



1 Introduction

- •Future projections for European climate suffer from uncertainties in changes of the North Atlantic jet stream
- Jet latitude shift has been found to be anticorrelated with simulated present-day jet latitude bias
- •But this may be caused by any differences between models
- •Objective: isolating the effect of model basic state biases by modifying the climatology of ECHAM6 global atmospheric model

2 Single model with different biases With ECHAM6: Uncorrected control run and four difference-corrected experiments

Difference correction method for modifying model climatology: Using ERA5 reanalysis and present-day ICON, CESM and MPAS experiments as reference data (Kharin and Scinocca 2012, Tyrrell et al. 2020):

reference, X

1) Nudging run: aiming to remove difference ECHAM6. to reference data in each time step



3) Corrected runs: applying correction tendencies ECHAM6 to present-day and future experiments without constraining the model state

Future responses to global warming: Time-slice experiments with forcings from present-day (1985–2014, CMIP6 historical) and future (2090–2099, SSP5-8.5)



The effect of model biases on the simulated future changes of the North Atlantic jet stream

nudging tendency, $f(X-X_r)$

seasonal cycle nudaina tendencies



corrected



Figure 1. Mean 850 hPa zonal wind bias (present-day model climatology minus ERA5) in the ECHAM6 experiments in December– February (DJF, a–e) and June–August (JJA, f–j). Contours show the seasonal ERA5 climatology (interval 10 m/s). Stippling indicates insignificant biases.

Future climatology

Future response



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Figure 5. The jet stream mean latitude in presentday, and its future response in the reference models and in the ECHAM6 experiments in different seasons. The error bars show the 95 % confidence intervals. The horizontal line and the gray shading indicate the present-day mean latitude in ERA5.

and its future response in the five ECHAM6 experiments (first row),

	DJF	MAM	JJA	SON
IAM6 experiments (5)	-0.58	-0.71	-0.28	-0.69
trol and reference models (4)	-0.82	-0.74	-0.85	-0.72

•About half of differences in winter responses may be attributed to biases