, AFR]
76	CNRM-CERFACS_CNRM-CM5_r1i1p1_CLMcom_CCLM5-0-2_v1	CNRM-CM5	CCLM5-0-2	[EAS]
77	CNRM-CERFACS_CNRM-CM5_r1i1p1_CNRM_ALADIN63_v2	CNRM-CM5	ALADIN63	[EUR]
78	CNRM-CERFACS_CNRM-CM5_r1i1p1_DMI_HIRHAM5_v2	CNRM-CM5	HIRHAM5	[EUR]
79	CNRM-CERFACS_CNRM-CM5_r1i1p1_GERICS_REMO2015_v2	CNRM-CM5	REMO2015	[EUR]
80	CNRM-CERFACS_CNRM-CM5_r1i1p1_IITM_RegCM4-4_v5	CNRM-CM5	RegCM4-4	[WAS]
81	CNRM-CERFACS_CNRM-CM5_r1i1p1_IPSL_WRF381P_v2	CNRM-CM5	WRF381P	[EUR]
82	CNRM-CERFACS_CNRM-CM5_r1i1p1_KNMI_RACMO22E_v2	CNRM-CM5	RACMO22E	[EUR]
83	CNRM-CERFACS_CNRM-CM5_r1i1p1_OURANOS_CRCM5_v1	CNRM-CM5	CRCM5	[NAM, CAM]

84	CNRM-CERFACS_CNRM-CM5_r1i1p1_RMIB-UGent_UGent-ALARO-0_v1	CNRM-CM5	UGent-ALARO-0	[EUR]
85	CNRM-CERFACS_CNRM-CM5_r1i1p1_SMHI_RCA4_v1	CNRM-CM5	RCA4	[EUR, AFR, CAM]
86	CNRM-CERFACS_CNRM-CM5_r1i1p1_SMHI_RCA4_v2	CNRM-CM5	RCA4	[WAS]
87	CSIRO-BOM_ACCESS1-0_r1i1p1_CSIRO_CCAM-2008_v1	ACCESS1-0	CCAM-2008	[AUS]
88	CSIRO-BOM_ACCESS1-0_r1i1p1_UNSW_WRF360J_v1	ACCESS1-0	WRF360J	[AUS]
89	CSIRO-BOM_ACCESS1-0_r1i1p1_UNSW_WRF360K_v1	ACCESS1-0	WRF360K	[AUS]
90	CSIRO-BOM_ACCESS1-3_r1i1p1_ULg_MAR311_v1	ACCESS1-3	MAR311	[ANT]
91	CSIRO-BOM_ACCESS1-3_r1i1p1_UNSW_WRF360J_v1	ACCESS1-3	WRF360J	[AUS]
92	CSIRO-BOM_ACCESS1-3_r1i1p1_UNSW_WRF360K_v1	ACCESS1-3	WRF360K	[AUS]
93	CSIRO-QCCCE_CSIRO-Mk3-6-0_r1i1p1_IITM_RegCM4-4_v5	CSIRO-Mk3-6-0	RegCM4-4	[WAS]
94	CSIRO-QCCCE_CSIRO-Mk3-6-0_r1i1p1_SMHI_RCA4_v1	CSIRO-Mk3-6-0	RCA4	[AFR, CAM]
95	CSIRO-QCCCE_CSIRO-Mk3-6-0_r1i1p1_SMHI_RCA4_v2	CSIRO-Mk3-6-0	RCA4	[WAS]
96	CSIRO-QCCCE_CSIRO-Mk3-6-0_r1i1p1_SMHI_RCA4_v3	CSIRO-Mk3-6-0	RCA4	[SAM]
97	ICHEC_EC-EARTH_r12i1p1_CLMcom_CCLM4-8-17-CLM3-5_v1	EC-EARTH	CCLM4-8-17-CLM3-5	[AUS]
98	ICHEC_EC-EARTH_r12i1p1_CLMcom_CCLM4-8-17_v1	EC-EARTH	CCLM4-8-17	[EUR, AFR]
99	ICHEC_EC-EARTH_r12i1p1_CLMcom_CCLM5-0-2_v1	EC-EARTH	CCLM5-0-2	[EAS]
100	ICHEC_EC-EARTH_r12i1p1_CLMcom_ETH-COSMO-crCLIM-v1-1_v1	EC-EARTH	ETH-COSMO-crCLIM-v1-1	[EUR, WAS]
101	ICHEC_EC-EARTH_r12i1p1_DMI_HIRHAM5_v1	EC-EARTH	HIRHAM5	[EUR]
102	ICHEC_EC-EARTH_r12i1p1_ICTP_RegCM4-6_v1	EC-EARTH	RegCM4-6	[EUR]
103	ICHEC_EC-EARTH_r12i1p1_IPSL_WRF381P_v1	EC-EARTH	WRF381P	[EUR]
104	ICHEC_EC-EARTH_r12i1p1_KNMI_RACMO21P_v1	EC-EARTH	RACMO21P	[ANT]

105	ICHEC_EC-EARTH_r12i1p1_KNMI_RACMO22E_v1	EC-EARTH	RACMO22E	[EUR]
106	ICHEC_EC-EARTH_r12i1p1_KNMI_RACMO22T_v1	EC-EARTH	RACMO22T	[AFR]
107	ICHEC_EC-EARTH_r12i1p1_MOHC_HadREM3-GA7-05_v1	EC-EARTH	HadREM3-GA7-05	[EUR]
108	ICHEC_EC-EARTH_r12i1p1_MPI-CSC_REMO2009_v1	EC-EARTH	REMO2009	[AFR]
109	ICHEC_EC-EARTH_r12i1p1_SMHI_RCA4-SN_v1	EC-EARTH	RCA4-SN	[ARC]
110	ICHEC_EC-EARTH_r12i1p1_SMHI_RCA4_v1	EC-EARTH	RCA4	[NAM, ARC, EUR, AFR, CAM]
111	ICHEC_EC-EARTH_r12i1p1_SMHI_RCA4_v2	EC-EARTH	RCA4	[WAS]
112	ICHEC_EC-EARTH_r12i1p1_SMHI_RCA4_v3	EC-EARTH	RCA4	[SAM]
113	ICHEC_EC-EARTH_r1i1p1_KNMI_RACMO21P_v1	EC-EARTH	RACMO21P	[ANT]
114	ICHEC_EC-EARTH_r1i1p1_RU-CORE_RegCM4-3_v4	EC-EARTH	RegCM4-3	[SEA]
115	ICHEC_EC-EARTH_r3i1p1_DMI_HIRHAM5_v1	EC-EARTH	HIRHAM5	[EAS, NAM, ARC, ANT]
116	ICHEC_EC-EARTH_r3i1p1_DMI_HIRHAM5_v2	EC-EARTH	HIRHAM5	[EUR, AFR]
117	IPSL_IPSL-CM5A-LR_r1i1p1_GERICS_REMO2009_v1	IPSL-CM5A-LR	REMO2009	[AFR]
118	IPSL_IPSL-CM5A-LR_r1i1p1_IITM_RegCM4-4_v5	IPSL-CM5A-LR	RegCM4-4	[WAS]
119	IPSL_IPSL-CM5A-LR_r1i1p1_RU-CORE_RegCM4-3_v4	IPSL-CM5A-LR	RegCM4-3	[SEA]
120	IPSL_IPSL-CM5A-MR_r1i1p1_DMI_HIRHAM5_v1	IPSL-CM5A-MR	HIRHAM5	[EUR]
121	IPSL_IPSL-CM5A-MR_r1i1p1_GERICS_REMO2015_v1	IPSL-CM5A-MR	REMO2015	[EUR]
122	IPSL_IPSL-CM5A-MR_r1i1p1_IPSL_WRF381P_v1	IPSL-CM5A-MR	WRF381P	[EUR]
123	IPSL_IPSL-CM5A-MR_r1i1p1_KNMI_RACMO22E_v1	IPSL-CM5A-MR	RACMO22E	[EUR]
124	IPSL_IPSL-CM5A-MR_r1i1p1_SMHI_RCA4_v1	IPSL-CM5A-MR	RCA4	[EUR, AFR, CAM]
125	IPSL_IPSL-CM5A-MR_r1i1p1_SMHI_RCA4_v2	IPSL-CM5A-MR	RCA4	[WAS]
126	IPSL_IPSL-CM5A-MR_r1i1p1_SMHI_RCA4_v3	IPSL-CM5A-MR	RCA4	[SAM]

127	MIROC_MIROC5_r1i1p1_CSIRO_CCAM-2008_v1	MIROC5	CCAM-2008	[AUS]
128	MIROC_MIROC5_r1i1p1_GERICS_REMO2009_v1	MIROC5	REMO2009	[AFR]
129	MIROC_MIROC5_r1i1p1_ORNL_RegCM4-7_v0	MIROC5	RegCM4-7	[WAS]
130	MIROC_MIROC5_r1i1p1_SMHI_RCA4_v1	MIROC5	RCA4	[AFR, CAM]
131	MIROC_MIROC5_r1i1p1_SMHI_RCA4_v2	MIROC5	RCA4	[WAS]
132	MIROC_MIROC5_r1i1p1_SMHI_RCA4_v3	MIROC5	RCA4	[SAM]
133	MOHC_HadGEM2-ES_r1i1p1_CLMcom_CCLM4-8-17_v1	HadGEM2-ES	CCLM4-8-17	[EUR, AFR]
134	MOHC_HadGEM2-ES_r1i1p1_CLMcom_CCLM5-0-2_v1	HadGEM2-ES	CCLM5-0-2	[EAS]
135	MOHC_HadGEM2-ES_r1i1p1_CLMcom_ETH-COSMO-crCLIM-v1-1_v1	HadGEM2-ES	ETH-COSMO-crCLIM-v1-1	[EUR]
136	MOHC_HadGEM2-ES_r1i1p1_CLMcom_HZG-CCLM5-0-15_v1	HadGEM2-ES	HZG-CCLM5-0-15	[AUS]
137	MOHC_HadGEM2-ES_r1i1p1_CLMcom_KIT-CCLM5-0-15_v1	HadGEM2-ES	KIT-CCLM5-0-15	[AFR]
138	MOHC_HadGEM2-ES_r1i1p1_CNRM_ALADIN63_v1	HadGEM2-ES	ALADIN63	[EUR]
139	MOHC_HadGEM2-ES_r1i1p1_DMI_HIRHAM5_v2	HadGEM2-ES	HIRHAM5	[EUR]
140	MOHC_HadGEM2-ES_r1i1p1_GERICS_REMO2009_v1	HadGEM2-ES	REMO2009	[AFR]
141	MOHC_HadGEM2-ES_r1i1p1_GERICS_REMO2015_v1	HadGEM2-ES	REMO2015	[EAS, AUS, SEA, NAM, SAM, AFR, CAM, WAS]
142	MOHC_HadGEM2-ES_r1i1p1_ICTP_RegCM4-3_v4	HadGEM2-ES	RegCM4-3	[SAM, CAM]
143	MOHC_HadGEM2-ES_r1i1p1_ICTP_RegCM4-4_v0	HadGEM2-ES	RegCM4-4	[EAS]
144	MOHC_HadGEM2-ES_r1i1p1_ICTP_RegCM4-6_v1	HadGEM2-ES	RegCM4-6	[EUR]
145	MOHC_HadGEM2-ES_r1i1p1_ICTP_RegCM4-7_v0	HadGEM2-ES	RegCM4-7	[AUS, SEA, SAM, AFR, CAM]
146	MOHC_HadGEM2-ES_r1i1p1_IPSL_WRF381P_v1	HadGEM2-ES	WRF381P	[EUR]
147	MOHC_HadGEM2-ES_r1i1p1_ISU_RegCM4_v4-4-rc8	HadGEM2-ES	RegCM4	[NAM]

148	MOHC_HadGEM2-ES_r1i1p1_KNMI_RACMO21P_v2	HadGEM2-ES	RACMO21P	[ANT]
149	MOHC_HadGEM2-ES_r1i1p1_KNMI_RACMO22E_v2	HadGEM2-ES	RACMO22E	[EUR]
150	MOHC_HadGEM2-ES_r1i1p1_KNMI_RACMO22T_v2	HadGEM2-ES	RACMO22T	[AFR]
151	MOHC_HadGEM2-ES_r1i1p1_MOHC_HadREM3-GA7-05_v1	HadGEM2-ES	HadREM3-GA7-05	[EUR]
152	MOHC_HadGEM2-ES_r1i1p1_NCAR_WRF_v3-5-1	HadGEM2-ES	WRF	[NAM]
153	MOHC_HadGEM2-ES_r1i1p1_RU-CORE_RegCM4-3_v4	HadGEM2-ES	RegCM4-3	[SEA]
154	MOHC_HadGEM2-ES_r1i1p1_SMHI_RCA4_v1	HadGEM2-ES	RCA4	[SEA, EUR, AFR, CAM]
155	MOHC_HadGEM2-ES_r1i1p1_SMHI_RCA4_v2	HadGEM2-ES	RCA4	[WAS]
156	MOHC_HadGEM2-ES_r1i1p1_SMHI_RCA4_v3	HadGEM2-ES	RCA4	[SAM]
157	MPI-M_MPI-ESM-LR_r1i1p1_CLMcom_CCLM4-8-17-CLM3-5_v1	MPI-ESM-LR	CCLM4-8-17-CLM3-5	[AUS]
158	MPI-M_MPI-ESM-LR_r1i1p1_CLMcom_CCLM4-8-17_v1	MPI-ESM-LR	CCLM4-8-17	[EUR, AFR]
159	MPI-M_MPI-ESM-LR_r1i1p1_CLMcom_CCLM5-0-2_v1	MPI-ESM-LR	CCLM5-0-2	[EAS]
160	MPI-M_MPI-ESM-LR_r1i1p1_CLMcom_ETH-COSMO-crCLIM-v1-1_v1	MPI-ESM-LR	ETH-COSMO-crCLIM-v1-1	[EUR, WAS]
161	MPI-M_MPI-ESM-LR_r1i1p1_CLMcom_HZG-CCLM5-0-15_v1	MPI-ESM-LR	HZG-CCLM5-0-15	[AUS]
162	MPI-M_MPI-ESM-LR_r1i1p1_CLMcom_KIT-CCLM5-0-15_v1	MPI-ESM-LR	KIT-CCLM5-0-15	[AFR]
163	MPI-M_MPI-ESM-LR_r1i1p1_CNRM_ALADIN63_v1	MPI-ESM-LR	ALADIN63	[EUR]
164	MPI-M_MPI-ESM-LR_r1i1p1_DMI_HIRHAM5_v1	MPI-ESM-LR	HIRHAM5	[EUR]
165	MPI-M_MPI-ESM-LR_r1i1p1_GERICS_REMO2015_v1	MPI-ESM-LR	REMO2015	[EAS, AUS, SEA, NAM, SAM, AFR, CAM, WAS]
166	MPI-M_MPI-ESM-LR_r1i1p1_ICTP_RegCM4-6_v1	MPI-ESM-LR	RegCM4-6	[EUR]
167	MPI-M_MPI-ESM-LR_r1i1p1_KNMI_RACMO22E_v1	MPI-ESM-LR	RACMO22E	[EUR]
168	MPI-M_MPI-ESM-LR_r1i1p1_MGO_RRCM_v1	MPI-ESM-LR	RRCM	[ARC]

169	MPI-M_MPI-ESM-LR_r1i1p1_MOHC_HadREM3-GA7-05_v1	MPI-ESM-LR	HadREM3-GA7-05	[EUR]
170	MPI-M_MPI-ESM-LR_r1i1p1_MPI-CSC_REMO2009_v1	MPI-ESM-LR	REMO2009	[EUR, SAM, AFR, WAS]
171	MPI-M_MPI-ESM-LR_r1i1p1_NCAR_RegCM4_v4-4-rc8	MPI-ESM-LR	RegCM4	[NAM]
172	MPI-M_MPI-ESM-LR_r1i1p1_OURANOS_CRCM5_v1	MPI-ESM-LR	CRCM5	[NAM]
173	MPI-M_MPI-ESM-LR_r1i1p1_SMHI_RCA4-SN_v1	MPI-ESM-LR	RCA4-SN	[ARC]
174	MPI-M_MPI-ESM-LR_r1i1p1_SMHI_RCA4_v1	MPI-ESM-LR	RCA4	[ARC, EUR, AFR, CAM]
175	MPI-M_MPI-ESM-LR_r1i1p1_SMHI_RCA4_v1a	MPI-ESM-LR	RCA4	[EUR]
176	MPI-M_MPI-ESM-LR_r1i1p1_SMHI_RCA4_v2	MPI-ESM-LR	RCA4	[WAS]
177	MPI-M_MPI-ESM-LR_r1i1p1_SMHI_RCA4_v3	MPI-ESM-LR	RCA4	[SAM]
178	MPI-M_MPI-ESM-LR_r1i1p1_UA_WRF_v3-5-1	MPI-ESM-LR	WRF	[NAM]
179	MPI-M_MPI-ESM-LR_r1i1p1_UQAM_CRCM5_v1	MPI-ESM-LR	CRCM5	[NAM, AFR]
180	MPI-M_MPI-ESM-LR_r2i1p1_SMHI_RCA4_v1	MPI-ESM-LR	RCA4	[EUR]
181	MPI-M_MPI-ESM-LR_r3i1p1_GERICS_REMO2015_v1	MPI-ESM-LR	REMO2015	[EUR]
182	MPI-M_MPI-ESM-MR_r1i1p1_ICTP_RegCM4-3_v4	MPI-ESM-MR	RegCM4-3	[CAM]
183	MPI-M_MPI-ESM-MR_r1i1p1_ICTP_RegCM4-4_v0	MPI-ESM-MR	RegCM4-4	[EAS]
184	MPI-M_MPI-ESM-MR_r1i1p1_ICTP_RegCM4-7_v0	MPI-ESM-MR	RegCM4-7	[AUS, SEA, SAM, AFR, CAM]
185	MPI-M_MPI-ESM-MR_r1i1p1_IITM_RegCM4-4_v5	MPI-ESM-MR	RegCM4-4	[WAS]
186	MPI-M_MPI-ESM-MR_r1i1p1_ORNL_RegCM4-7_v0	MPI-ESM-MR	RegCM4-7	[WAS]
187	MPI-M_MPI-ESM-MR_r1i1p1_RU-CORE_RegCM4-3_v4	MPI-ESM-MR	RegCM4-3	[SEA]
188	MPI-M_MPI-ESM-MR_r1i1p1_UQAM_CRCM5_v1	MPI-ESM-MR	CRCM5	[NAM, ARC]
189	NCC_NorESM1-M_r1i1p1_CLMcom_ETH-COSMO-crCLIM-v1-1_v1	NorESM1-M	ETH-COSMO-crCLIM-v1-1	[EUR, WAS]
190	NCC_NorESM1-M_r1i1p1_CLMcom_HZG-CCLM5-0-15_v1	NorESM1-M	HZG-CCLM5-0-15	[AUS]

191	NCC_NorESM1-M_r1i1p1_CLMcom_KIT-CCLM5-0-15_v1	NorESM1-M	KIT-CCLM5-0-15	[AFR]
192	NCC_NorESM1-M_r1i1p1_CNRM_ALADIN63_v1	NorESM1-M	ALADIN63	[EUR]
193	NCC_NorESM1-M_r1i1p1_CSIRO_CCAM-2008_v1	NorESM1-M	CCAM-2008	[AUS]
194	NCC_NorESM1-M_r1i1p1_DMI_HIRHAM5_v3	NorESM1-M	HIRHAM5	[EUR]
195	NCC_NorESM1-M_r1i1p1_GERICS_REMO2015_v1	NorESM1-M	REMO2015	[EAS, AUS, SEA, NAM, EUR, SAM, AFR, CAM, WAS]
196	NCC_NorESM1-M_r1i1p1_ICTP_RegCM4-4_v0	NorESM1-M	RegCM4-4	[EAS]
197	NCC_NorESM1-M_r1i1p1_ICTP_RegCM4-7_v0	NorESM1-M	RegCM4-7	[AUS, SEA, SAM, AFR]
198	NCC_NorESM1-M_r1i1p1_IPSL_WRF381P_v1	NorESM1-M	WRF381P	[EUR]
199	NCC_NorESM1-M_r1i1p1_KNMI_RACMO22E_v1	NorESM1-M	RACMO22E	[EUR]
200	NCC_NorESM1-M_r1i1p1_MOHC_HadREM3-GA7-05_v1	NorESM1-M	HadREM3-GA7-05	[EUR]
201	NCC_NorESM1-M_r1i1p1_ORNL_RegCM4-7_v0	NorESM1-M	RegCM4-7	[WAS]
202	NCC_NorESM1-M_r1i1p1_SMHI_RCA4_v1	NorESM1-M	RCA4	[ARC, EUR, AFR, CAM]
203	NCC_NorESM1-M_r1i1p1_SMHI_RCA4_v2	NorESM1-M	RCA4	[WAS]
204	NCC_NorESM1-M_r1i1p1_SMHI_RCA4_v3	NorESM1-M	RCA4	[SAM]
205	NCC_NorESM1-M_r1i1p1_ULg_MAR311_v1	NorESM1-M	MAR311	[ANT]
206	NOAA-GFDL_GFDL-ESM2G_r1i1p1_GERICS_REMO2009_v1	GFDL-ESM2G	REMO2009	[AFR]
207	NOAA-GFDL_GFDL-ESM2M_r1i1p1_CSIRO_CCAM-2008_v1	GFDL-ESM2M	CCAM-2008	[AUS]
208	NOAA-GFDL_GFDL-ESM2M_r1i1p1_ICTP_RegCM4-7_v0	GFDL-ESM2M	RegCM4-7	[CAM]
209	NOAA-GFDL_GFDL-ESM2M_r1i1p1_IITM_RegCM4-4_v5	GFDL-ESM2M	RegCM4-4	[WAS]
210	NOAA-GFDL_GFDL-ESM2M_r1i1p1_ISU_RegCM4_v4-4-rc8	GFDL-ESM2M	RegCM4	[NAM]
211	NOAA-GFDL_GFDL-ESM2M_r1i1p1_NCAR_WRF_v3-5-1	GFDL-ESM2M	WRF	[NAM]

212	NOAA-GFDL_GFDL-ESM2M_r1i1p1_OURANOS_CRCM5_v1	GFDL-ESM2M	CRCM5	[NAM, CAM]
213	NOAA-GFDL_GFDL-ESM2M_r1i1p1_SMHI_RCA4_v1	GFDL-ESM2M	RCA4	[AFR, CAM]
214	NOAA-GFDL_GFDL-ESM2M_r1i1p1_SMHI_RCA4_v2	GFDL-ESM2M	RCA4	[WAS]
215	NOAA-GFDL_GFDL-ESM2M_r1i1p1_SMHI_RCA4_v3	GFDL-ESM2M	RCA4	[SAM]

Table A1.1. Simulations (members) for the different experiments/domains (last column) provided by the Atlas Monthly v1 dataset.

Copernicus Climate Change Service

ECMWF - Shinfield Park, Reading RG2 9AX, UK

Contact: https://support.ecmwf.int/