ModE-Sim - A new medium-size AGCM ensemble to analyze climate variability in the modern era

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Motivation: Climate reconstructions for the past 600 years

Within our project PALAEO-RA we would like to combine informations from different sources (historical observations, documentary data and proxies) with physical constraints from an AGCM.

Idea of our simulations:

- Main purpose: Deliver the background state for an offline data assimilation to create a novel global climate reconstruction for the period 1420 to 2009.
- We use forcings that include historical information on ocean conditions and volcanic forcings, while accounting for uncertainties in these.
- Beyond that, the simulations may be used for further studies of climate variability during this time.

Experimental Setup(s)

Our simulations consist of different subsets:

The Model

ECHAM 6.3.05

LR version:
horizontal:
T63 (~1.8°)
vertical:
47 levels

HR version:
horizontal:
T127 (~0.9°)
vertical:
95 levels

60 members LR (3 subsets à 20 members)
- **Subset 1:**
  - SST: ensemble of 20 reconstructions (Samakinwa et al.)
  - SIC: analogue approach based on HadISST
  - Volcanoes: PMIP4 (same across all members)
- **Subset 2**
  - SST: another ensemble of 20 reconstructions
  - SIC: analogue approach based on HadISST
  - Volcanoes: 20 realizations EVA ensemble
- **Subset 3**
  - SST: 20 reconstructions (same as in subset 1)
  - SIC: HadISST climatology 1850-1900 (same across all members)
  - Volcanoes: PMIP4 (same across all members)

5 members HR
- same as subset 1

36 members LR
- **Subset 1 (10 members)**
  - SST: 10 native realisations of HadISST
  - SIC: HadISST (same across all members)
  - Volcanoes: PMIP4 (same across all members)
- **Subset 2 (10 members)**
  - differs from subset 1 only i.t.o. initialization
- **Subset 3 (16 members)**
  - SST: 16 linear combinations of HadISST real.
  - SIC: HadISST (same across all members)
  - Volcanoes: PMIP4 (same across all members)

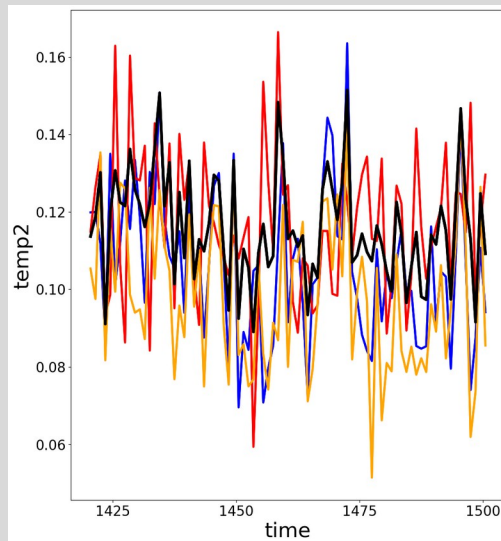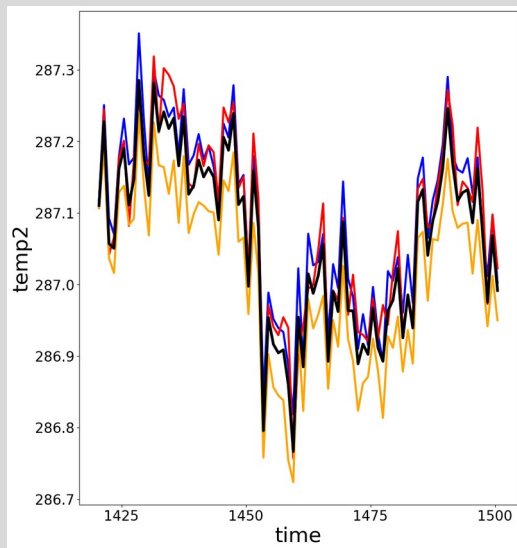1420   1850   2009

Initialization from spin-up   Initialization from spin-up (LR only)

Are 20/60 members enough to capture forced signals/ (forced changes in) internal variability?

Global mean 2m temperature

ensemble mean

ensemble std

all 60 members

20 members PMIP4 volcanoes/Sea ice best analogue

20 members volcanoes from EVA ensemble/Sea ice best analogue

20 members PMIP4 volcanoes/climatological Sea Ice

... analysis to be extended to seasonal/regional level

Getting into contact

If you are interested in using our simulations, please contact me:
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Please also have a look at the related companion presentations:

- Laura Hövel et al.: A global assessment of heatwaves since 1850 in different datasets (EGU22-2728, NH 1.1, today 16:18, room C)
- Eric Samakinwa et al.: Global monthly sea surface temperature and sea ice reconstruction for historical AGCM simulations (EGU22-11664, CL 1.2.6, Monday)

More information about PALAEO-RA-Project: https://www.palaeo-ra.unibe.ch