

Meteonorm Version 9

Majors news of the upcoming Version

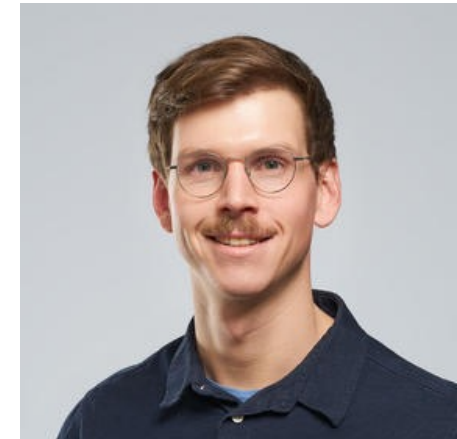
21.08.2024

Jan Remund, Pascal Graf, Michael Schmutz, David Urwyler,
Matthias Aschwanden, Gerry Zaugg, Laurens Inauen

Meteonorm core Development Team



Climatologists



Software-Developers



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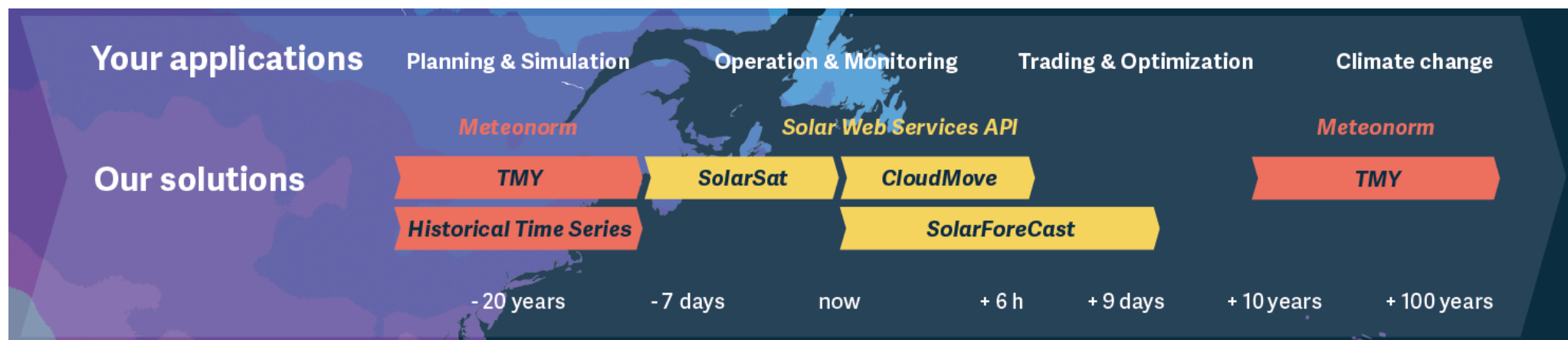
Meteonorm: History



- First Version 1985 (Handbook, Univ. Bern)
- First digital Version 1995 (Meteotest)
- 1997: Meteonorm 3 → first international version
- 2011: Meteonorm 7 → C# / VB core
- 2020: Meteonorm 8 → focus on «time series»
- 2025: Meteonorm 9 → complete refactoring → online

Main updates

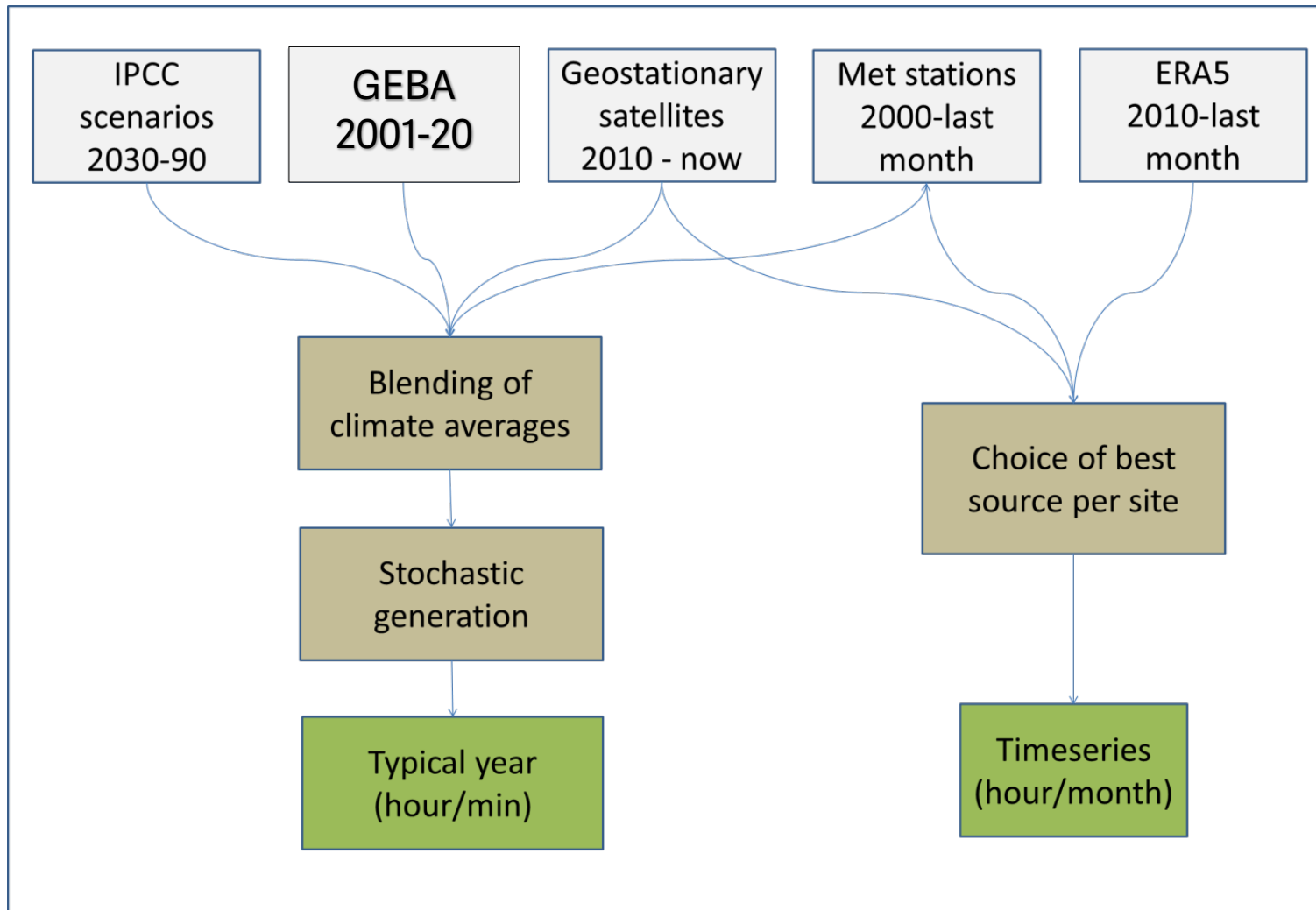
- Complete Refactoring
 - «Go» (core, webservice) and Python (web app, shop)
 - 5 times faster
- Web first → Online tool (no desktop anymore)
- Combining all data sources / apps:



Data Sources of Meteonorm

- Data sources:
 - Global Energy Balance Archive (GEBA): 2001 – 2020
 - Globalsod (NCEP, NOAA): 2001 – 2020
 - Temperature (TT), Wind, Precipitation
 - DWD, MeteoSwiss climate values (Precipitation, TT)
 - Re-Analysis (ERA5, Copernicus): 2001-2020
 - Non-radiation param., GHI > 62°N and < 55°S
 - Climate change: CMIP 6 Data (2010 – 2100)
 - Satellite data
 - 5 geostationary satellites
 - Altitude information: switch to global 30 m DEM (Jaxa)

Two main chains of Meteonorm

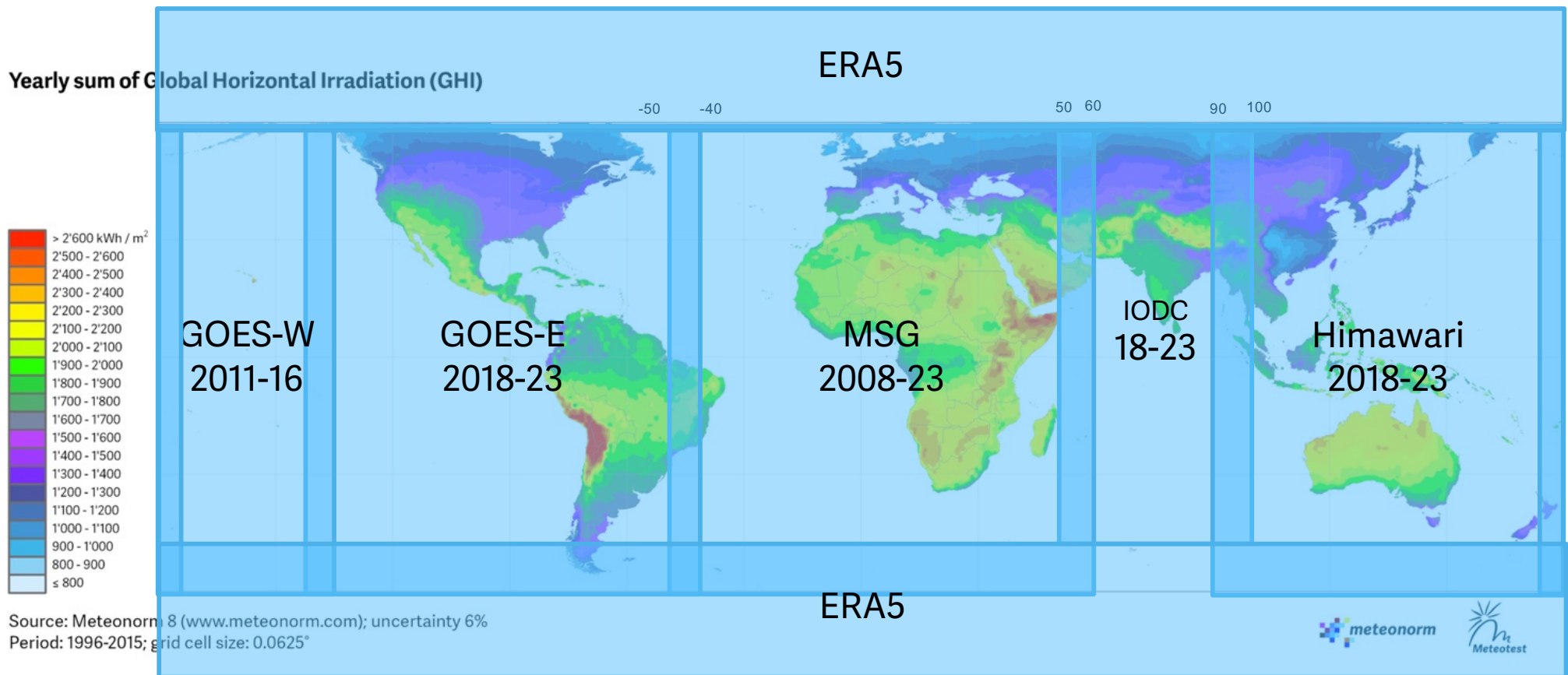


Satellite data



Satellite data: 5 geostationary satellites, $1/8^\circ$ resolution

- Own, slightly updated Heliosat method (MT) based on 15 min. data

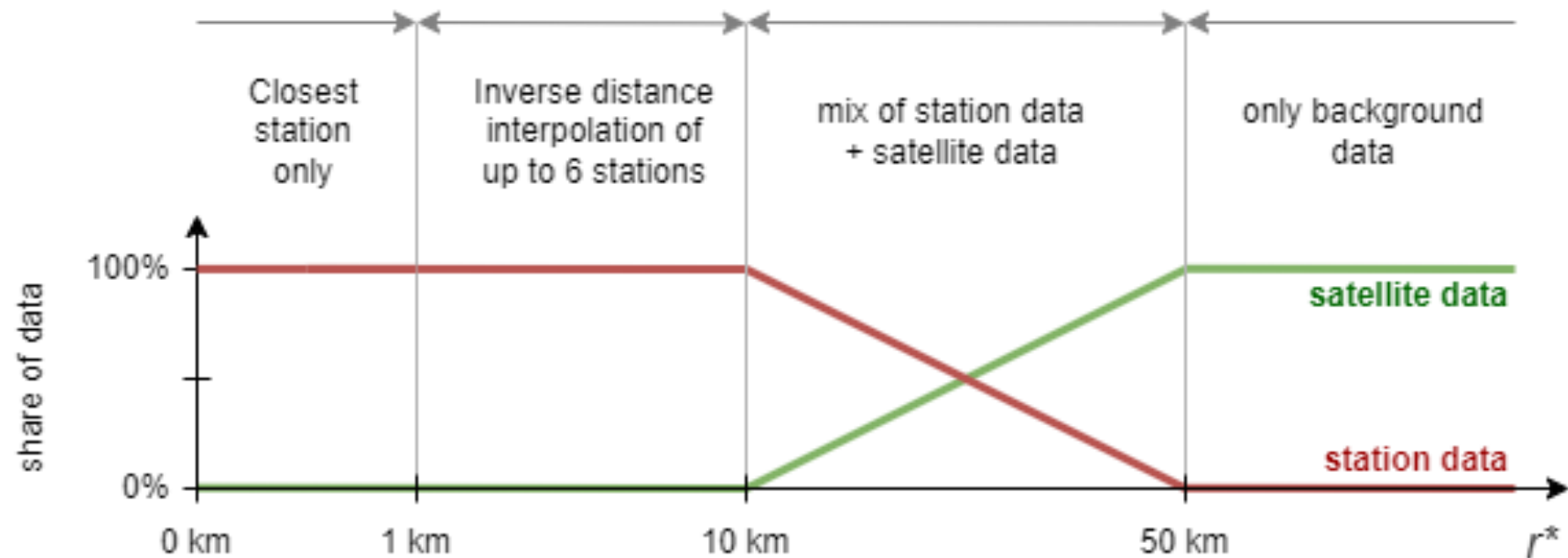


Blending of data

For GHI (satellite) and for Version 9 also for non-radiation parameters (ERA5)

→ 2nd blending of ground and satellite data on the fly

→ Result fields must be equal at ground sites ($\Delta = 0$)

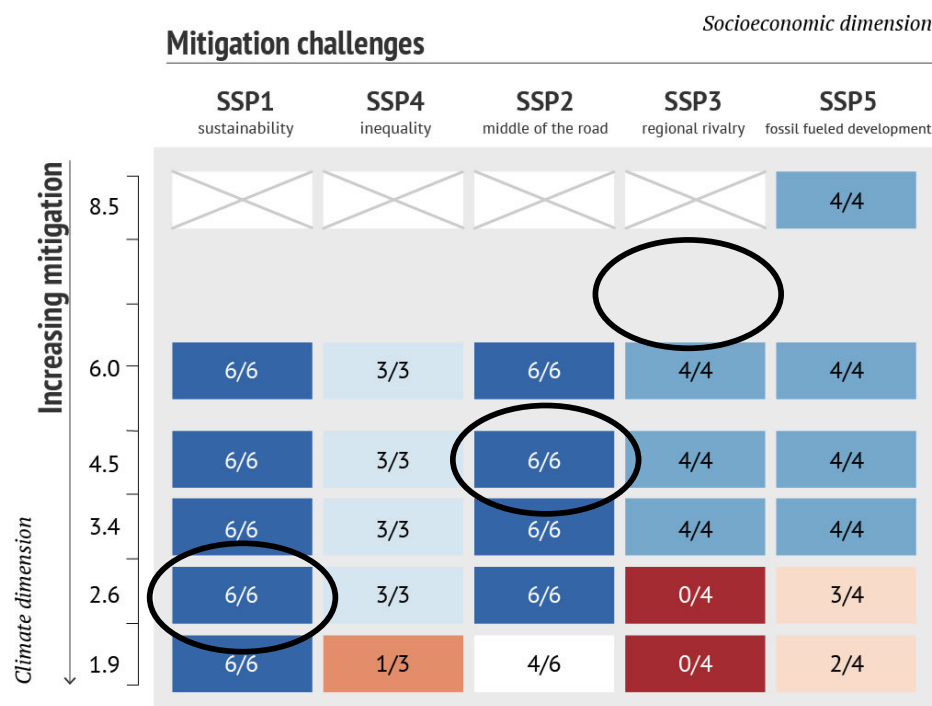


Climate change

- Meteonorm climate data + average anomalies per decade (2030, 2040 ... – 2100)
 - Basis for stochastic generation
- Source: 15 global models
- Parameters: GHI, TT, Precip.
- Scenarios:
 - SSP1-26: 2°C scenario
 - SSP2-45: mid range scenario (current path)
 - SSP3-70: high-end scenario

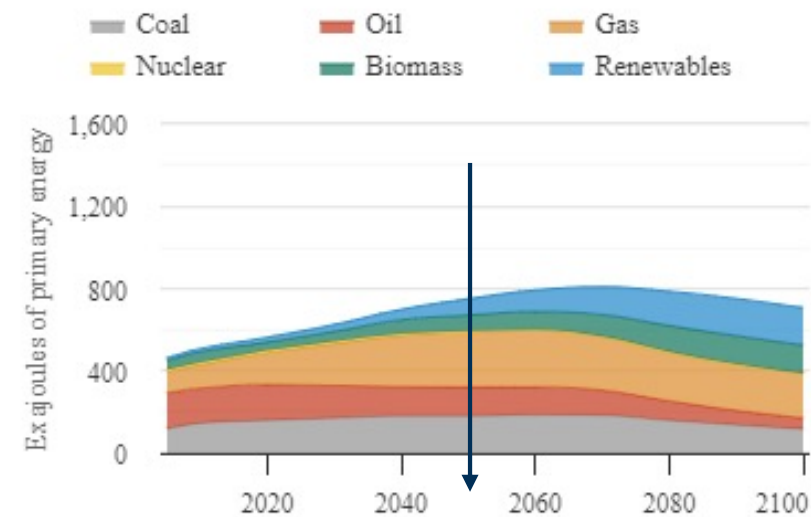
Climate change scenarios

- Combination of SSP and RCP chosen
 - SSP = Shared Socioeconomic Pathways
 - RCP = Representative Concentration Pathways



SSP = Shared Socioeconomic Pathway. Source: Rogelj et al (2018). CB

SSP1

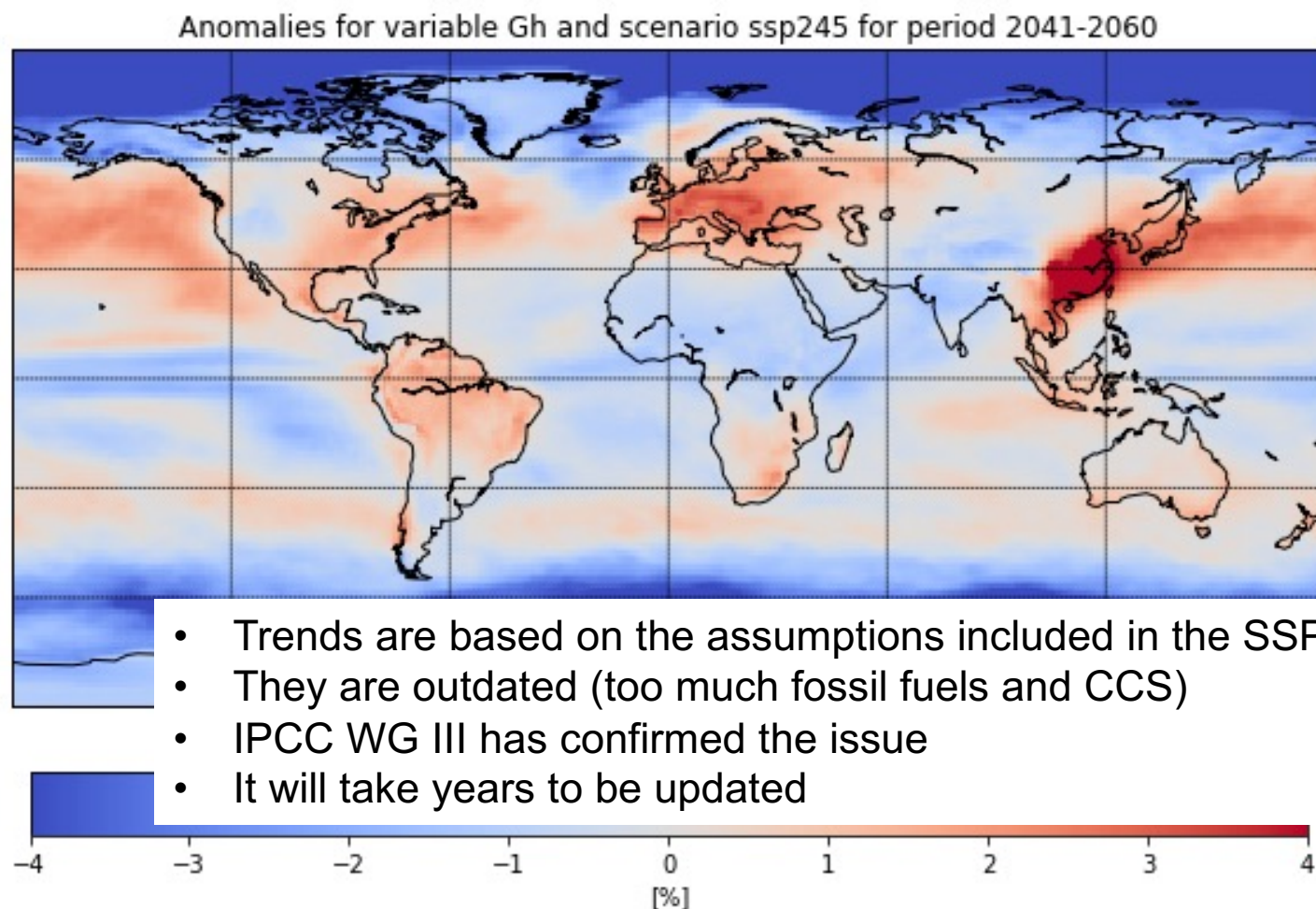


SSP1: even the low scenario includes large shares of fossils and therefore aerosols*
Renewables are heavily underestimated

* <https://www.carbonbrief.org/explainer-how-shared-socioeconomic-pathways-explore-future-climate-change/>

Climate change

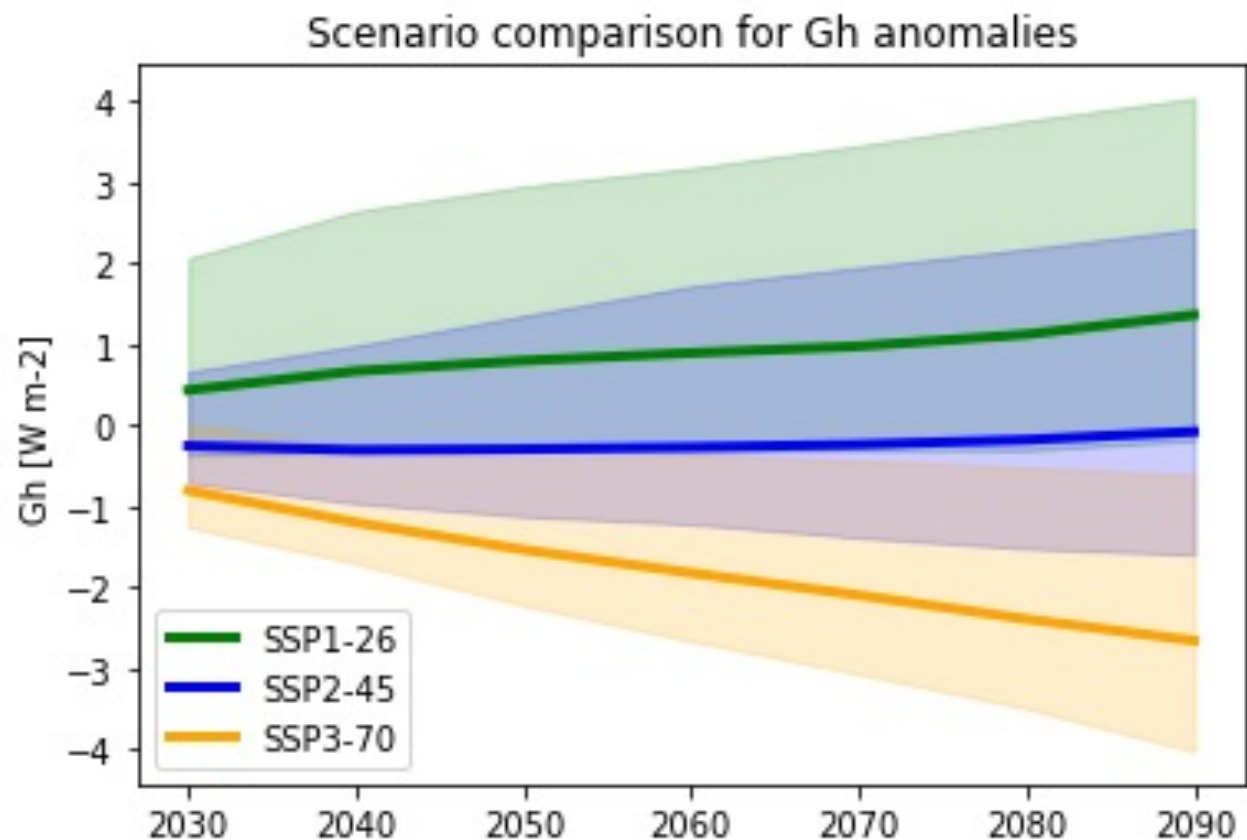
Anomalies of GHI 2050 vs. Today (2001-20) for SSP2-RCP45: lowering of aerosols over China



Climate change

Spread of model trends:

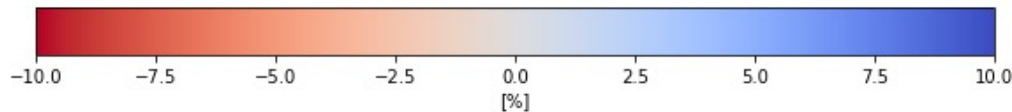
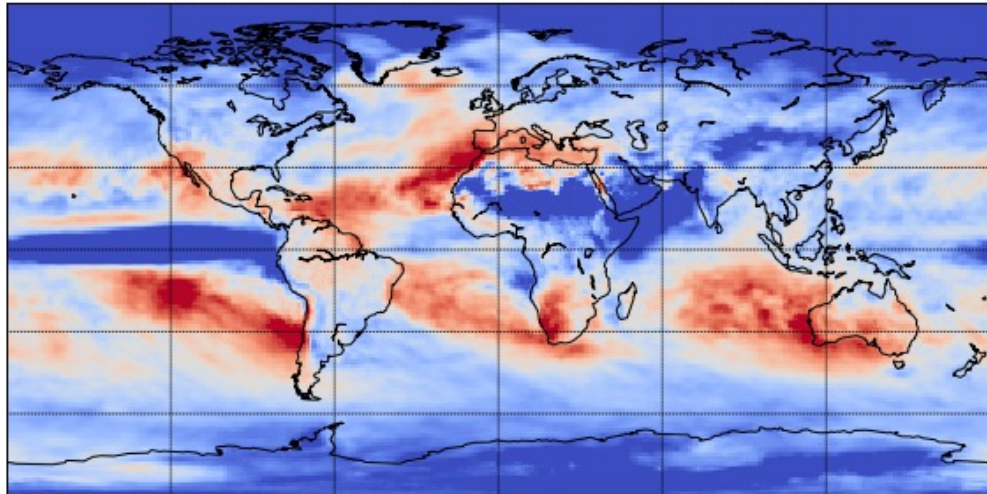
- SSP1-26: positive
 - SSP2-45: constant
 - SSP3-70: negative
- Trends based on aerosol assumptions



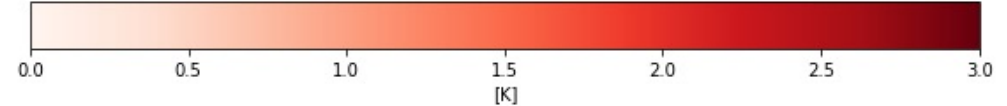
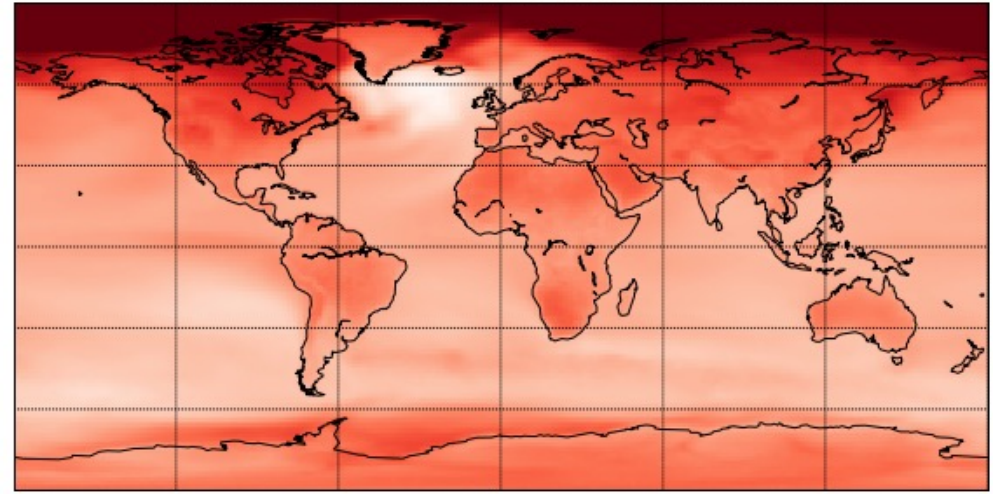
Climate change

Temperature and Precipitation anomalies
for SSP2-RCP45 (mid scenario) till 2050:

Anomalies for variable rr and scenario ssp245 for period 2041-2060



Anomalies for variable tt and scenario ssp245 for period 2041-2060

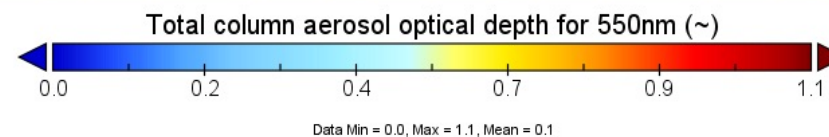
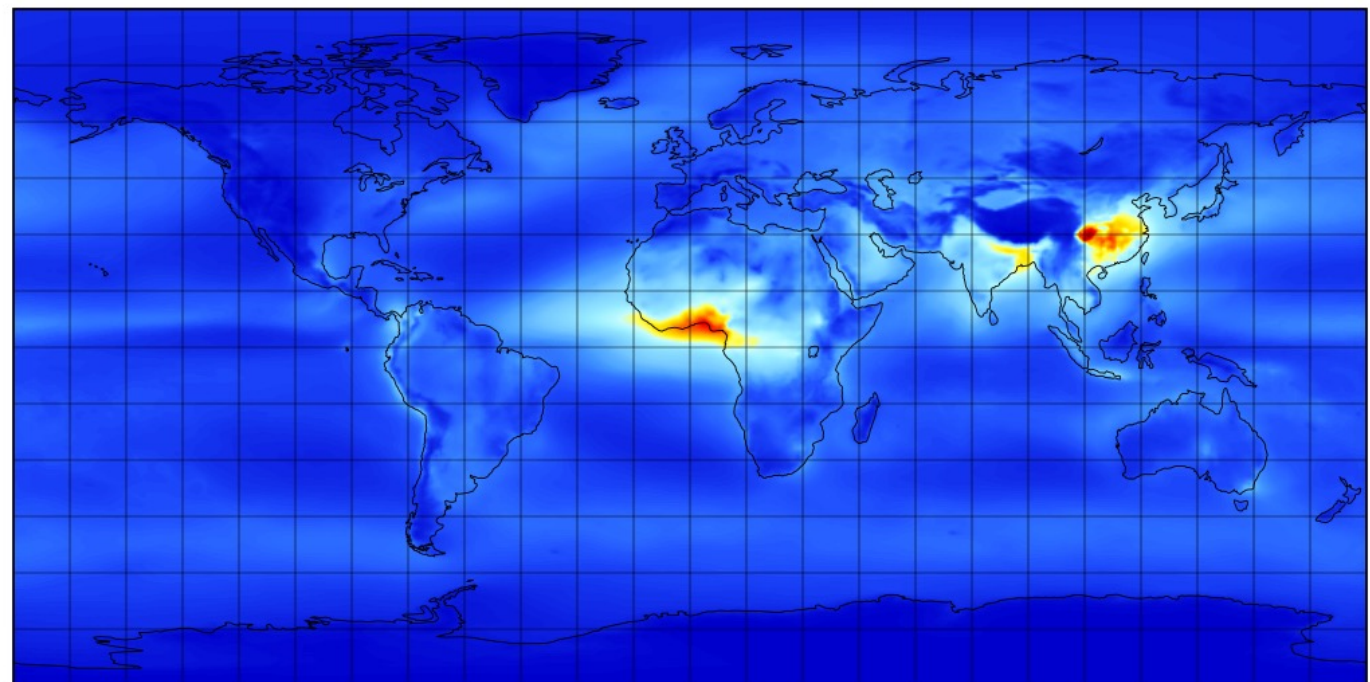


Aerosols

- Update of climatology to NASA Merra2 (2004-23)
- Differences to MN 8 (mix, 2001-15) are small

Total column aerosol optical depth for 550nm

AOD 550 nm,
2004-2023
average, MERRA2



Outlook



- Time line:
 - October 2024: core webservice Beta
 - December 2024: Webservice and DLL ready
 - April 2025: Publication of new Web application
 - End of 2025: ongoing smaller updates (to include all options)

Many thanks for your attention

