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The impact of mid Holocene Saharan greening on the Euro Atlantic climate variability

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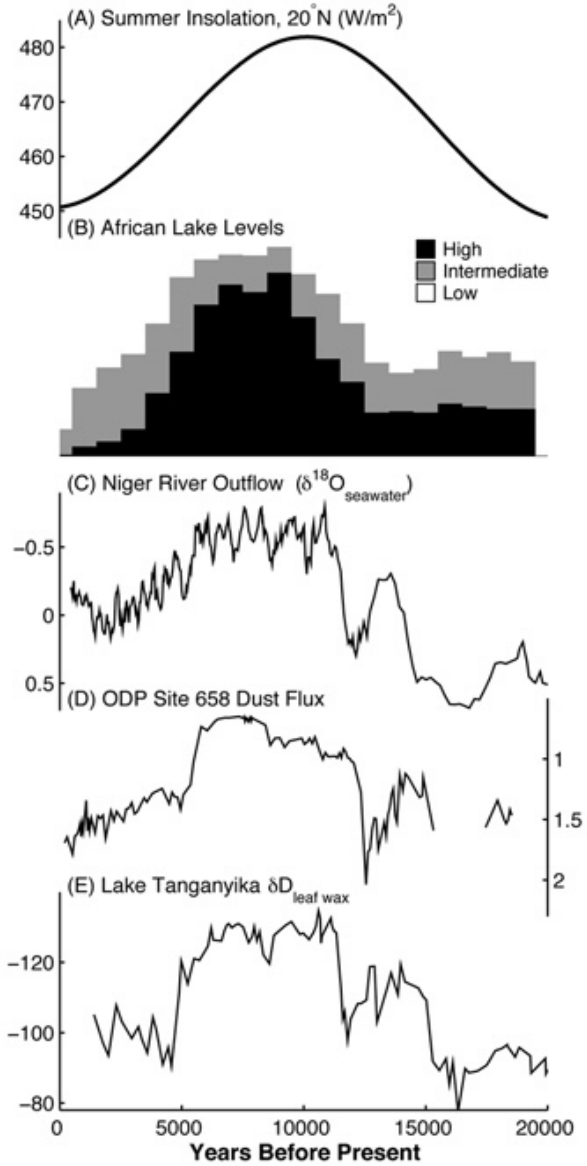
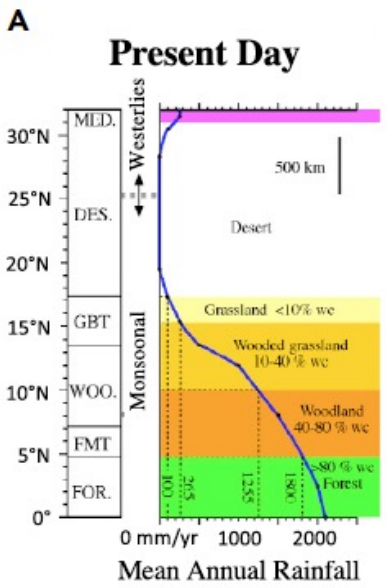
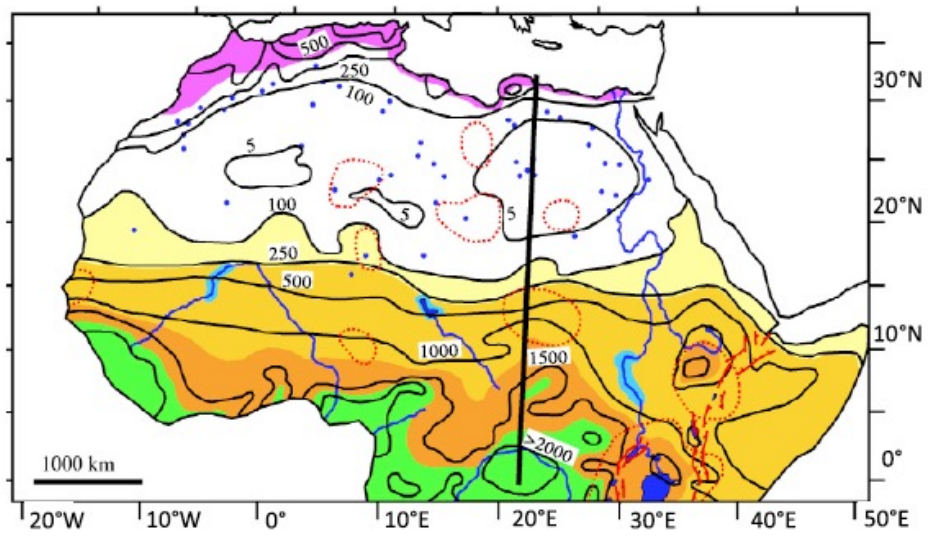
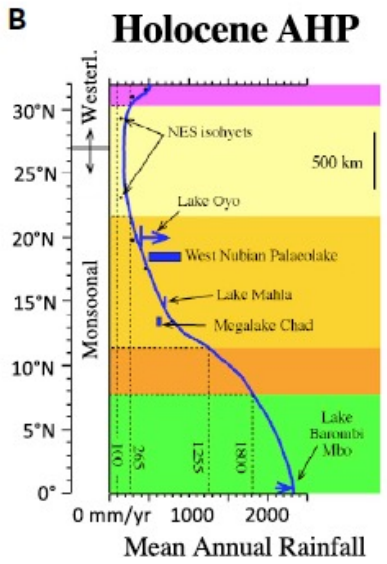
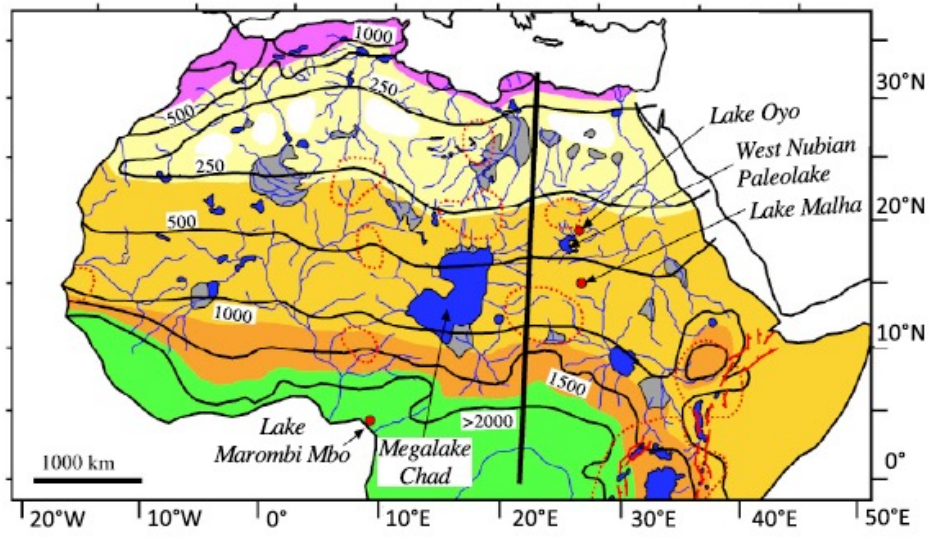
Mid-Holocene African humid period (5-10k year ago)





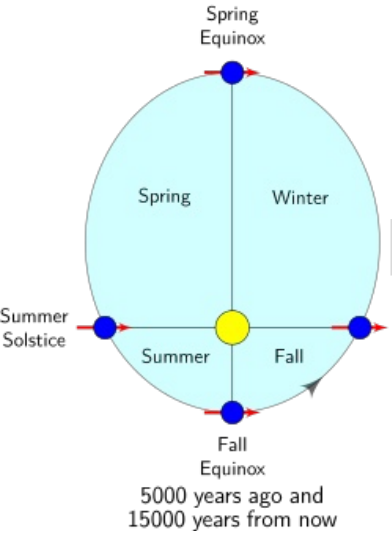


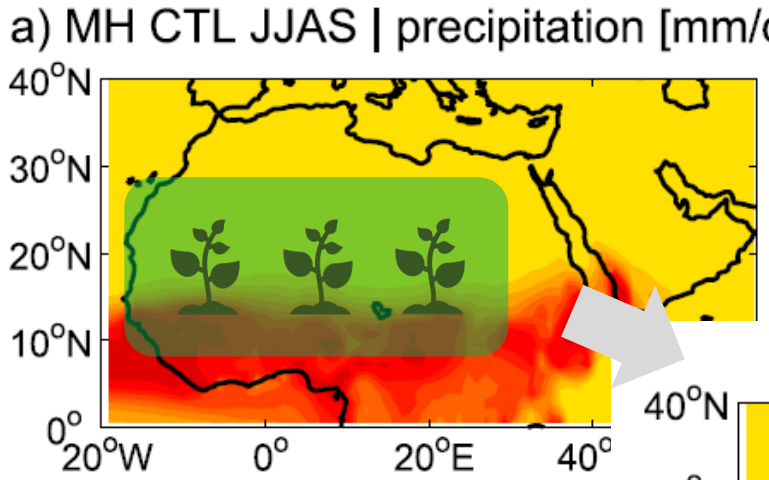


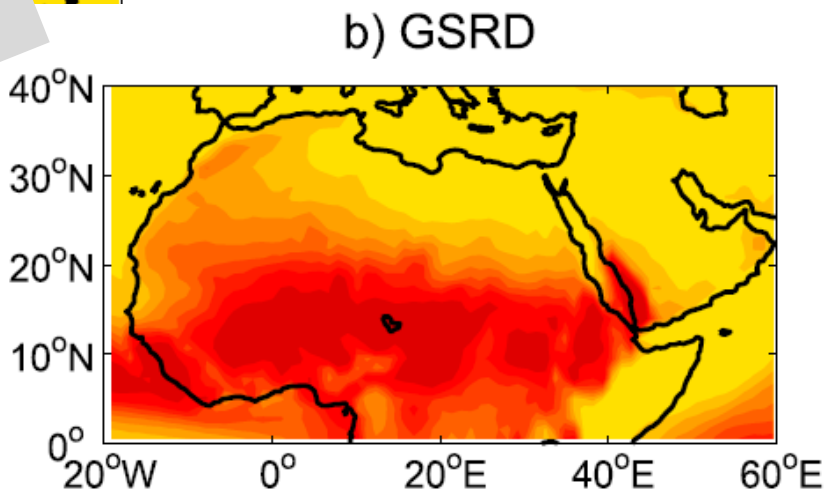


Pausata et al. 2020, https://doi.org/10.1016/j.oneear.2020.03.002

Simulating the Mid-Holocene African Humid Period (with an Earth System Model: EC-Earth)



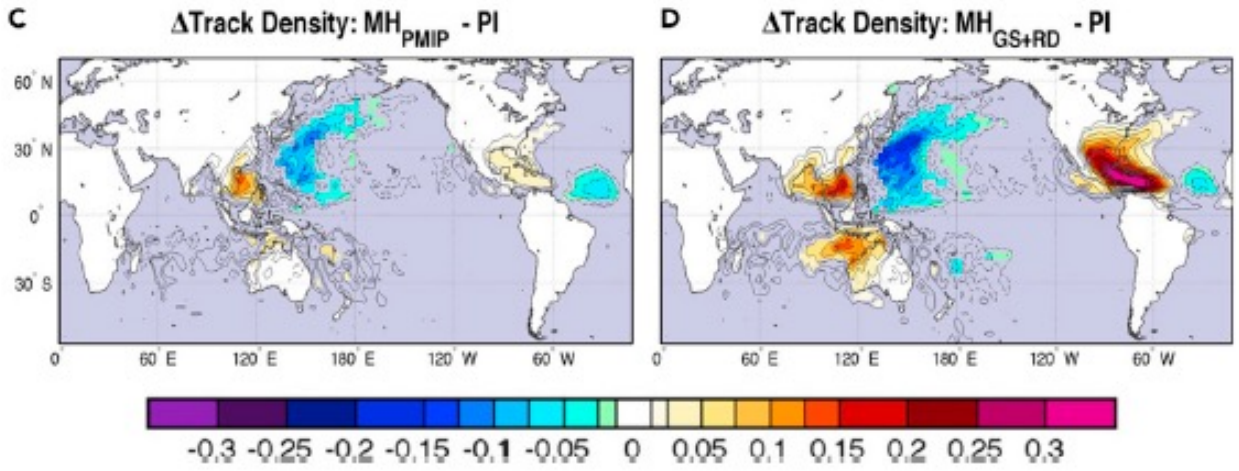


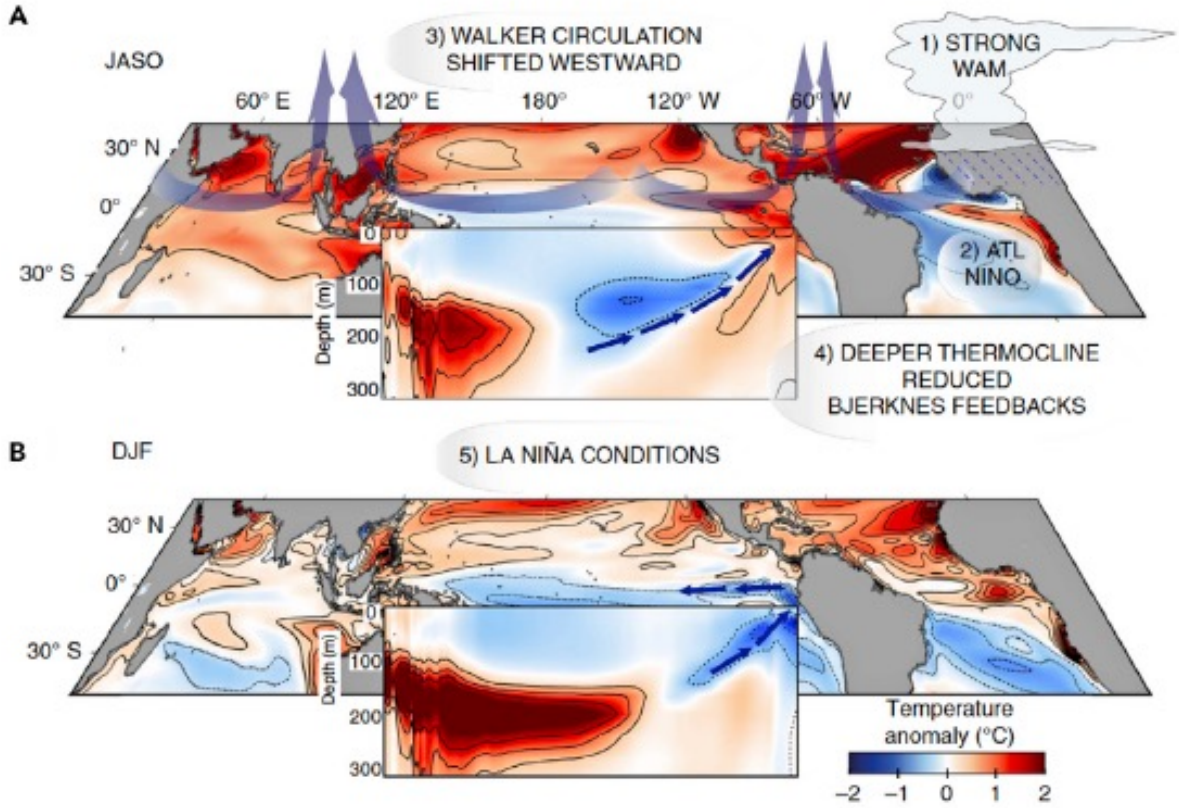


Prescribing Green Sahara (with reduced dust) → stronger monsoon (vs PI)

Pausata et al. 2016, https://doi.org/10.1016/j.epsl.2015.11.049
Gaetani et al. 2017, https://doi.org/10.1175/JCLI-D-16-0299.1
Messori et al. 2019, https://doi.org/10.1002/joc.5924

Simulating Green Sahara impact in the Tropics (with an Earth System Model: EC-Earth)





Green Sahara → changes in TCs and ENSO (vs PI)

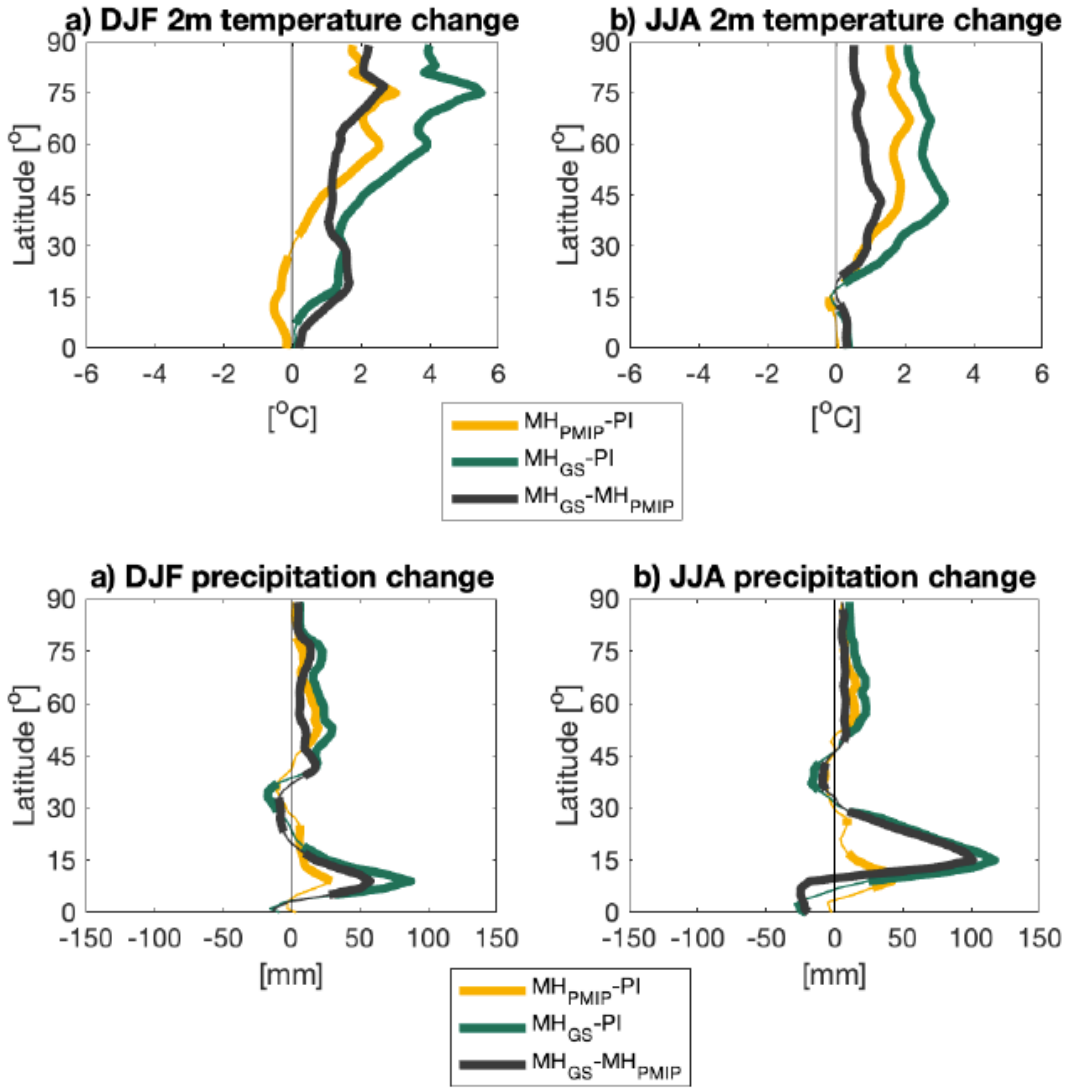
Pausata et al. 2017, https://doi.org/10.1073/pnas.1619111114
Pausata et al. 2017, https://www.nature.com/articles/ncomms16020

Objective:

→ **using the same Earth System Model: EC-Earth,**

→ **to simulate the Green Sahara impact at midlatitudes.**

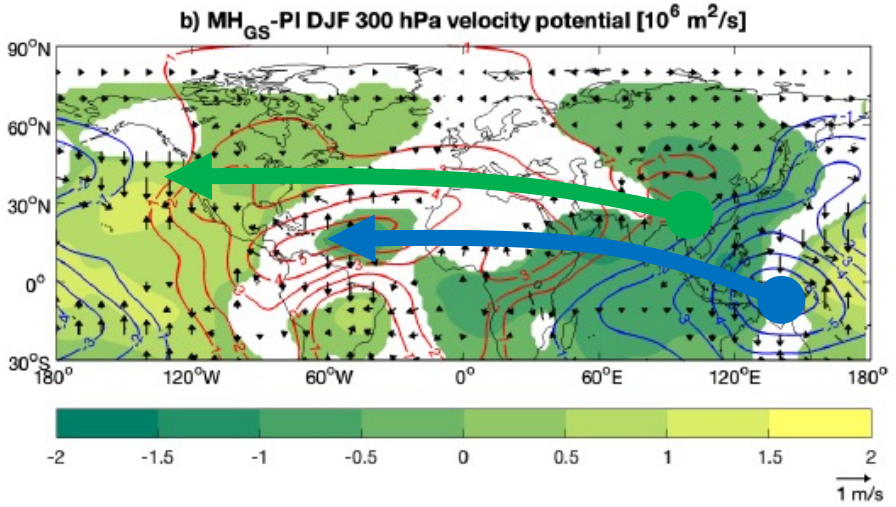
Green Sahara impact in the Northern Hemisphere

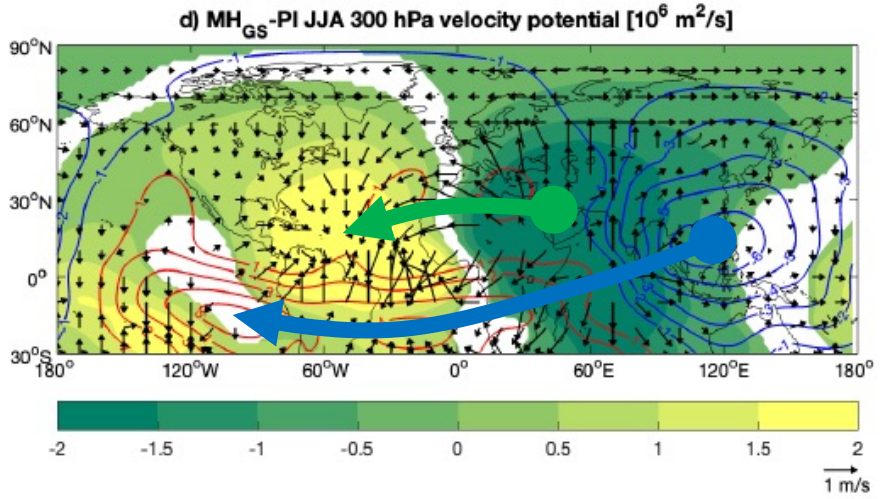


Green Sahara → warmer and wetter NH (vs PI)

Gaetani et al. 2024, https://doi.org/10.5194/egusphere-2024-272

Green Sahara impact on teleconnections

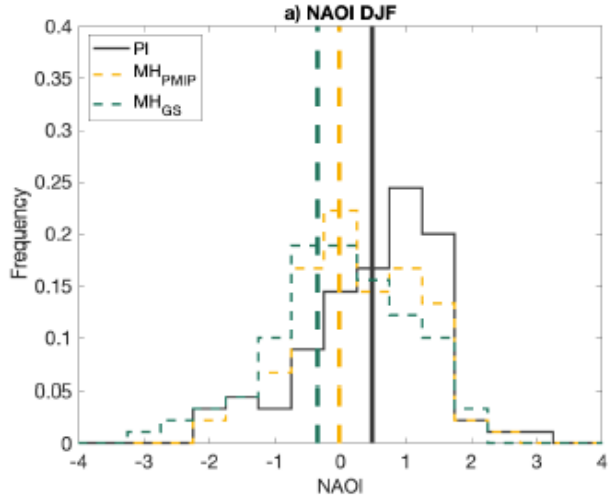




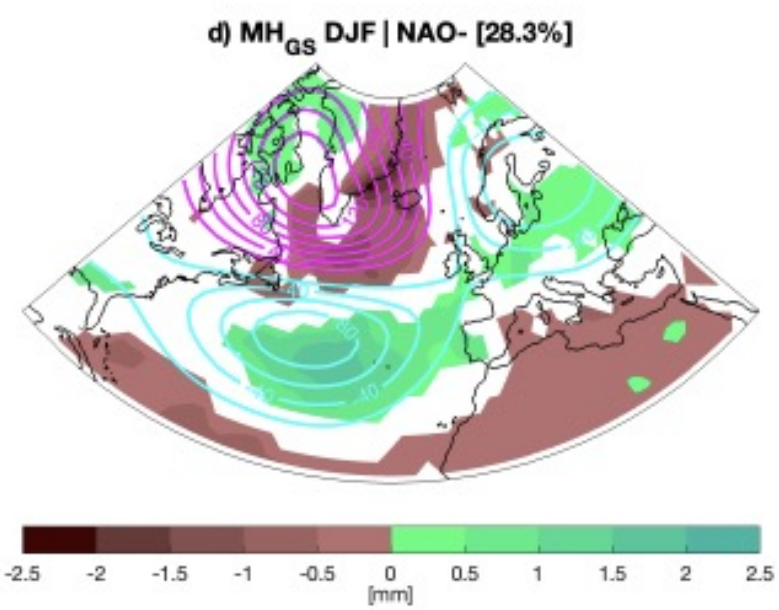
Green Sahara → modification of zonal circulation (vs PI)

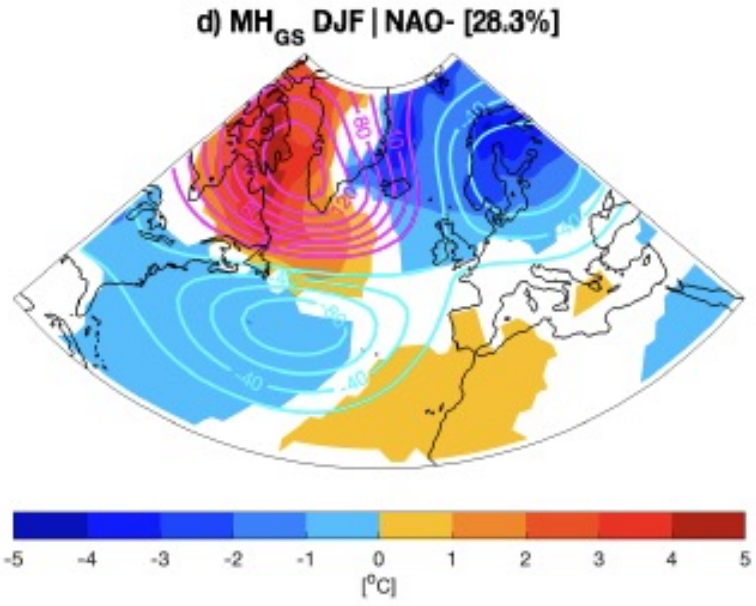
Gaetani et al. 2024, https://doi.org/10.5194/egusphere-2024-272

Green Sahara impact on winter NAO



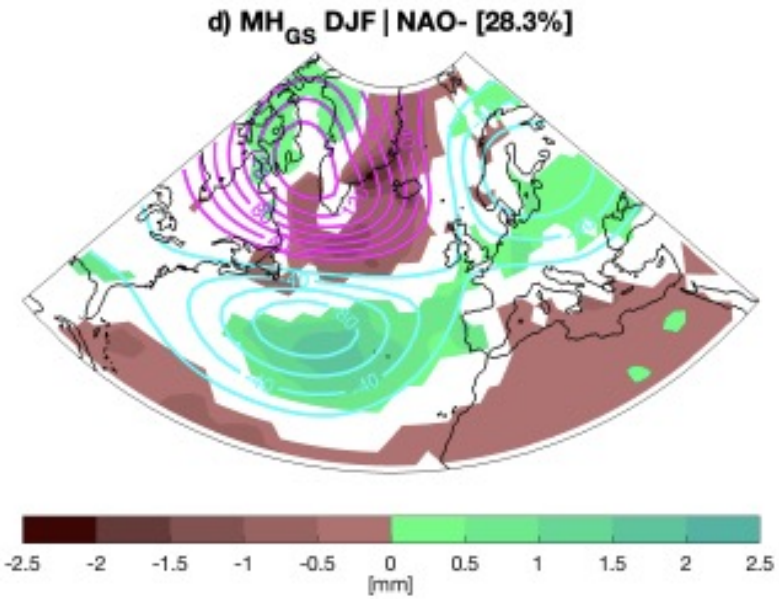
Green Sahara → negative NAO (vs PI)

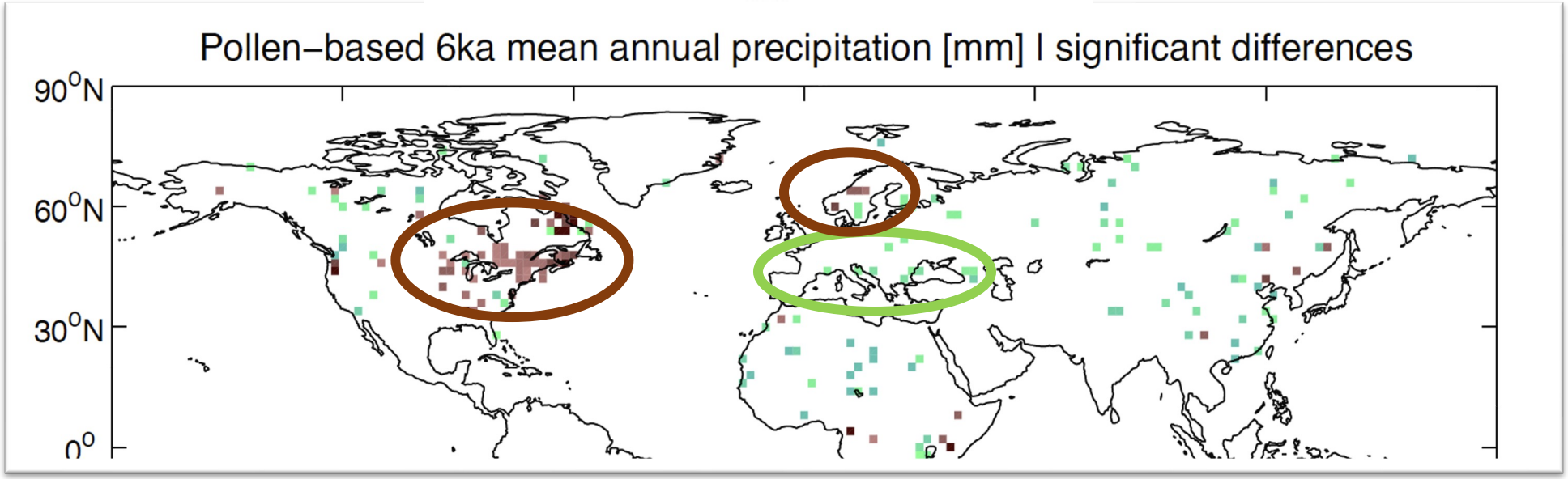




Gaetani et al. 2024, https://doi.org/10.5194/egusphere-2024-272

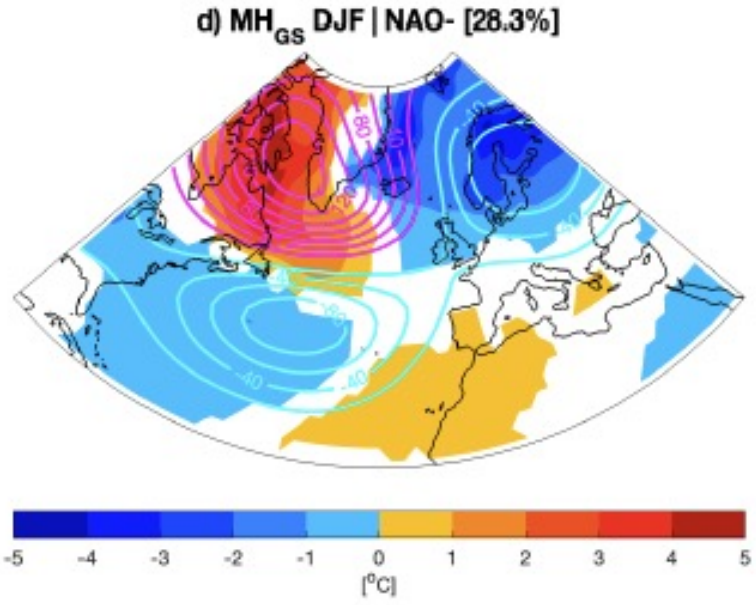
Green Sahara impact on winter NAO

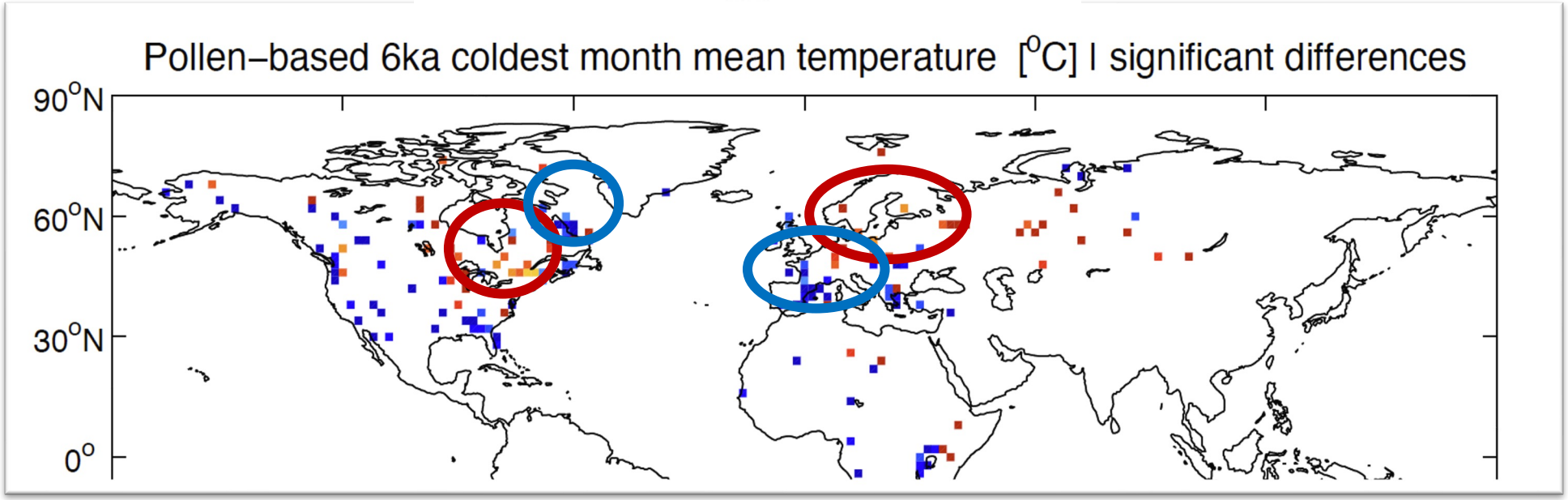




Bartlein et al. 2011, https://doi.org/10.1007/s00382-010-0904-1

Green Sahara impact on winter NAO

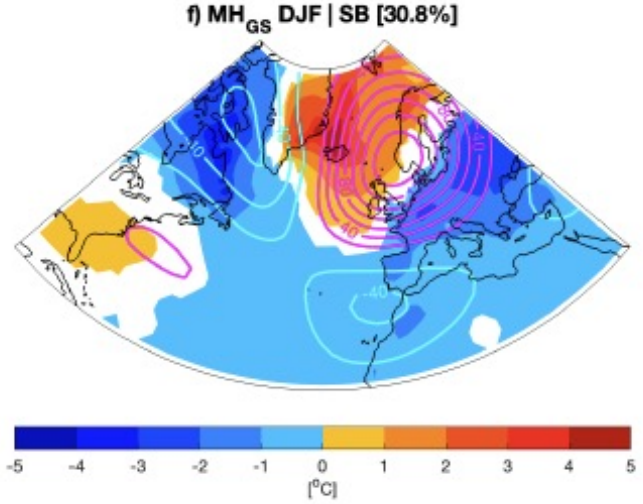




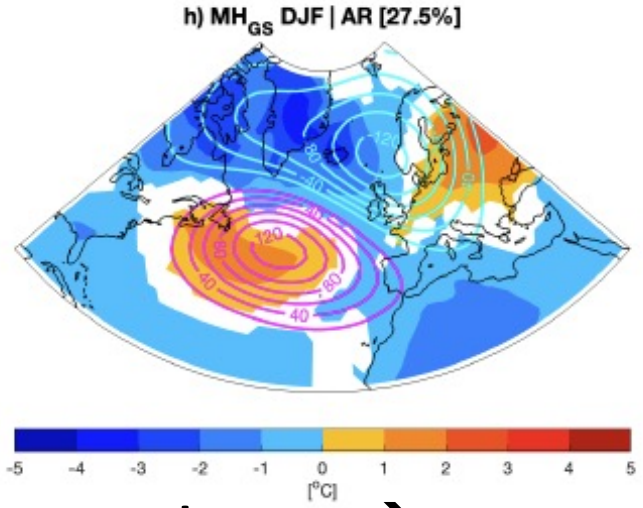
Bartlein et al. 2011, https://doi.org/10.1007/s00382-010-0904-1

Green Sahara impact on North Atlantic WRs

Scandinavian blocking



Atlantic ridge



	NAO+	NAO-	AR	SB
	Winter			
Concatenated simulations	26.8	23.0	24.8	25.4
PI	40.2	17.6	23.1	19.1
MH_{PMIP}	26.7	23.1	25.7	24.4
MH_{GS}	13.4	28.3	27.5	30.8

Green Sahara → more frequent AR and SB vs PI

Gaetani et al. 2024, https://doi.org/10.5194/egusphere-2024-272

Take-home messages

→ Vegetation-dust feedback is key to understand MH climate (Tropics and midlatitudes).

→ Saharan greening shows impacts at midlatitudes.

→ Analysing changes in atmospheric circulation variability provides insights for interpretation of proxies.

→ More work needed on model simulations (e.g. including worldwide land cover changes) and proxy reconstructions (improving regional coherence).

Gaetani, M., Messori, G., Pausata, F. S. R., Tiwari, S., Alvarez Castro, M. C., and Zhang, Q.: Mid-Holocene climate at mid-latitudes: assessing the impact of the Saharan greening, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-272, 2024