

Welcome to Germany

Welcome at Potsdam

Part 1

Climate Data & Diagnostic

RD1

EARTH SYSTEM ANALYSIS

Atmosphere, Ocean, Ice Sheet & Vegetation



Multi-sector Impacts and Climate Extremes

CLIMATE IMPACTS AND VULNERABILITIES

RD2

RD3

SUSTAINABLE SOLUTIONS

Global Adaption Strategies, Policy Assessment



Complex Networks and Visualization

TRANSDISCIPLINARY CONCEPTS & METHODS

RD4

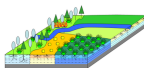
Models/Tools at compute cluster:



Potsdam Earth Model



Parallel Ice Sheet Model



Lund-Potsdam-Jena managed Land



COSMO-ClimateLimited-areaModelling



Soil and Water Integrated Model



FORESt Ecosystems in a Changing Environment



Outline:

① Climate Data

- ① from global to national: access ++ costs ++ handling

② Climate Diagnostic

- ① from global to local: circulation pattern ++ extremes

③ Climate Scenarios

- ① from global to regional: dynamical/statistical ++ access ++ bias correction

④ Weather in Climate Models

- ① objectivation of European circulation pattern
- ② assessment of climate models

Climate Data:

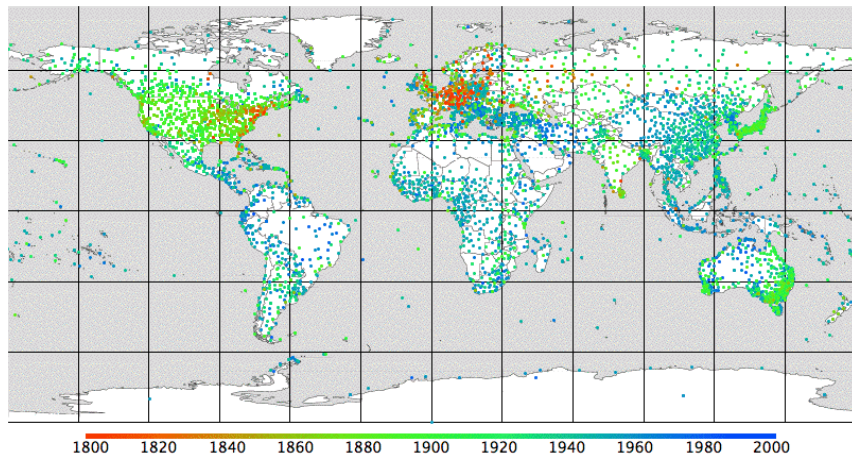
| Scale | Dataset | | Access | Costs | Usage |
|----------|---------|--------------|----------------|-----------|-------------|
| global | WATCH | daily | consortium | — | ISI-MIP |
| | CRU | monthly | consortium | — | Studies |
| | WDC | monthly | connection | 5000 €/yr | Studies |
| regional | E-OBS | daily | free access | — | Monitoring |
| national | DWD | hourly/daily | limited access | 250 €/yr | Swim-live |
| | | | | | downscaling |
| global | GFS/CFS | 3 hourly | free access | — | forecasting |

- Data handling:

- ▶ exchange via ftp and wget
- ▶ interactive programming languages: R & Python



Climate Data: global



GCHN Database, as used by CRU and NCDC

Climate Data: monthly climate data

WDC, Obninsk

Ethiopia (Part B)(63300- 63599)

6333120150208055199999902281089199999999999903101015010901
6340220150208367199999902001124105101691194103161008412121
6347120150208865199999902461125199900001017103231016912721

Kenya & Tanzania (United Republic of) & Uganda(63600- 63979)

6375620150208858199999902401214104100361999902891999992401
6383220150208826199999902341215110100841999902981015912351
6396220150208950199999902261219112100751001102861015111731
6397120150209979110107102731295103100961999903091023712451

Zaire|(64000- 64379)

6421020150209753110101102631277110102411999903171022619999

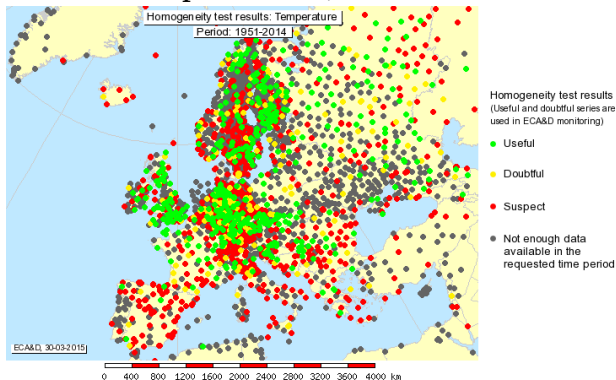
NST(5) + YEAR(4) + MONTH(2) + P0(6:0.1mb) + P(6:0.1mb) + TMEAN(5:0.1°C) + VAP(4:0.1mb) +
N(3:>1mm) + R(5:1mm) + ST(4) + TMAX(5:0.1°C) + TMIN(5:0.1°C) + SUN(4:1h)



Station_list: 637560 HTMW MWANZA TN -0246 +03291 1140

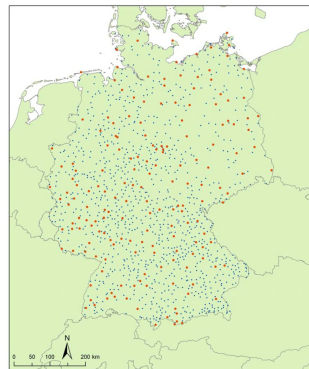
Climate Data: regional to national

Europe (E-OBS, $0.25^\circ \times 0.25^\circ$)



ca. 250 useful stations

Germany (DWD)



180 & 1038

Climate Data: Access



WebWerdis



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Customer / User

Data flow statistics

Miscellaneous

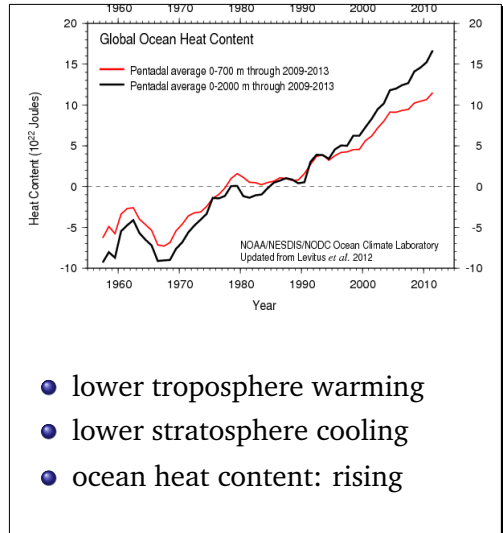
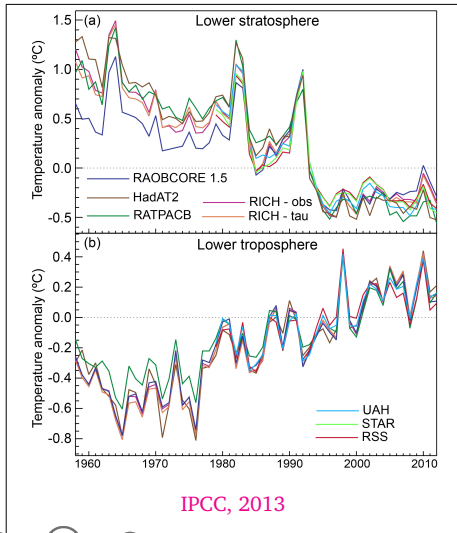
Matches: 59

[First page](#) | [Previous 15](#) | [1 - 15 of 59](#) | [Next 15](#) | [Last page](#)

| Product ID | Title | Product | Metadata | XML | Example |
|------------------------------|---|---------|----------|-----|---------|
| de.dwd.cpd.rcm | Regional Climate Projections | ✗ | ○ | ○ | - |
| de.dwd.hydromet.owlk.climate | oWLK-GCM objective weather types derived from General Circulation Models (Reanalysis data and Global Climate Model Simulations) | ○ | ○ | ○ | - |
| de.dwd.nkdz.collections | Time series of different meteorological elements provided on files related to the federation states of Germany and some 1-km-grid fields for download | ○ | ○ | ○ | - |
| de.dwd.nkdz.DDHM | Climatological time serie: hourly means of wind direction (in degrees) | ○ | ○ | ○ | - |
| de.dwd.nkdz.FBDM | Climatological time serie: daily mean of windforce (in Bft) | ○ | ○ | ○ | - |
| de.dwd.nkdz.FFDM | Climatological time serie: daily mean of windspeed (in m/sec) | ○ | ○ | ○ | - |
| de.dwd.nkdz.FFDX | Climatological time serie: daily maximum of windspeed (in m/sec) | ○ | ○ | ○ | - |
| de.dwd.nkdz.FFHM | Climatological time serie: hourly means of wind speed (in m/sec) | ○ | ○ | ○ | - |
| de.dwd.nkdz.HRRMS | monthly sums of precipitation (homogeneous) (in mm) | ○ | ○ | ○ | - |
| de.dwd.nkdz.HTAMM | monthly means of air temperature (homogeneous) (in degree C) | ○ | ○ | ○ | - |

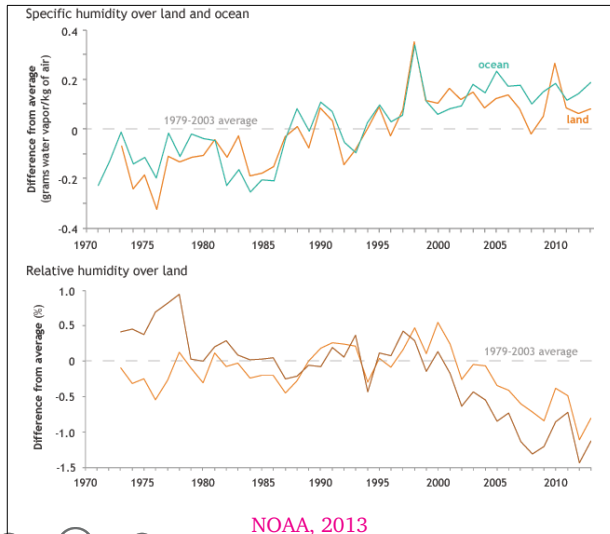


Climate Diagnostic: Temperature (Atmos./Ocean)

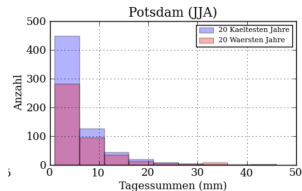


- lower troposphere warming
- lower stratosphere cooling
- ocean heat content: rising

Climate Diagnostic: Humidity (global)



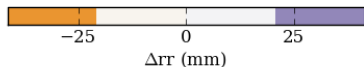
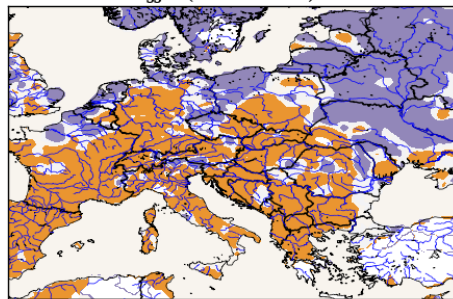
- specific humidity (g/kg)
 - ▶ rising
 - ▶ more wv in atmosphere
- relative humidity (%)
 - ▶ falling
 - ▶ condensation level rises
- if its rain than more heavy
- shift of the precipitation spectrum



Climate Diagnostic: Precipitation (Europe)

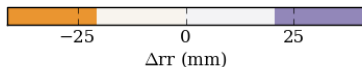
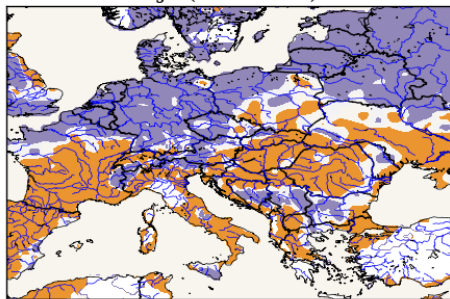
1984-2013 — 1951-1980

JJA (8413-5180)



Summer

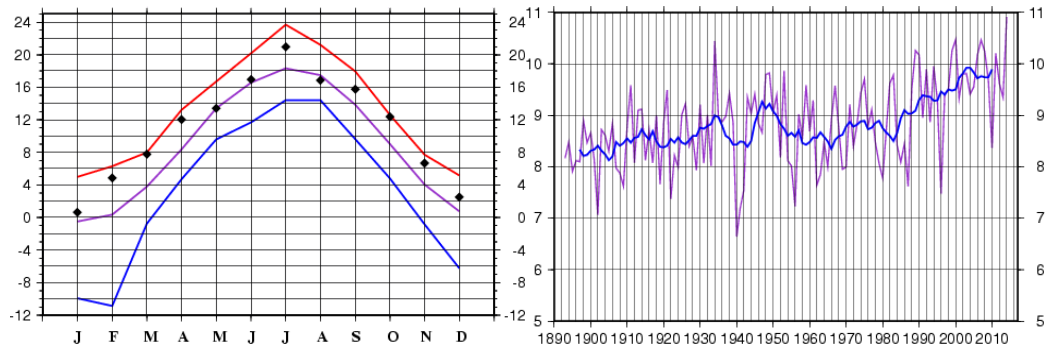
DJF (8413-5180)



Winter

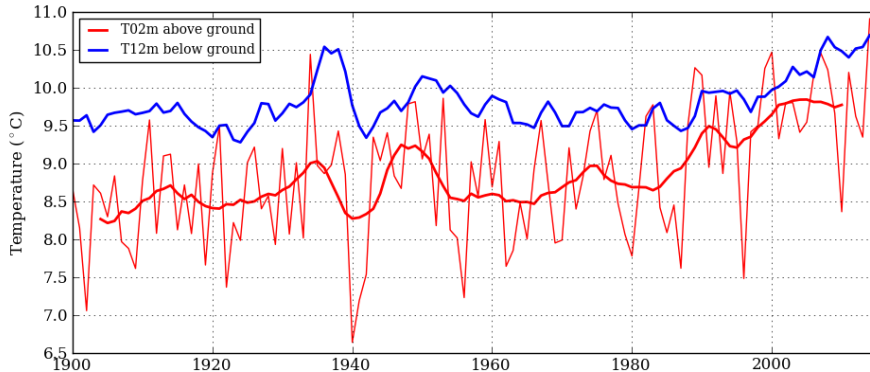
E-OBS

Climate Diagnostic: Potsdam



2014: the warmest year on record (10.91°C)
globally, in Europe and in Germany

Climate Diagnostic: Potsdam



annual mean Temperature
2m-Temperature and 12m Temperature below ground



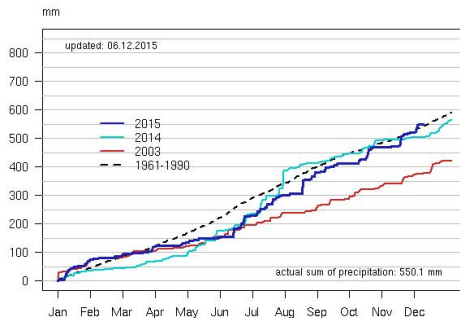
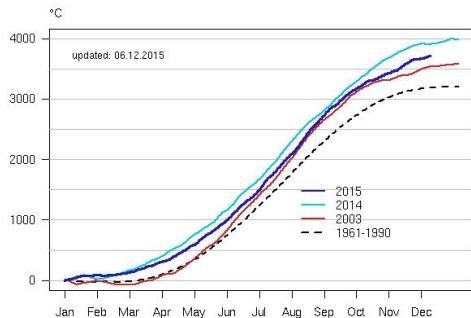
Climate Diagnostic: Potsdam

| • year | • Jan | • Feb | • Mar | • Apr | • May | • Jun |
|------------|--|-------|-------|-------|-------|-------|
| | • Jul | • Aug | • Sep | • Oct | • Nov | • Dec |
| show | | | | | | |
| date | highest daily maximum of air temperature in year | | | | | |
| 9. 8.1992 | 39.1 °C | | | | | |
| 11. 7.1959 | 38.4 °C | | | | | |
| 10. 7.1959 | 38.2 °C | | | | | |
| 11. 7.2010 | 38.0 °C | | | | | |
| 1. 8.1994 | 37.7 °C | | | | | |

| • year | • Jan | • Feb | • Mar | • Apr | • May | • Jun |
|------------|---|-------|-------|-------|-------|-------|
| | • Jul | • Aug | • Sep | • Oct | • Nov | • Dec |
| show | | | | | | |
| date | lowest daily minimum of air temperature in year | | | | | |
| 11. 2.1929 | -26.8 °C | | | | | |
| 10. 2.1929 | -26.0 °C | | | | | |
| 19. 1.1893 | -25.7 °C | | | | | |
| 21.12.1969 | -24.5 °C | | | | | |
| 18. 1.1893 | -24.3 °C | | | | | |

| • year | • Jan | • Feb | • Mar | • Apr | • May | • Jun |
|------------|--|-------|-------|-------|-------|-------|
| | • Jul | • Aug | • Sep | • Oct | • Nov | • Dec |
| show | | | | | | |
| date | highest daily total of precipitation in year | | | | | |
| 8. 8.1978 | 105.7 mm | | | | | |
| 12. 8.2002 | 83.9 mm | | | | | |
| 9. 7.1927 | 83.1 mm | | | | | |
| 29. 8.1969 | 79.2 mm | | | | | |
| 25. 6.1940 | 69.2 mm | | | | | |

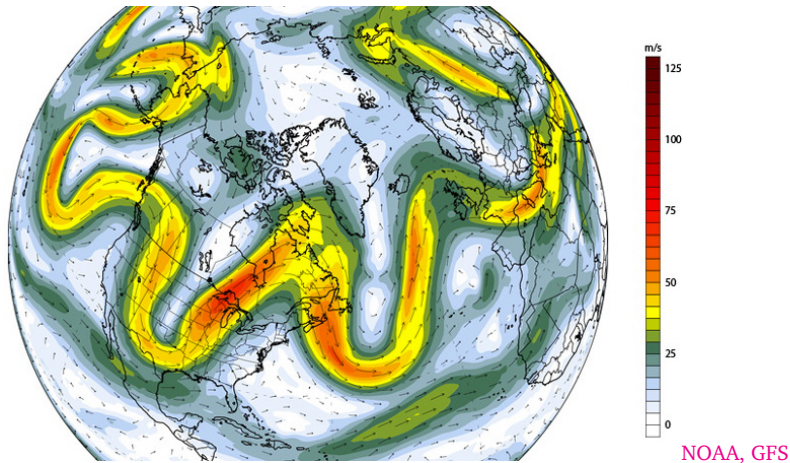
Climate Diagnostic: Potsdam



2015: cumulative charts

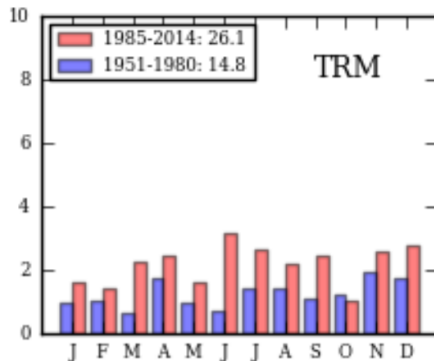
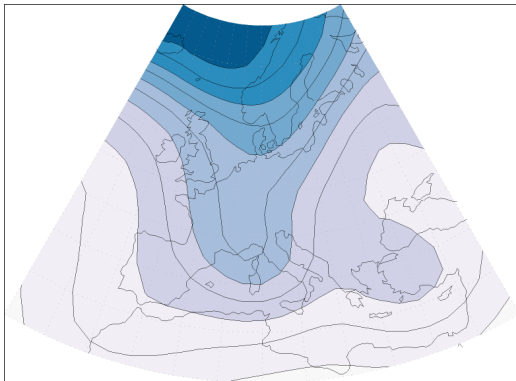
Temperature (left) and Precipitation (right)

Climate Diagnostic: Jetstream



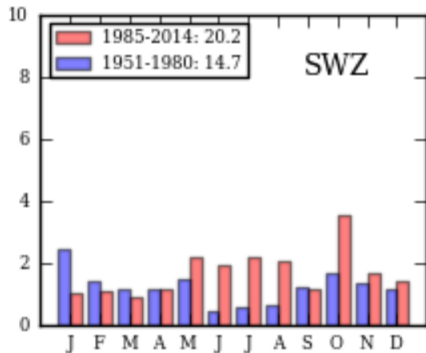
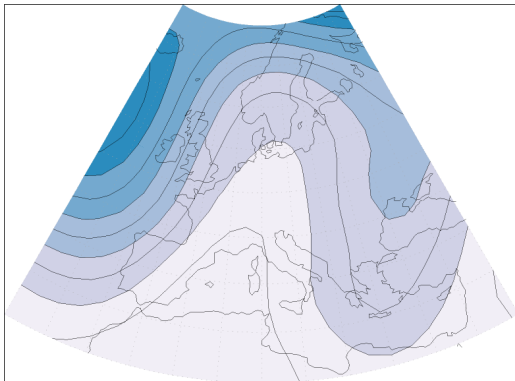
weather driver

Climate Diagnostic: Weather Situations



”Trough over Central Europe”
increasing

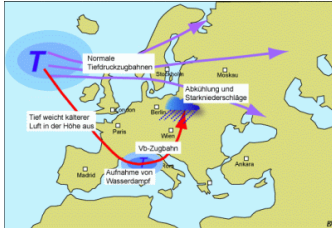
Climate Diagnostic: Weather Situations



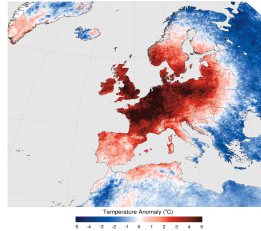
**"Southwest Cyclonic"
increasing**

Climate Diagnostic: Extreme Weather Events

Floods



Heatwaves



Storms



Thunderstorms



Black Ice



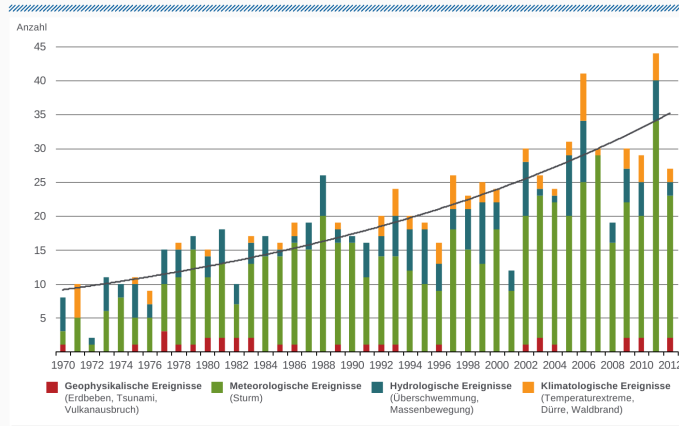
Climate Diagnostic: Natural Disasters

NatCatSERVICE

Naturkatastrophen in Deutschland 1970 – 2012

Anzahl der Ereignisse mit Trend

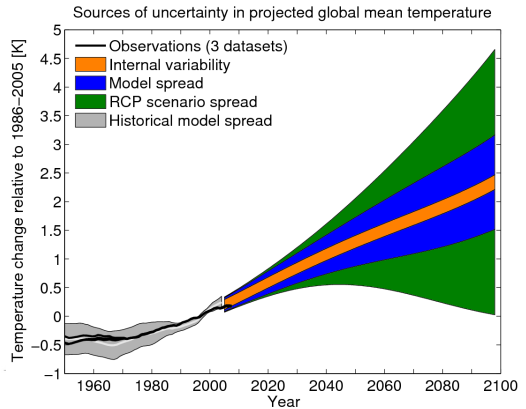
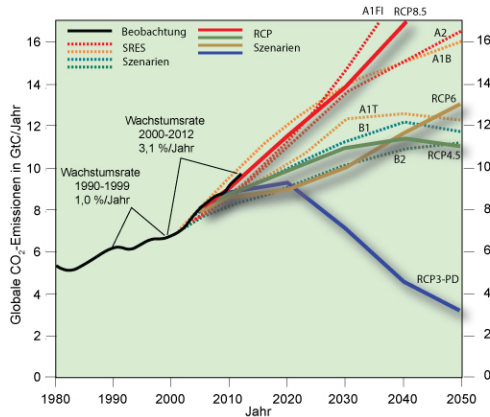
Munich RE 



© 2013 Münchener Rückversicherungs-Gesellschaft, GeoRisikoForschung, NatCatSERVICE – Stand Januar 2013

Munich RE, 2013

Climate Scenarios: Emissions & Temperature



IPCC, 2013

RCP 8.5 (business as usual scenario): $4K \pm 0.5$
the most likely one

Climate Scenarios: ESGF



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[\(x\) domain:EUR-11](#)
[\(x\) model:CCLM4-8-17](#)
[\(x\) experiment:rcp85](#)
[\(x\) time frequency:day](#)
[\(x\) driving model:MPI-M-MPI-ESM-LR](#)
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Search Categories

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| Institute |
| Model |
| Instrument |

Temporal Search
Clear search
constraints and
datacart
Search Help
Search Controlled
Vocabulary

Examples: *temperature*, *"surface temperature"*, *climate AND project:CMIP5 AND variable:hus*.
To download data: add datasets to your Data Cart, then click on *Expand* or *wget*.

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Results

Data Cart

[cordex.output.EUR-11.CLMcom.MPI-M-MPI-ESM-LR.rcp85.r1i1p1.CCLM4-8-17.v1.day.tas](#)

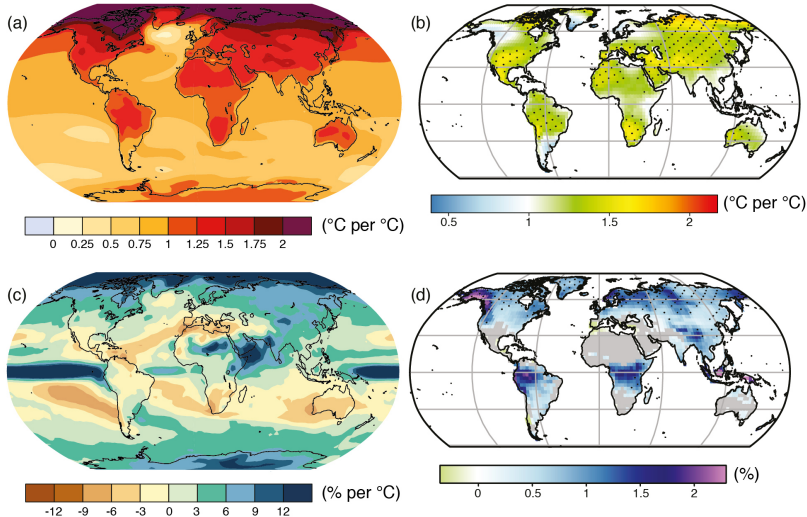
Data Node: carbon.dkrz.de

Version: 20140515

No description available.

Further options: [Add To Cart](#) [Visualize and Analyze](#)

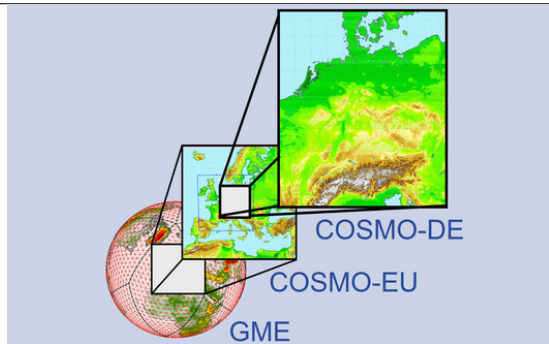
Climate Scenarios: global (1° warming level)



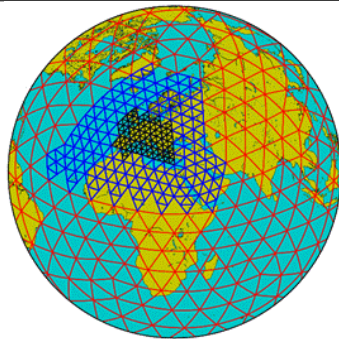
IPCC, 2013

Climate Scenarios: downscaling

CMIP5 → Cordex



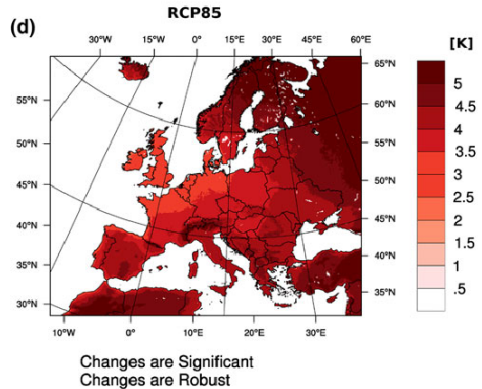
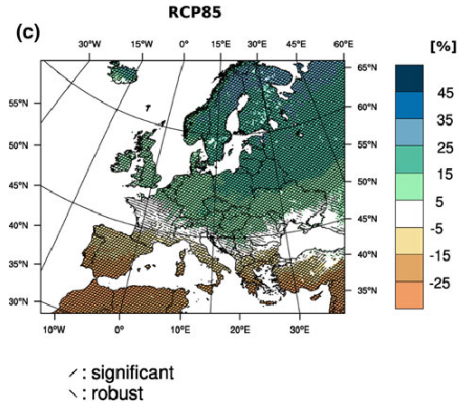
ICON



DWD

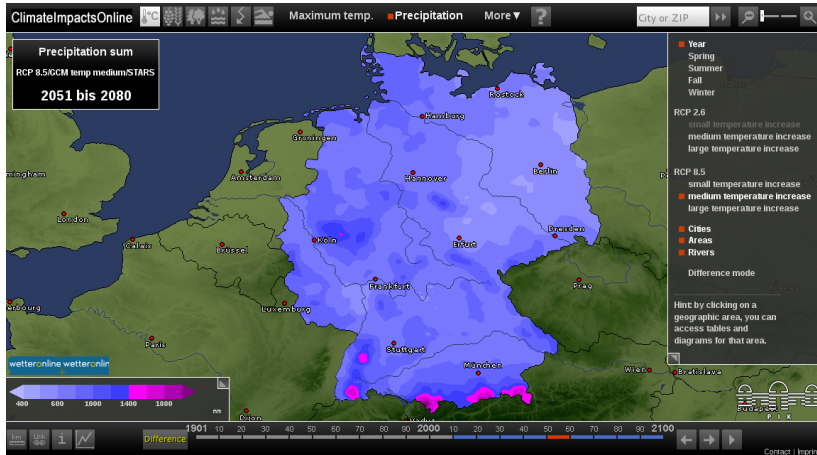
dynamical downscaling

Climate Scenarios: regional



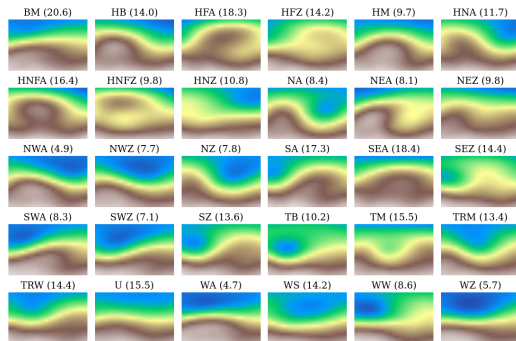
Jacob et al. 2013

Climate Scenarios: national



ClimateImpactsOnline

Weather in Climate Models: Pattern in Reanalyses

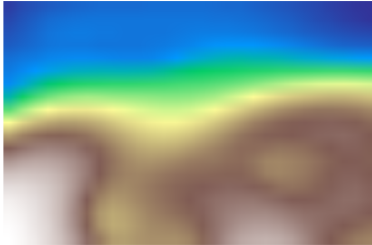


| | |
|-----|-----------------------------------|
| WZ | Cyclonic Westerly |
| SWA | Anticyclonic South-Westerly |
| NWZ | Cyclonic North-Westerly |
| HM | High over Central Europe |
| BM | Zonal Ridge across Central Europe |
| TM | Low (Cut-Off) over Central Europe |
| NA | Anticyclonic Northerly |
| NZ | Cyclonic Northerly |
| HB | High over the British Isles |
| TRM | Trough over Central Europe |
| SA | Anticyclonic Southerly |
| SZ | Cyclonic Southerly |
| TB | Low over the British Isles |
| TRW | Trough over Western Europe |

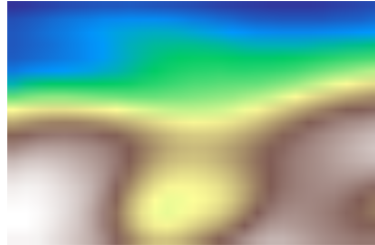
European circulation pattern at GPH500
Climatology

Weather in Climate Models: Image Comparison

had: TRM (1980-12-02)



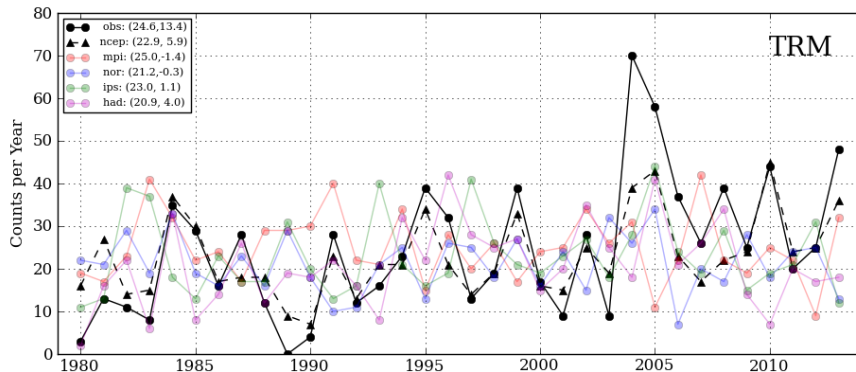
ncep/ncar (1982-12-24)



Daily patterns in climate models are compared with daily patterns in reanalysis data to detect the most similar day!

Weather in Climate Models: long-term Trends

Identification of European circulation pattern via image comparison “Trough over Europe”



observation/reanalyses



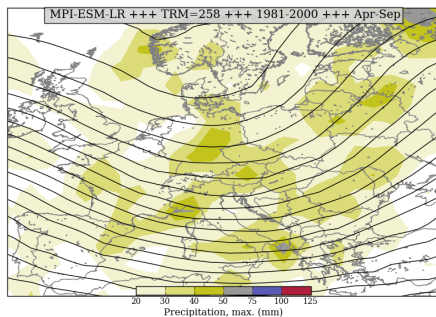
climate models



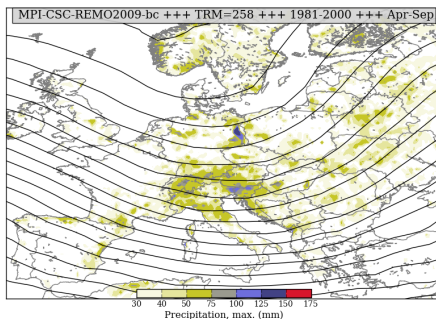
Weather in Climate Models: Applications

Trough over Central Europe (TRM)

GCM



RCM

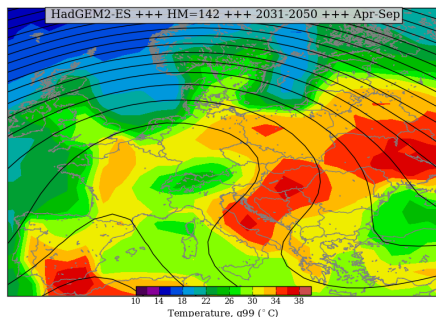


heavy precipitation

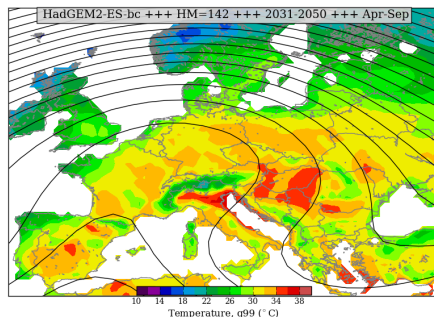
Weather in Climate Models: Applications

High over Central Europe (HM)

GCM uncorrected

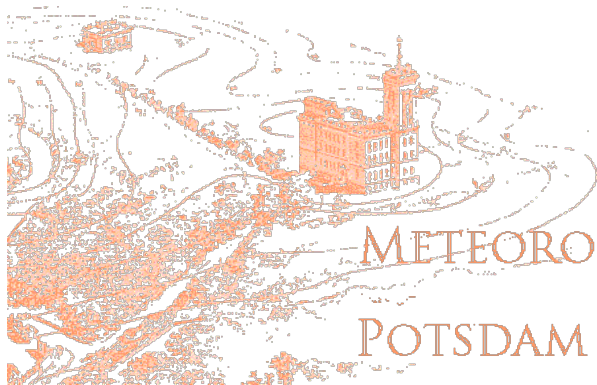


GCM corrected



temperature extreme

INVITATION TO VISIT



LONG-TERM
METEOROLOGICAL STATION
POTSDAM TELEGRAFENBERG



- 100 year without gaps (81m)
- unchanged measurement and boundary conditions
- recording of the most important meteorol. values
- jewel among the meteorol. long-term series worldwide
- first official weather observation: 1st Jan 1893
- Reinhard Süring: director from 1909 for 23+5 years
- record ballon ascend: 31st July 1901 (10.800m)
- Süring died in the age of 85 years (1951)
- 2020: DWD plans to say goodbye from visual observ.

The long-term station Potsdam is the only one worldwide measuring before 1900:

- soil temperature + snow cover + frost depth + Tmin near ground + cloud forms + sight + precip. kind

Measurement Programme:

- soil temperature: 2cm, 5cm, 10cm, 20cm, 50cm, 1m, 2m, 4m, 6m, 12m