Projected changes in near-surface wind speed over Iberian Peninsula

Miguel Andres-Martin[1], Yue Yu[2], Cheng Shen[3], Cesar Azorin-Molina[1], Kaiqiang Deng[4], Shalenys Bedoya-Valestt[1], and Eduardo Utrabo-Carazo[1]

miguelandres714@gmail.com

1 CIDE Centro de Investigaciones Sobre Desertificación

CLIMATOC-LAB

@ClimatocLab

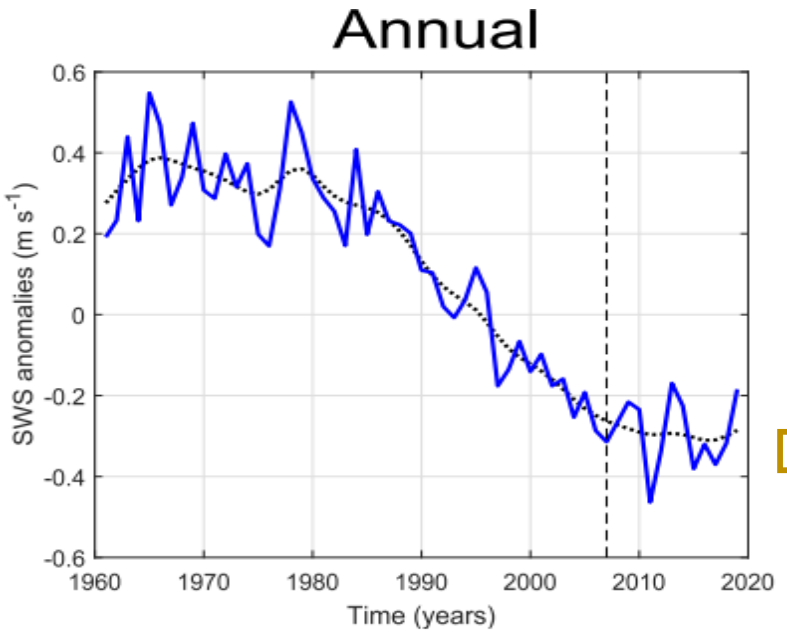
2 NANJING METEOROLOGICAL BUREAU

3 UNIVERSITY OF GOTHENBURG

RCG Regional Climate Group

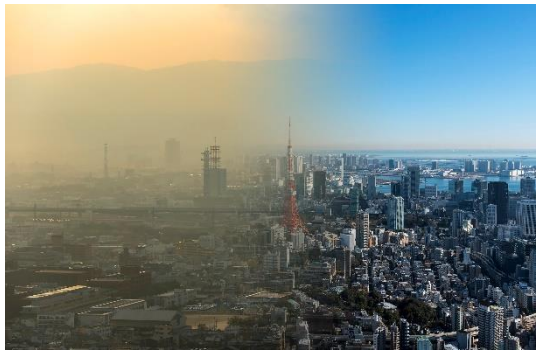
4 SUN YAT-SEN UNIVERSITY

"STILLING" vs. "REVERSAL"



Utrabo-Carazo et al. 2022. Atmos. Res. 272, 106153 doi: 10.1016/j.atmosres.2022.106153

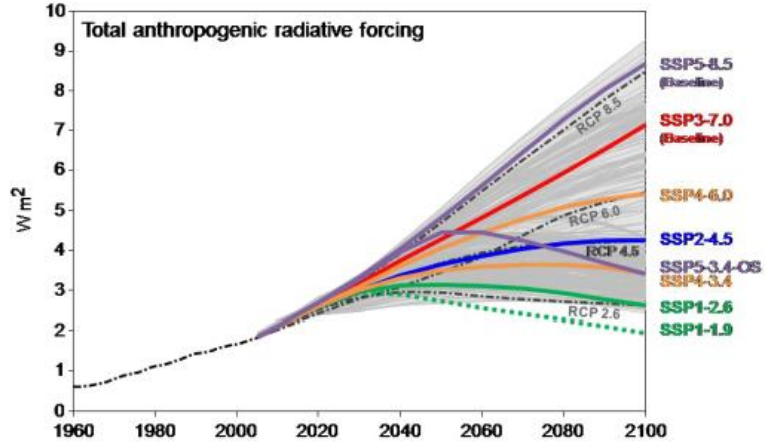
Socioeconomic and environmental impacts



MOTIVATION: **What is projected to happen with winds in the future?**

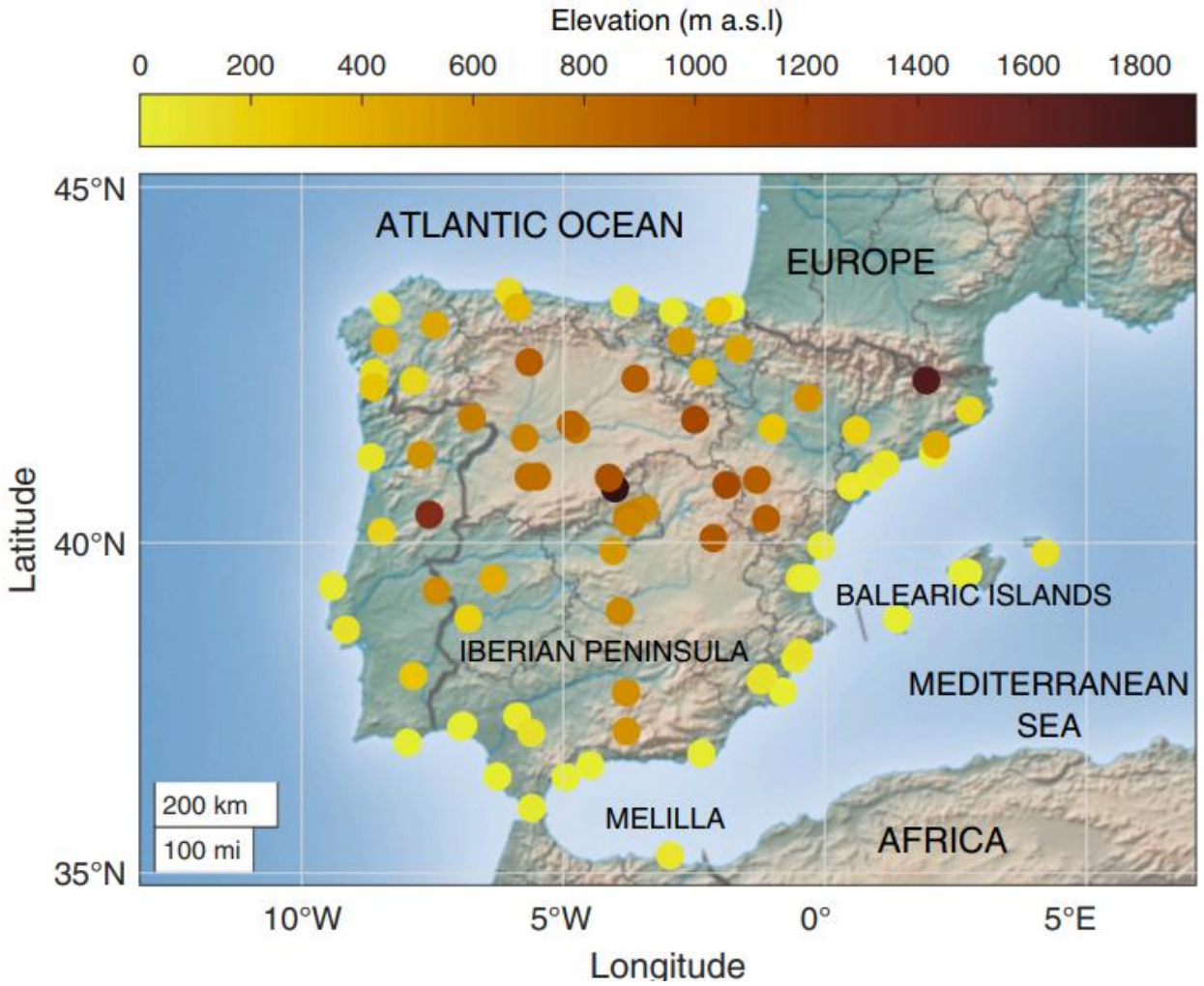
OBJECTIVES

- **To evaluate the performance of CMIP6 models in reproducing historical Surface Wind Speed (SWS) over the Iberian Peninsula.**
- **To assess the projected SWS changes under 4 different CMIP6 SSP scenarios.**



O'Neill et al et al. 2016. *Geoscientific Model Development*, *9*(9), 3461-3482 doi:10.5194/gmd-9-3461-2016

STUDY AREA: IBERIAN PENINSULA



Utrabo-Carazo et al. (2022)

- Including the Balearic Islands, Ceuta and Melilla.
- Complex terrain.
- Land-ocean interfaces.
- Different land cover and climate regimes.

WIND SPEED OBSERVATIONS

86 stations, 76 in Spain and 10 in Portugal

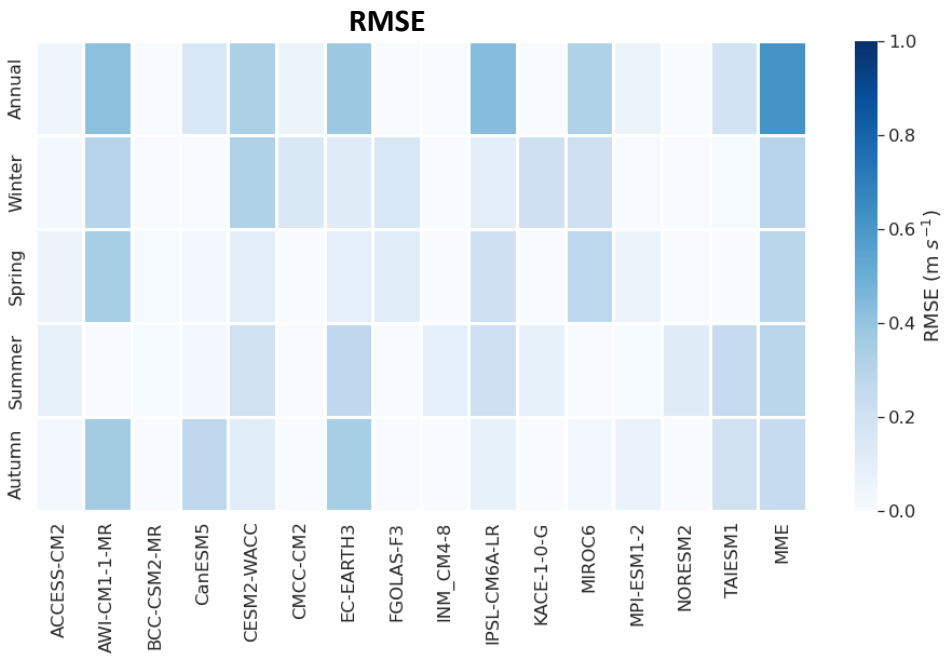
Quality control and homogenization in CLIMATOL

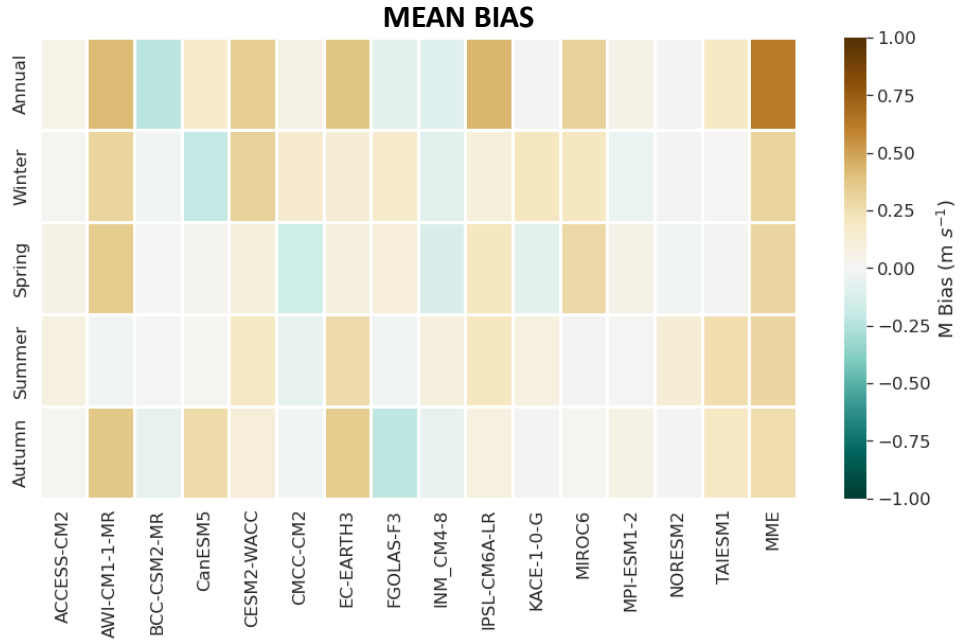
CMIP6 MODELS

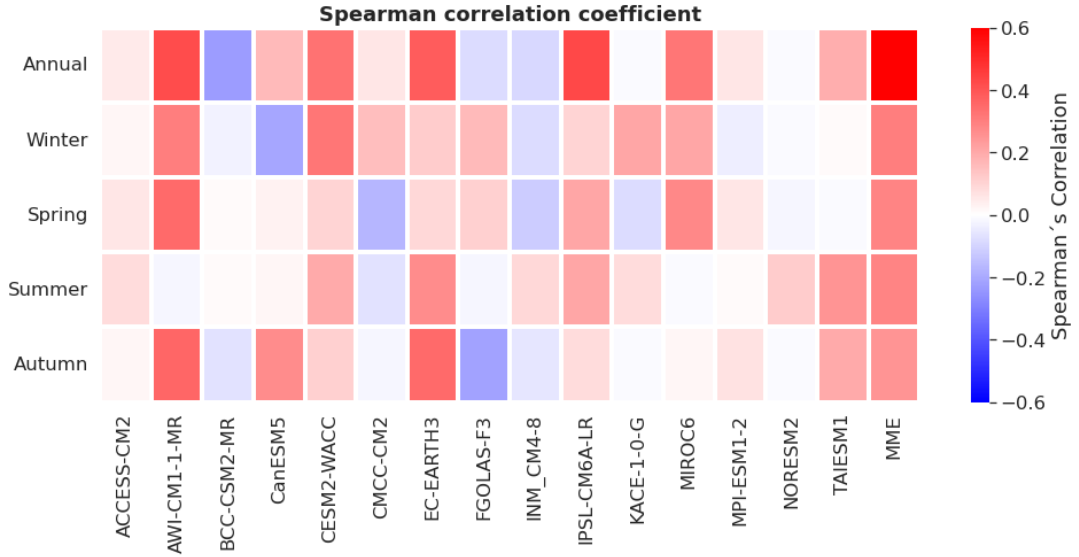
Model name	Institution	Resolution(lat × lon)	Variant label
ACESS-CM2	CSIRO-ARCCSS	192 × 144	r1i1p1f1
NorESM2-MM	NCC	288 × 192	r1i1p1f1
EC-Earth3	ICHEC	512 × 256	r1i1p1f1
CESM2-WACCM	NCAR	288 × 192	r1i1p1f1
IPSL-CM6A-LR	IPSL	144 × 143	r1i1p1f1
KACE-1-0-G	NIMS-KMA	192 × 144	r1i1p1f1
MPI-ESM1-2-HR	MPI-M	384 × 192	r1i1p1f1
FGOALS-f3-L	LASG, Chinese Academy Science	180 × 120	r1i1p1f1
AWI-CM-1-1-MR	Alfred Wegener Institute	384 × 192	r1i1p1f1
BCC-CSM2-MR	BCC	320 × 160	r1i1p1f1
MIROC6	MIROC	256 × 128	r1i1p1f1
CanESM5	CCCma	128 × 64	r1i1p1f1
INM-CM4-8	INM	180 × 120	r1i1p1f1
MIR-ESM2-0	MRI	320 × 160	r1i1p1f1
TaiESM1	Research Center for Environmental Changes	288 × 192	r1i1p1f1

REMAP to 1ºx1º and REGRIDED using a BILINEAR INTERPOLATION method to the observations

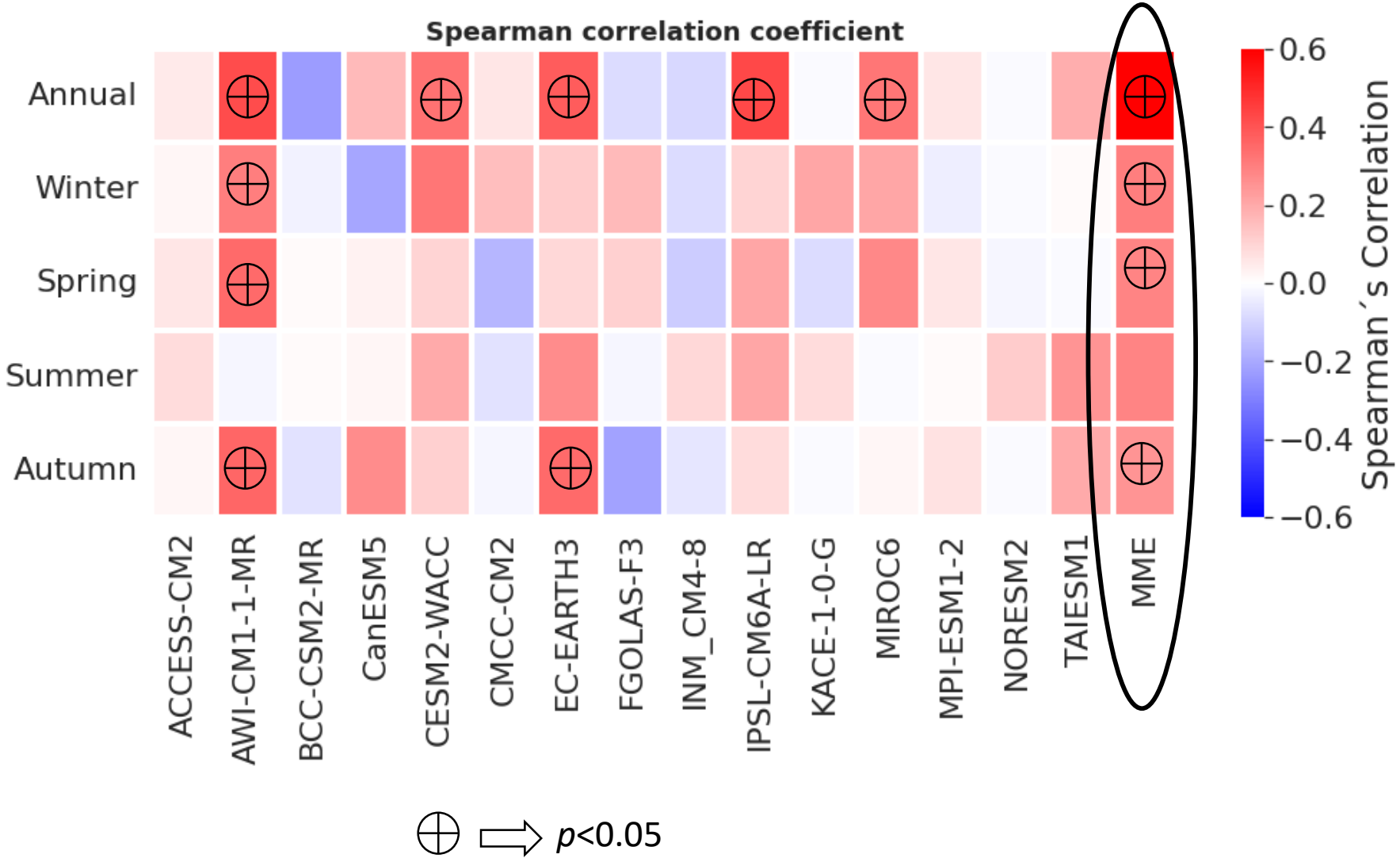
EVALUATION OF CMIP6 MODELS *vs.* OBSERVATIONS







EVALUATION OF CMIP6 MODELS *vs.* OBSERVATIONS

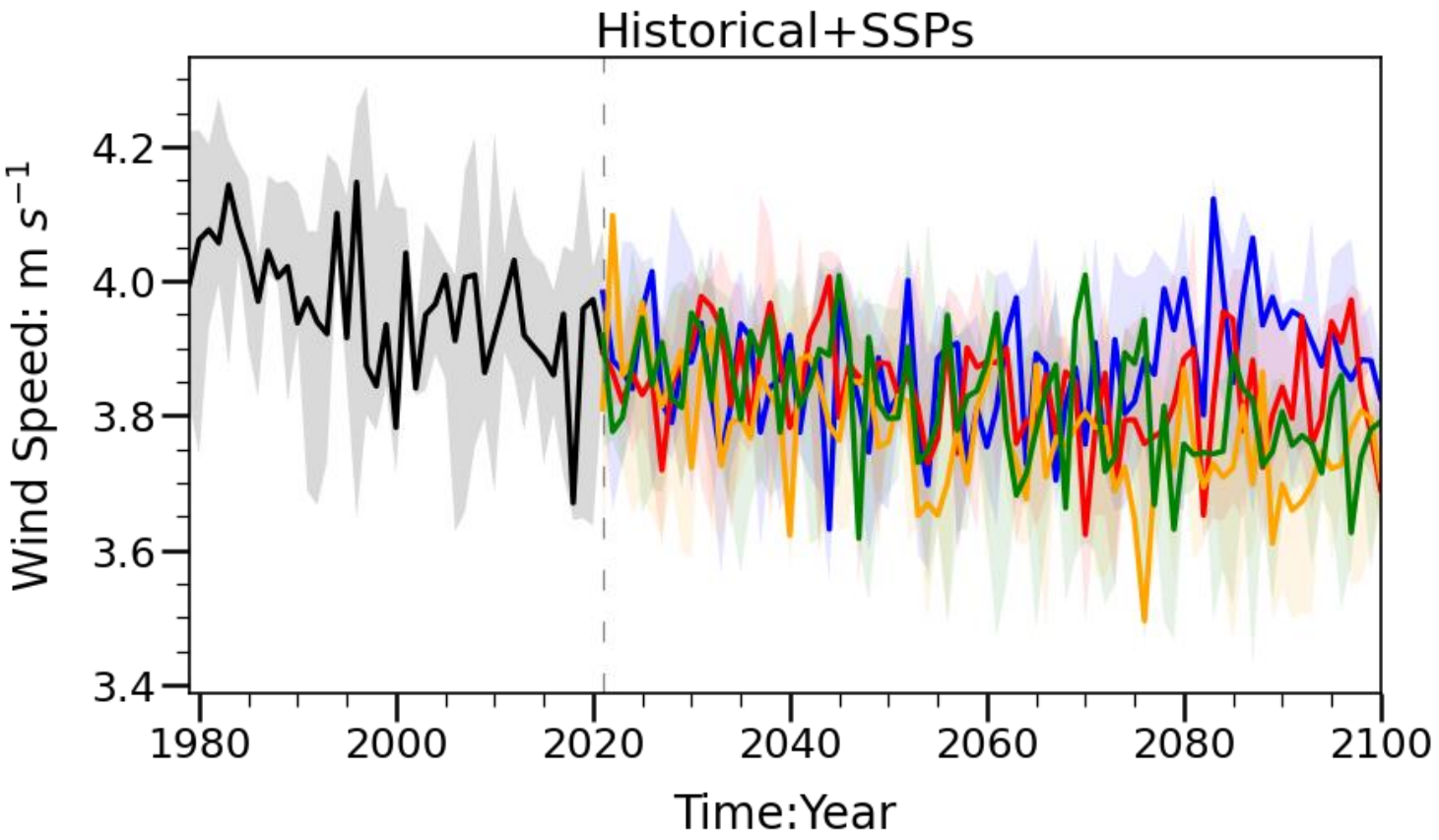


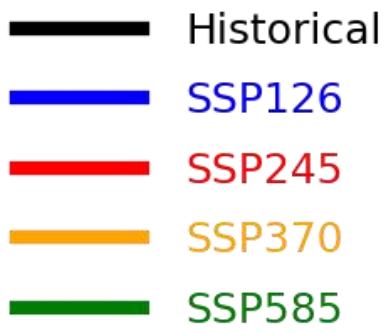
⊕ ⇨ $p<0.05$

MME shows the best performance in reproducing SWS over the Iberian Peninsula

	MME
Annual	**0.62**
Winter (DJF)	**0.3**
Spring (MAM)	**0.29**
Summer (JJA)	**0.29**
Autumn (SON)	0.25

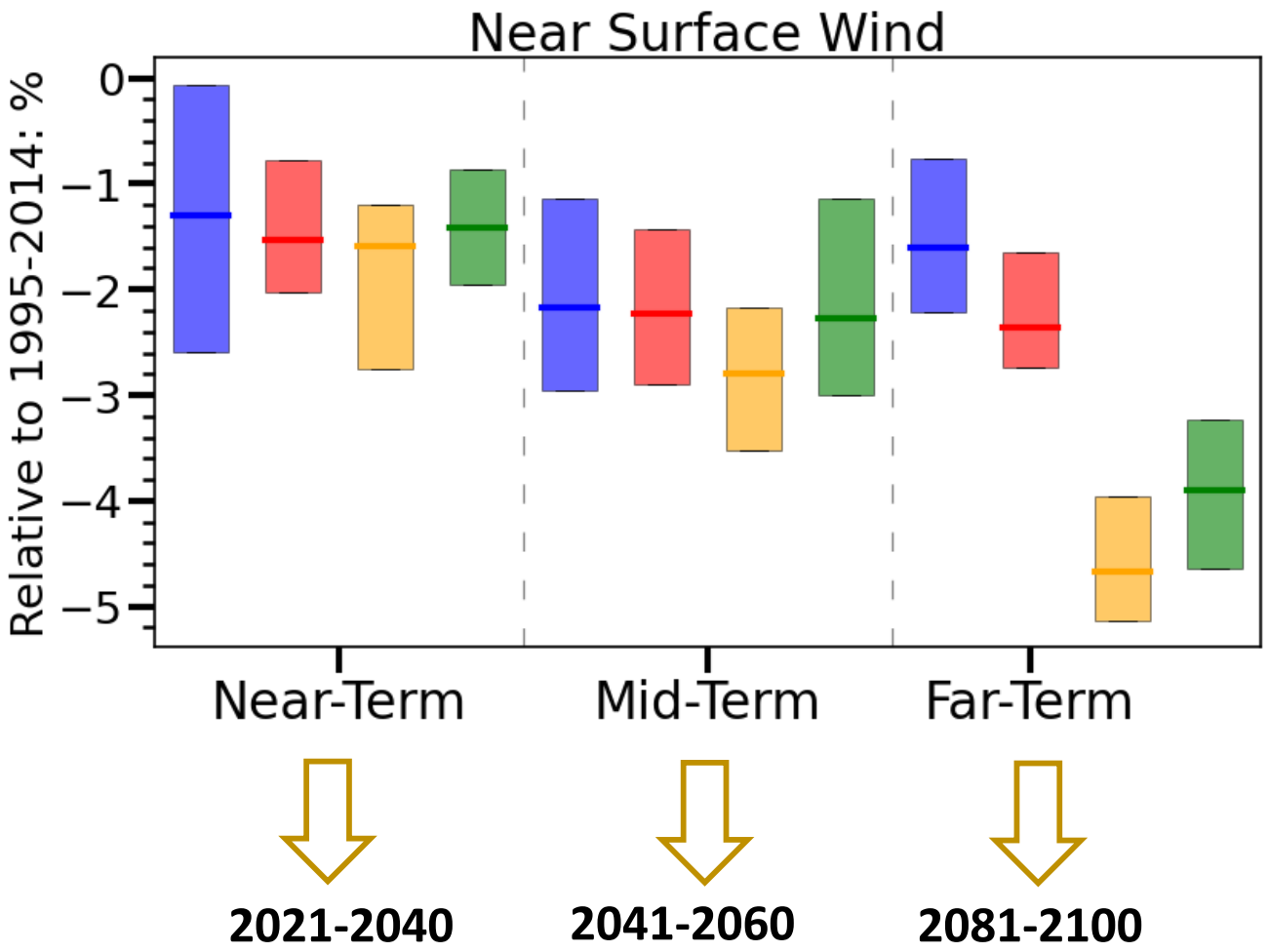
PROJECTED SWS TIME SERIES





Thick line represents the MME and the shading the uncertainty of the different CMIP6 models.

- **CMIP6 models can reproduce the observed stilling of the historical period but fail in reproducing the reversal since ~2010.**
- **SSP370 and SSP585 project a dominance of the stilling in the 21st century.**
- **SSP126 and SSP245 shows a interdecadal oscillation in the end of the century.**



UNCERTANITY OF MODELS IN DIFFERENT FUTURE TERMS

SSP126

SSP245

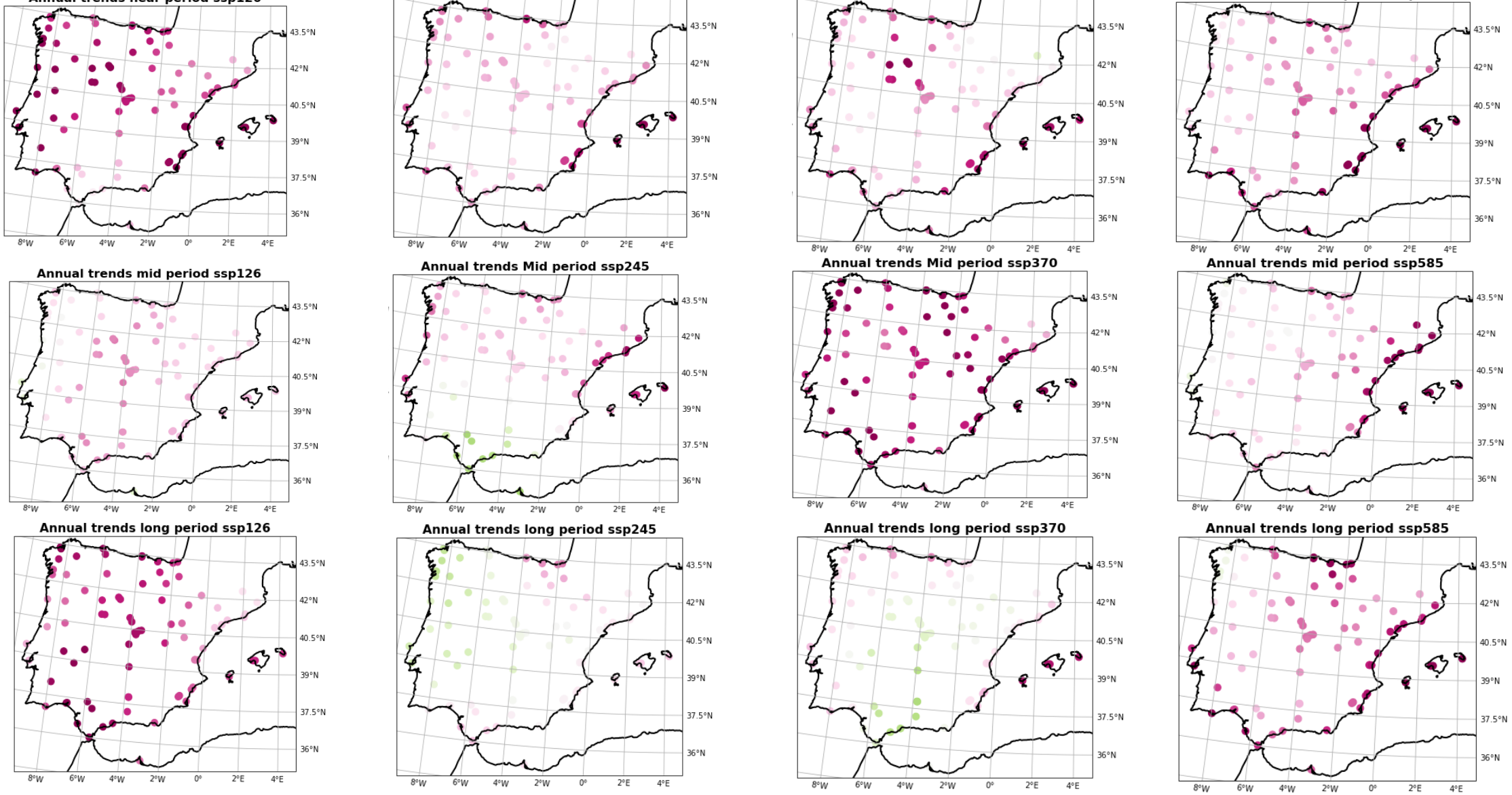
SSP370

SSP585

- **SSP126 exhibits a recovery for the long period compared with the previous one.**
- **SSP370 and SSP585 display the most marked stilling with a relative decline of SWS against the reference period of >4%.**

SPATIAL TRENDS

	SSP126	SSP245	SSP370	SSP585
NEAR	Annual trends near period ssp126	Annual trends Near period ssp245	Annual trends Near period ssp370	Annual trends near period ssp585
MID	Annual trends mid period ssp126	Annual trends Mid period ssp245	Annual trends Mid period ssp370	Annual trends mid period ssp585
LONG	Annual trends long period ssp126	Annual trends long period ssp245	Annual trends long period ssp370	Annual trends long period ssp585



- **MME shows the best performance in reproducing near-surface wind speed over the IP; anual maximun correlation of 0.62 (p<0.05).**
- **CMIP6 models reproduce the observed stilling over the IP, but missed the cessation or weak recent reversal in the last two decades.**
- **SSP126 projects a interdecadal oscillation for the last decades of the century.**
- **As CMIP6 models have a coarse resolution for our study area, further work will focus on using a downscalled product.**

Acknowledgements: This study was supported by the Leonardo grant 2021 from the BBVA Foundation (“*Stilling vs. Reversal: proyecciones de la velocidad del viento en el siglo XXI y oscilaciones atmósfera-océano asociadas*”), and also the Spanish Ministry of Science and Innovation (RTI2018-095749-A-I00), the Valencian Regional Government (AICO/2021/023), and the CSIC Interdisciplinary Thematic Platform PTI-CLIMA.

BBVA Foundation