



**u<sup>b</sup>**

**UNIVERSITÄT  
BERN**

**OESCHGER CENTRE  
CLIMATE CHANGE RESEARCH**

# Structural Behaviour of COSMO-CLM Under Different Forcings

CLM Assembly 2020  
17.09.2020

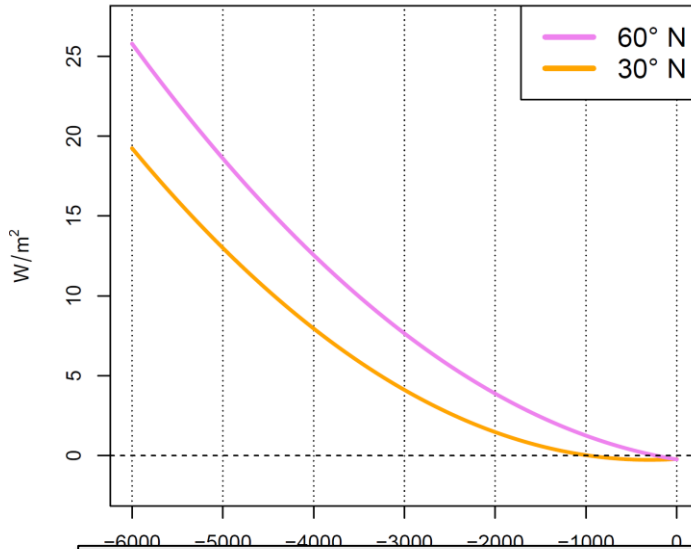
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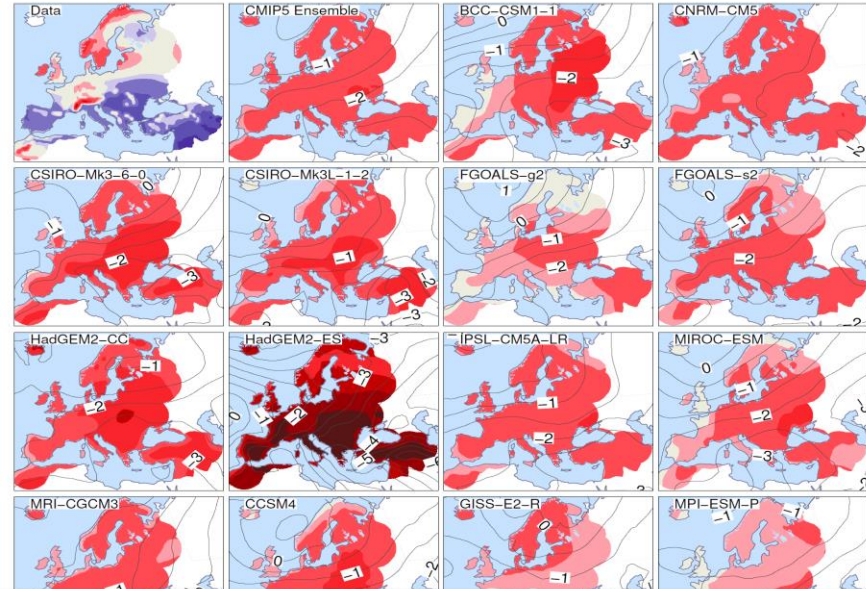
# The Mid-Holocene (6000BP)

## Summer Insolation Diff.



## JJA T2M Diff. (MH-PI)

Credit: Mauri et al. 2014



Is there a special configuration (process) that could lead to a better match with proxies?

# Ensemble Realization

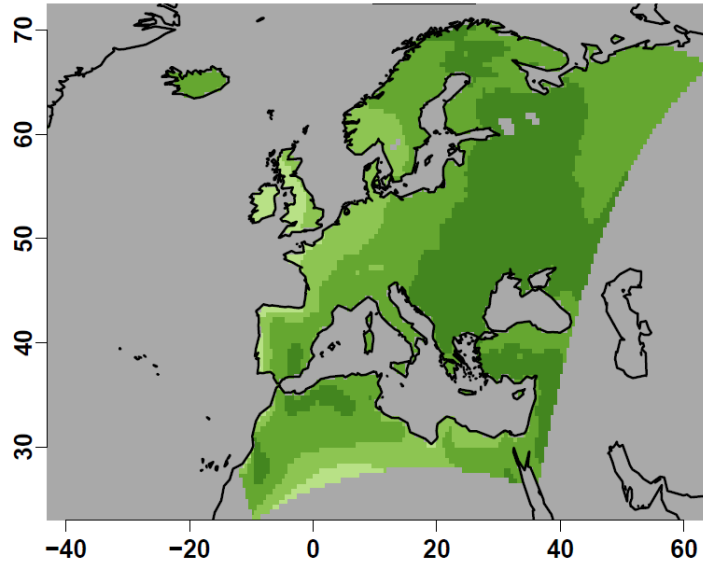
Parameter	Description	Values
<b>itype_hybound</b>		(3)
<b>icldm_rad</b>		(0)
<b>icldm_rad</b>		(2)
<b>ninc_rad</b>		(6)
<b>itype_albedo</b>		(2)
<b>itype_albedo</b>		(4)
<b>Turbulence</b>		
<b>tkhmin</b>	minimal diffusion coefficients for heat	(0,0.4,1,2)
<b>tur_len</b>	maximal turbulent length scale	(100,500,1000)
<b>d_heat</b>	factor for turbulent heat dissipation	(12,10.1,15)
<b>d_mom</b>	factor for turbulent momentum dissipation	(12,15,16.6)
<b>Land Surface</b>		
<b>rat_sea</b>	ratio of laminar scaling factors for heat over sea and land	(20,50,100)
<b>entr_sc</b>	mean entrainment rate for shallow convection	(5e-5, 1e-4, 3e-4, 1e-3, 2e-3)
<b>Radiation</b>		
<b>uc1</b>	parameter for computing amount of cloud cover in saturated conditions	(0.2,0.5,0.625,0.8)
<b>radfac</b>	fraction of cloud water/ice used in radiation scheme	(0.3,0.5,0.9)
<b>Soil</b>		
<b>soilhyd</b>	multipl. factor for hydraulic conductivity and diffusivity	(1,1.62,6)
<b>fac_rootdp2</b>	Uniform factor for the root depth field	(0.5,1,1.5)

**30 x 25-year long simulations at 0.44° driven by MPI-ESM for 2 periods:**

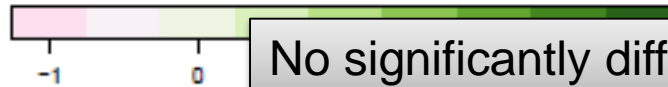
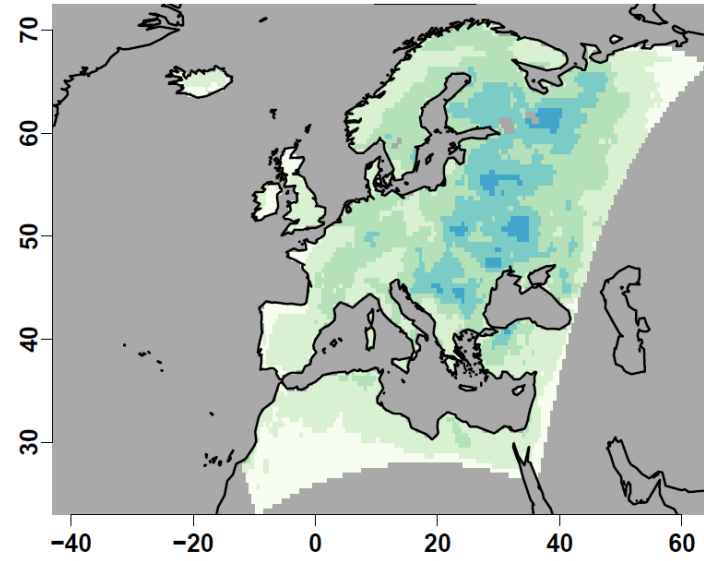
- **Pre-Industrial**
- **Mid-Holocene**

# Ensemble Behaviour: T2M JJA

## T2M Ens. Mean Diff. MH-PI



## T2M Spread Diff. MH-PI



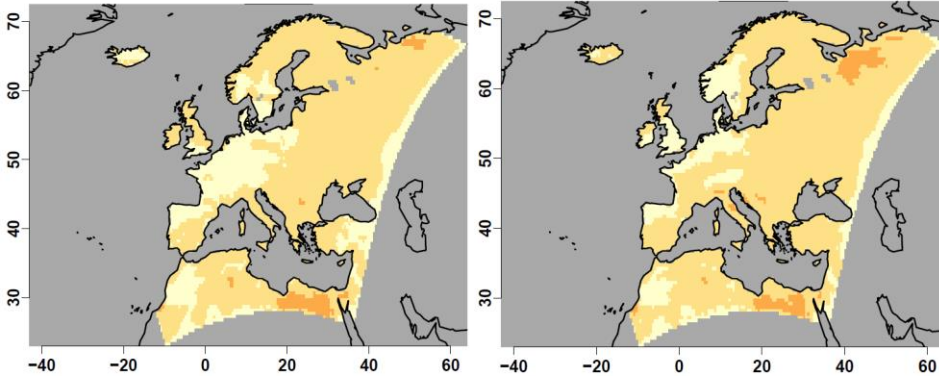
No significantly different model answer evident

# Model Structural Behaviour: T2M

## Ensemble Spread JJA

PI

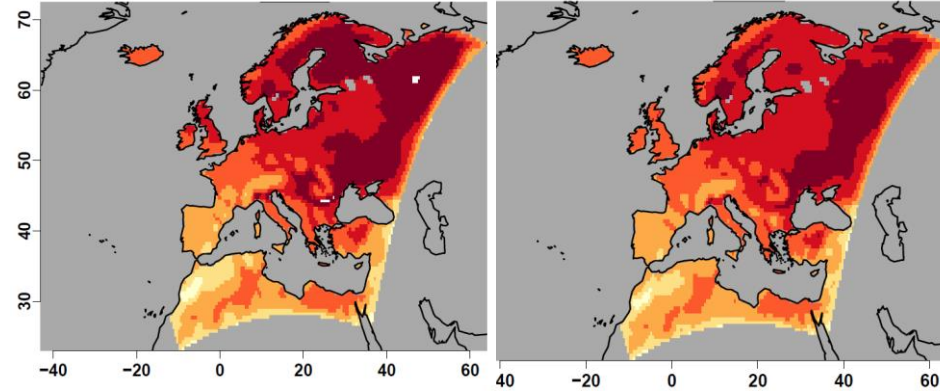
MH



## Ensemble Spread DJF

PI

MH



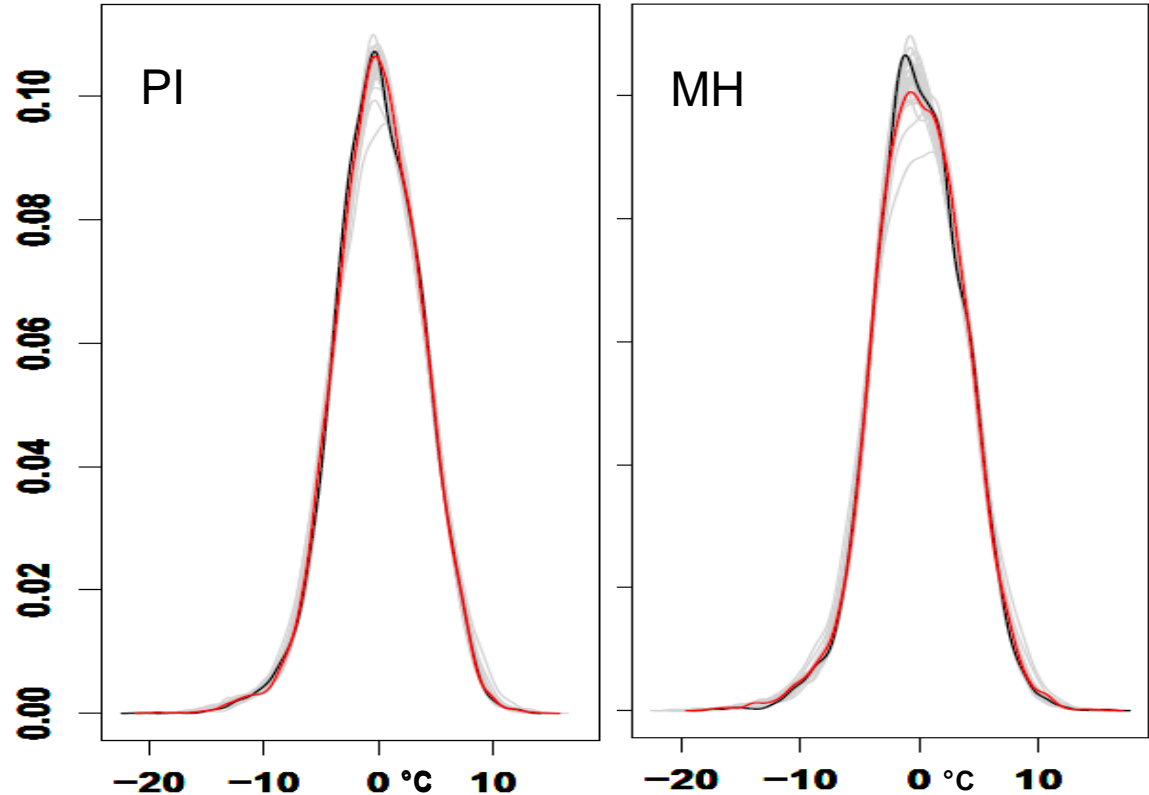
- Does and how model behaviour change in the 2 periods?
- Effect of the Boundaries Vs Forcings

# Model Structural Behaviour: T2M

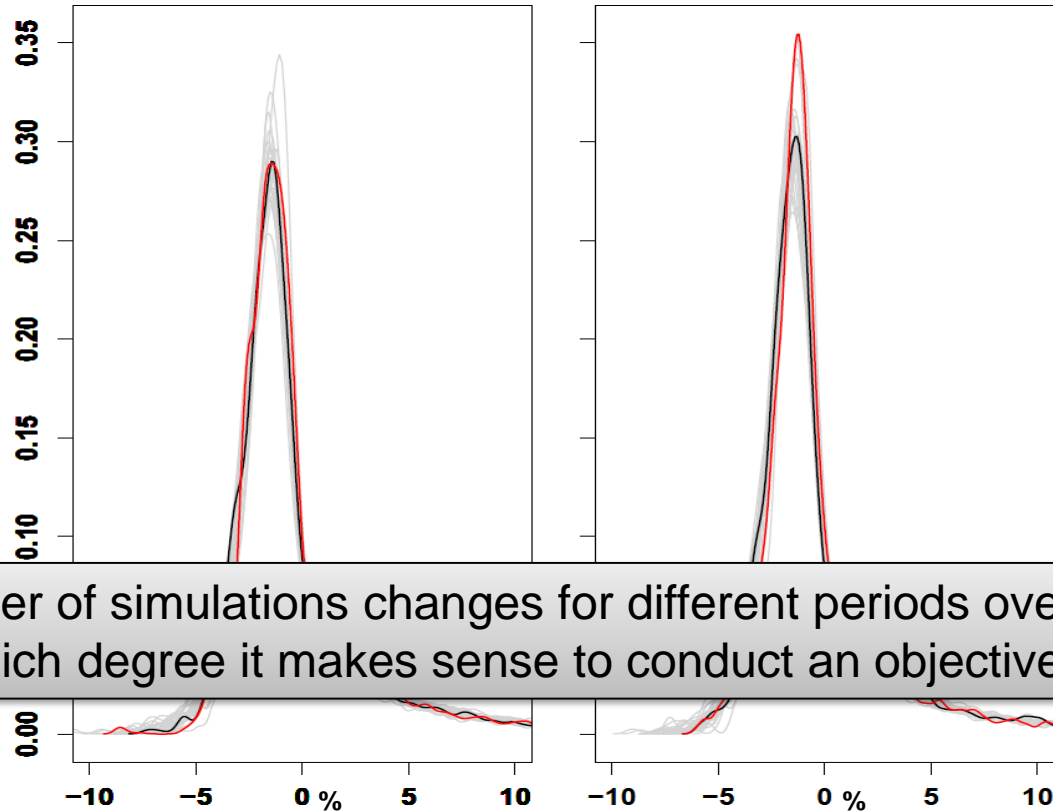
- Analysis of randomly selected points
- Anomalies of daily means

- NATURE

- OPTIMAL



# Model Structural Behaviour: Cloud Cover



- NATURE

- OPTIMAL

The order of simulations changes for different periods over different points:  
- To which degree it makes sense to conduct an objective calibration?

# Model Structural Behaviour: Effect of the Boundaries

- Does and How model behaviour change in the 2 periods?
- Effect of the Boundaries Vs Forcings

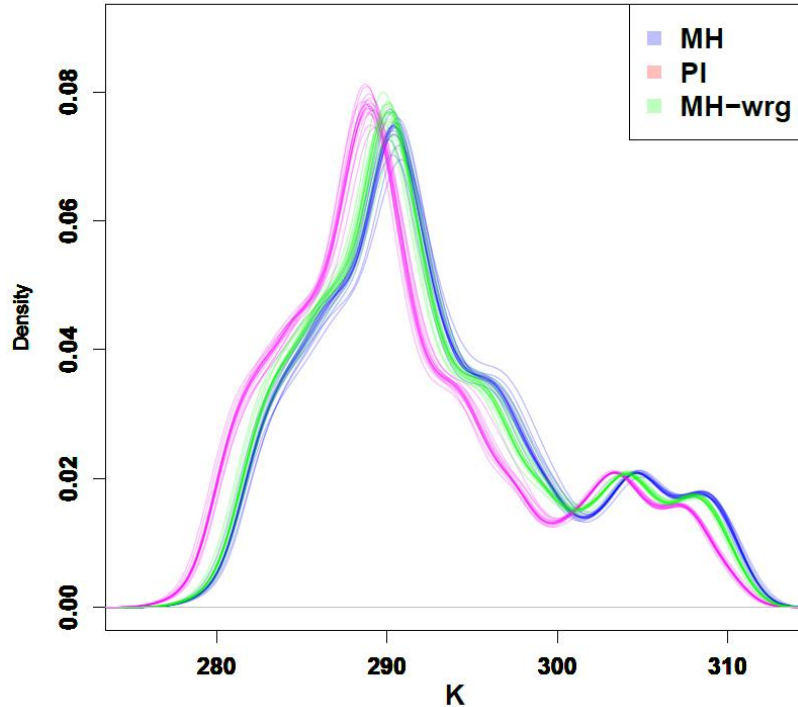
## Different Ensembles

- Pre-Industrial
- Mid-Holocene
- Mid-Holocene Wrong-Boundaries (21 runs)  
PI forcings but MH Boundaries

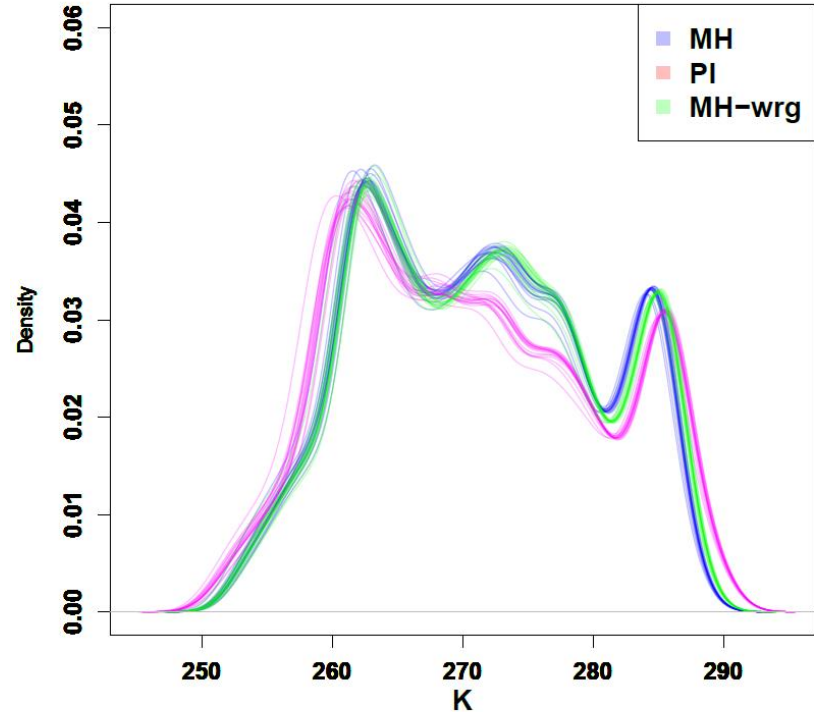


# Model Structural Behaviour: Effect of the Boundaries

T2M JJA PDF Single Real.

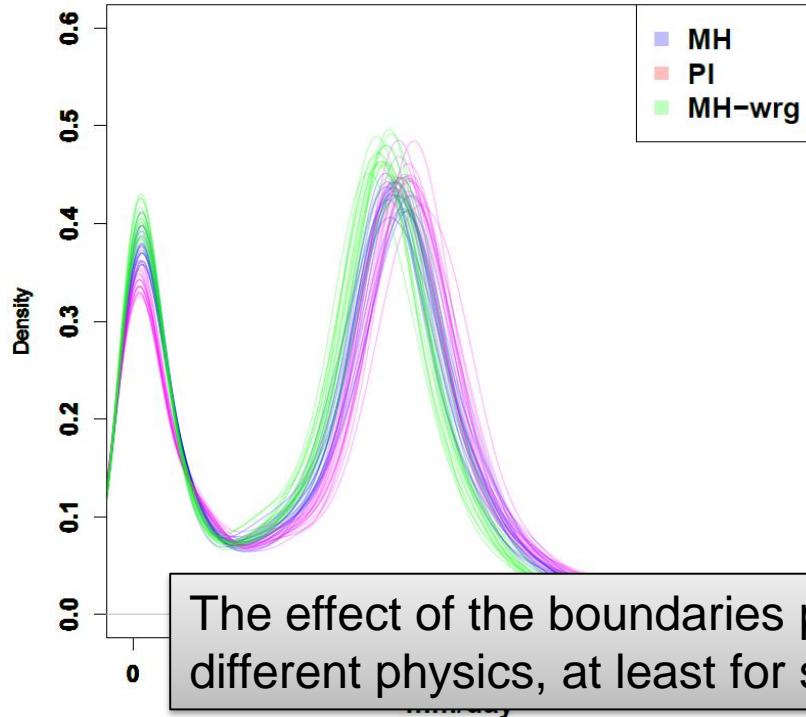


T2M DJF PDF Single Real.

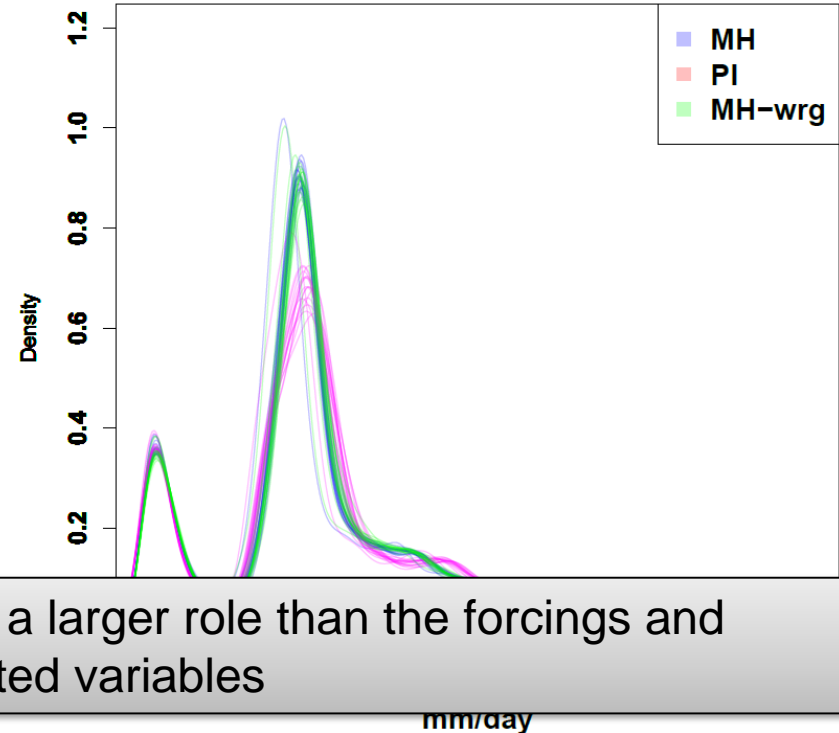


# Model Structural Behaviour: Effect of the Boundaries

PRE JJA PDF Single Real.



PRE DJF PDF Single Real.



The effect of the boundaries plays a larger role than the forcings and different physics, at least for selected variables

## Conclusions and Outlook

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- Not big differences between MH and PI using different physical model options
  - Reconsidering PPE approaches rather than objective calibration methods
  - More attention to the selection of the boundaries than to calibration?
  - Further analyses needed
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