Two-way against one-way nesting for climate downscaling using LMDZ

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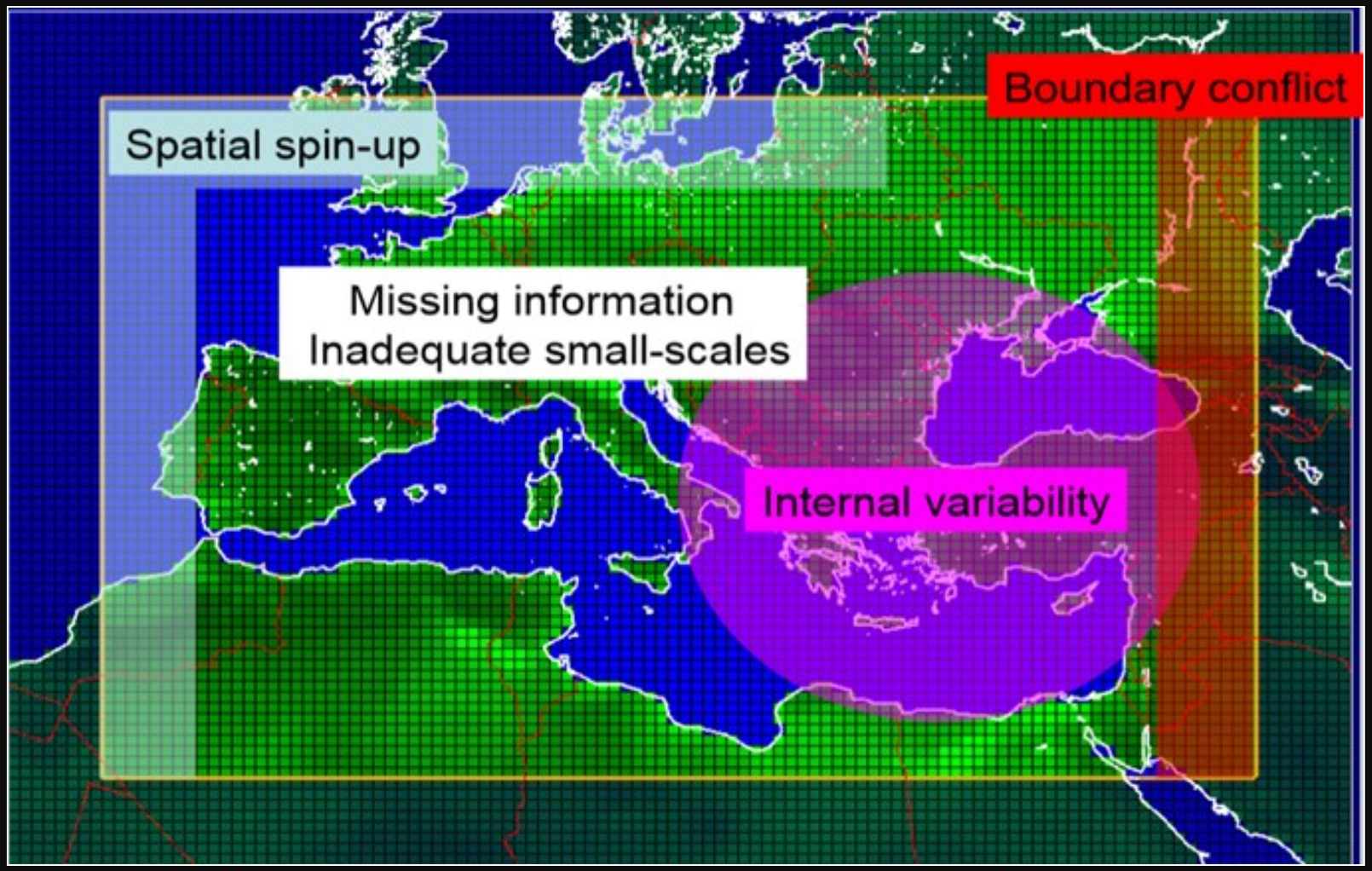
CL5.09 Regional climate modeling, including CORDEX

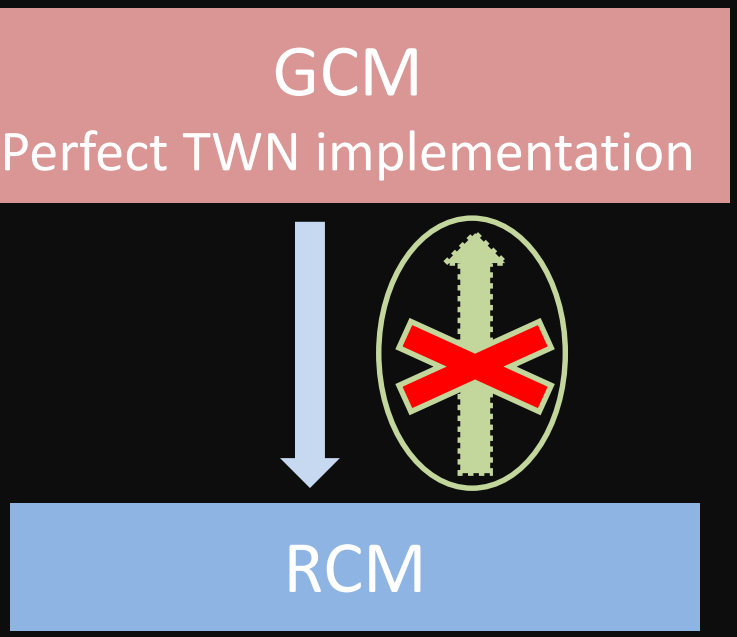
Evaluate the methodology of climate downscaling



Somot (2012)

Two approaches of downscaling

CORDEX project



Reference	GCM	LMDZ-global (atmosphere-continent)
OWN	RCM	LMDZ-regional
TWN	Coupling GCM-RCM	Coupling LMDZ-global and LMDZ-regional

same spatial resolution, over 80 years

Research objectives

❖ Evaluate the methodology of one-way nesting

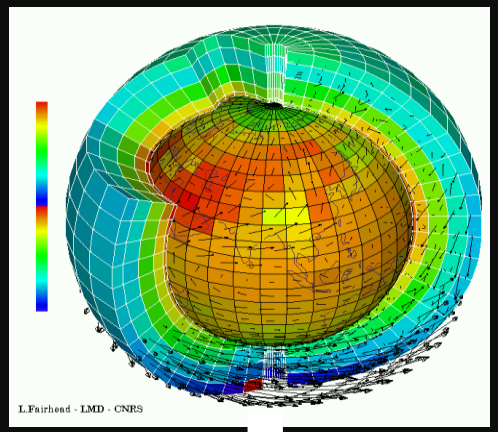
What is the imperfections of traditional downscaling?

❖ Test the performance of two-way nesting

- Can two-way nesting system improves performance of RCM?
- Is there more natural effect of climate variability?

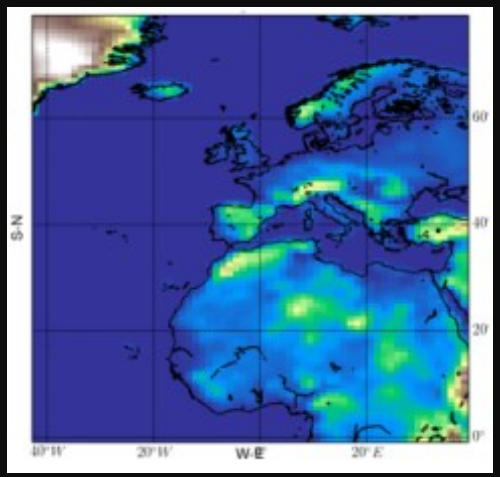
One-way nesting system (OWN)

atmospheric component of the IPSL model



LMDZ – global

SST (climatology)

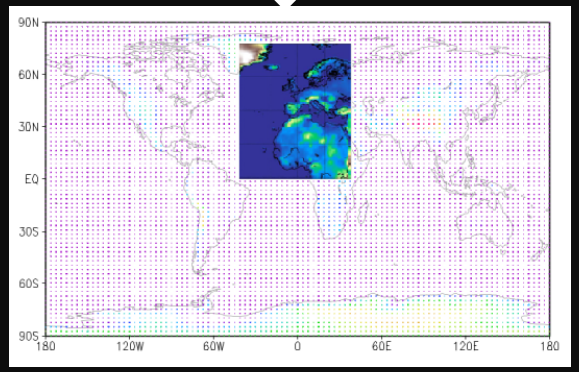


research domain (including Euro-CORDEX domain)

+

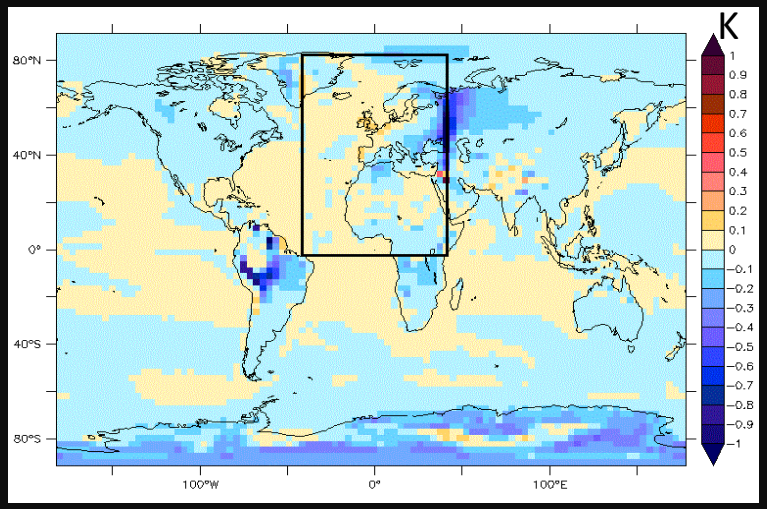
$$\frac{\delta X}{\delta t} = M(X) + \frac{(Xreference - X)}{\tau}$$

$$\tau = 90\ minutes$$

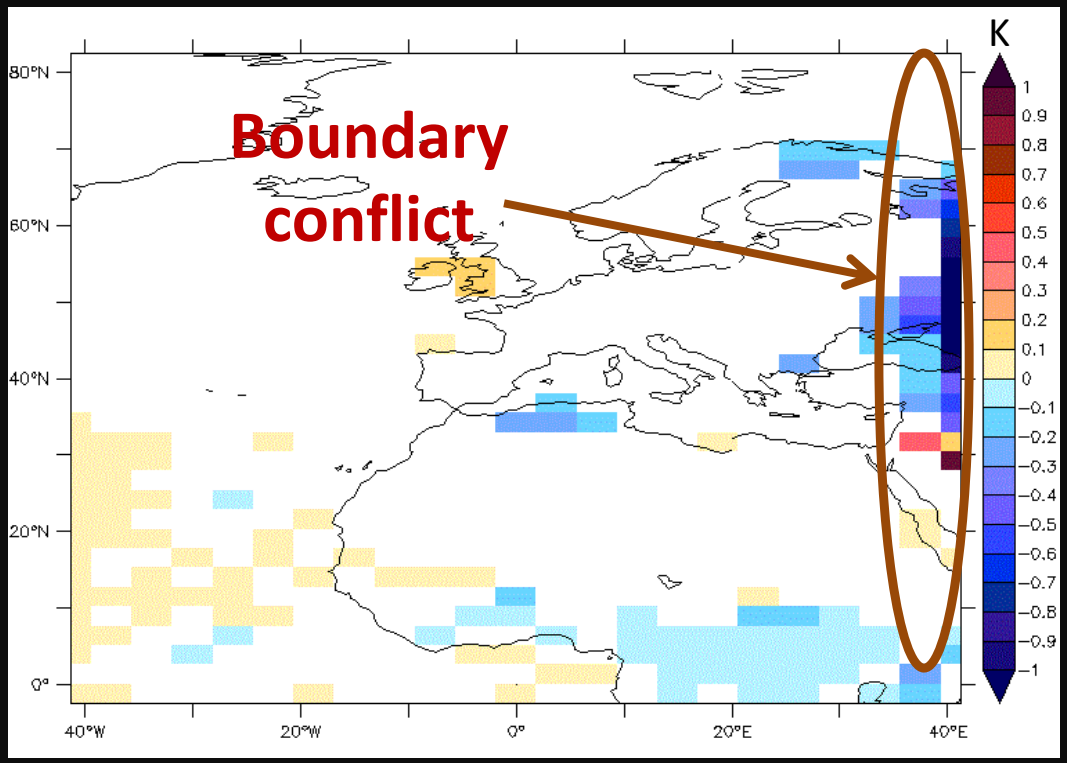


LMDZ – regional

Issues with one-way nesting



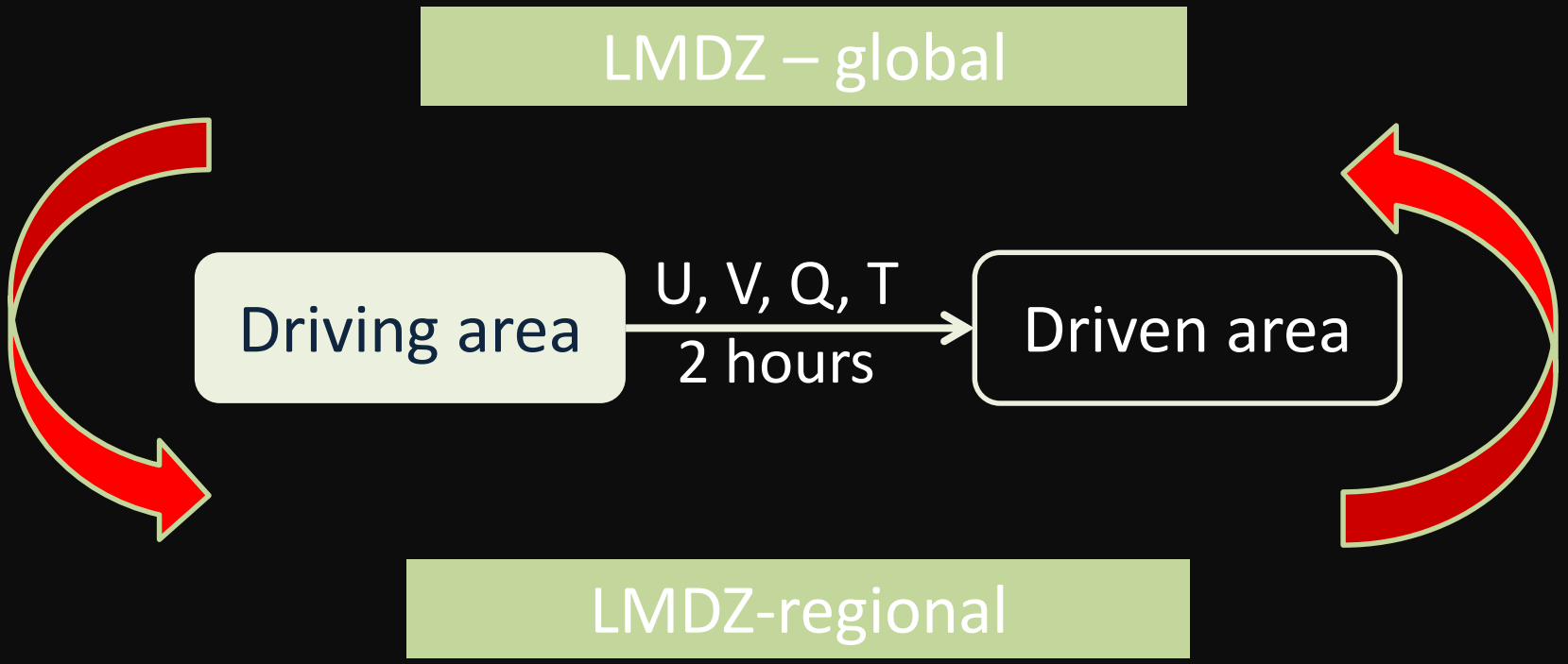
climatology difference of 2-meter temperature in Autumn (Sep.-Nov.)
OWN – reference



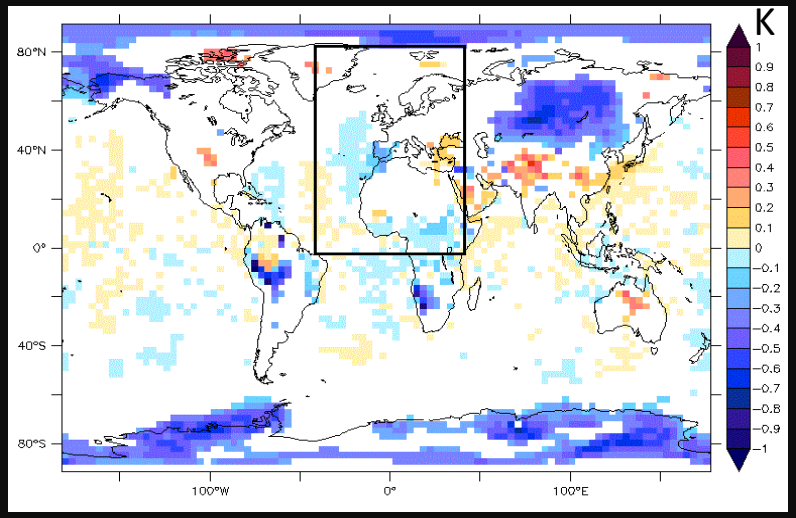
- bad continuity
- internal dynamics

with the 95% confidence interval

Two-way nesting system (TWN)



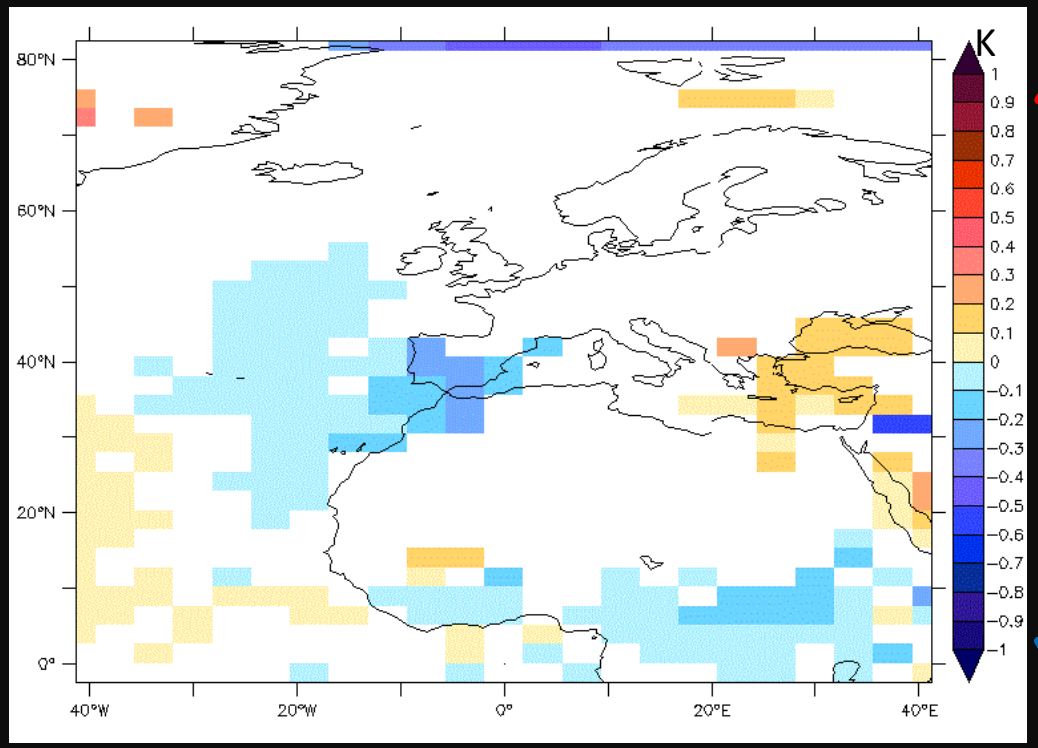
2-meter temperature in Autumn
TWN – reference



climatology difference of 2-meter temperature in Autumn between TWN and reference simulation with the 95% confidence interval

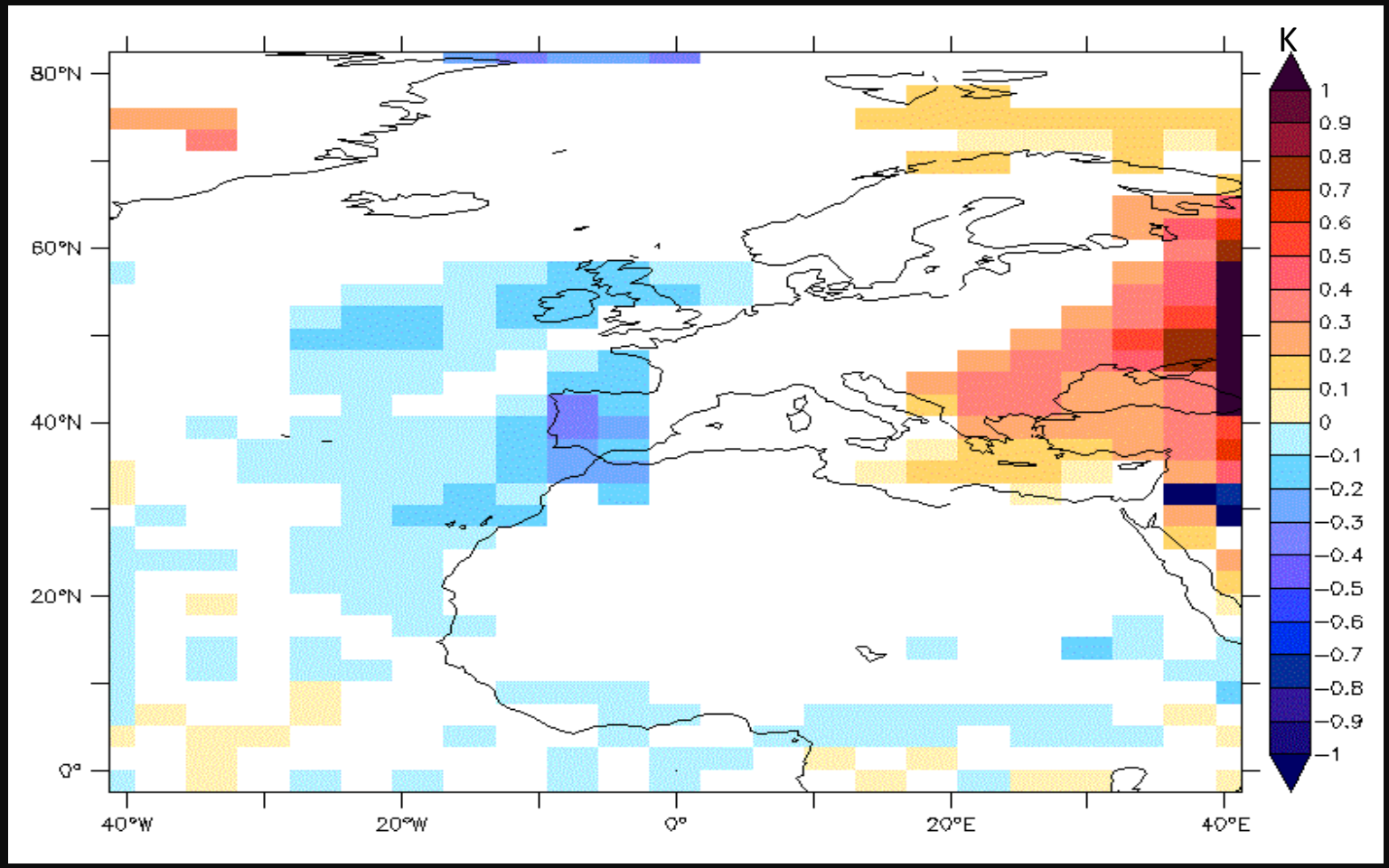
K

global climate change due to **feedback** from the region



fewer drawbacks of boundaries

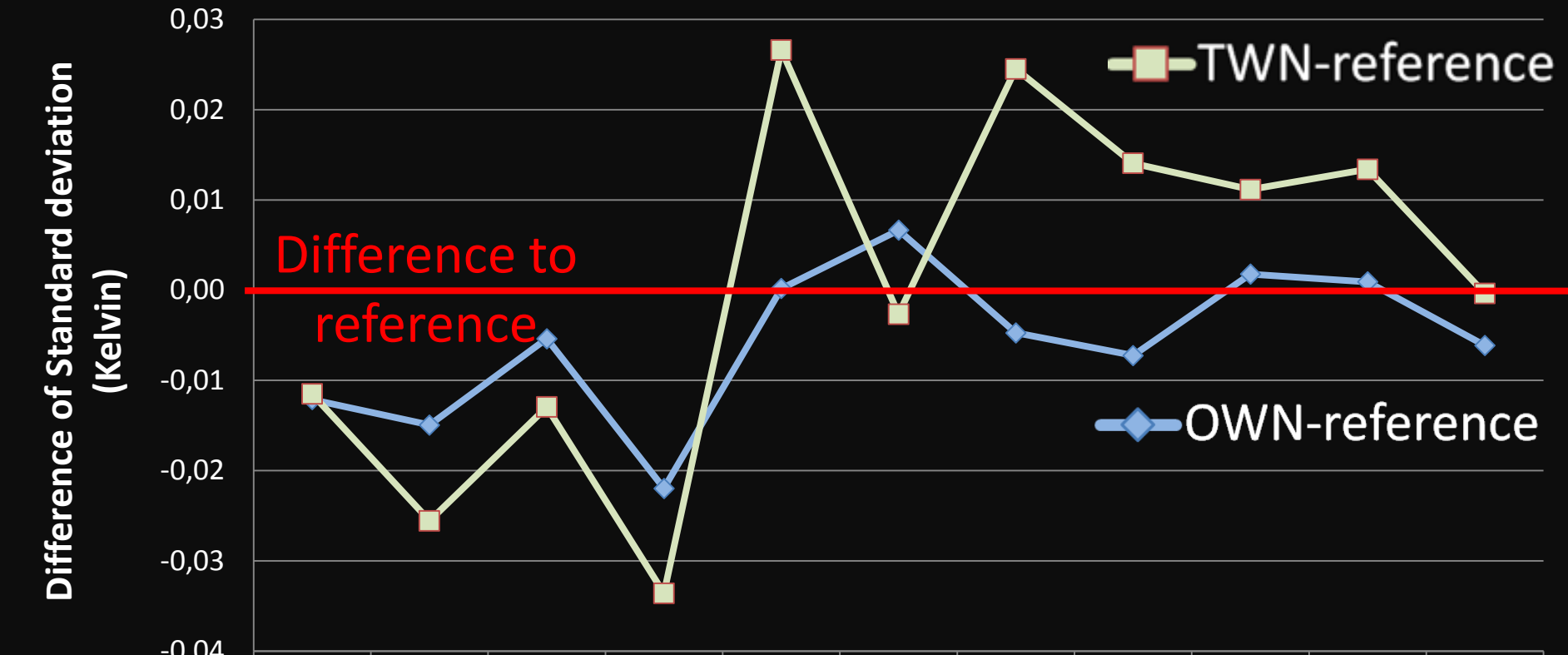
Impact of two-way nesting (TWN – OWN)



climatology difference of 2-meter temperature in Autumn between TWN and OWN for study area with the 95% confidence interval

TWN allows more variability than OWN

Differences of standard deviation with the reference in Autumn for different components (PC)



	Total	EOF1	EOF2	EOF3	EOF4	EOF5	EOF6	EOF7	EOF8	EOF9	EOF10
OWN-reference	-0,0121	-0,0149	-0,0054	-0,0220	0,0002	0,0066	-0,0047	-0,0072	0,0018	0,0009	-0,0061
TWN-reference	-0,0115	-0,0256	-0,0130	-0,0336	0,0266	-0,0027	0,0245	0,0141	0,0111	0,0134	-0,0004

Discussion and Outlook

OWN: constrained conditional model

- bad continuity
- internal variability
- boundary conflict (temperature, precipitation, different levels of geopotential of all seasons)

TWN: derivative model

- degrees of freedom is more important
- global climate change due to feedback from the region
- more natural climate variability, less inconsistency of boundaries

Physical mechanism ?

Thanks for your attention

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