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**XIII giornata sulla modellistica in ARIA(NET)  
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# Impatto delle emissioni di inquinanti (forzanti climatiche a vita breve) sul clima europeo al 2050

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## What are short-lived climate forcers?

SLCFs are substances that affect climate and most of them are air pollutants too. **They include:**

- **aerosols or particulate matter (PM) components** (SOA, SIA, BC, mineral dust and sea spray),
- **chemically reactive gases** (CH<sub>4</sub>, O<sub>3</sub>, NO<sub>2</sub>, CO, VOCs, SO<sub>2</sub>, NH<sub>3</sub>, halogenated compounds).

## Why are they important as climate forcers?

- **SLCFs are either radiatively active or precursors of radiatively active compounds** formed by atmospheric chemistry, **that can have either cooling or warming effects.**
- While CO<sub>2</sub> impacts are understood with high confidence level, **there are knowledge gaps concerning the impact of non-CO<sub>2</sub> radiative forcers**

## What do their features imply?

- **SLCFs effect occurs predominantly in the first two decades** after their emission/formation
- **The return time of emission reduction policies is expected to be much shorter than for CO<sub>2</sub>**
- Due to their short lifetime, **they can have regional impact**

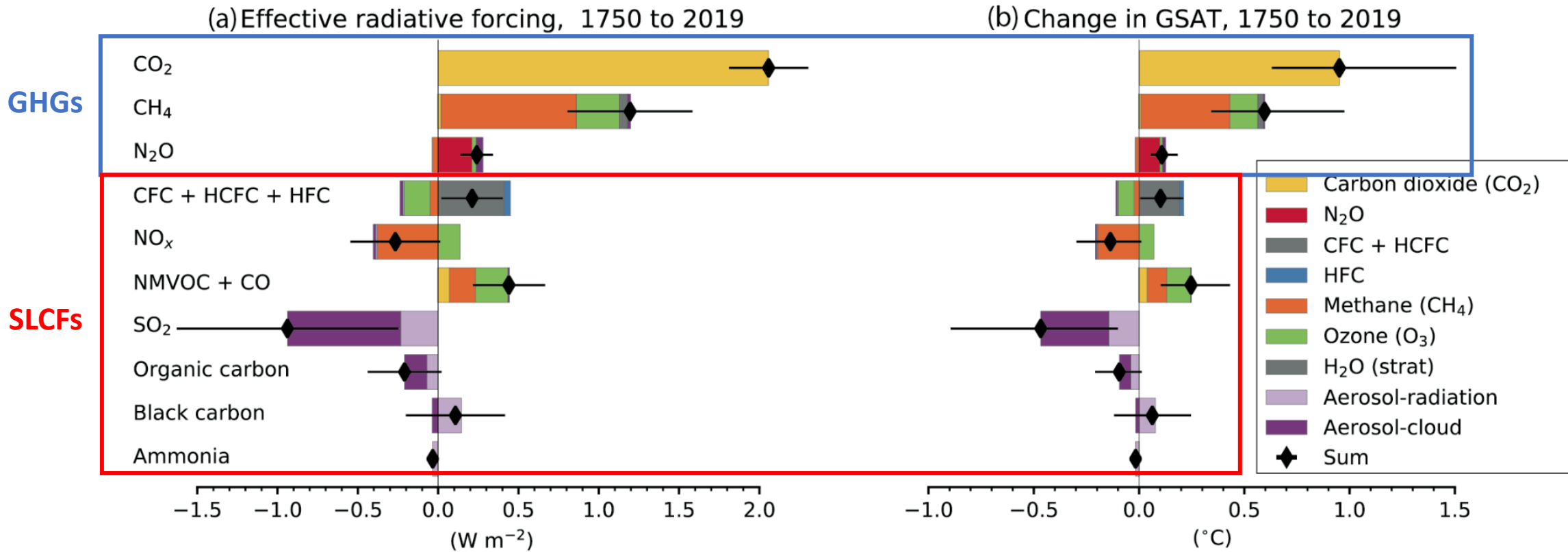
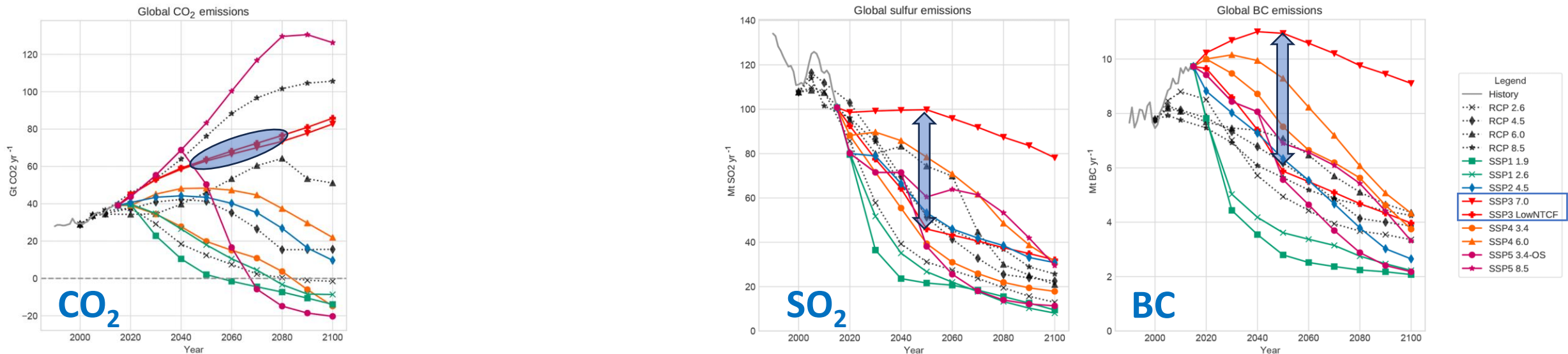


Figure 6.12 | Contribution to effective radiative forcing (ERF) (a) and global mean surface air temperature (GSAT) change (b) from component emissions between 1750 to 2019 based on CMIP6 models (Thornhill et al., 2021b).

## Future Shared Socioeconomic Pathways (SSPs) scenarios:

To determine how SLCFs can impact climate in the near future **ssp370** and **ssp370-lowNTCF** are compared. They have similar CO<sub>2</sub> emissions whereas in ssp370-lowNTCF, SLCF emissions follow a stronger pollution control.

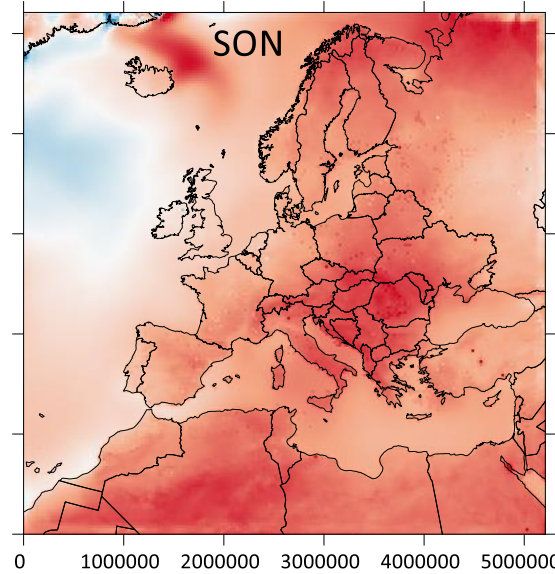
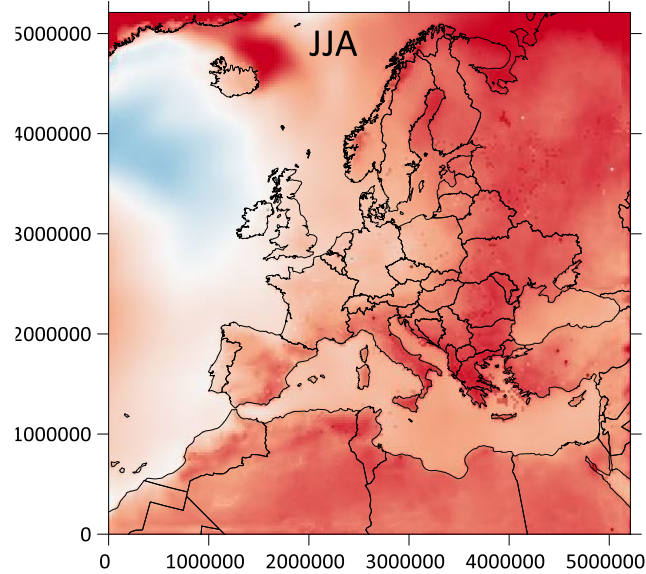
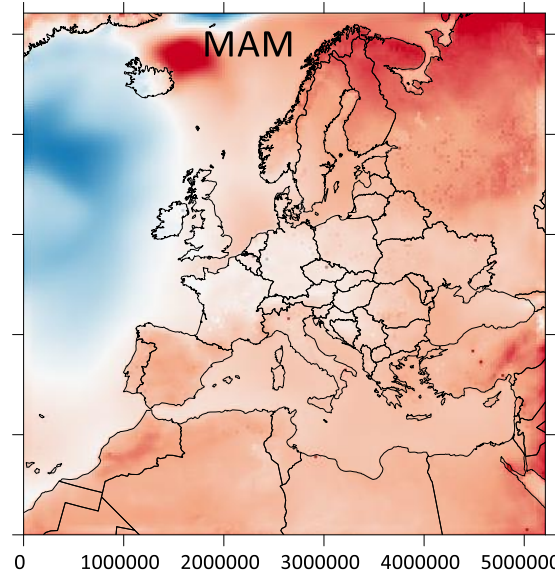
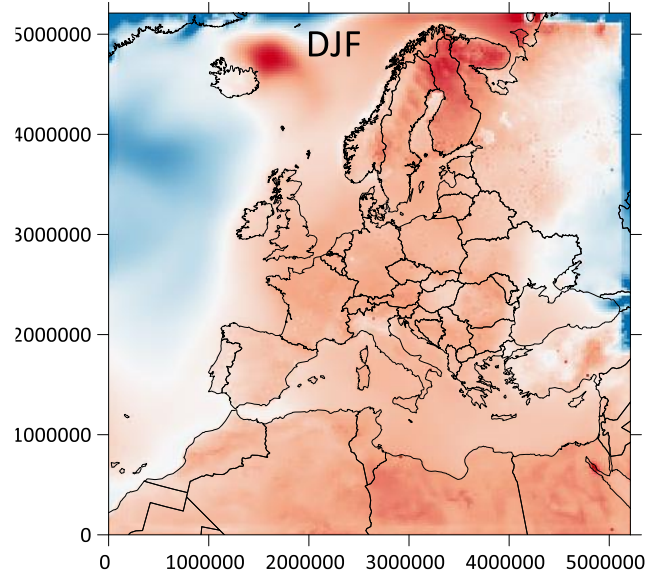


Figures from: Gidden et al. 2019, **Global emissions** pathways under different socioeconomic scenarios for use in CMIP6, Geosci. Model Dev., 12, 1443–1475

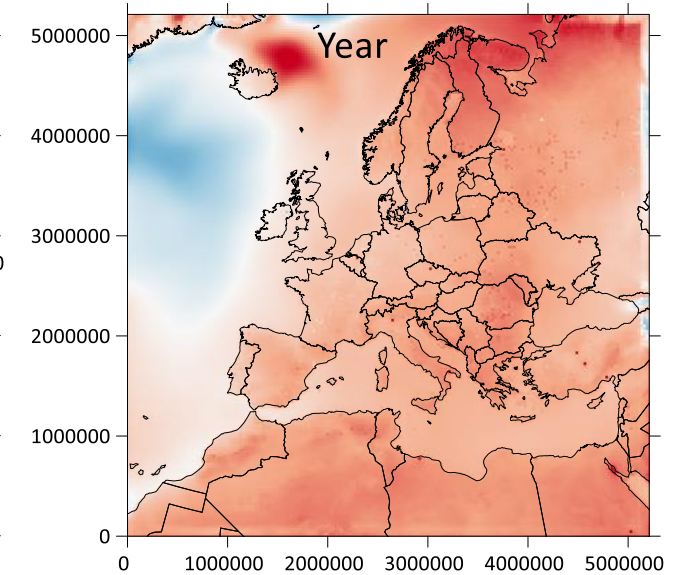
Scenario	Models	Time window	Met. driver	Atmospheric composition driver	Emissions	Land Cover
Historical driven by reanalyses (2004-2019)	WRF+FARM	2004-2019	ERA5	CAMS global Reanalyses	CEDS	LUCAS (LH2 compatible)
Historical driven by EC-Earth3 (historical 2004-2014 and SSP3.7.0 2015-2019)	WRF+FARM	2004-2019	EC-Earth3	EC-Earth3	CEDS	LUCAS (LH2 compatible)
CMIP6 SSP3.7.0 scenario (2045-2055)	WRF+FARM	2045-2055	EC-Earth3	EC-Earth3	ScenarioMIP	LUCAS (LH2 compatible)
CMIP6 SSP3.7.0-low NTCF scenario (2045-2055)	WRF+FARM	2045-2055	EC-Earth3	EC-Earth3	AerChemMIP	LUCAS (LH2 compatible)

SSP3-7.0 scenario is a medium-high reference scenario within the “regional rivalry” socio-economic family  
 SSP3-7.0-LowNTCF variant of the SSP3-7.0 scenario with reduced near-term climate forcer (NTCF) emissions

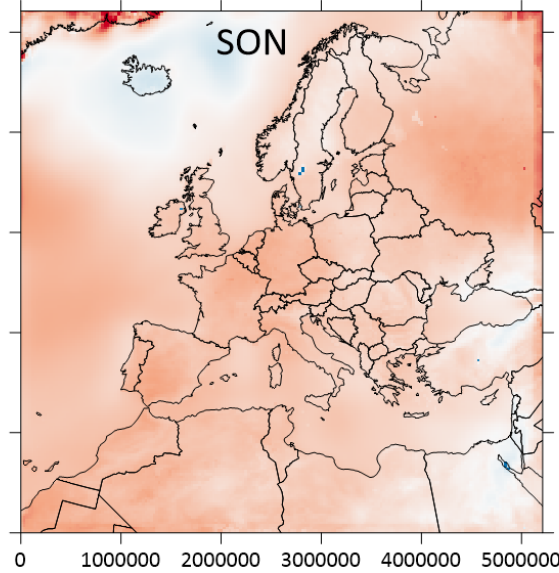
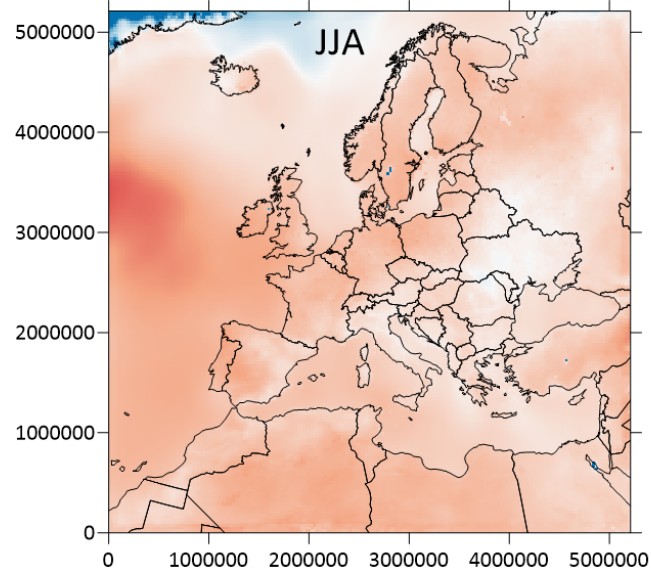
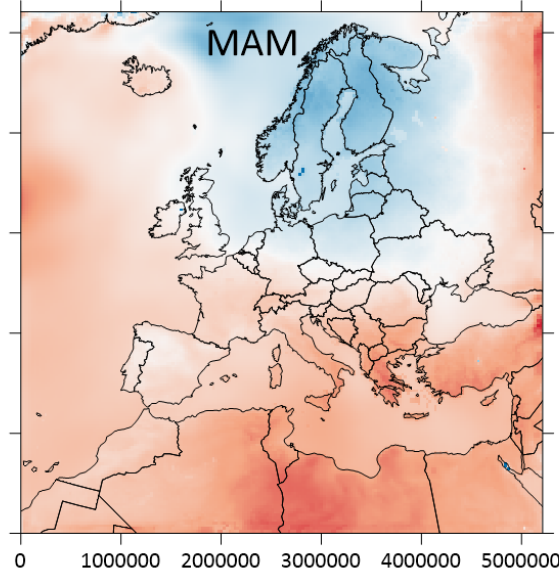
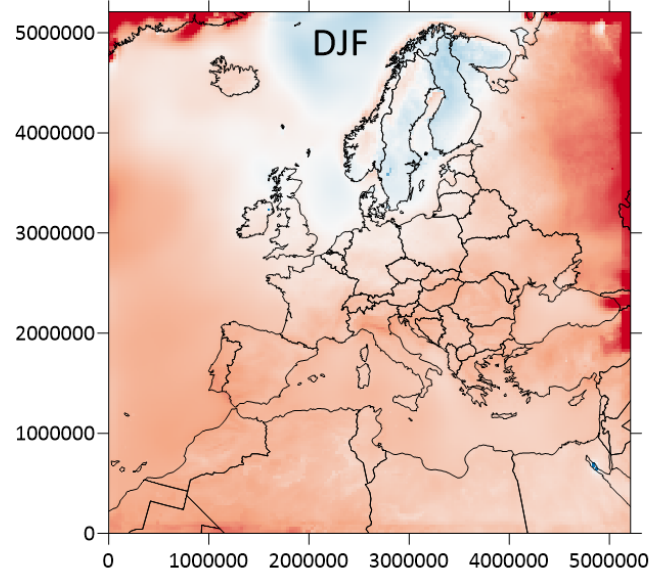
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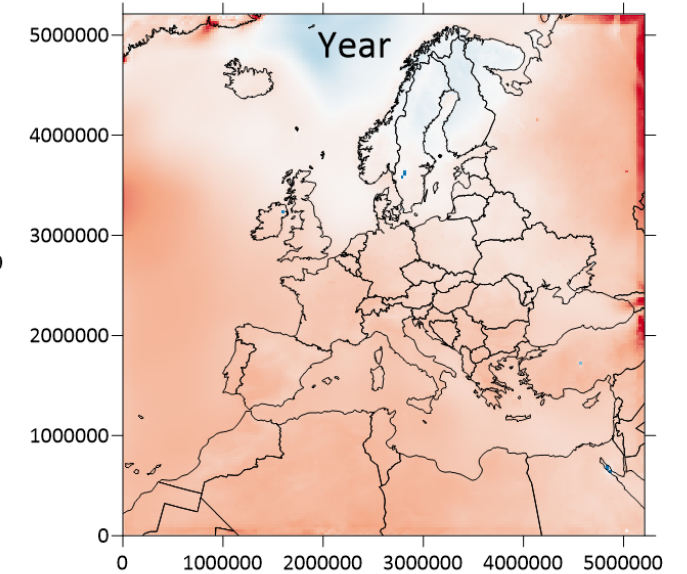
## Futuro (2050) – presente (2010)



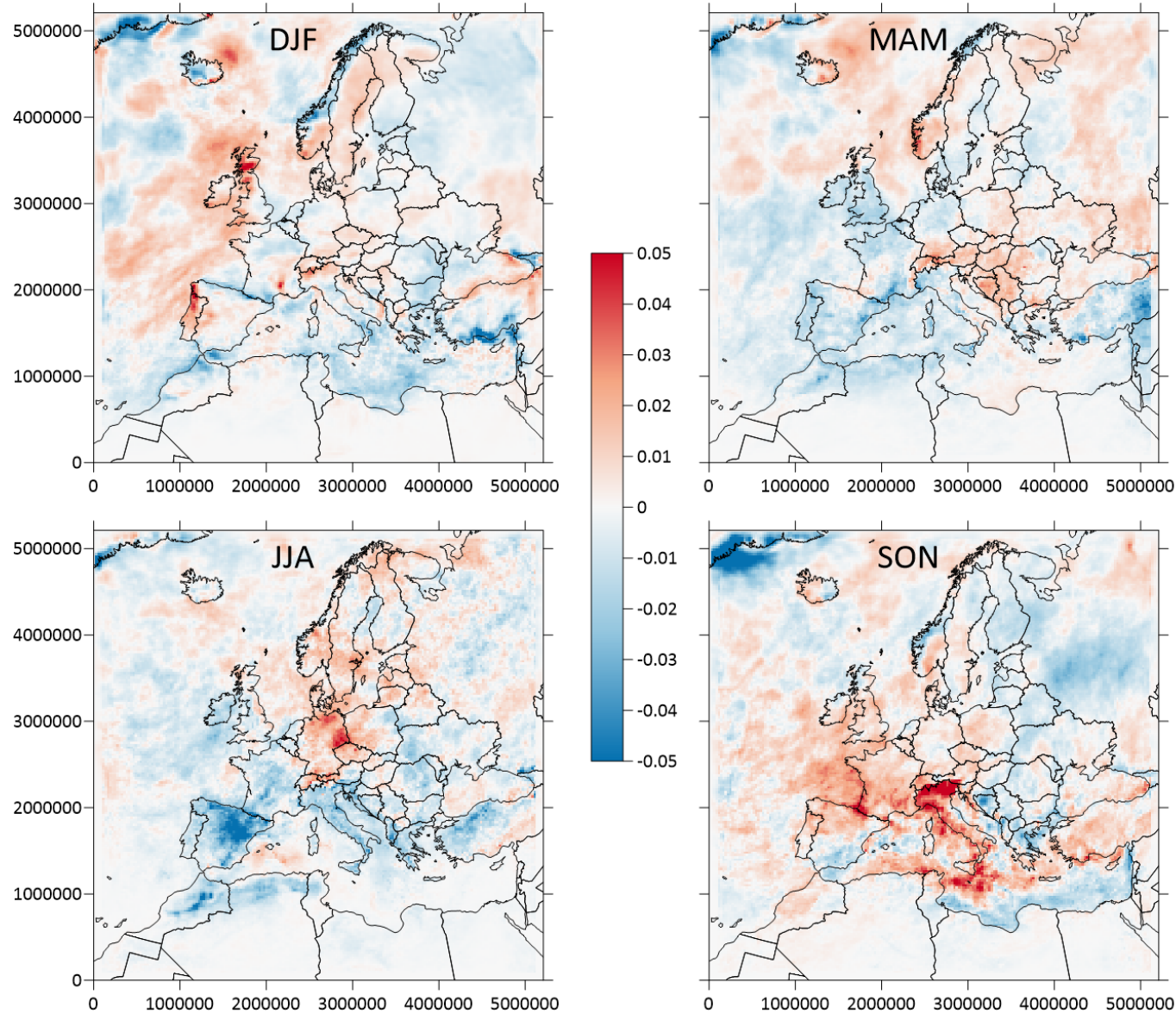
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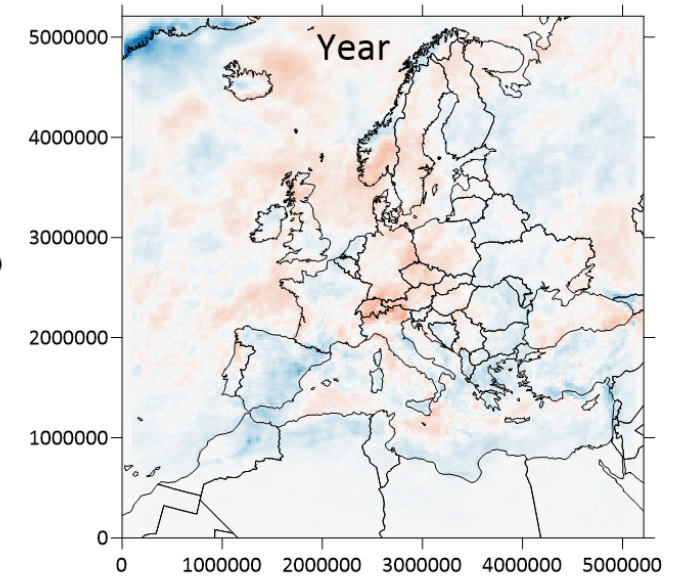
## Riduzione SLCP al 2050



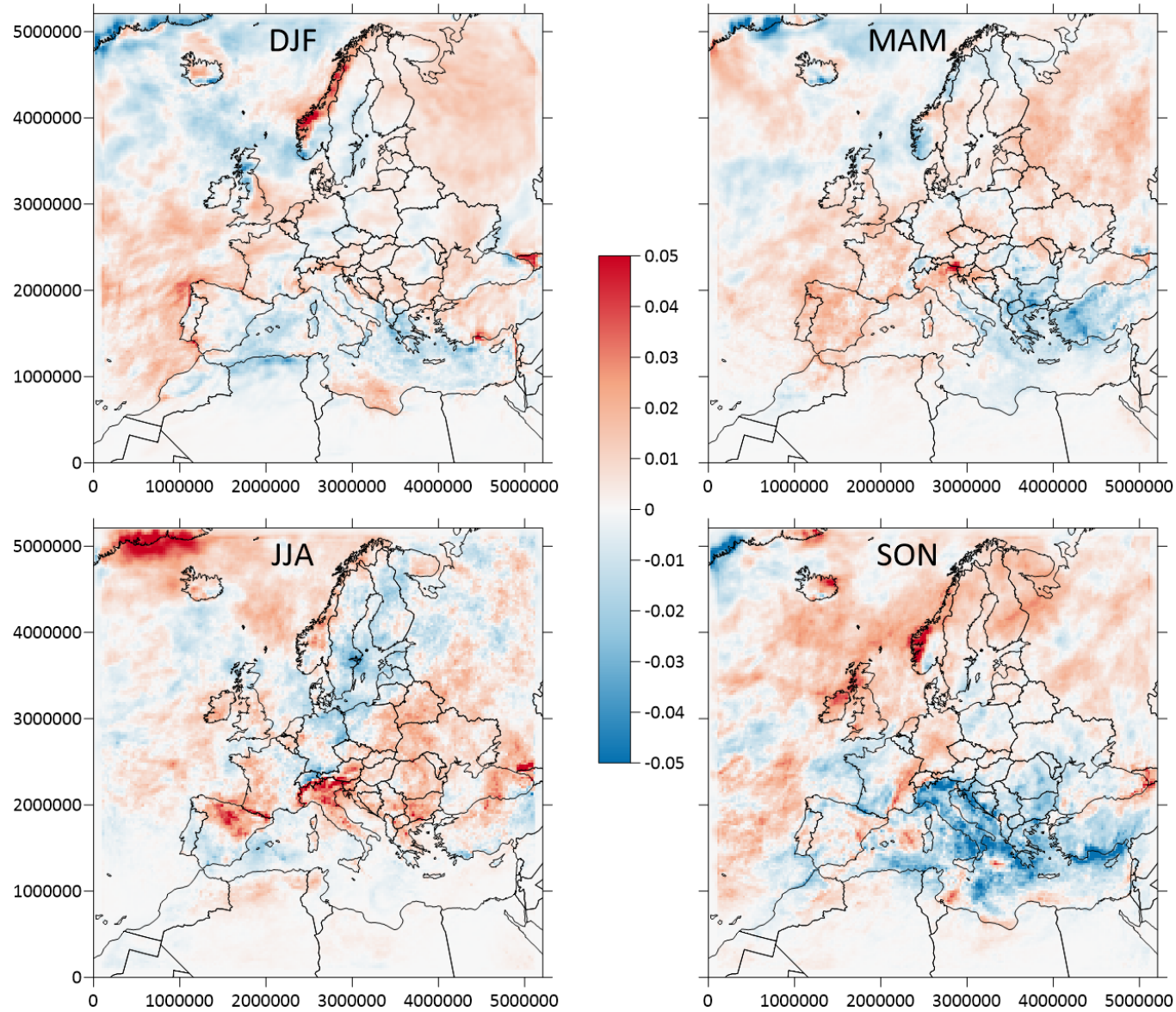
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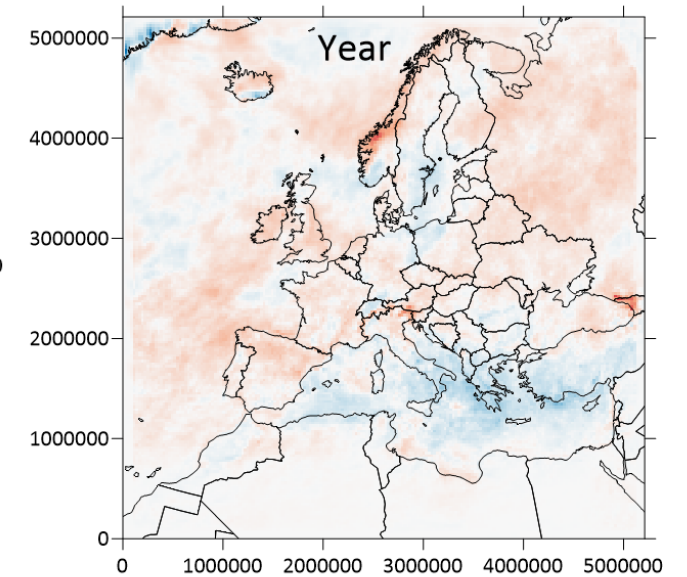
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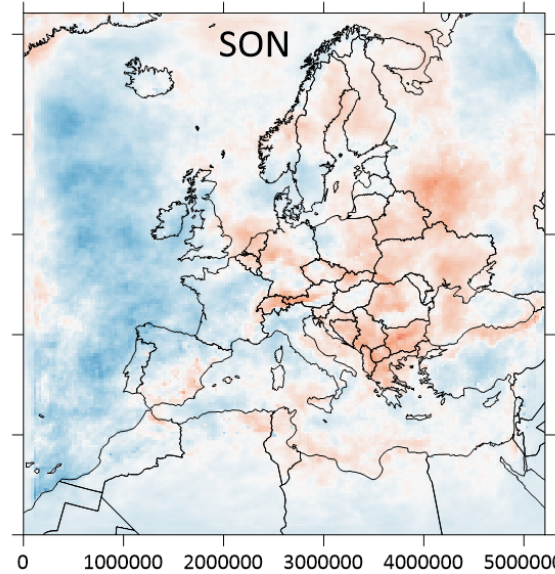
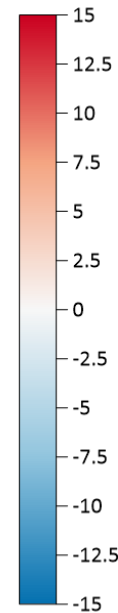
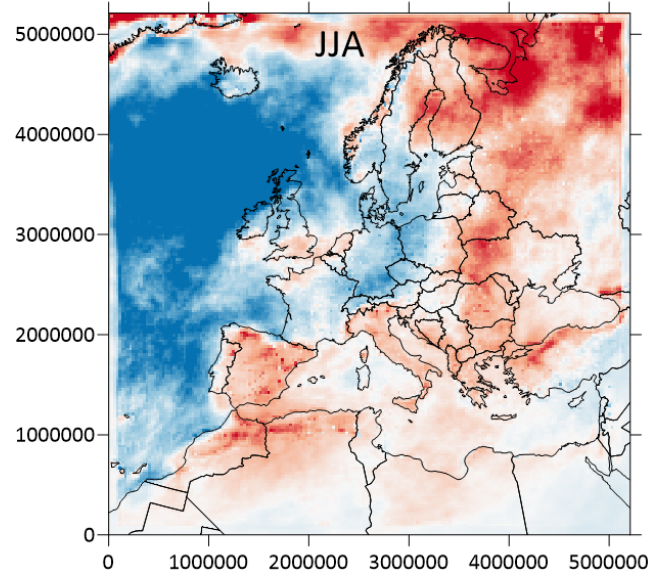
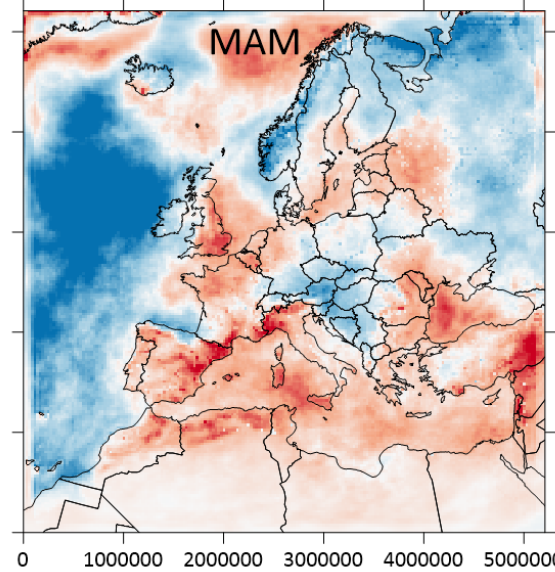
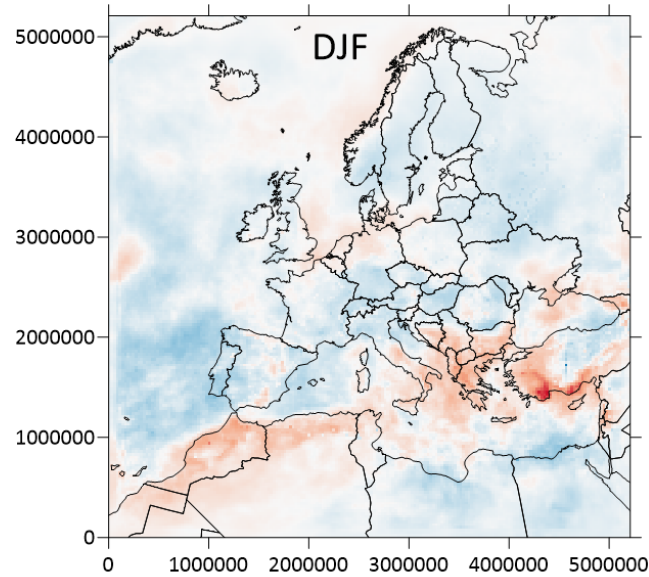
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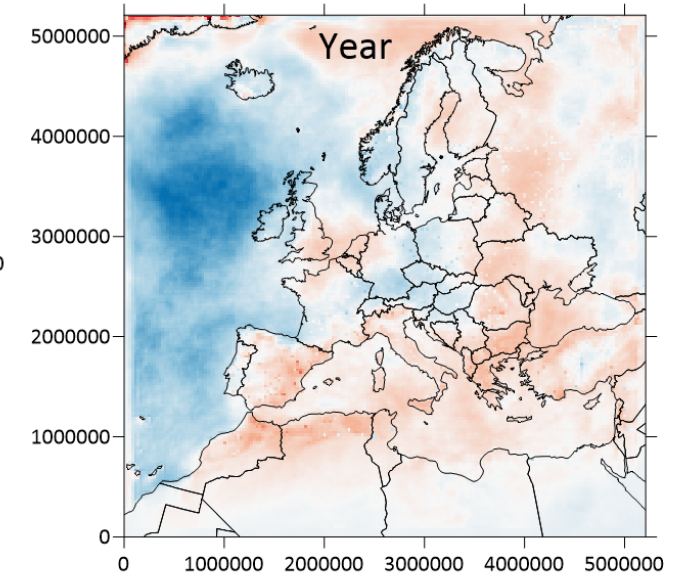
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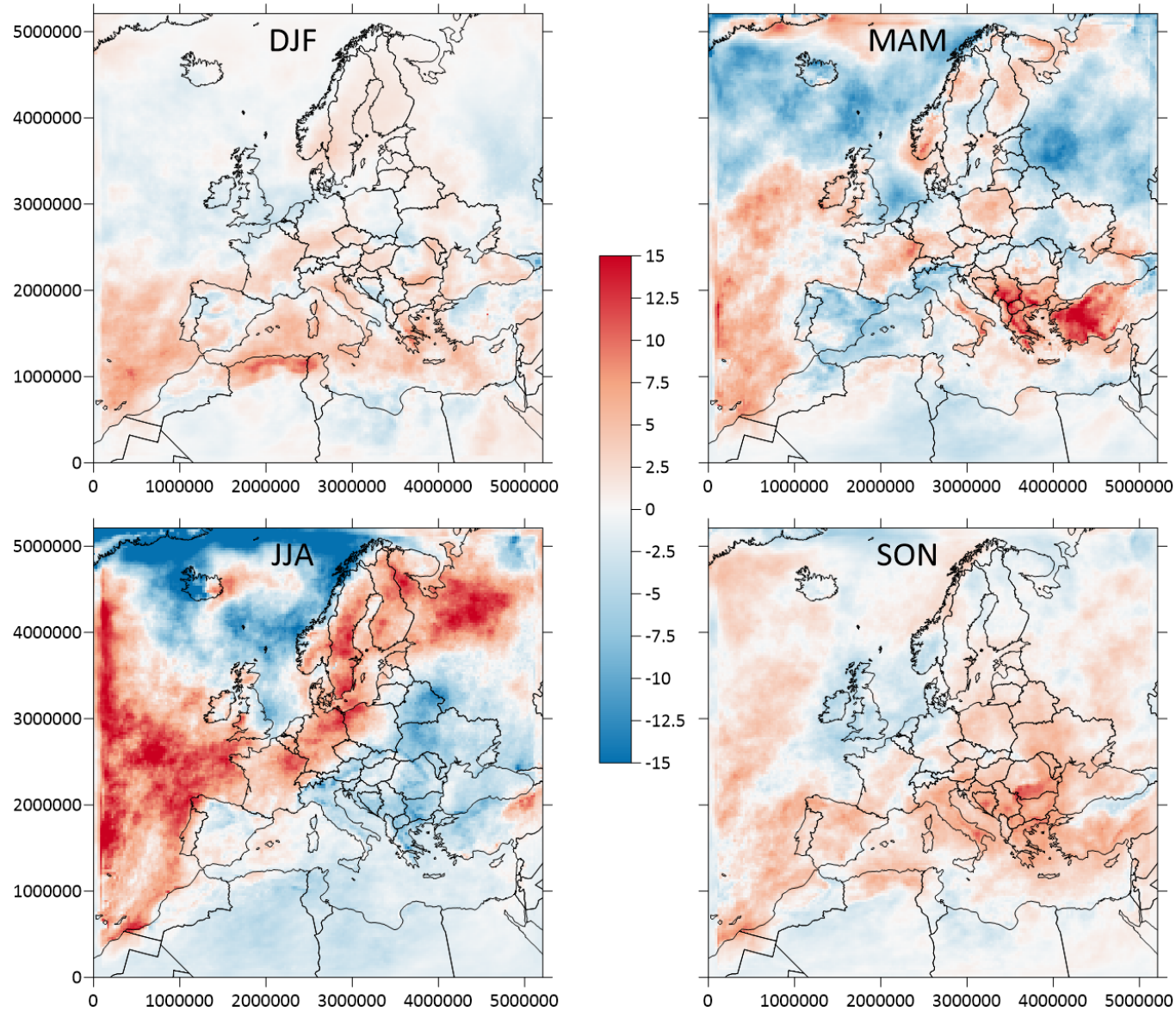
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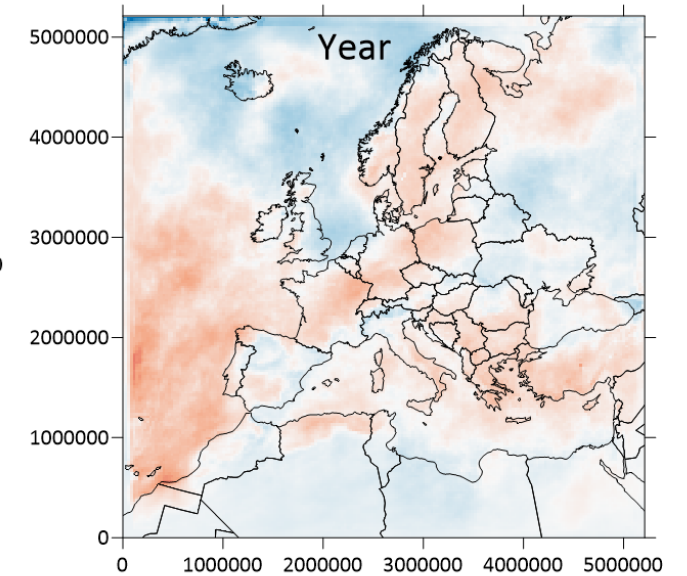
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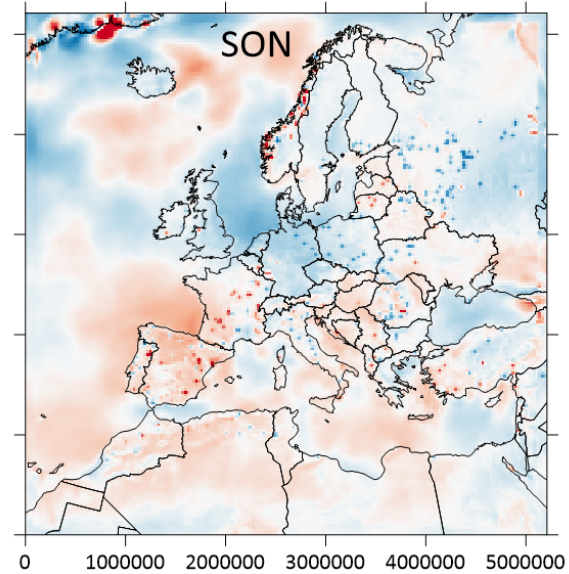
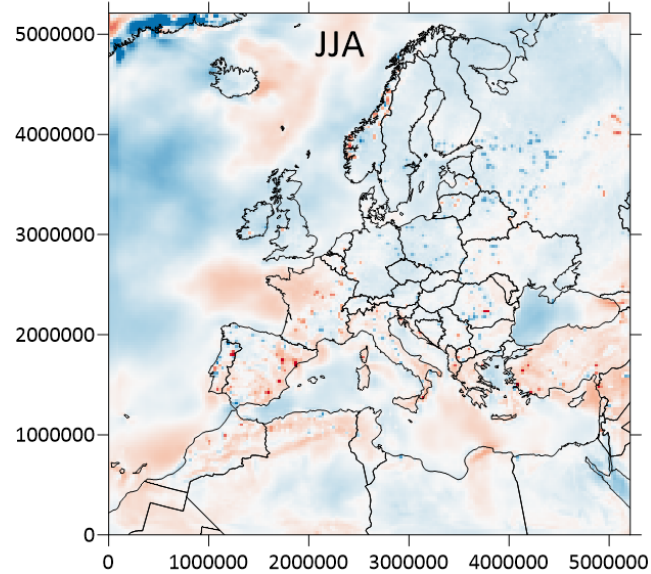
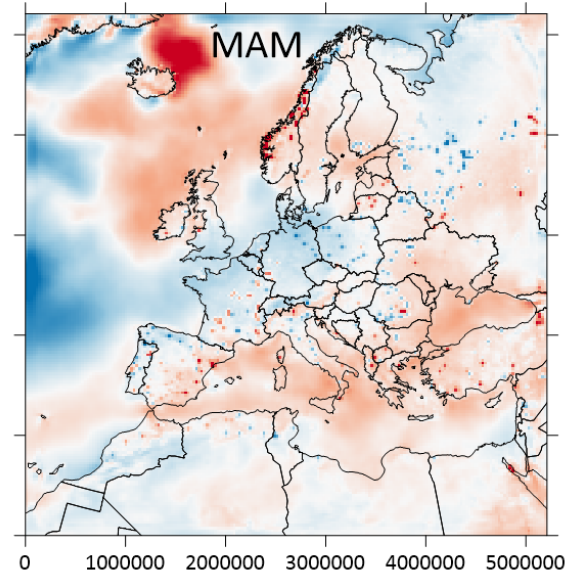
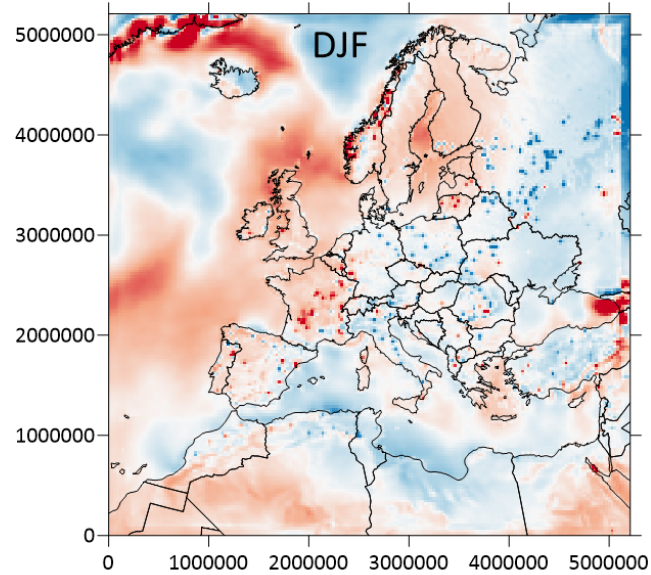
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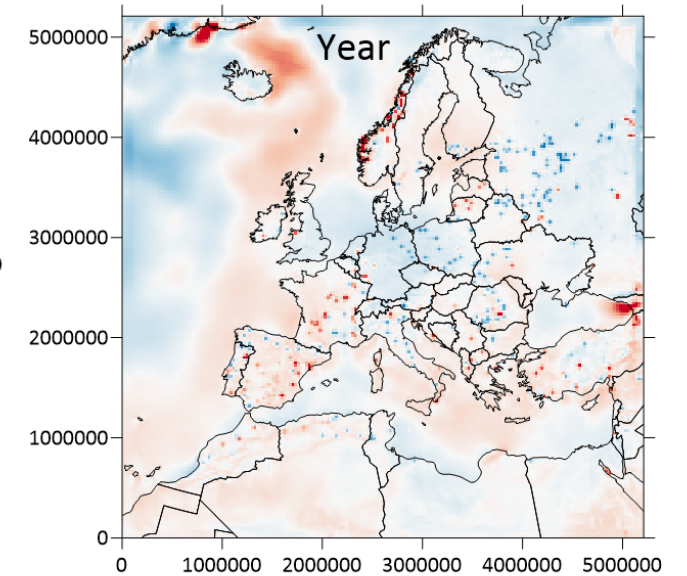
## Riduzione SLCP al 2050



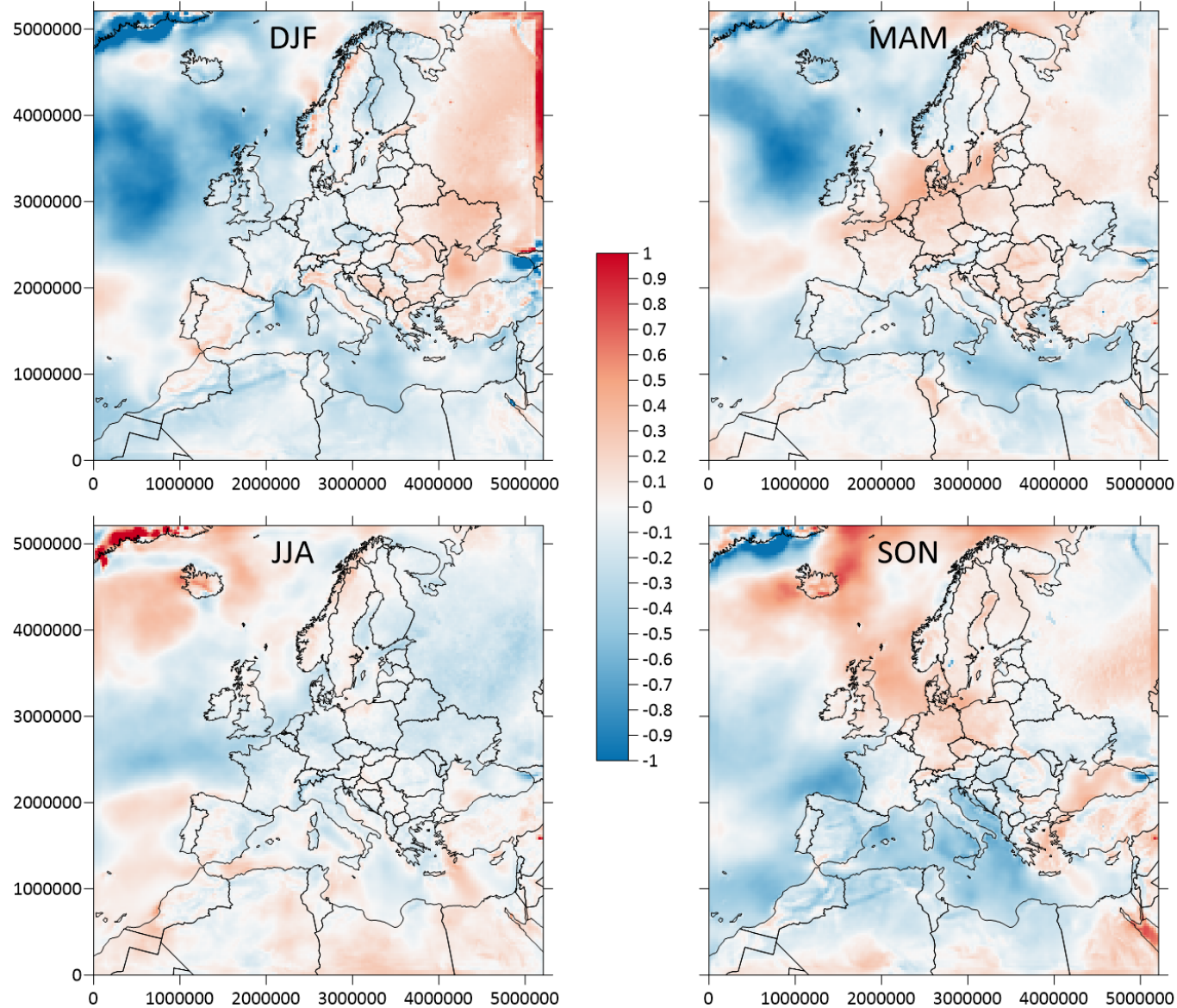
## Speed10m



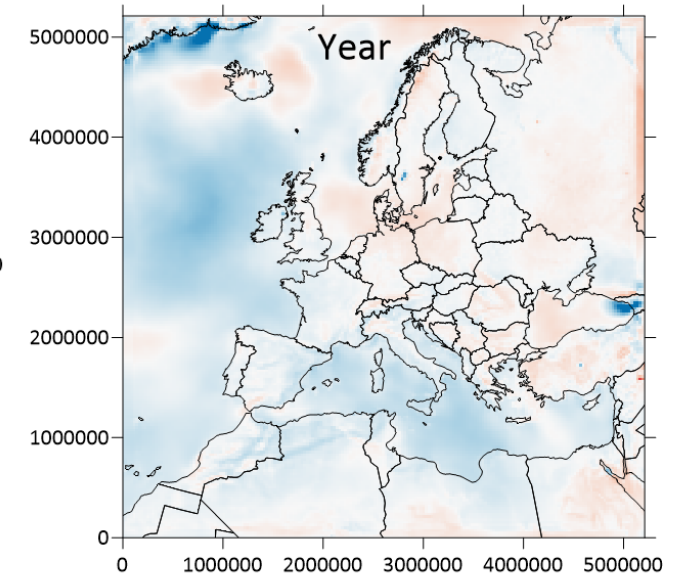
## Futuro (2050) – presente (2010)



## Speed10m



## Riduzione SLCP al 2050



- Future impact of SLCF has been estimated by 2050 results of SSP3-7.0 and SSP3-7.0-lowNTCF scenarios compared with the latest decade of historical simulation
- SSP370 predicts a large increase of temperature over Europe, with extreme seasonal warming over Mediterranean region and Scandinavia. Reduction of precipitation and increase of radiation over the Mediterranean and Balkan regions
- SLCF reduction increases predicted heating over almost all Europe, during all seasons, with the only exception of Scandinavia, where cooling is predicted
- SLCF reduction compensates seasonal changes of precipitation/radiation over Southern Europe, during all seasons, even if the overall change is somewhere increased

**Thank you for your attention!**

**ACKNOWLEDGEMENTS**

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