



biogeografie
uni bayreuth

Climate Data Crash Course

Nationale
Forschungsplattform
für Zoonosen





What is climate?

Climate is a measure of the average pattern of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other meteorological variables in a given region over long periods of time. Climate is different from weather, in that weather only describes the short-term conditions of these variables in a given region.

- Wikipedia



Why is climate important for VBD?



Why is climate important for VBD?

On large spatio-temporal scales, climate is one of the primary factors governing species' distributions.



Pictures: Polar Bear by Arturo de Frias Marques, license: [CC BY-SA 4.0](#)
Dromedary by Bjørn Christian Tørrissen, license: [CC BY-SA 3.0](#)

Why is climate important for VBD?

On large spatio-temporal scales, climate is one of the primary factors governing species' distributions.

That's true for many vectors as well!



Pictures: *Aedes albopictus* by James Gathany, CDC
Ixodes Ricinus by Hubert Berberich, license: [CC BY-SA 3.0](#)

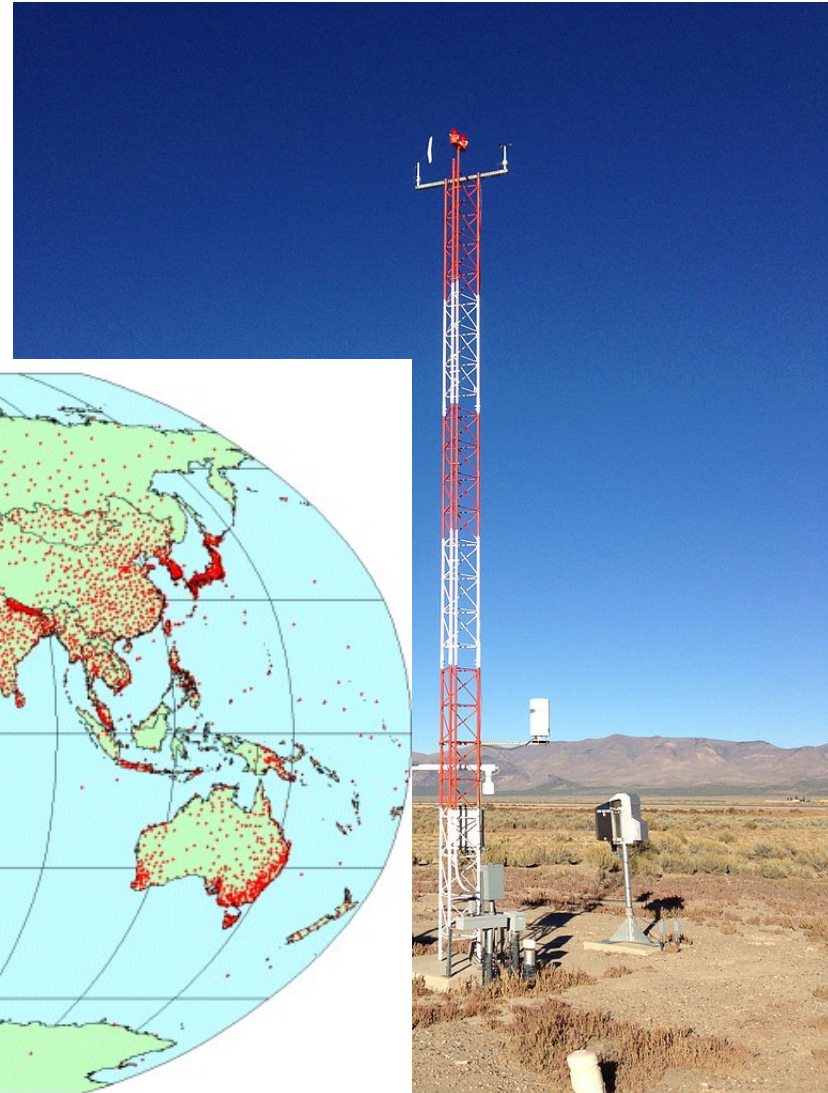
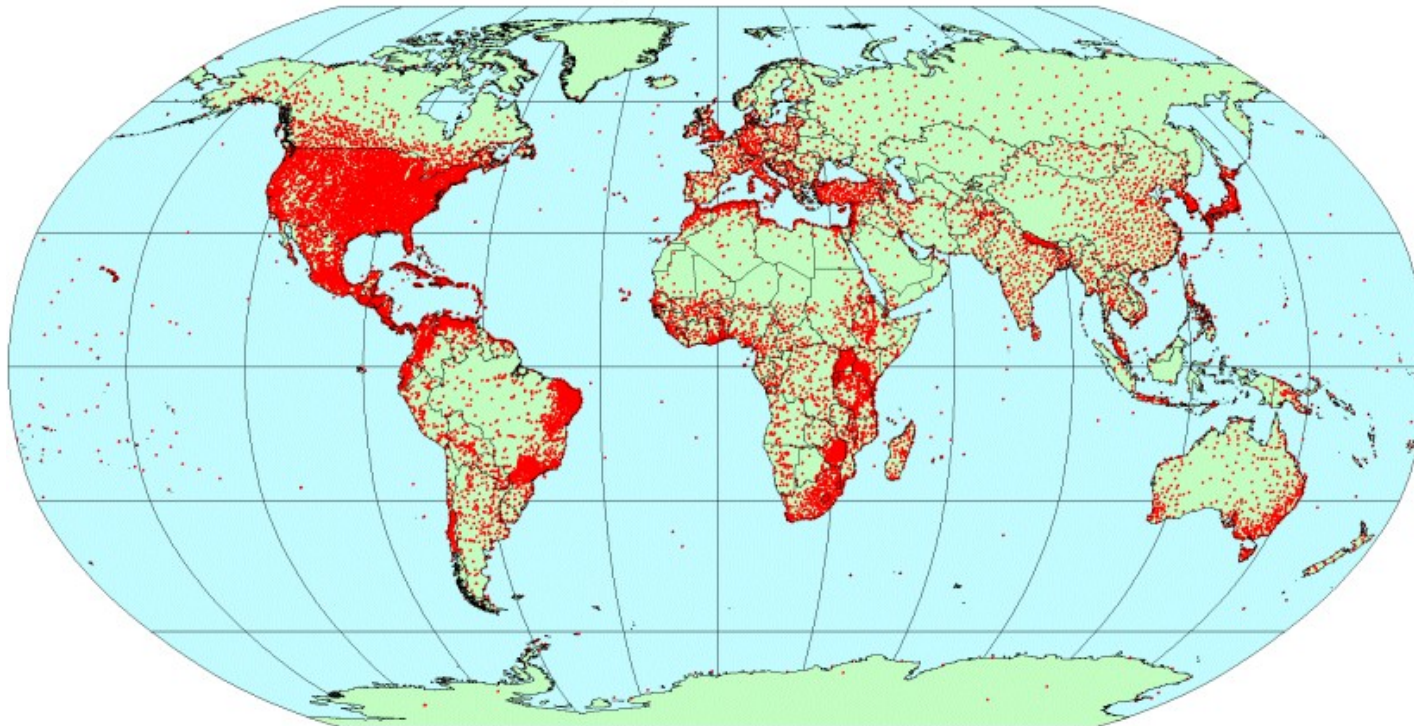


Climate data: where does it come from?





Climate data: where does it come from?



Pictures: Weather station: Famartin, license: [CC BY-SA 4.0](#)
Weather station map: Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005.
Very high resolution interpolated climate surfaces for global land areas. Int. J.Climatol. 25: 1965-1978.



Sources for global, gridded climate data

WorldClim - Global Climate Data

Free climate data for ecological modeling and GIS

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About us

WorldClim

WorldClim is a set of global climate layers (climate grids) with a spatial resolution of about 1 square kilometer. The data can be used for mapping and spatial modeling in a GIS or with other computer programs. If you are not familiar with such programs, you can try [DIVA-GIS](#) or the *R* [raster](#) package.

The current version is Version 1.4 (release 3). Please [write us](#) if you find any problems.

---> **Download data**

Information about the [methods](#) used to generate the climate layers, and the [units and formats](#) of the data. You can find more info in the **preferred citation**:

Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high resolution interpolated climate surfaces for global land areas. [International Journal of Climatology](#) 25: 1965-1978.



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About us

- + monthly means (1961-90)
- + high resolution (30 arcsec, ca. 0.7 km at 45° latitude)
- temperature & precipitation only
- + bioclimatic variables

WorldClim

WorldClim is a set of global climate layers (climate grids) with a spatial resolution of 30 arcseconds (ca. 1 km at the equator). The data can be used for mapping and spatial modeling in a GIS or other computer programs. If you are not familiar with such programs, you can try [DIVA-GIS](#) or the [R raster](#) package.

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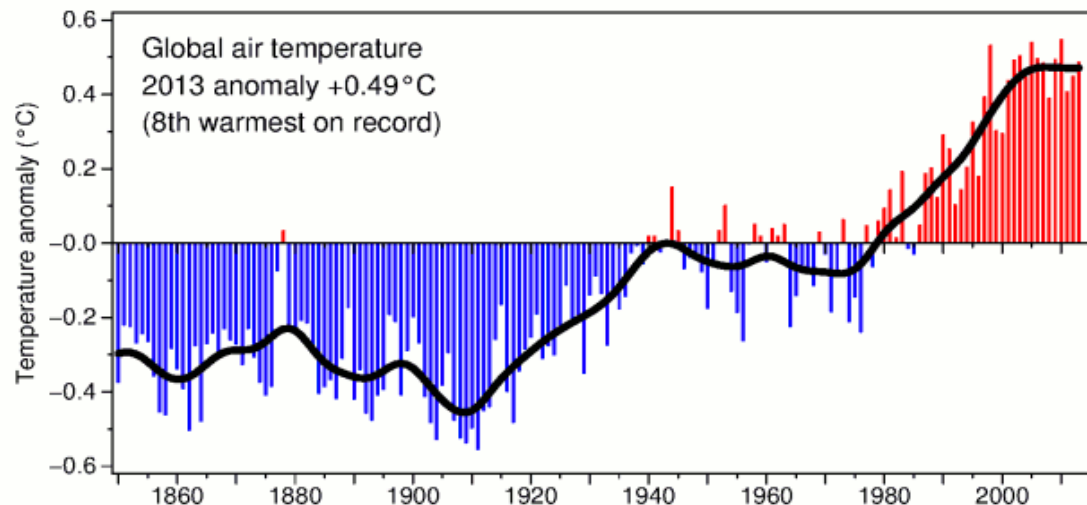
Sources for global, gridded climate data



Home

The aim of the Climatic Research Unit (CRU) is to improve scientific understanding in

- past climate history and its impact on humanity
- the course and causes of climate change during the present century
- prospects for the future



Home: <http://www.cru.uea.ac.uk/>

data download: <http://www.cru.uea.ac.uk/cru/data/hrg/tmc/>



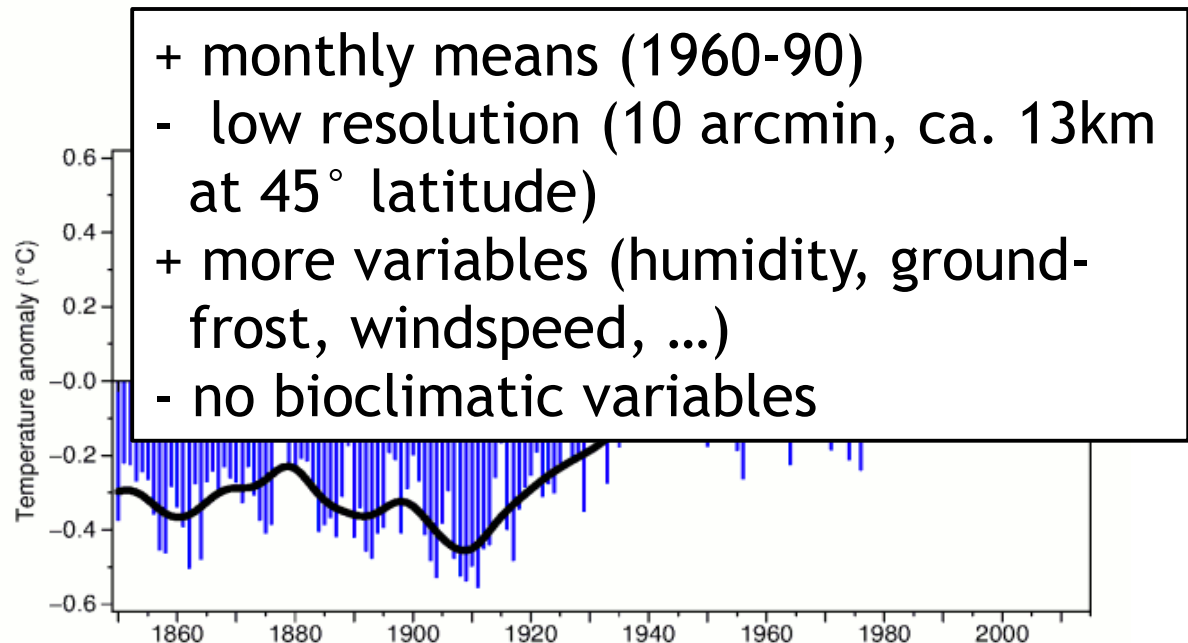
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Sources for global, gridded climate data



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- Crop Monitoring and Yield Forecasting
- Crop Modelling
- Climate Change Research
- Area Estimates
- Wiki MCYFS
- Models & Software Tools
- Data distribution**

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AGRI4CAST Interpolated Meteorological Data

One of the main output of the [CGMS system](#) are the Meteorological Interpolated data.

In compliance with the Commission policy these data are available to the scientific community.

The CGMS database contains daily meteorological interpolated data **from 1975** to the last calendar year completed, covering the EU Member States, neighbouring European countries, and the Mediterranean countries.

The available meteorological parameters interpolated to a 25x25 km [grid](#) are:

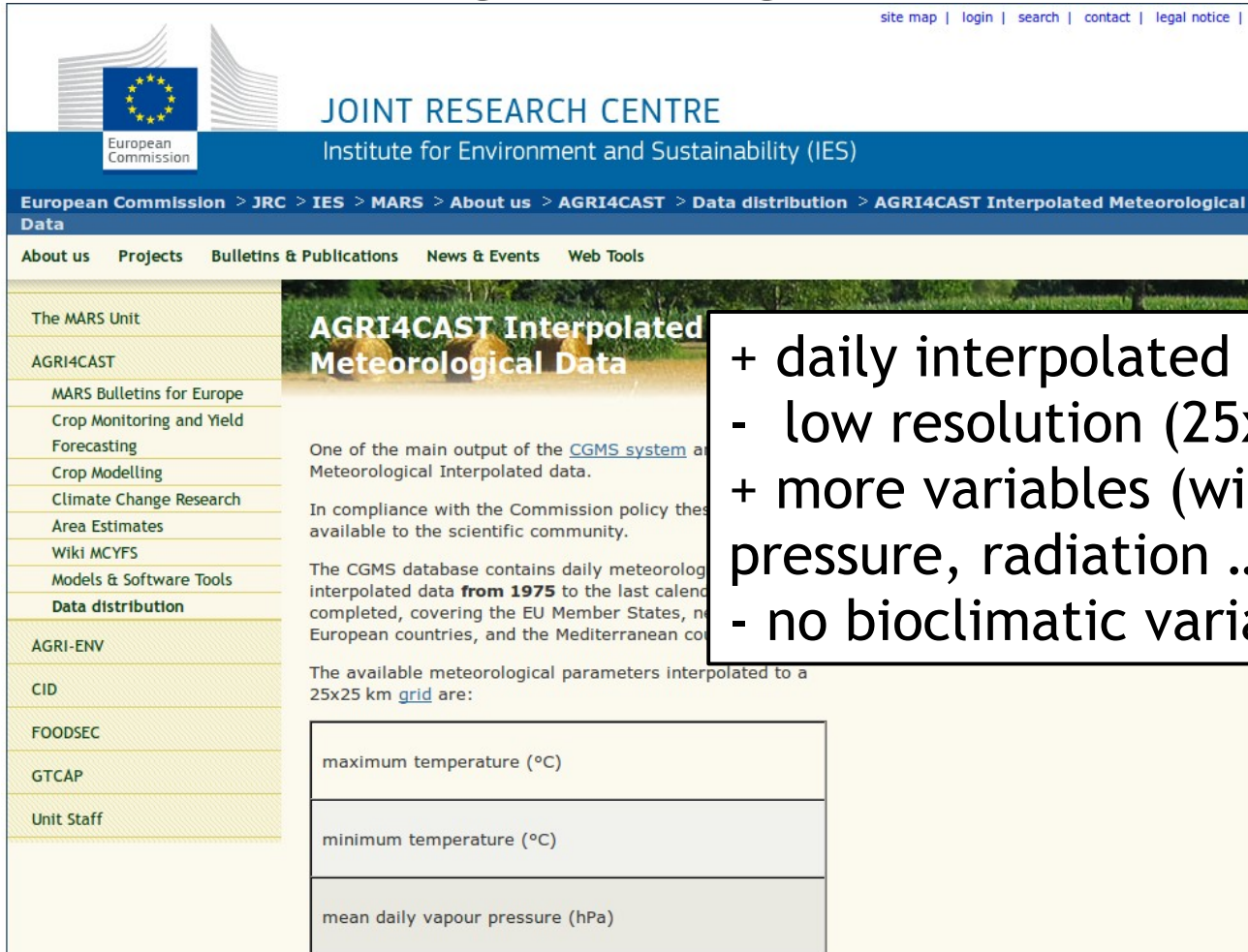
| |
|----------------------------------|
| maximum temperature (°C) |
| minimum temperature (°C) |
| mean daily vapour pressure (hPa) |

[AGRI4CAST Interpolated Meteorological Data](#)
[AGRI4CAST Remote Sensing Data](#)

Home: <http://mars.jrc.ec.europa.eu/>
data download: [DataPortal](#)



Sources for global, gridded climate data



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| |
|----------------------------------|
| maximum temperature (°C) |
| minimum temperature (°C) |
| mean daily vapour pressure (hPa) |

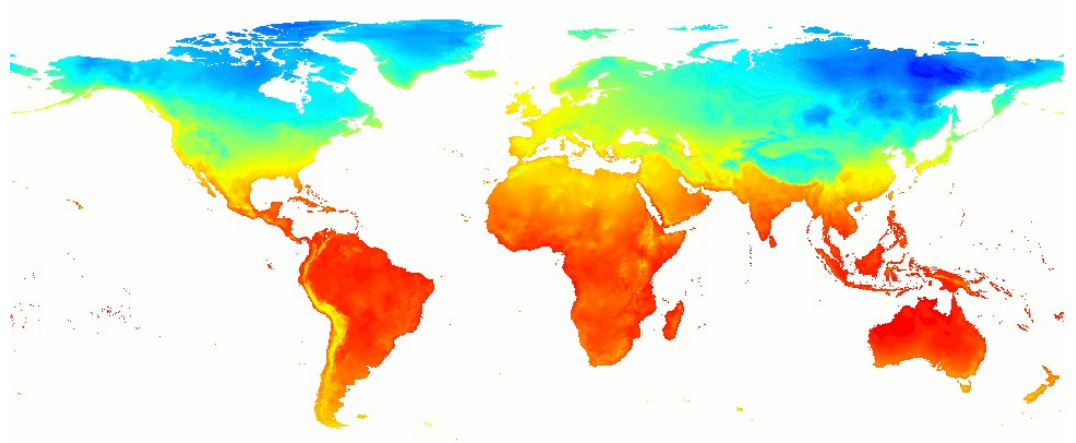
- + daily interpolated data starting 1975
- low resolution (25x25 km)
- + more variables (windspeed, vapour pressure, radiation ...)
- no bioclimatic variables



Interlude: Bioclimatic data

Problem with monthly
climate data:

“January” is winter in
Stockholm but summer in
South Africa

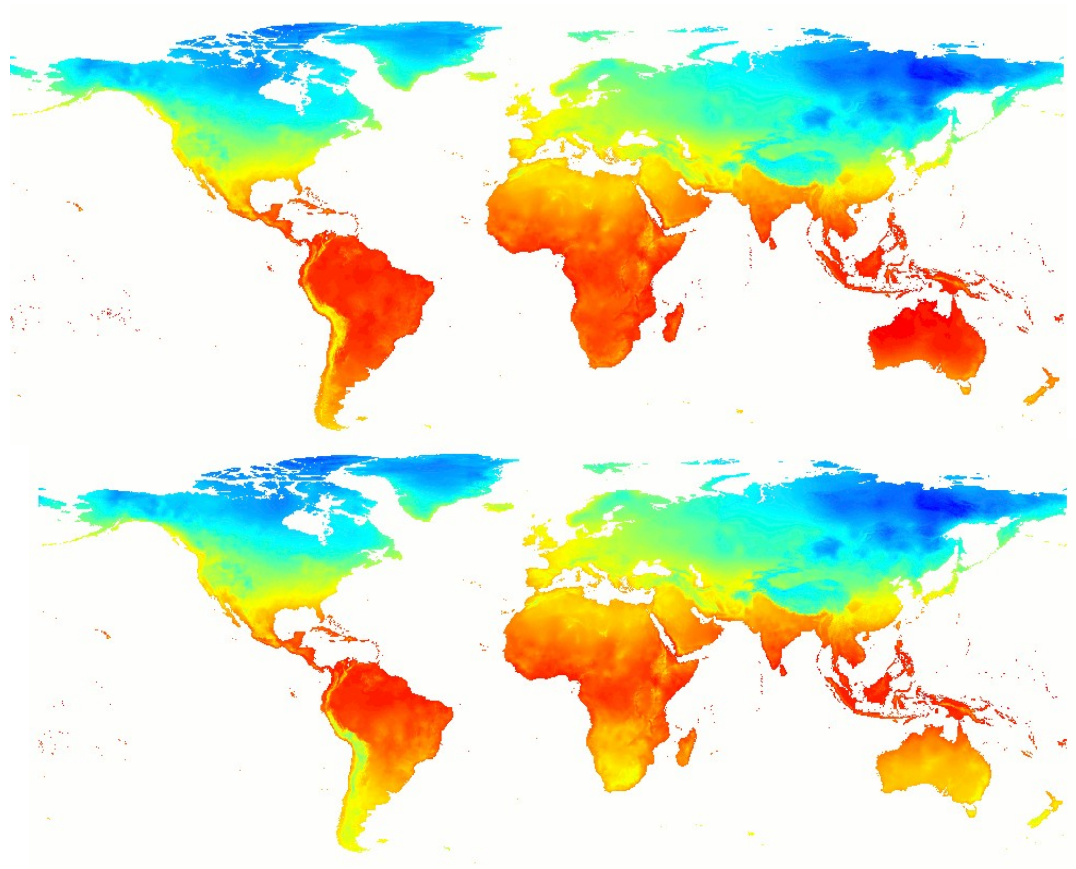


Interlude: Bioclimatic data

Problem with monthly
climate data:

“January” is winter in
Stockholm but summer in
South Africa

Solution: Use ecologically
more meaningful variables



Top: Minimum temperature in January (Worldclim.org)

Bottom: Minimum Temperature of the coldest month (Worldclim.org)



Interlude: Bioclimatic data

BIO1 = Annual Mean Temperature

BIO2 = Mean Diurnal Range (Mean of monthly (max temp - min temp))

BIO3 = Isothermality (BIO2/BIO7) (* 100)

BIO4 = Temperature Seasonality (standard deviation *100)

BIO5 = Max Temperature of Warmest Month

BIO6 = Min Temperature of Coldest Month

BIO7 = Temperature Annual Range (BIO5-BIO6)

BIO8 = Mean Temperature of Wettest Quarter

BIO9 = Mean Temperature of Driest Quarter

BIO10 = Mean Temperature of Warmest Quarter

BIO11 = Mean Temperature of Coldest Quarter

BIO12 = Annual Precipitation

BIO13 = Precipitation of Wettest Month

BIO14 = Precipitation of Driest Month

BIO15 = Precipitation Seasonality (Coefficient of Variation)

BIO16 = Precipitation of Wettest Quarter

BIO17 = Precipitation of Driest Quarter

BIO18 = Precipitation of Warmest Quarter

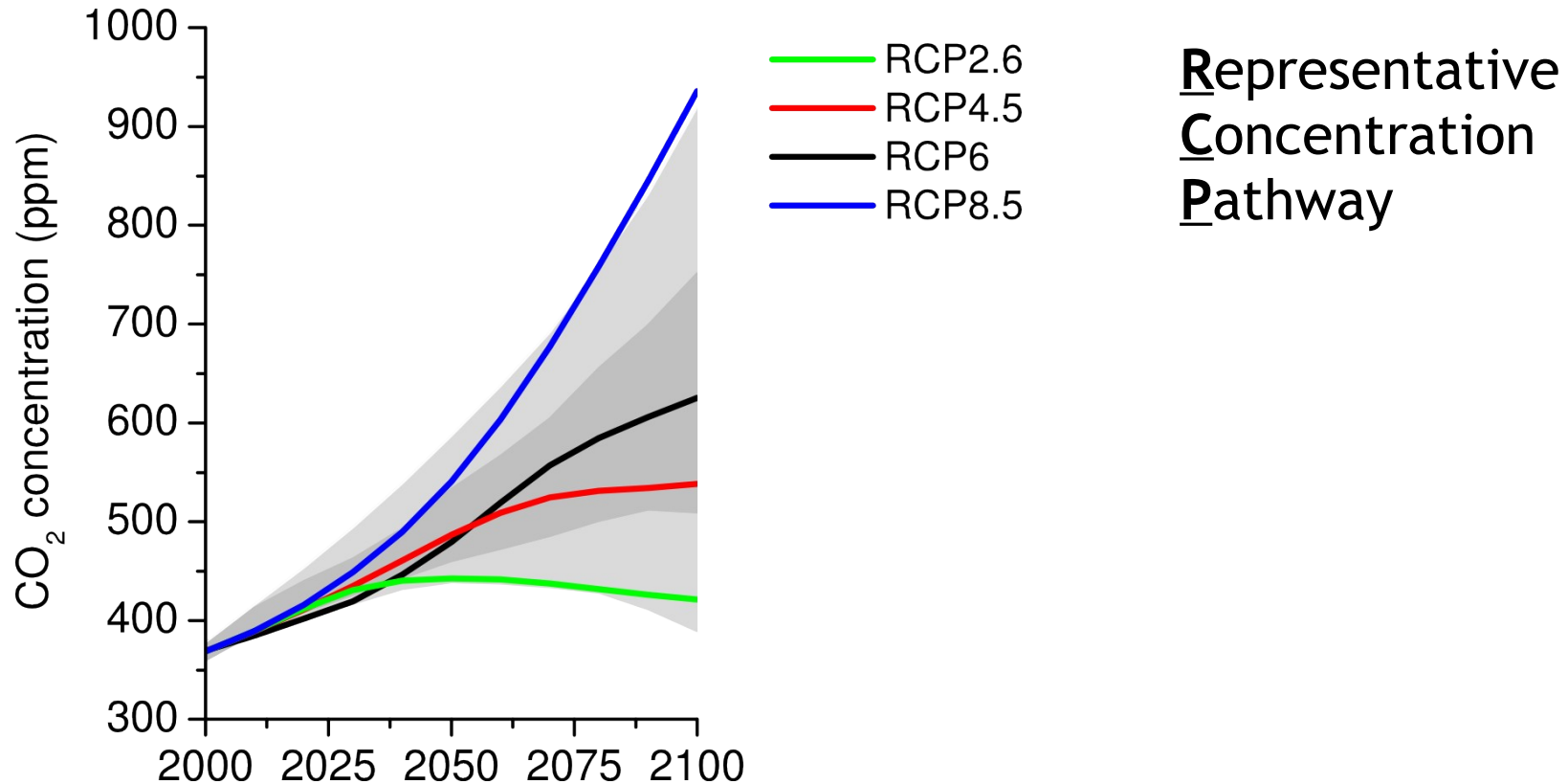
BIO19 = Precipitation of Coldest Quarter



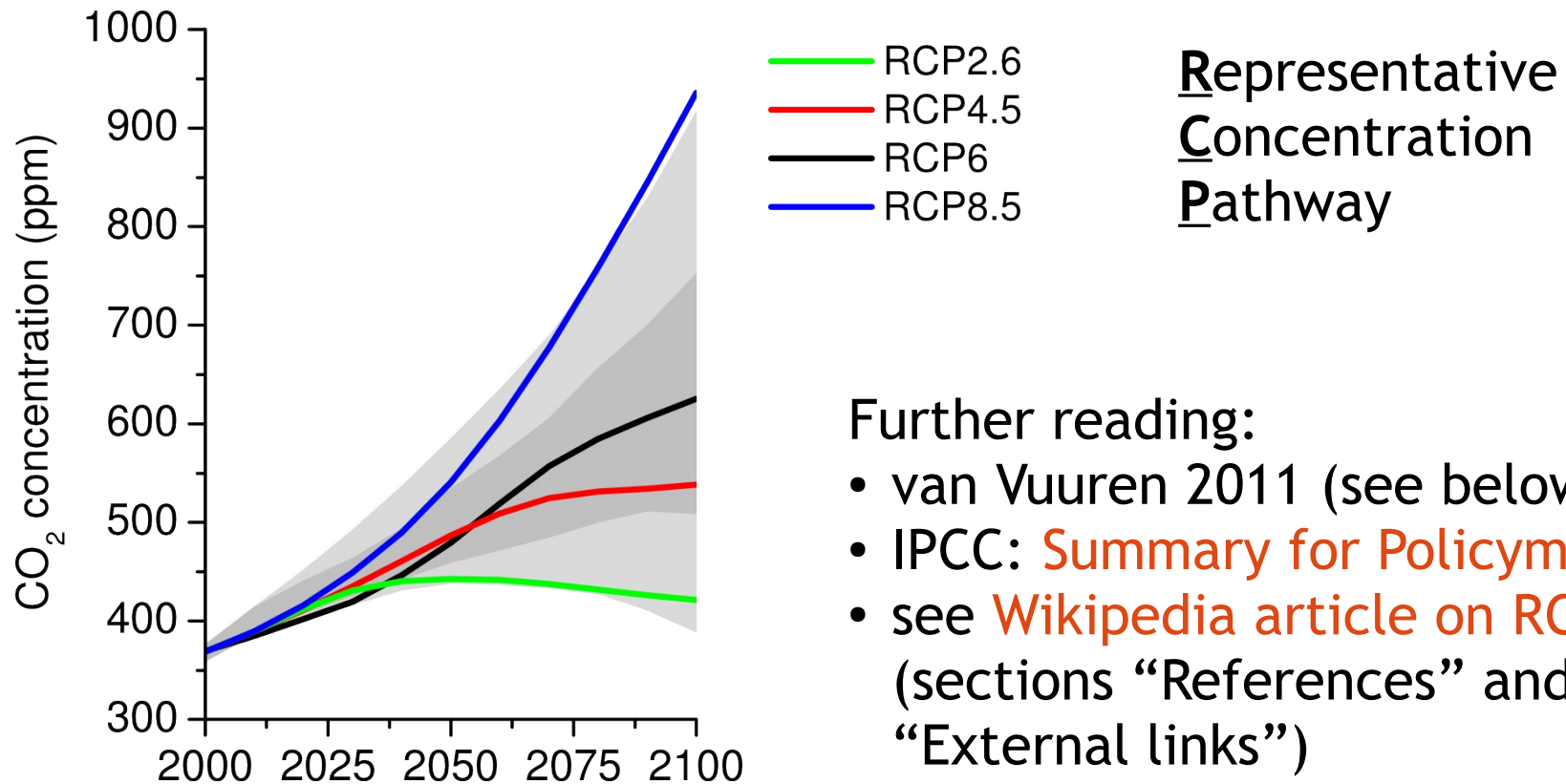
Future climate: IPCC 5 scenarios



Future climate: IPCC 5 scenarios



Future climate: IPCC 5 scenarios





Future climate: CMIP5

- models are not reality
- there is not a single “right” model
- different models give different results
- different models are good/bad at different things



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- models are not reality
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Coupled Model Intercomparison Project:

Many different institutions are building different models after common conventions, and compare them to see where they (dis-) agree



Future climate: CMIP 5

| Modeling Center (or Group) | Institute ID | Model Name |
|---|--------------|-----------------------------|
| Commonwealth Scientific and Industrial Research Organization (CSIRO) and Bureau of Meteorology (BOM), Australia | CSIRO-BOM | ACCESS1.0 ACCESS1.3 |
| Beijing Climate Center, China Meteorological Administration | BCC | BCC-CSM1.1 BCC-CSM1.1(m) |
| Instituto Nacional de Pesquisas Espaciais (National Institute for Space Research) | INPE | BESM OA 2.3* |
| College of Global Change and Earth System Science, Beijing Normal University | GCESS | BNU-ESM |
| Canadian Centre for Climate Modelling and Analysis | CCCMA | CanESM2 CanCM4 CanAM4 |
| University of Miami - RSMAS | RSMAS | CCSM4(RSMAS)* |
| National Center for Atmospheric Research | NCAR | CCSM4 |



Data sources - future climate: pre-processed

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CMIP5

Downscaled IPCC5 (CMIP5) data

The data available here are climate projections from global climate models (GCMs) for four [representative concentration pathways](#) (RCPs). These are the most recent GCM climate projections that are used in the Fifth Assessment IPCC report. The GCM output was [downscaled and calibrated \(bias corrected\)](#) using [WorldClim 1.4](#) as baseline 'current' climate.

The data are available at different spatial resolutions (expressed as minutes or seconds of a degree of longitude and latitude): [10 minutes](#), [5 minutes](#), [2.5 minutes](#), [30 seconds](#). The variables included are monthly minimum and maximum temperature, precipitation, and 'bioclimatic' variables.

- + high resolution (30 arcsec)
- low temporal resolution (monthly)
- + bioclimatic variables
- starts 2041



Data sources - future climate: pre-processed

- + high resolution (30 arcsec)
- low temporal resolution (monthly)
- + bioclimatic variables
- + starts ~ 2000
- + more choices available
- + great support

Home: ccaafs-climate.org
data download: ccaafs-climate.org/data

Data sources - future climate: pre-processed

- + GCM data output downscaled to high spatial resolution
- + pre-processed into bioclimatic variables
- + data formats (ESRI-grid, ASCII-grid) relatively easy to handle for non-climatologists
- monthly resolution



Data sources - future climate: “raw” data



ESGF
Earth System Grid Federation

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

GEFÖRDERT VOM
Bundesministerium
für Bildung
und Forschung

DKRZ
DEUTSCHES
KLIMARECHENZENTRUM

WDC
CLIMATE

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This is where climatologists publish their data ...

<http://esgf-data.dkrz.de/esgf-web-fe/>

Welcome to the ENES archive at DKRZ



Peer Nodes

-  [ANL Node](#) 
-  [BADC Node](#) 
-  [BNU Node](#) 
-  [CMCC Node](#) 



About WDC/DKRZ

DKRZ, the German
Climate Computing Centre,
provides tools and the



Resources



Quick Links

- [Create Account](#)



Data sources - future climate: “raw” data

Pros:

- full output from most climate models
- many parameters
- up to daily resolution

Cons:

- native spatial resolution of most GCMs: $>1^\circ$
- easy to get lost in the data base unless you know exactly what you want
- data format NetCDF can be hard to handle
- pre-processing downloaded data can take weeks





Data sources - future climate: “raw” data

Where to get help/more information:

- Paola Petrelli: **CMIP5 and other climate data survival guide**
- CMIP-homepage: <http://cmip-pcmdi.llnl.gov/index.html>
 - Taylor et al.: **CMIP5 Data Reference Syntax**
 - Taylor et al.: **CMIP5 Model Output Requirements**
 - overview of variables: **standard_output.xls**
- Higher resolution data :
 - **CORDEX initiative** (regional downscaling)
 - Christensen: **CORDEX Archive Design**
 - **EURO-CORDEX** (data available from ESGF-hubs)



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