

# **DISTENDER**

**WP4 “Downscaling Climate Scenarios”**  
**WP4 partners (speaker: B. Ahrens, Goethe Univ. Frankfurt)**

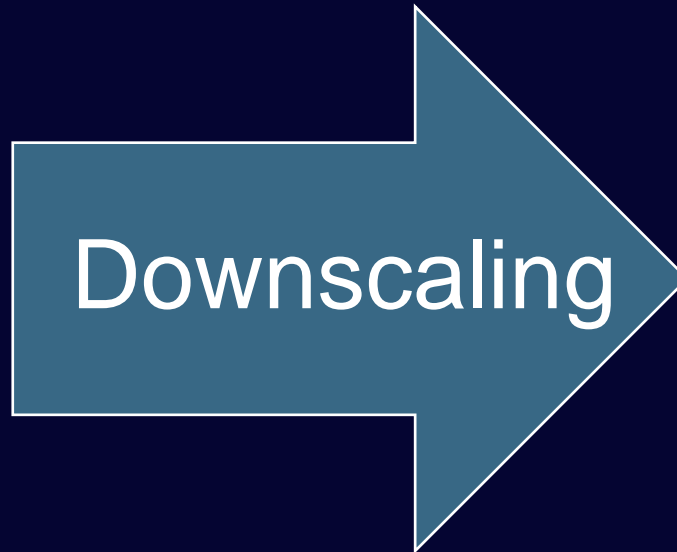
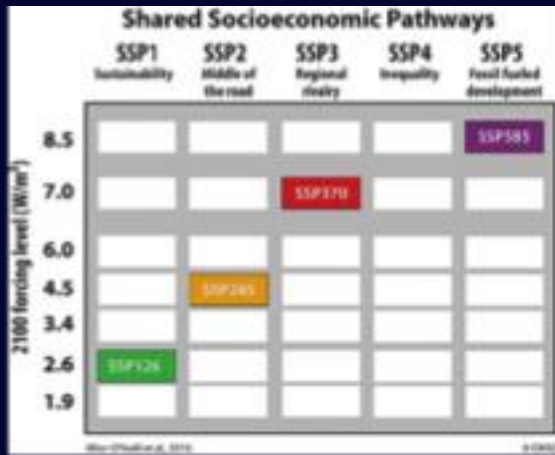


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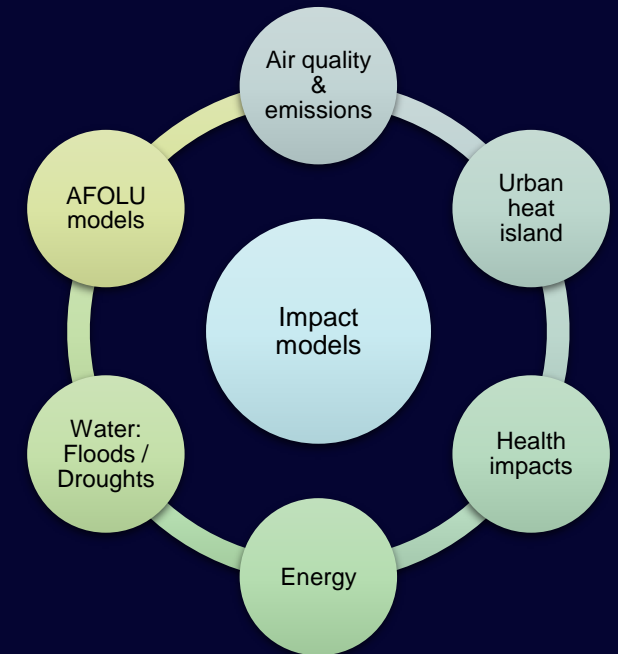


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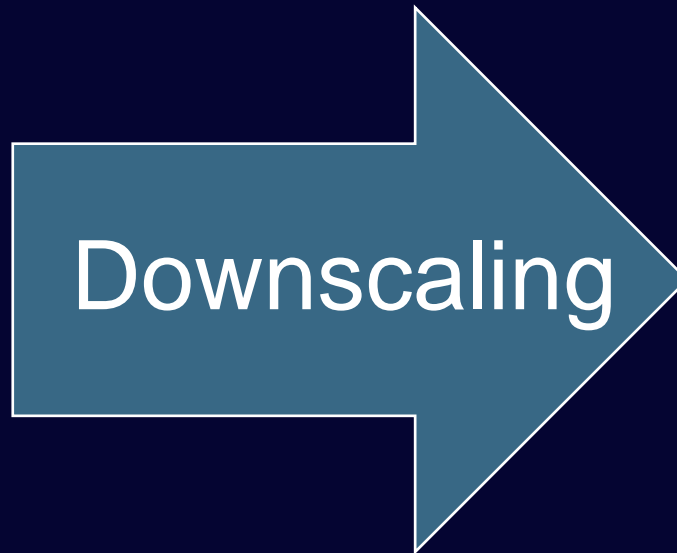
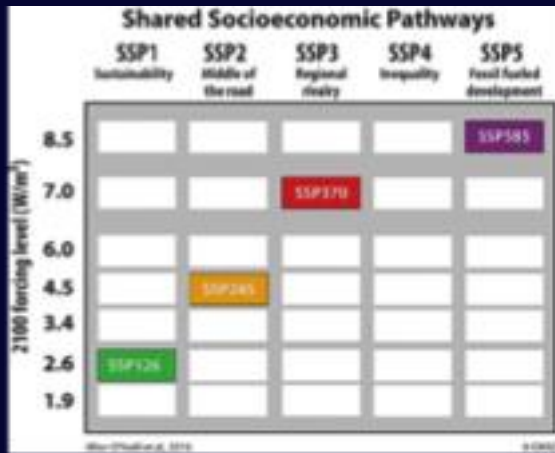
# Why? Goal 1: reference climate scenarios



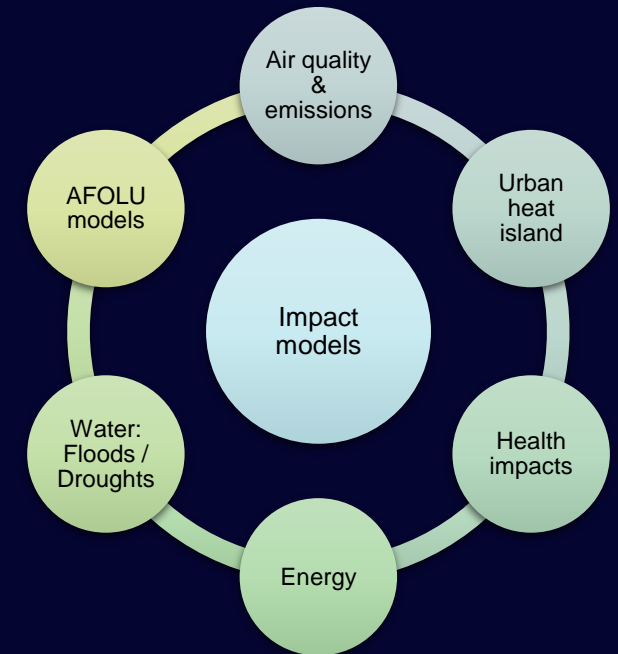
## DISTENDER Users



# Why? Goal 2: what-if climate scenarios



## DISTENDER Users



WCRP CMIP6  
World Climate Research Programme

+

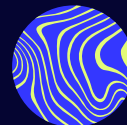
SSP localisation  
(WP3)



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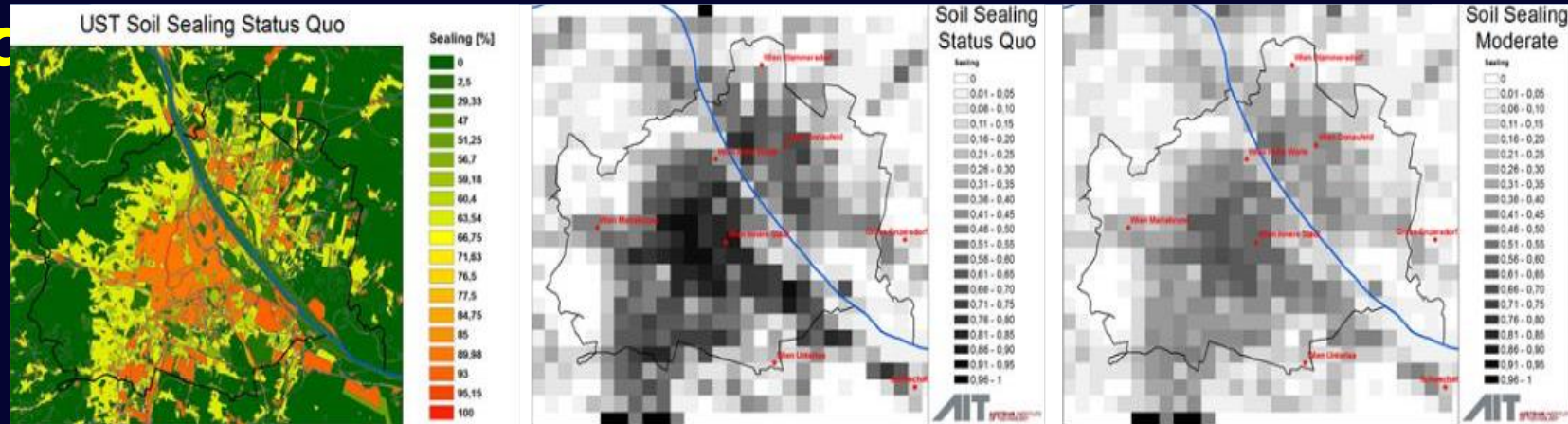


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# Illustration: Vienna – Summer 2003 in

*silic*



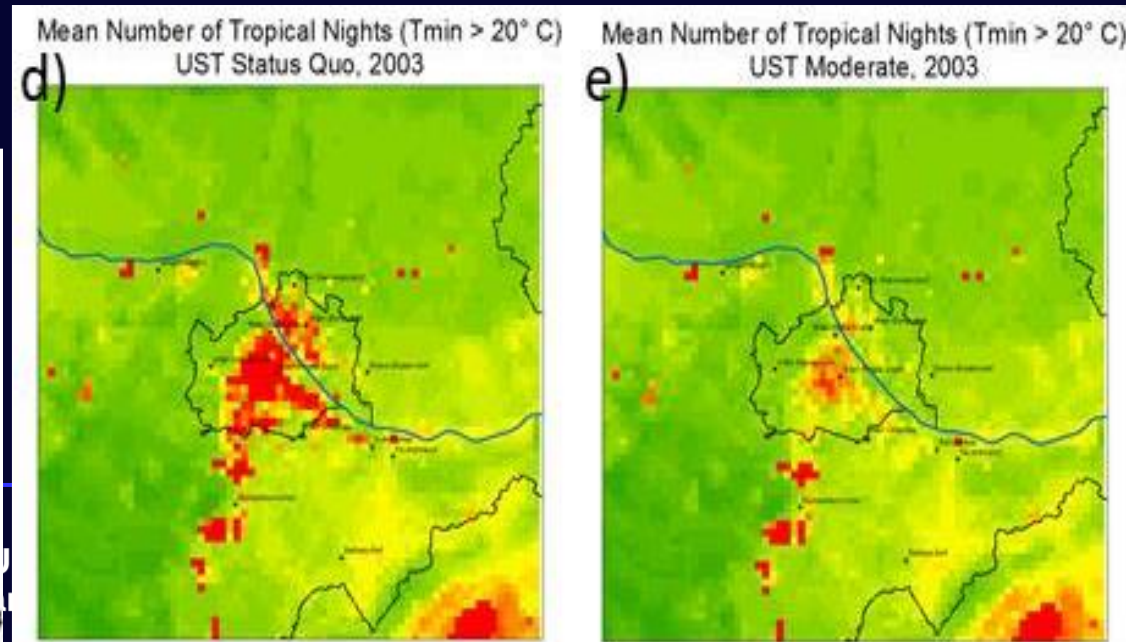
Round 1



Round 2

Counterfactual  
Soil sealing

km-scale  
climate  
simulations



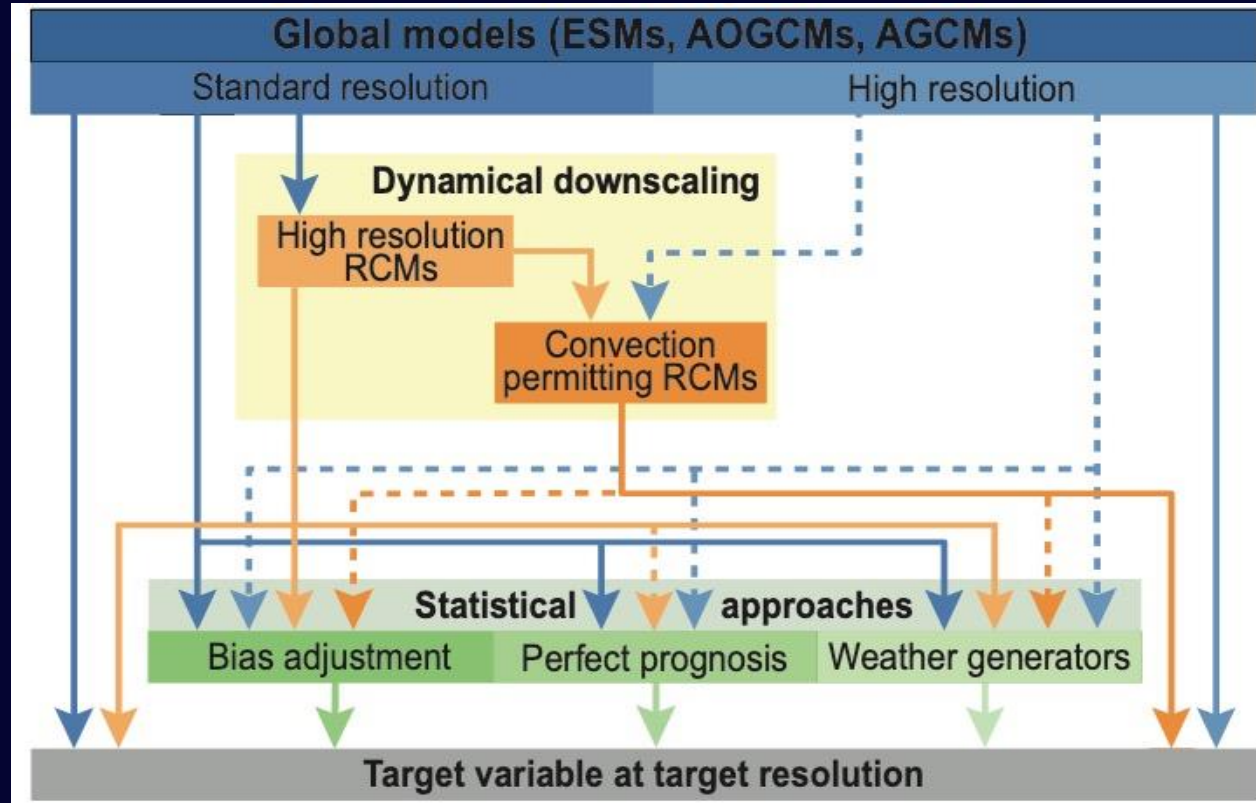
Counterfactual  
Climate:  
# Tropical Nights



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Züger et al. (2022)  
with COSMO-CLM/  
TERRA-URB

# How? Downscaling techniques



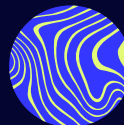
IPCC, AR (2021),  
Fig. 10.5



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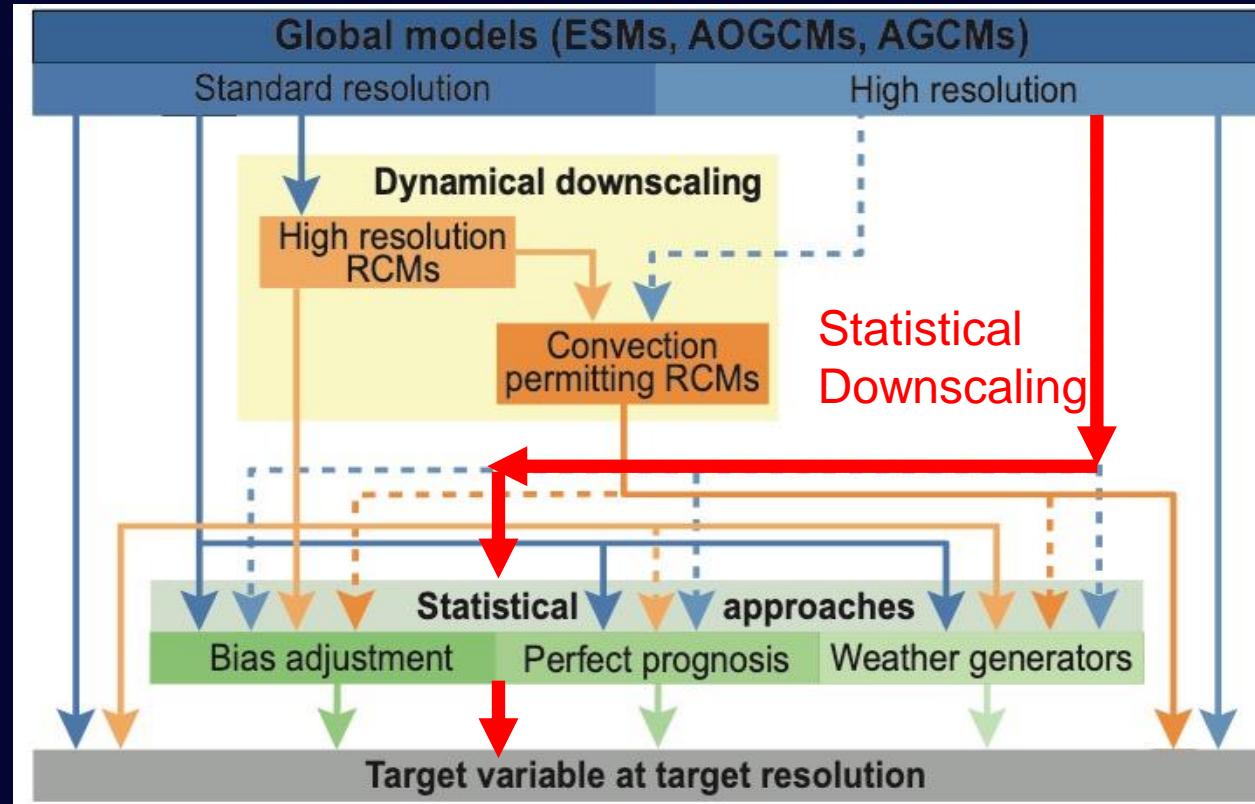


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# How? Downscaling techniques

Two complementary downscaling techniques (with bias correction):



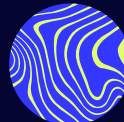
IPCC, AR (2021),  
modified Fig. 10.5



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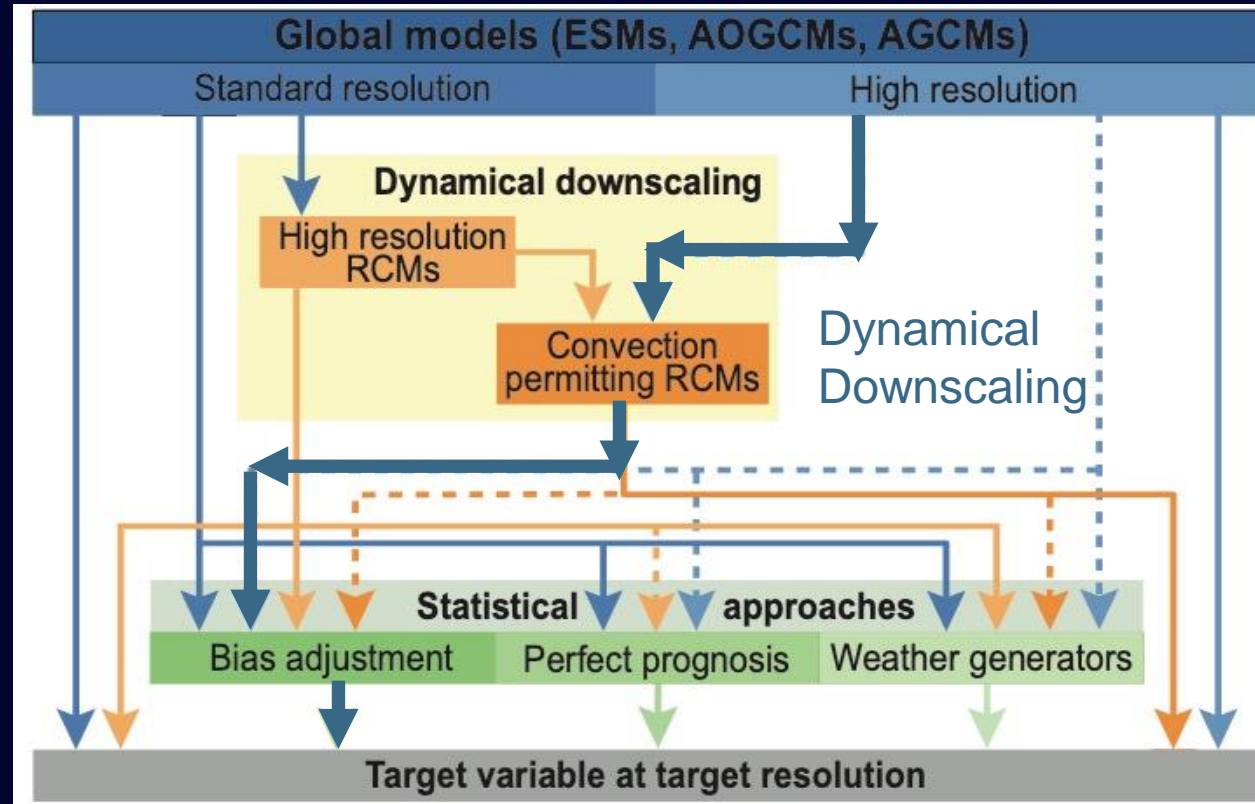


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# How? Downscaling techniques

Two complementary downscaling techniques (with bias correction):



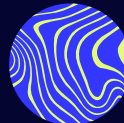
IPCC, AR (2021),  
modified Fig. 10.5



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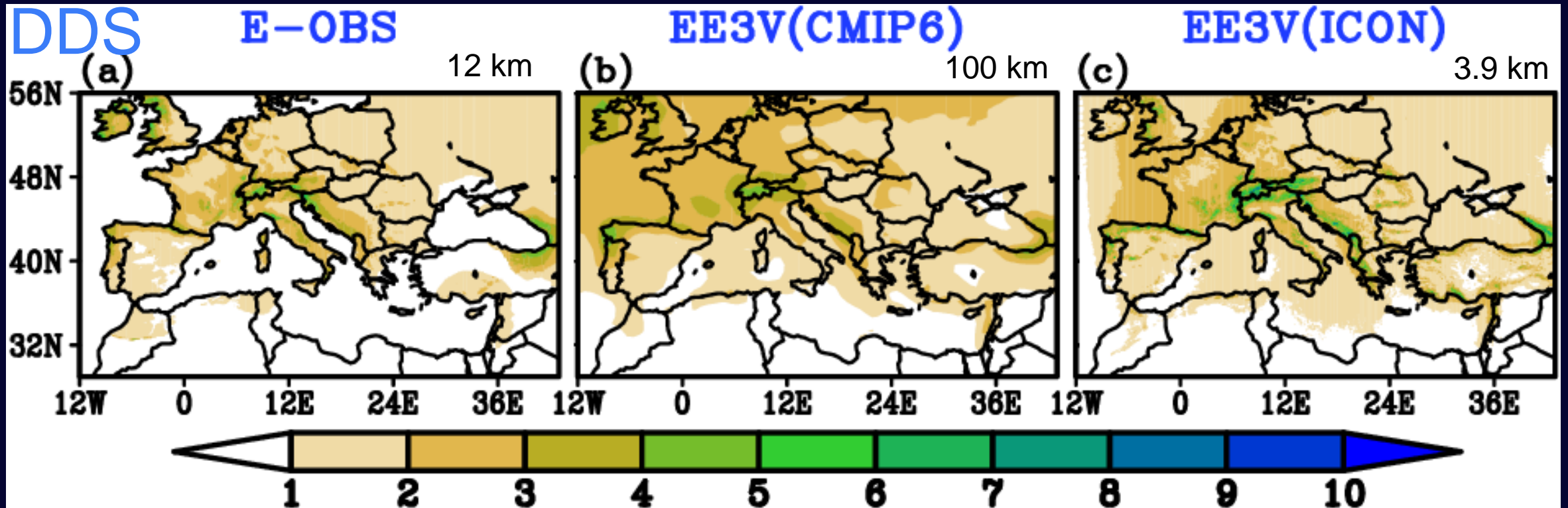
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# Q1: Why bias adjustment? (1/2)

Adequacy-for-purpose

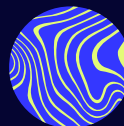
Mean daily precipitation (mm/d) – historical period: sims vs obs.



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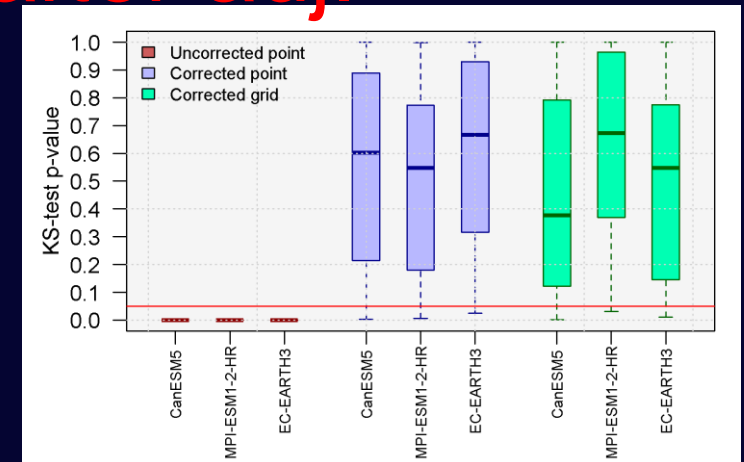
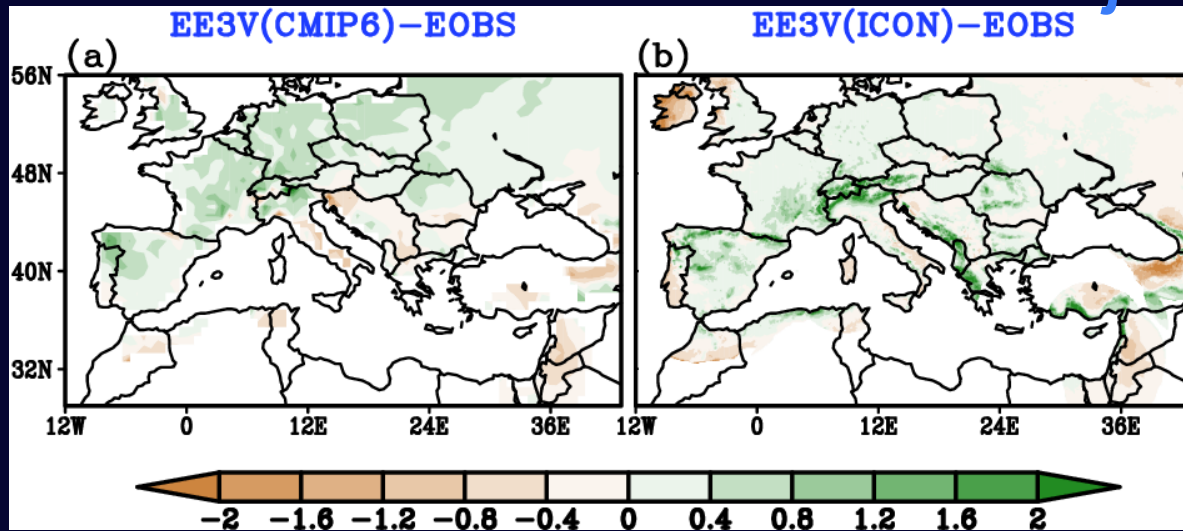
# Q1: Why bias adjustment? (2/2)

Adequacy-for-purpose

Precipitation bias (mm/d) – historical period: sims vs obs.

DDS – need for further adj

SDS- fitness before/  
after adj.



Challenge: No obs reference avail. for some target variables (e.g. u, v at 2000 m)

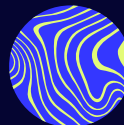
→ ERA5



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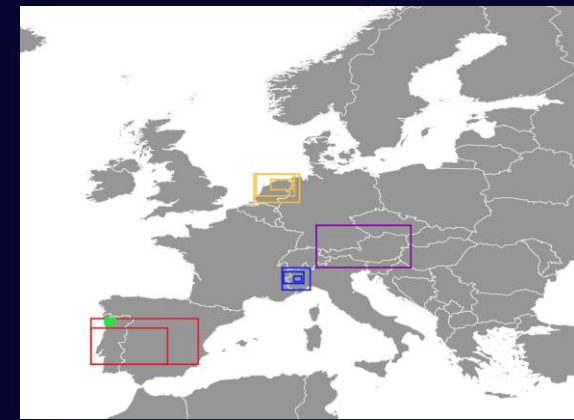
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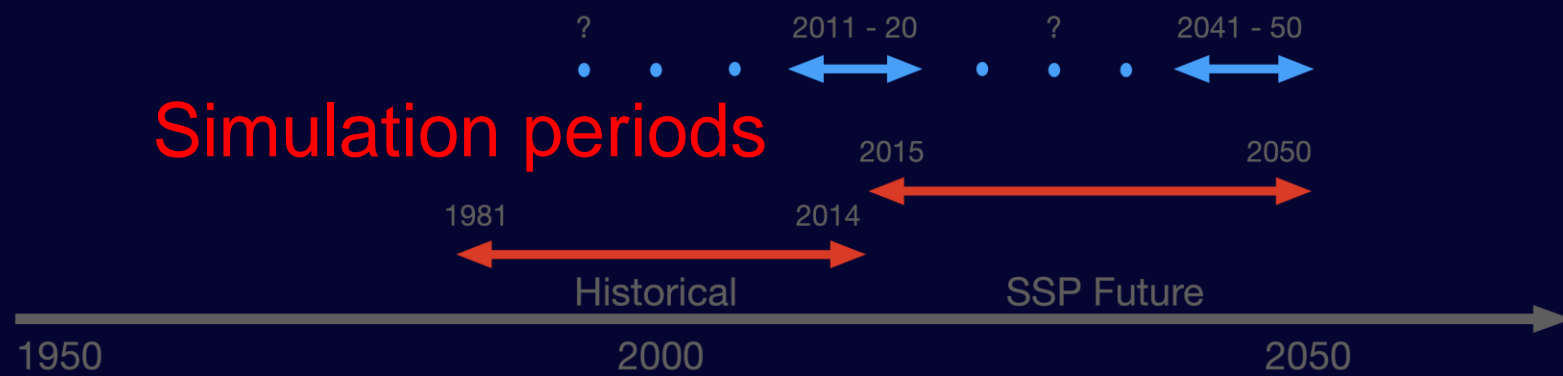
# Q2: Why two downscaling techniques?

Target resolutions: (9 km, 1d), (3 km, 1h), ...  
depending on impact model domains

3 global climate models (→ climate sensitivity)



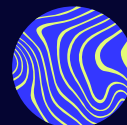
Lowest	Medium	Highest
MPI-ESM1.2-HR	EC-Earth3	CanESM5



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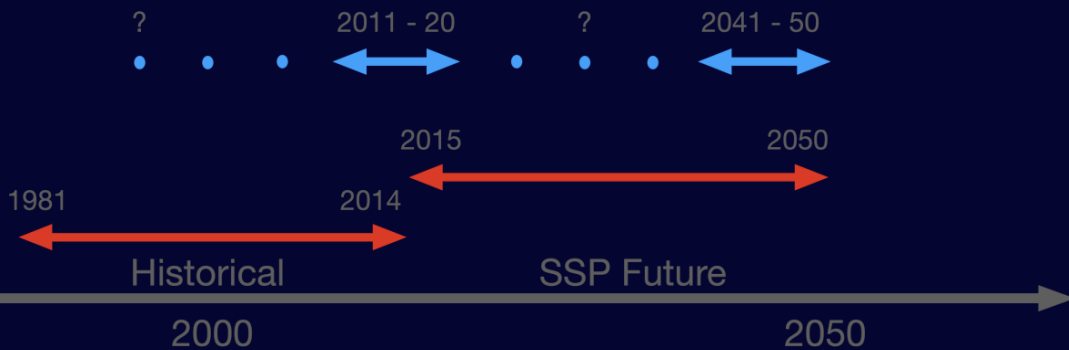
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## Q2: Why two downscaling techniques?

**Dynamical downscaling:** pro: covers ~Europe, physically consistent  
con: too expensive for long periods, 3 CMIP6

**Statistical downscaling:** pro: cheaper, empirically based  
con: limited What-if exercises (e.g.  $\Delta$ (soil sealing))



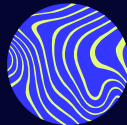
→ Mini ensemble (fitness-for-purpose)  
→ Complementary advantages



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# Summary

- WP4 delivers climate scenarios in extremely high resolution ( $\Delta x$ : 9 to 0.1 km,  $\Delta t = 1$  h depending on CCS domains)
- Statistical downscaling done (~16TB output for users); dynamical downscaling ongoing

## Next steps:

- Bias correction
- Investigation of fitness-for-purpose (added value wrt. to historical uncertainty + added usefulness for the impact modelling)
- What-if?



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