

UKCP18 Guidance: Data availability, access and formats

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1. What data is available for download?

The UKCP18 data for the marine and land projections are available for download. The climate models and scenarios available are summarised in Tables 1 and 2. You can find a list of the variables and details of the regional averaging (e.g. over the UK, river basin and administrative regions) in Tables 4 and 5 below.

Dataset	Description	Emissions scenarios	Time Period	Domain
Time mean sea level at 12 km	Projections of future changes in sea water level	RCP2.6 RCP4.5 RCP8.5	2007-2100	UK coastline
Storm surge trend at 12km	Projections of storm surge trend around the UK coastline	RCP8.5	2007-2100	UK coastline
Storm surge simulations	Time series of gridded historical and future simulations of sea water level	RCP8.5	1970-2099	UK
Short event case studies	Time series of gridded historical and future simulations of sea water level for three events (6 Dec 2013, 3 Feb 2014, 11 Jan 2015)	N/A	N/A	UK
Time mean sea level at 12km	Exploratory projections of future changes in sea water level around the UK coastline	RCP2.6 RCP4.5 RCP8.5	2007-2300	UK

Table 1 Summary of UKCP18 marine projections data

Dataset	Description	Emissions scenarios	Time Period	Geographical Domain
Probabilistic projections	Probabilistic projections over land	RCP2.6 RCP4.5 RCP6.0 RCP8.5 SRESA1B	1961-2100	UK
Global (60km) projections	Global climate model projections including 15 from the Met Office Hadley Centre (PPE-15) and 13 models from other international climate modelling centres (CMIP5-13)	RCP8.5	1900-2100	Global UK
Regional (12km) projections	A set of 12 high resolution climate projections at 12km spatial resolution driven by the global climate model projections	RCP8.5	1981-2080	Europe UK
Local (2.2km) projections	A set of 12 high resolution climate projections at 2.2km spatial resolution driven by the regional climate model projections	RCP8.5	1981-2000 2021-2040 2061-2080	UK
Derived projections	Projections for RCP2.6 and worlds with 2°C and 4°C warming produced using statistical methods and based on the global climate model projections	RCP2.6 2°C world 4°C world	1900-2100	UK

Table 2 Summary of UKCP18 climate models and scenarios for projections over land

2. Where can you download the data?

There are four locations where you can download the data:

- [UKCP Website](#). You can download a spreadsheet with the key results from the marine and probabilistic projections.
- [UKCP User interface \(UI\)](#). You can download datasets and plot graphs and maps for the UK from the user interface. Beware that the UI provides easy access to frequently requested data for the UK and some datasets are not available (e.g. the global dataset and storm surge case

studies). These can be downloaded using the methods below listed below. You need to register to access the products and instructions are available at the UI.

- [CEDA Data Catalogue](#). All datasets set out in Tables 1, 2, 4 and 5 are available for download via the CEDA data catalogue. You can click and download individual files or write a script to download a set of files automatically (see the [CEDA website](#) for more details).
- **Application Programming Interface (API)**. You can develop web applications that call upon the web-processing services underpinning the UI. Instructions on how to use the API are available at the [UKCP UI](#).

3. How do you register for access to the data?

For the UKCP User Interface, you can register at the [Sign Up](#) page. Enter your information in the fields and click “submit”. The interface will send you an email with a link to activate your account. Please check your spam/junk folder and you may need to move it to your inbox to allow it to activate your account.

All data is provided under the [Open Government Licence](#).

4. Where can you find out more about the underpinning science

The science underpinning the climate data is described in the following reports and sets of guidance available from the [UKCP website](#):

- Peer-Reviewed science reports
 - UKCP18 Science Overview
 - UKCP18 Land Projections Science Report
 - UKCP18 Marine Projections Report
 - UKCP18 Derived Projections Report
 - UKCP Convection Permitting Model Science Report
- Peer Reviewed user guidance
 - UKCP18 Factsheets on sea level and storm surge, temperature, precipitation, wind, weather types
 - UKCP18 Guidance: How to use the Land Projections
 - UKCP18 Guidance: How to bias correct
 - UKCP18 Guidance: Caveats and Limitations
- Additional user guidance
 - UKCP Factsheet: Local (2.2km) Projections
 - UKCP18 Guidance: UKCP18 for UKCP09 Users
 - UKCP18 Guidance: Representative Concentration Pathways
 - UKCP18 Factsheet on snow

- UKCP18 Guidance on using different visualisation products such as plume plots, PDF and CDF plots, probabilistic projections maps.

5. What are the restrictions on use?

The [Open Government Licence](#) (OGL) applies to all datasets.

6. What do you need to be aware of before using the data?

Before using the data, familiarise yourself with UKCP18 Guidance: Caveats and Limitations available from the [UKCP website](#).

Whilst the projections represent the latest scientific understanding and the results have been peer reviewed by independent experts, keep in mind the caveats and limitations of the projections. Although our understanding and ability to simulate the climate is advancing all the time, our models are not able to represent all of the features seen in the present day real climate. This means that when applying the climate projections to your decision-making, consider how best to factor the capabilities and limitations of UKCP18. This should be informed by a thorough understanding of the consequences of different climate outcomes – perhaps including those beyond the ranges of uncertainty presented in UKCP18.

7. What data formats are available?

The following table summarises the available file formats.

Product	Formats	Notes
CDF plot Joint probability plot Maps PDF plot Plume plot	png, jpg, pdf resolutions of 900x600, 1200x800, 2400x1600	
Raw data	CSV	This can be used in EXCEL or any text file reader. You can also import it into ArcGIS if you replace the metadata at the top of the file such that it resembles ESRI ASCII raster format ¹
	NetCDF	This is for users familiar with programming and details can be found at www.unidata.ucar.edu/software/netcdf

Table 3 Summary of UKCP18 file formats

¹http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/ESRI_ASCII_raster_format/009t000000z000000/

8. What spatial resolutions and regional averages are available?

Spatial resolutions and coordinate systems

The data is available in more than one spatial coordinate system. All projections over land for the UK are available in the Ordnance Survey's [National Grid](#). See Table 4 for a summary of the spatial coordinate systems used for each dataset.

The raw model data from the projections over land are in a number of different coordinate systems. We have opted to make the data available in British National Grid for the UK for all land projections to ease analysis for most UK users. It is also consistent with the coordinate system used by the Met Office's National Climate Information Centre who provide observed datasets. This required regriding the original climate model data and the details of the method and coordinate systems can be found in Appendix B. Users in Northern Ireland may need to carry out their own regriding if the Irish Grid is required.

Dataset	Spatial resolution	Domain	Spatial coordinate system	Regional averages available
Probabilistic projections	25km	UK Channel Islands Isle of Man	British National Grid (OSGB)	Country Administrative Regions River basin regions
Global (60km) projections	60km	Global	Regular latitude-longitude in geographic projection	Country Administrative Regions River basin regions
	60km	UK only Channel Islands Isle of Man	British National Grid (OSGB)	
Regional (12km) projections	12km	Europe	Latitude-longitude in rotated pole coordinates	Country Administrative Regions River basin regions
		UK Channel Islands Isle of Man	British National Grid (OSGB)	
Local (2.2km) projections	2.2km	UK Isle of Man	Latitude-longitude in rotated pole coordinates	Country Administrative Regions River basin regions
	5km		British National Grid (OSGB)	
Marine projections	12km	UK Channel Islands Isle of Man	Regular latitude-longitude in geographic projection	None

Table 4 Summary of geographical characteristics of UKCP18 data

The marine projections are provided as grid cells along the UK coastline (for sea level and extreme water levels) and for UK sea waters (storm surge runs and short event case studies) using a regular latitude-longitude geographic projection.

Regional Averages

The data will be available for three types of aggregated areas country regions (see Figure 1), administrative regions (see Figure 2) and River basin regions (see Figure 3). The regional averages for all aggregated areas have been calculated using 2-D conservative method. See Appendix B for details.

To make it easier to share and use the shapefiles, we have created the administration and river basin region as well as country shapefiles from open-source datasets. The shapefiles are available with an Open Government Licence. Note that there are some differences between UKCP09 and UKCP18 administration region shapefiles. These are in Scotland where Eastern, Western and Northern Scotland are based on aggregating regions from [OS Boundary Line](#). There are also some small changes to river basins which are based on the European Environment Agency's [European river catchments](#).

UKCP Local (2.2km) provides the most spatially detailed picture of future climate for the mainland UK. However, due to the proximity of the Shetland Isles to the northern boundary of the model domain used for these projections, data produced here is not reliable and should not be used. This is because at the edge of the model domain the projections are influenced by the techniques required to drive the model at its boundaries, which prevent Local (2.2km) from developing its own climatology over Shetland. We do not include these grid cells to calculate the regional average.

UKCP Local (2.2km) is just one of the tools available in the UKCP suite that provide national climate change information. We advise using the alternate tools to access future climate data over the Shetland Islands. For example, the Regional (12km) projections use a much larger European model domain which places the northern boundaries much further north. Shetland is represented at a 12km resolution and is free from any boundary issues.

The shapefiles are available at <https://github.com/ukcp-data/ukcp-spatial-files>.



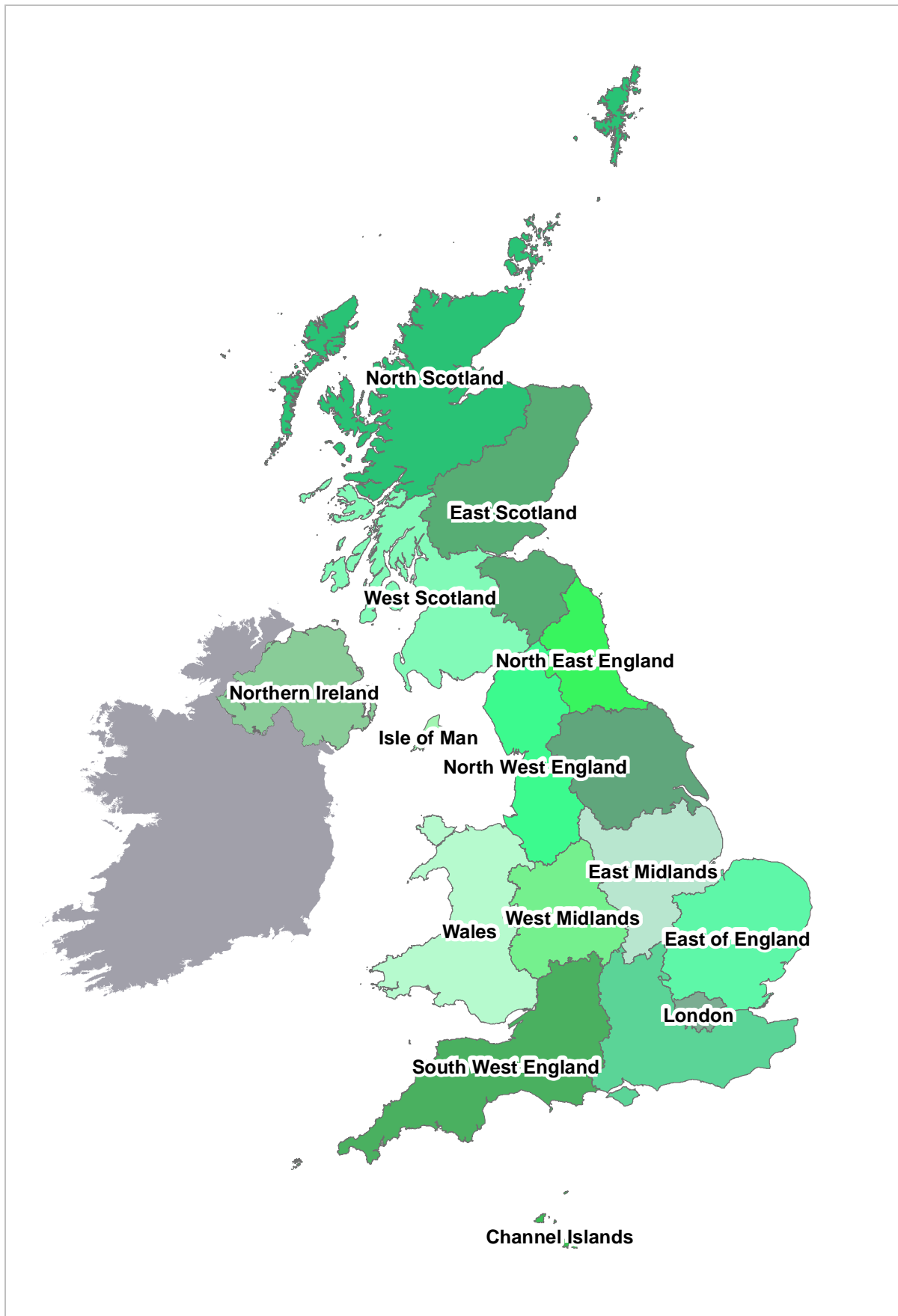


Figure 2 Map of administrative regions used in UKCP18

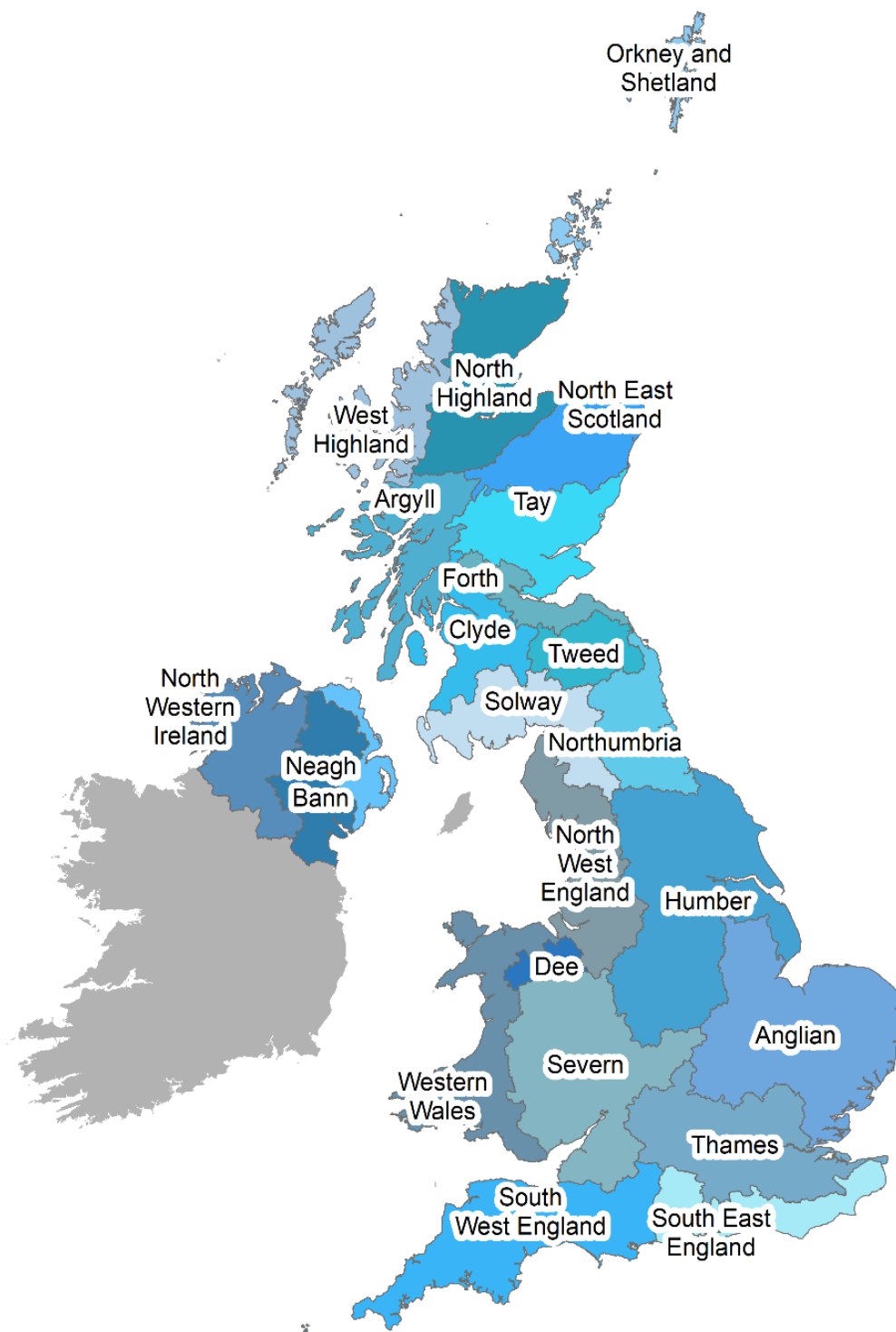


Figure 3 Map of river basin regions used in UKCP18

9. What variables are available?

Variable at the surface (short name in CEDA catalogue)	Units	Marine	Probabilistic	†Global (60km)	Regional (12km)	Local (2.2km)	Derived
Cloud cover (clt)	%		✓	✓	✓	✓	
Precipitation (pr)	mm/day		✓	✓	✓	✓ hourly	✓*
Radiation, total downward short wave flux (rsds)	Wm ⁻²		✓				
Radiation, net long wave (rls)	Wm ⁻²		✓	✓	✓	✓	
Radiation, net short wave (rss)	Wm ⁻²		✓	✓	✓	✓	
Relative humidity (hurs)	%			✓	✓	✓	✓
Sea level pressure (psl)	hPa		✓	✓	✓	✓	
Sea water level	m	✓					
Snow: snowfall amount (prsn)	mm				✓	✓	
Snow: lying snow amount (snw)	mm				✓	✓	
Specific humidity (huss)			✓	✓	✓	✓	
Temperature, maximum (tasmax)	°C		✓	✓	✓	✓	
Temperature, Mean (tas)	°C		✓	✓	✓	✓ hourly	✓*
Temperature, minimum (tasmin)	°C		✓	✓	✓	✓	
Wind gusts (wsgmax10m)	m/s					✓ 3-hourly	
Wind speed (sfcWind)	m/s			✓	✓	✓ 3-hourly	✓
Wind speed eastwards (uas)	m/s			✓	✓	✓	✓
Wind speed northwards (vas)	m/s			✓	✓	✓	✓
Time steps		Dataset- dependent	Monthly Seasonal Annual 20/30-year means		Daily Monthly Seasonal* Annual* 20/30-year means*		Daily* Monthly

Table 5 Available UKCP18 variables for the marine and projections over land. Further variables and metrics such as sea surface temperatures, extreme metrics for precipitation and temperature, weather types are being considered for release. Note that all daily variables are provided on a 360-day year. *these are available over the UK only †only daily precipitation and temperature are available for the derived projections †Not all variables are available for CMIP-13 (see Appendix A).

10. Where can you go for more information

If you want to find out more about the UKCP18 project visit the [UKCP website](#).

If you have enquiries about the data licence conditions and have feedback for the UKCP18 User Interface or CEDA Data Catalogue please contact us through the online support form on the [UKCP website](#).

Appendix A Data availability: Global projections CMIP-13

The UKCP18 global projections also include information from climate modelling centres other than the Met Office Hadley Centre. The availability of climate variables from these models are dependent on whether the climate modelling centres saved the data. Table A.1 sets out the daily variables that are missing for the CMIP-13 set of global projections. Table A.2 sets out the monthly variables that are missing for the CMIP-13 set of global projections.

CMIP5-13 member ID	CMIP5 name		clt	hurs	huss	pr	psl	rls	rss	sfcWind	tas	tasmin	tasmax	uas	vas
16	bcc-csm1-1	1950	x							x				1950	
17	CCSM4		x	x	x					x				x	x
18	CESM1-BGC		x	x	x					x				x	
19	CanESM2			x											
20	CMCC-CM	1950		x	x									1950	1950
21	CNRM-CM5	1950		x										1950	1950
22	EC-EARTH		x	x	x					x		1900		x	x
23	ACCESS1-3	1950		x										1950	1950
24	HadGEM2-ES	1949		x										1949	1949
25	IPSL-CM5A-MR			x											
26	MPI-ESM-MR	1950		x	x									1950	1950
27	MRI-CGCM3	1950		x										1950	1950
28	GFDL-ESM2G			x											

Table A.1. Summary of daily fields that are missing (x) for the CMIP5-13 in the Global Projections, or that do not have data for the whole period 1/12/1899 to 30/11/2099 (these are shown by the first year for which there is data). clt is total cloud cover, hurs is relative humidity at the surface, huss is specific humidity at the surface, psl is sea level pressure, rls is the long wave radiation at the surface, rss is the short wave radiation at the surface, sfcWind is wind speed at 10m, tas is mean temperature at the surface, tasmin is minimum temperature at the surface, tasmax is maximum temperature at the surface, uas is horizontal wind at the surface and vas is vertical wind at the surface.

CMIP5-13 member ID	CMIP5 name													
		clt	hurs	huss	pr	psl	rls	rss	sfcWind	tas	tasmin	tasmx	uas	vas
16	bcc-csm1-1						x	x	x					
17	CCSM4						x	x	x				x	x
18	CESM1-BGC						x	x	x				x	x
19	CanESM2						x	x						
20	CMCC-CM		x	x			x	x						
21	CNRM-CM5						x	x					x	x
22	EC-EARTH	x	x	x			x	x	x		x		x	x
23	ACCESS1-3						x	x						
24	HadGEM2-ES						x	x						
25	IPSL-CM5A-MR						x	x						x
26	MPI-ESM-MR		x	x			x	x						
27	MRI-CGCM3						x	x	x				x	x
28	GFDL-ESM2G						x	x						

Table A.2. Summary of monthly fields that are missing (x) for the CMIP5-13 in the Global Projections, or that do not have data for the whole period 1/12/1899 to 30/11/2099 (these are shown by the first year for which there is data). clt is total cloud cover, hurs is relative humidity at the surface, huss is specific humidity at the surface, psl is sea level pressure, rls is the long wave radiation at the surface, rss is the short wave radiation at the surface, sfcWind is wind speed at 10m, tas is mean temperature at the surface, tasmin is minimum temperature at the surface, tasmx is maximum temperature at the surface, uas is horizontal wind at the surface and vas is vertical wind at the surface.

Appendix B Coordinate Systems, Regridding and Regional Averages

Coordinate Systems

As listed in Table 4, the climate projections are available in different coordinate systems and resolutions. The following are definitions of the different coordinate systems used in UKCP18 raw model data:

Global Projections and Marine Projections

The global and marine projections raw model data are provided on the geographic projection.

Regional Projections

The regional climate model projections for the European domain are available in a rotated pole coordinate system. The details are as follows:

- Rotated Pole
- Grid North Pole latitude = 39.25
- Grid North Pole longitude = 198.0

Regional Averages and Regridding

The processing tools used to provide the climate model data over land were developed in [Python 2.7](#) and [Iris](#). The probabilistic, global and regional projections are available regridded to the UK on the Ordnance Survey's National Grid as well as averaged regionally for countries, administrative regions and river basin regions. The same method was used for both regridding and regional averaging; this requires using shapefiles for the target National Grid or region and then carrying out an area-weighted method using [iris.analysis.geometry](#).

Note that there are no values for some of the small land areas for the global projections due to the coarser model grid resolution.

Appendix C: Filename and Folder Structure Conventions

The UKCP data files for the projections over land have been stored on the CEDA Data Archive using the conventions set out in Tables C.1, C.2 and C.3.

Dataset	Folder structure
Probabilistic	collection/domain/resolution/scenario/filetype/baseline/nyear/variable/frequency/version
Global (60km), Regional (12km), Local (2.2km), Derived	collection/domain/resolution/scenario/member/variable/frequency/version/

Table C.1 Folder structure convention for files on CEDA Data Archive

Dataset	Filename convention
Probabilistic	variable_scenario_collection_domain_resolution_filetype_baseline_nyear_frequency_timeslice.nc
Global (60km), Regional (12km), Local (2.2km), Derived	variable_scenario_collection_domain_resolution_member_frequency_timeslice.nc

Table C.2 Filename convention for files on CEDA Data Archive

Category	Category description	Values available	Value descriptions
collection	Describes the data collection	land-prob land-gcm land-rcm land-cpm	Probabilistic projections Global (60km) projections Regional (12km) projections Local (2.2km) projections
domain	The spatial extent of the data	global eur uk	Global Europe UK only
resolution	The resolution of the dataset	60km, 12km, 2.2km	Resolution of the climate model
		60km, 12km, 5km, country, region, river	Resolution of the regridded data and regional averages
scenario	Representative concentration pathway or emissions scenario	rcp2.6, rcp4.5, rcp6.0, rcp8.5, sreas-a1b	
filetype	The type of result	cdf pdf sample	Cumulative-distribution frequency Probability distribution function Samples
baseline	Baseline years used for calculating anomalies	b8100, b6190, b8110	1981-2000, 1961-1990, 1981-2010
nyear	Number of years used for calculating anomalies	1y, 20y, 30y	
member	Member number	see Table D.1	
variable	Variable short name	see Table 5	
frequency	Averaging frequency	1hr, 3hr, day, mon, seas, ann	1 hour, 3 hour, daily, monthly, seasonal, annual
		mon-20y, seas-20y, ann-20y	20-year monthly, seasonal and annual averages
		mon-20y, seas-20y, ann-20y	30-year monthly, seasonal and annual averages
version	Version number		

Table C.1 Description of folder and filename conventions used in CEDA Data Archive

Appendix D: Climate model name and conventions for Global (60km), Regional (12km), Local (2.2km) and Derived Projections

The Global (60km) projections comprise results from the Met Office Hadley Centre global climate model (HadGEM3-GC3.05) as well as climate models (CMIP5) used in the latest assessment report from the Intergovernmental Panel on Climate Change. Table D.1 shows the naming convention that was used in the filenames and metadata stored on the CEDA Data Archive.

Climate Model	Global Climate Model name	Member ID	Perturbed-Physics ID	Regional Climate Model name	Convection-Permitting Model name
Met Office Hadley Centre climate model	HadGEM3-GC3.05	01	r001i1p00000	HadREM3-GA705	HadREM3-RA11M
		02			
		03			
		04	r001i1p01113	HadREM3-GA705	HadREM3-RA11M
		05	r001i1p01554	HadREM3-GA705	HadREM3-RA11M
		06	r001i1p01649	HadREM3-GA705	HadREM3-RA11M
		07	r001i1p01843	HadREM3-GA705	HadREM3-RA11M
		08	r001i1p01935	HadREM3-GA705	HadREM3-RA11M
		09	r001i1p02123	HadREM3-GA705	HadREM3-RA11M
		10	r001i1p02242	HadREM3-GA705	HadREM3-RA11M
		11	r001i1p02305	HadREM3-GA705	HadREM3-RA11M
		12	r001i1p02335	HadREM3-GA705	HadREM3-RA11M
		13	r001i1p02491	HadREM3-GA705	HadREM3-RA11M
		14			
		15	r001i1p02868	HadREM3-GA705	HadREM3-RA11M
CMIP5 Climate Models	bcc-csm1-1	16			
	CCSM4	17			
	CESM1-BGC	18			
	CanESM2	19			
	CMCC-CM	20			
	CNRM-CM5	21			
	EC-EARTH	22			
	ACCESS1-3	23			
	HadGEM2-ES	24			
	IPSL-CM5A-MR	25			
	MPI-ESM-MR	26			
	MRI-CGCM3	27			
	GFDL-ESM2G	28			

Table D.1 Climate models used in the Global (60km), Regional (12km), Local (2.2km) and Derived Projections. Table includes climate model names, corresponding identifier (member ID) and the perturbed-physics ID (for Met Office Hadley Centre models) used in the filename convention in the CEDA Archive. Only Met Office Hadley Centre (MOHC) regional and convection-permitting climate models were used. The MOHC global climate models were used as input to the 12 regional climate models. The 12 regional climate models were used as input to the 12 convection-permitting models. Further details of the HadGEM3-GC3.05 perturbed physics data is available at Sexton et al (2019)².

² Sexton et al (2019), The elicitation of distributions of parameters in HadGEM3 versions GA4 and GA7 for use in perturbed parameter ensembles, Technical Note 101, Met Office. Available at: https://digital.nmla.metoffice.gov.uk/digitalFile_70d009c8-e04e-449b-98a2-ada3be97167d