



# Relation between maximum temperatures and weather types as a method for statistical-dynamical downscaling of CMIP6 models

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Key challenges

• Performance of the models



1. Evaluation of CMIP6 models:



# Metrics





- Defining (changes in) dynamics
- Defining (changes in) extreme heat
- Selection criteria for downscaling

Agreement in Lamb Weather Types (LWTs) between ERA5 and CMIP6 for 1985 – 2014 using the PSS

- 2. Timing of Global Warming Levels
- Relation LWTs and extreme heat: Adjusted, temperature-dependent LWT classification

 $= \sum_{i}^{LWTS} minimum(f_{i,ERA5}, f_{i,CMIP6})$ 

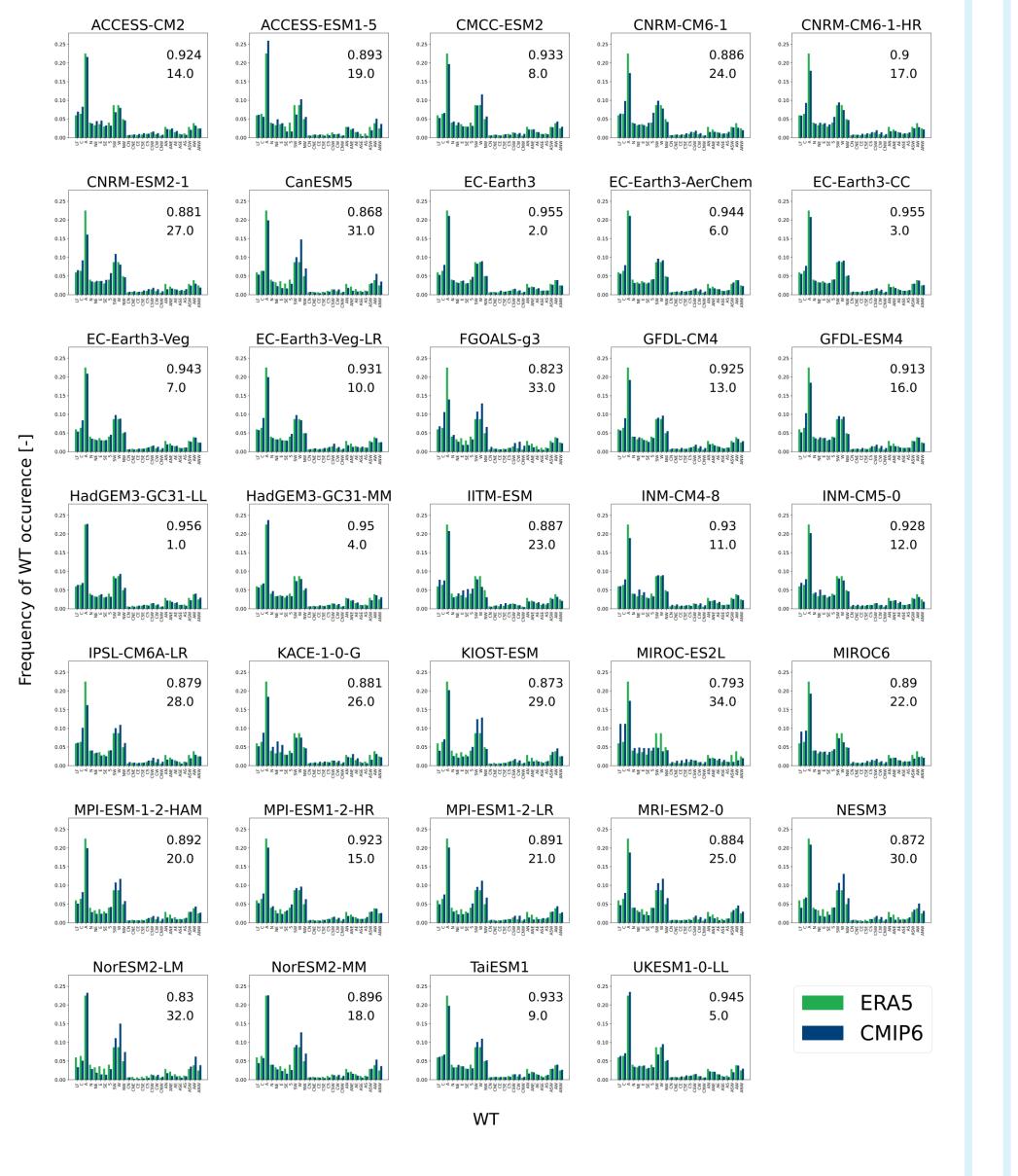
 Absolute change in maximum temperature in the x<sup>th</sup> -percentile (eg. P95)

 $= P x_{Tmax,fut} - P x_{Tmax,hist}$ 

How to select periods to downscale based on future changes in dynamics and extreme heat?

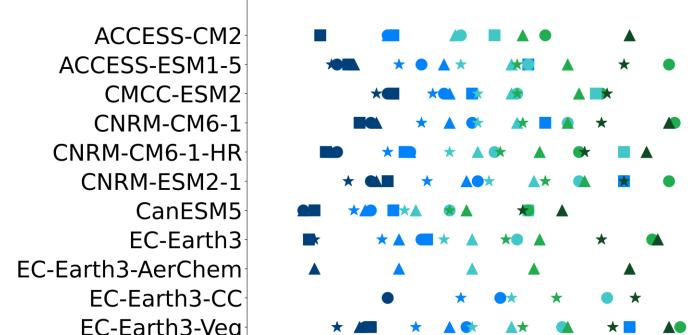
# 1. Evaluation of CMIP6

#### → Top 75%



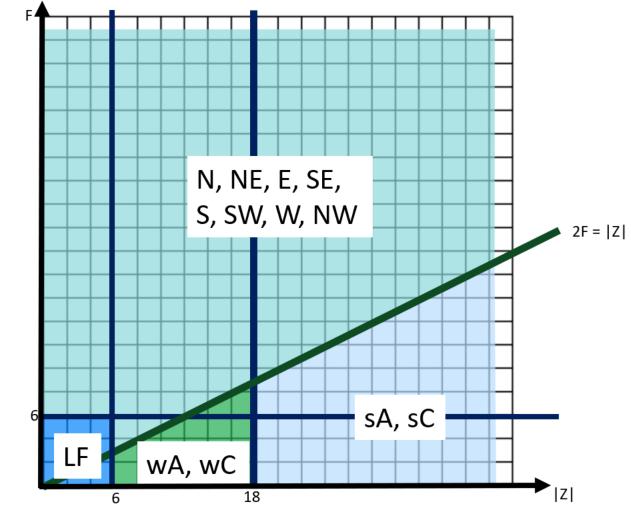
# 2. Timing of GWLs

#### $\rightarrow$ Possible futures



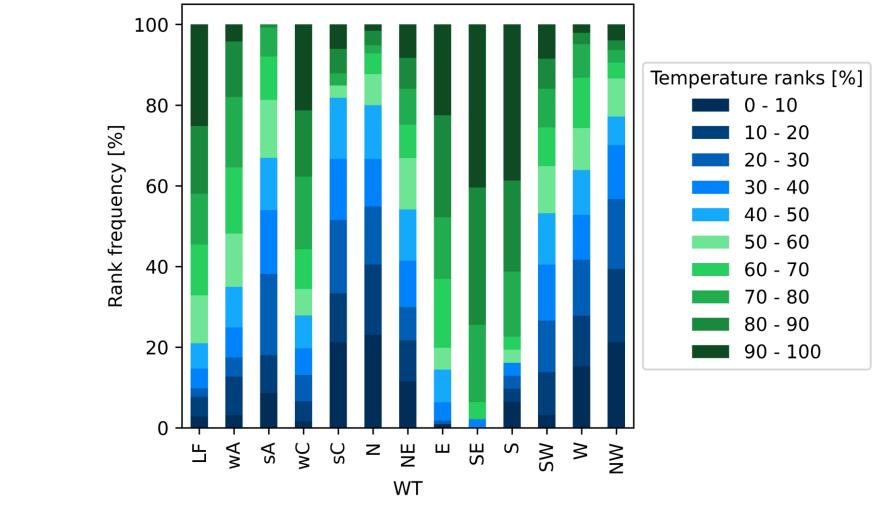
# 3. Relation LWTs and extreme heat

#### → Adjusted classification:



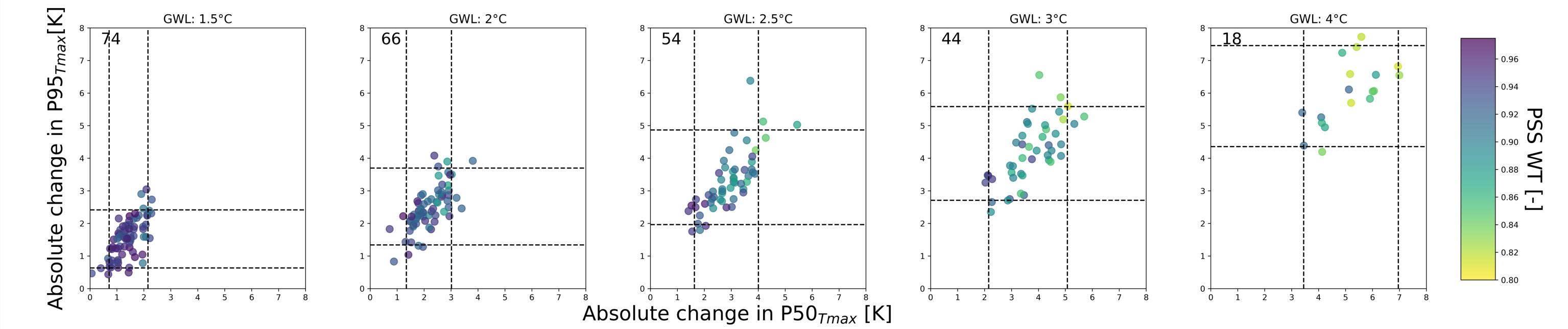
EC-Earth3-Veg	* 🛲 * A 🗞 A* 🖎 * 🖬 AO
EC-Earth3-Veg-LR	$1 0 \mathbf{I} 1 1 1 1 1 1 1 1$
FGOALS-g3	
GFDL-CM4	$\bigstar  \star  \bullet  \star  \bullet$
GFDL-ESM4	
HadGEM3-GC31-LL	
HadGEM3-GC31-MM	★■ ★ ■★ ★ ■ ★
IITM-ESM	$\bigstar \bullet  \star \bullet  \star \bullet \bullet \star  \star$
INM-CM4-8	$\star \bullet \star \blacksquare \star \bullet \blacktriangle \star \bullet \blacktriangle$
INM-CM5-0	
IPSL-CM6A-LR	
KACE-1-0-G	
KIOST-ESM	*• <b>*</b> *
MIROC-ES2L	* <b>=</b> * <b>^ * * *</b>
MIROC6	
MPI-ESM-1-2-HAM	
MPI-ESM1-2-HR	*** * *
MPI-ESM1-2-LR	*# * <b>*</b> * <b>*</b>
MRI-ESM2-0	* <b>=</b> * <b>A</b> * <b>=</b> • <b>A</b> *
NESM3	
NorESM2-LM	* • • *
NorESM2-MM	* <b>=</b> * <b>A © A</b> * <b>A</b>
TaiESM1	
UKESM1-0-LL	
	2020 2020 2030 2040 2050 2050 2050 2090
∎ ssp126	▲ ssp370 ♦ 1.5 ♦ 2.5 ♦ 4
● ssp245	
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→ LWT and maximum temperature:



### Results

#### → Starting point for final downscaling selection



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