

The year 2025 in context of global climate change

Dipl.-Met. Benjamin Held M.Sc. (Raziel)

4. Juli 2026

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- 1 Introduction
- 2 Observation data
- 3 Political decisions
- 4 Conclusion

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Local climate highlights recap 2024 [7]

Ref	T_{mean}	T_{Ref}	P_{mean}	P_{Δ}	Sun_{mean}	Sun_{Δ}
61-90	10.9°C	+2.7°C	902 mm	+14%	1675h	+8.4%

Tabelle: Meteorological mean values for germany in 2024

Temp.	Winter	Spring	Summer	Autumn
T_{Δ}	+3.8°C	+3.2°C	+2.2°C	+1.7°C
Precip.				
P_{Δ}	+53%	+23%	+0%	+21%
Sun				
Sun_{Δ}	-2%	+4%	+15%	+5%

Tabelle: Seasonal mean values for germany in 2024

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Local climate highlights recap 2025 [3]

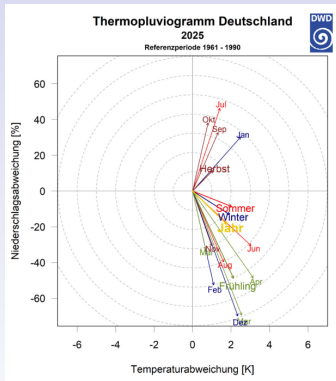
Ref	T_{mean}	T_{Ref}	P_{mean}	P_{Δ}	Sun_{mean}	Sun_{Δ}
61-90	10.0°C	+1.8°C	642 mm	-19%	1914h	+23.9%

Tabelle: Meteorological mean values for germany in 2025

Temp.	Winter	Spring	Summer	Autumn
T_{Δ}	+2.0°C	+2.1°C	+2.0°C	+1.0°C
Precip.				
P_{Δ}	-13%	-49%	-9%	+11%
Sun				
Sun_{Δ}	+19%	+49%	+15%	-4%

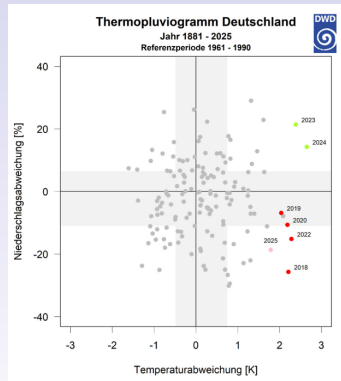
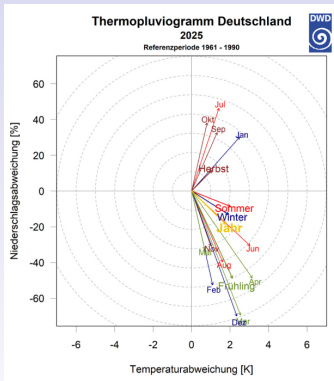
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Monthly anomalies



[3]

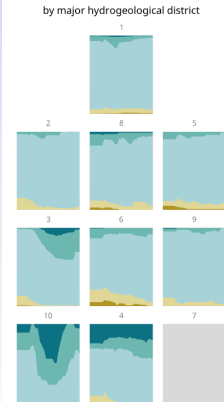
Monthly anomalies



[3]

Groundwater development

Monthly overview for January 2025



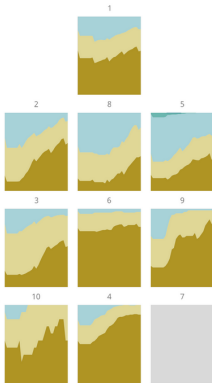
[9]

- good water level in jan 2025 due to winter rain in 2024
- rain deficit in spring, summer and winter led to reduced ground water levels
- autumn with minimal surplus, but yearly mean in deficit
- Spoiler 2026: deficit still holding, ground water levels are bad (ground water)

Groundwater development

Monthly overview for July 2025

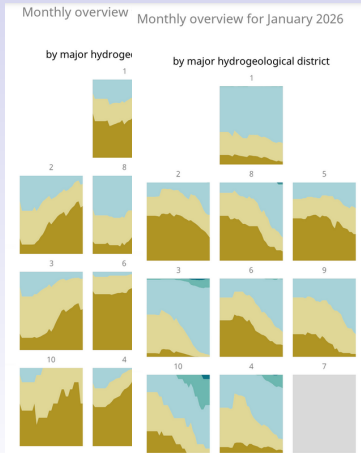
by major hydrogeological district



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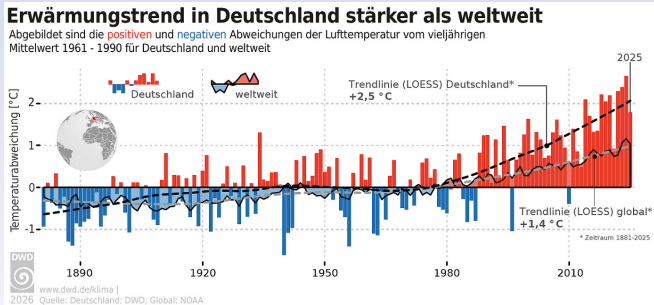
Groundwater development



[9]

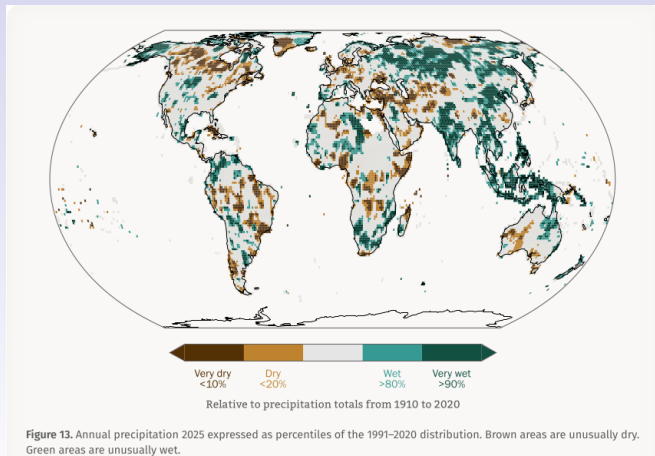
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Observation context to climate change



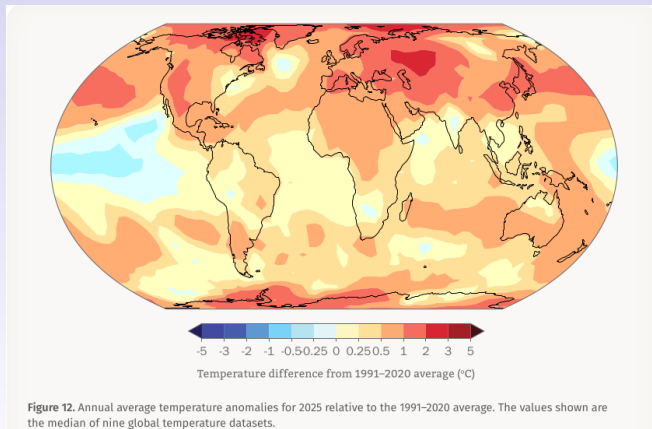
[3]

Global climate anomalies



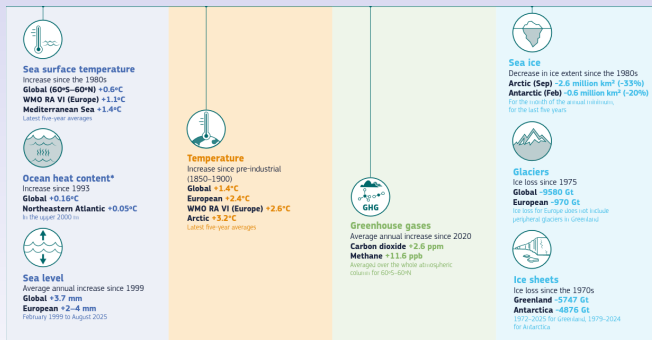
[11]

Global climate anomalies



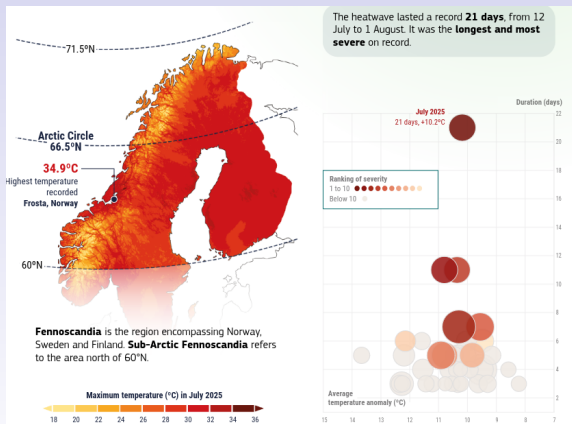
[11]

Global climate highlights



[1], [WMO RA VI]

Global climate highlights

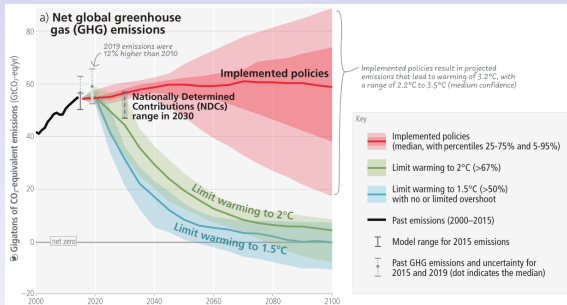


[1]

Inhalt

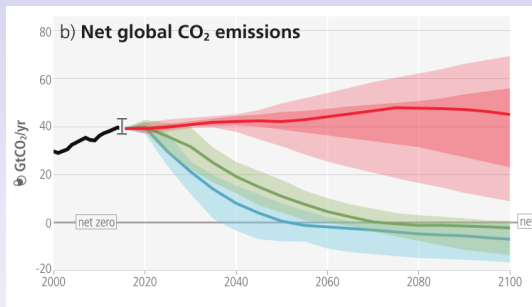
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Reports on climate change



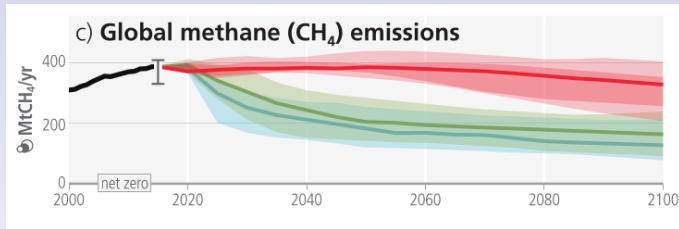
- IPCC report with observations and predictions on global and local climate change
- main problem: anthropogenic emissions
- several emission and energy usage scenarios [2]

Reports on climate change



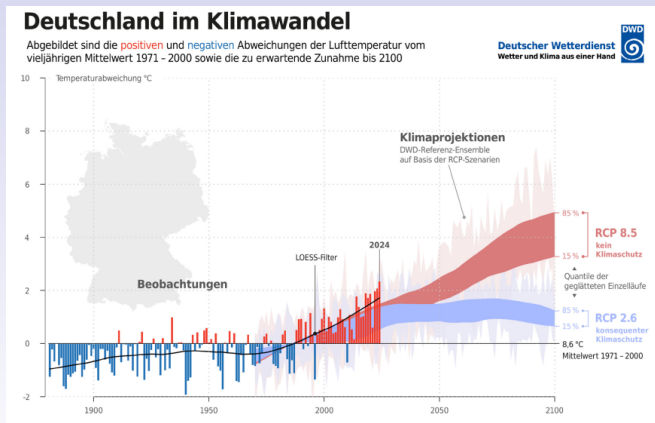
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Observation context to climate change



[7]

Game of Quotes

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- Mir geht es nicht darum, Ziele für Klimaschutz infrage zu stellen, sondern darum, ob es andere Wege gibt, kosteneffizienter zum Ziel zu kommen.

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Source of (most) of these citations?

A meeting symptomatic for the current politics regarding climate change:

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- Attendants: fossile energy, chemical industry, conservative economy politicians ...
but missing: representatives of renewable energies, green-tech and the few people talking about climate politics within the CDU

[8]

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Summary

- Europe and especially Germany are heating up faster than the global temperature change
- after 2 more humid year (overall mean) 2025 was more arid
- long term statistics points to warmer more arid year
- leading politicians actively sabotage actions to mitigate the impact of climate change
- even after the historic heatwave late juni / early july no leading politicians talked about adjustment of climate politics
- so it falls to Karlsruhe (again) to exterminate the results of current climate law making

I am sorry, but it is too late, and it is not worth saving.

...

I think we are doomed, and there is no way back.

> Bring me the Horizon - Doomed

Questions? Feedback?



C3S/ECMWF and WMO.

C3S-WMO European State of the Climate 2025.

<https://climate.copernicus.eu/sites/default/files/2026-04/ESOTC-2025-summary.pdf>, 3 2026.



H. Lee Core Writing Team and J. Romero (eds.).

IPCC, 2023: Climate Change 2023: Synthesis Report.

Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

IPCC, Geneva, Switzerland, 2023.



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Klimastatusbericht Deutschland Jahr 2025.

Offenbach, 3 2026. <https://www.dwd.de/DE/leistungen/klimastatusbericht/klimastatusbericht.html>

<https://www.dwd.de/DE/leistungen/klimastatusbericht/klimastatusbericht.html>



DWD.

German Weather Service (Deutscher Wetterdienst).

www.dwd.de, 09 2018.



ECMWF.

Data Coverage - Synop, Ship, Temp.

<https://charts.ecmwf.int/catalogue/packages/monitoring/products/d>
07 2024.



Benjamin Held.

Regionalisierung von Klimamodellen.

Diplomarbeit, Leibniz Universitaet Hannover, 2010.



Florian Imbery, Karsten Friedrich, Deborah Niermann, Andreas Becker, Ursula Klasen, and Geschäftsbereich Klima und Umwelt.

Klimastatusbericht Deutschland Jahr 2024.

https://www.dwd.de/DE/leistungen/klimastatusbericht/klimastatusbericht_2024_03_2025.



Various.

TAZ Tageszeitung.

<https://taz.de/Schwerpunkt-Klimawandel/!t5008262//>, 07 2025.



Prof. Dr. Ralph Watzel.

Ground water levels and forecast for germany.

<https://gruvo.bgr.de/website/month>, 06 2025.



Wetterzentrale.

Weather reports, forecasts, models.

www.wetterzentrale.de, 10 2018.



World Meteorological Organization (WMO).

State of the Global Climate 2025.

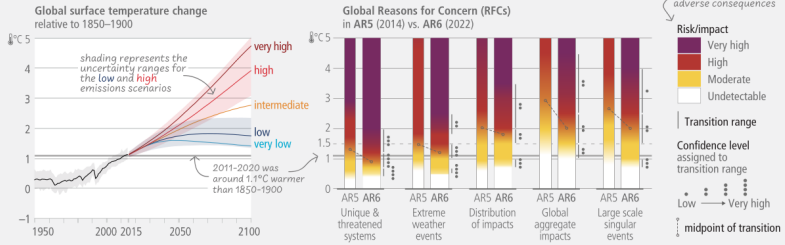
Geneva, 3 2026. <https://library.wmo.int/records/item/69807-state-of-the-global-climate-2025>.

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- 5 Appendix: IPCC report
- 6 Appendix: Numerical modelling details
- 7 Appendix: Basic equations

IPCC results (partial)

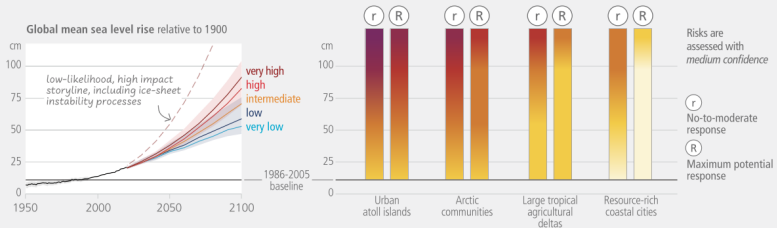
a) High risks are now assessed to occur at lower global warming levels



[2]

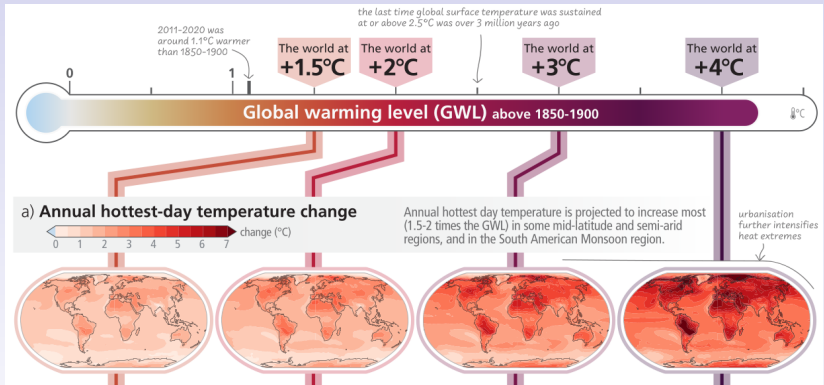
IPCC results (partial)

c) Risks to coastal geographies increase with sea level rise and depend on responses



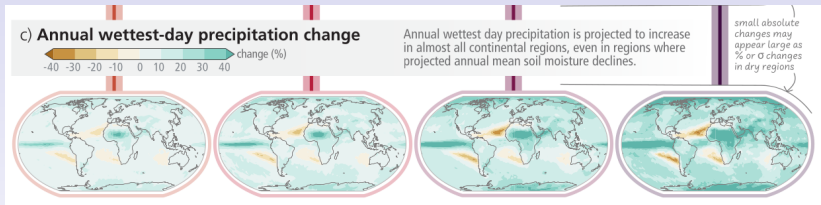
[2]

Temperature AR6 (global)



- in addition: increase of extrem weather events [2]

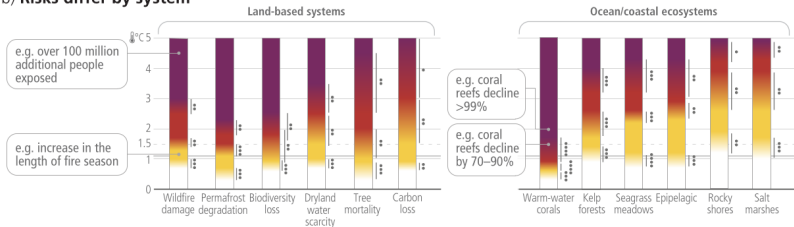
Precipitation AR6 (global)



- for Germany: minor increase of mean precipitation [2]

Additional Risk assessment

b) Risks differ by system

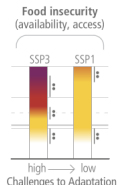
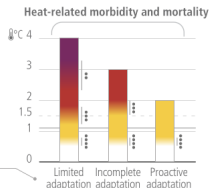


[2]

Additional Risk assessment

d) Adaptation and socio-economic pathways affect levels of climate related risks

Limited adaptation (failure to proactively adapt; low investment in health systems); incomplete adaptation (incomplete adaptation planning; moderate investment in health systems); proactive adaptation (proactive adaptation management; higher investment in health systems)



The SSP1 pathway illustrates a world with low population growth, high income, and reduced inequalities, food produced in low GHG emission systems, effective land use regulation and high adaptive capacity (i.e., low challenges to adaptation). The SSP3 pathway has the opposite trends.

[2]

Emission models

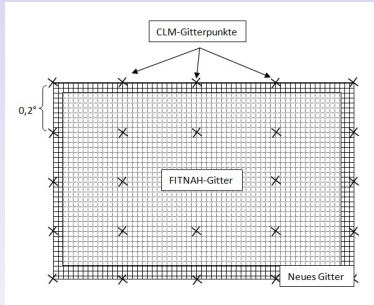
Category in WGIII	Category description	GHG emissions scenarios (SSPx-y*) in WGI & WGII	RCPy** in WGI & WGII
C1	limit warming to 1.5°C (>50%) with no or limited overshoot***	Very low (SSP1-1.9)	
C2	return warming to 1.5°C (>50%) after a high overshoot***		
C3	limit warming to 2°C (>67%)	Low (SSP1-2.6)	RCP2.6
C4	limit warming to 2°C (>50%)		
C5	limit warming to 2.5°C (>50%)		
C6	limit warming to 3°C (>50%)	Intermediate (SSP2-4.5)	RCP 4.5
C7	limit warming to 4°C (>50%)	High (SSP3-7.0)	
C8	exceed warming of 4°C (>50%)	Very high (SSP5-8.5)	RCP 8.5

* See footnote 21 for the SSPx-y terminology.

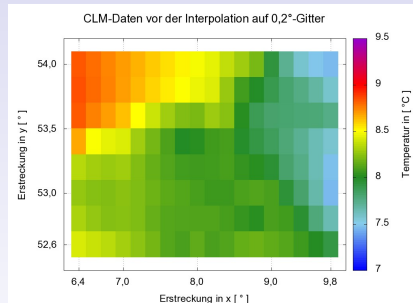
** See footnote 23 for the RCPy terminology.

*** Limited overshoot refers to exceeding 1.5°C global warming by up to about 0.1°C, high overshoot by 0.1°C-0.3°C, in both cases for up to several decades.

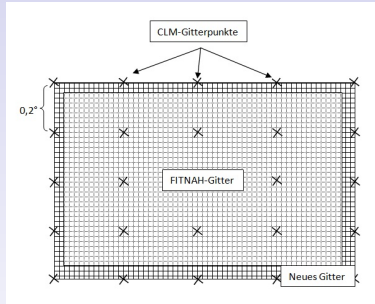
Appendix: Local models



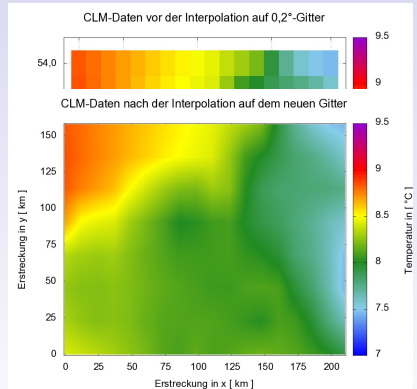
Nesting of models for local forecast with various starting values [6], here Climate limited-area modelling



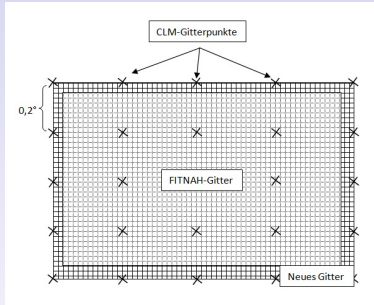
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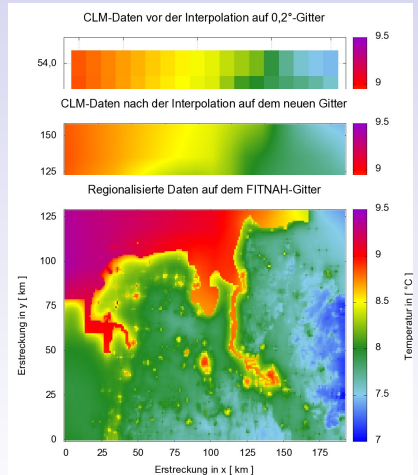
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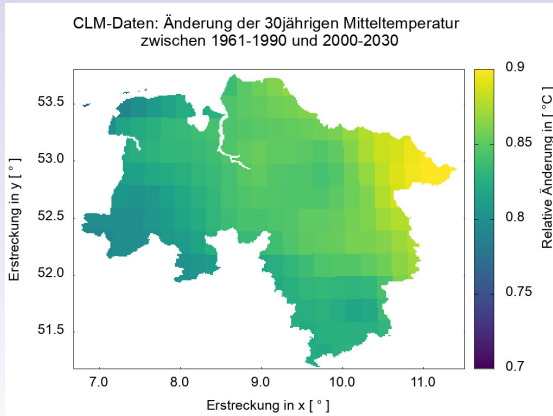
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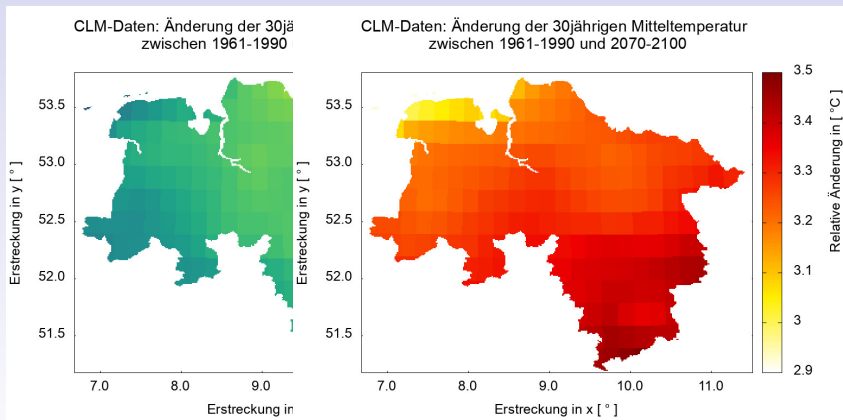


Appendix: Temperature AR4 (local)



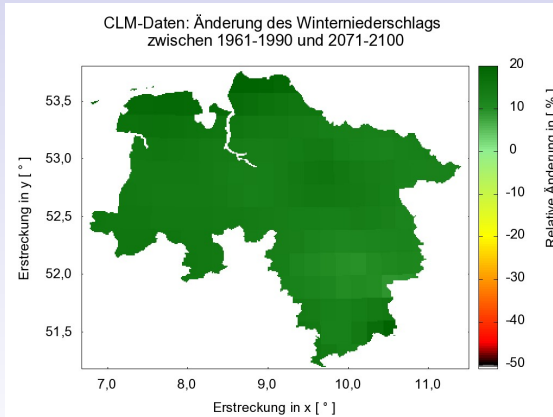
based on data from [6]

Appendix: Temperature AR4 (local)



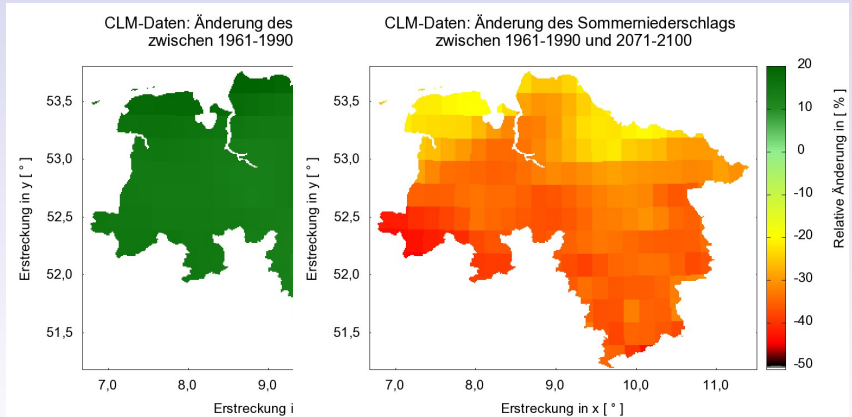
based on data from [6]

Precipitation AR4 (local)



[6]

Precipitation AR4 (local)



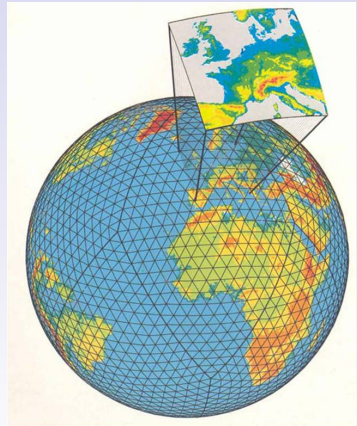
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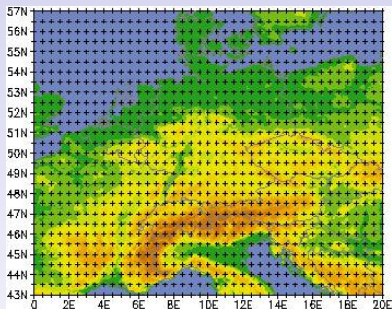
Numerical grid

Separation of the forecast region
by a three-dimensional numerical
grid

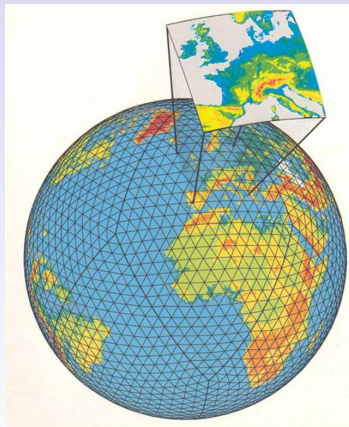
[10], [4]



Numerical grid

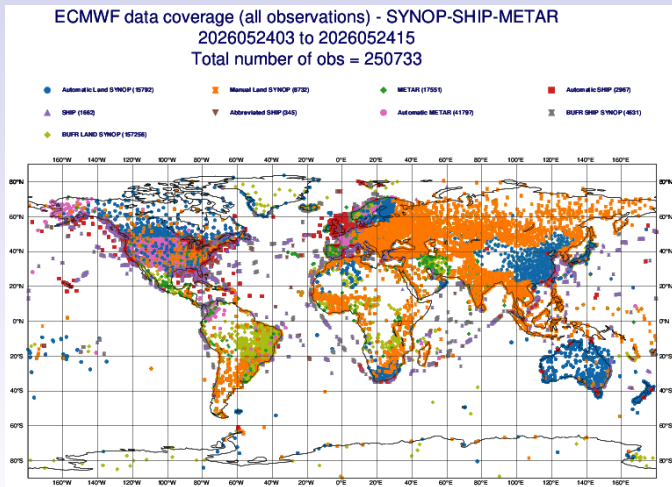


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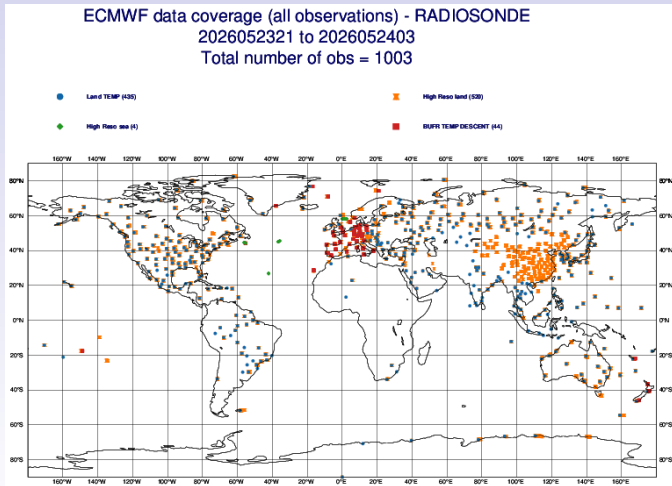
[10], [4]

Input data



[5]

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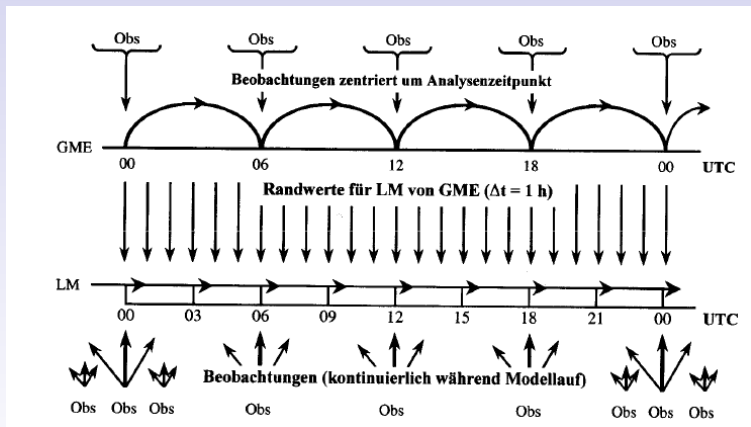


[5]

Starting conditions

- Land use: e.g. city, water, field, forest
- Ground-near wind profile: logarithmic function
- Large-scale wind speed: different direction
- Meteorological data for the starting point from models greater grid resolution
 - Temperature
 - Pressure
 - Wind direction and speed
 - Humidity

Usage of starting conditions



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- Die erste Gleichung ist die Erhaltungsgleichung für den Impuls, die Navier-Stokes-Gleichung.

$$\frac{\partial u_i}{\partial t} + u_k \frac{\partial u_i}{\partial x_k} = -\varepsilon_{ijk} f_j u_k - \frac{\partial \Phi}{\partial x_i} - \frac{1}{\rho} \frac{\partial p}{\partial x_i} + \frac{\mu}{\rho} \frac{\partial^2 u_i}{\partial x_k^2} \quad (1)$$

- Als Bilanzgleichung für die potentielle Temperatur dient der Erste Hauptsatz der Thermodynamik.

$$\frac{\partial \Theta}{\partial t} + u_k \frac{\partial \Theta}{\partial x_k} = P_\Theta \quad (2)$$

- Als weitere Gleichung dient die Bilanzgleichung für die spezifische Feuchte.

$$\frac{\partial s}{\partial t} + u_k \frac{\partial s}{\partial x_k} = P_s \quad (3)$$

- Die Kontinuitätsgleichung dient als Bilanzgleichung für die Masse.

$$\frac{\partial \rho}{\partial t} + u_k \frac{\partial \rho}{\partial x_k} = -\rho \frac{\partial u_k}{\partial x_k} \quad (4)$$