



Extratropical Cyclone statistics during the last millennium

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- Is CESM able to realistically simulated winter cyclones over Europe?
- How do cyclone characteristics change in a seamless simulation from AD 850 -2100?
- Has external forcing an influence on cyclone characteristics?

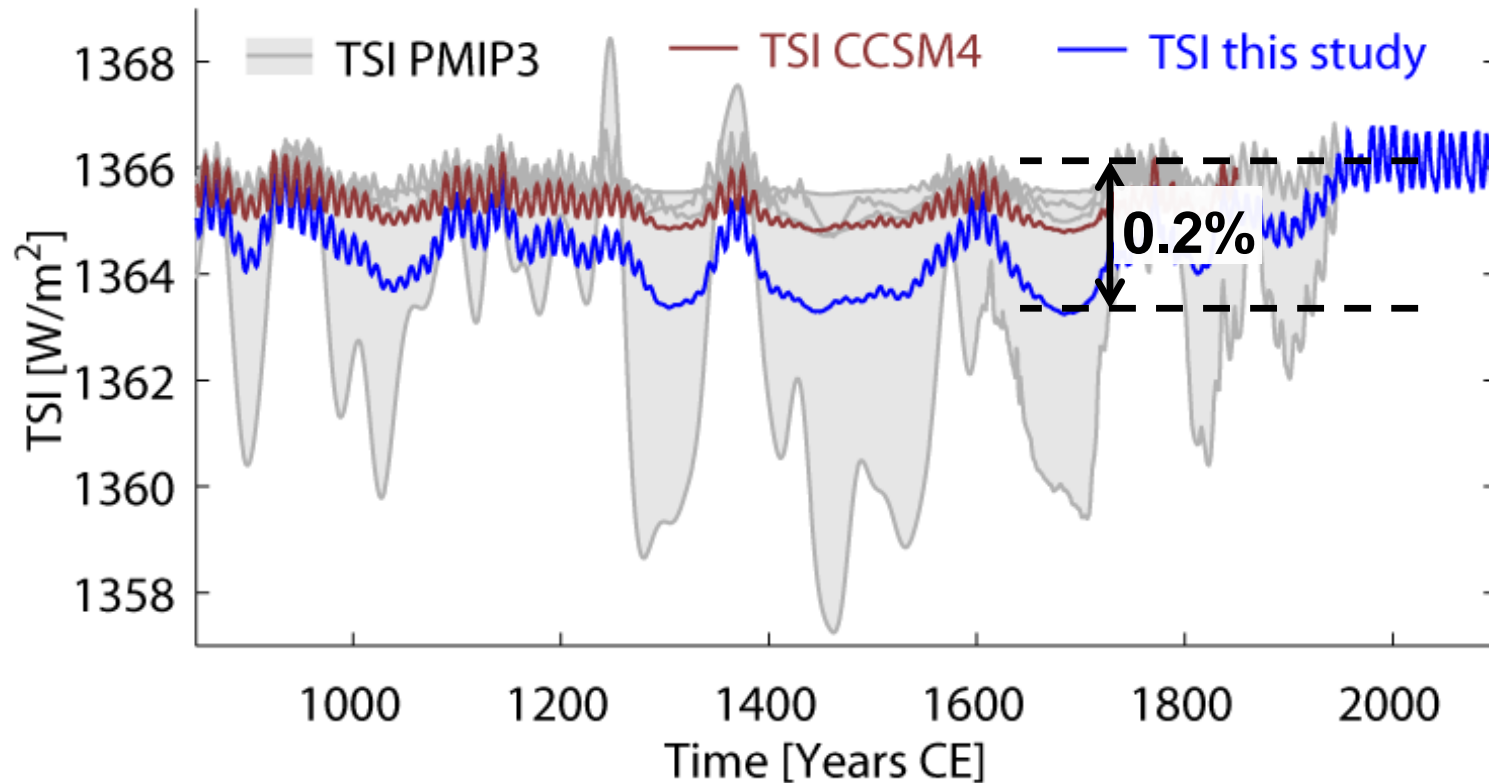
CESM 1.0.1:

- CAM4, CLM4, CICE, POP2
- 0.9x1.25_gx1v6 (approx. 1°)
- Prognostic carbon cycle does not feed back to radiative code; climate is forced by reconstructed forcing

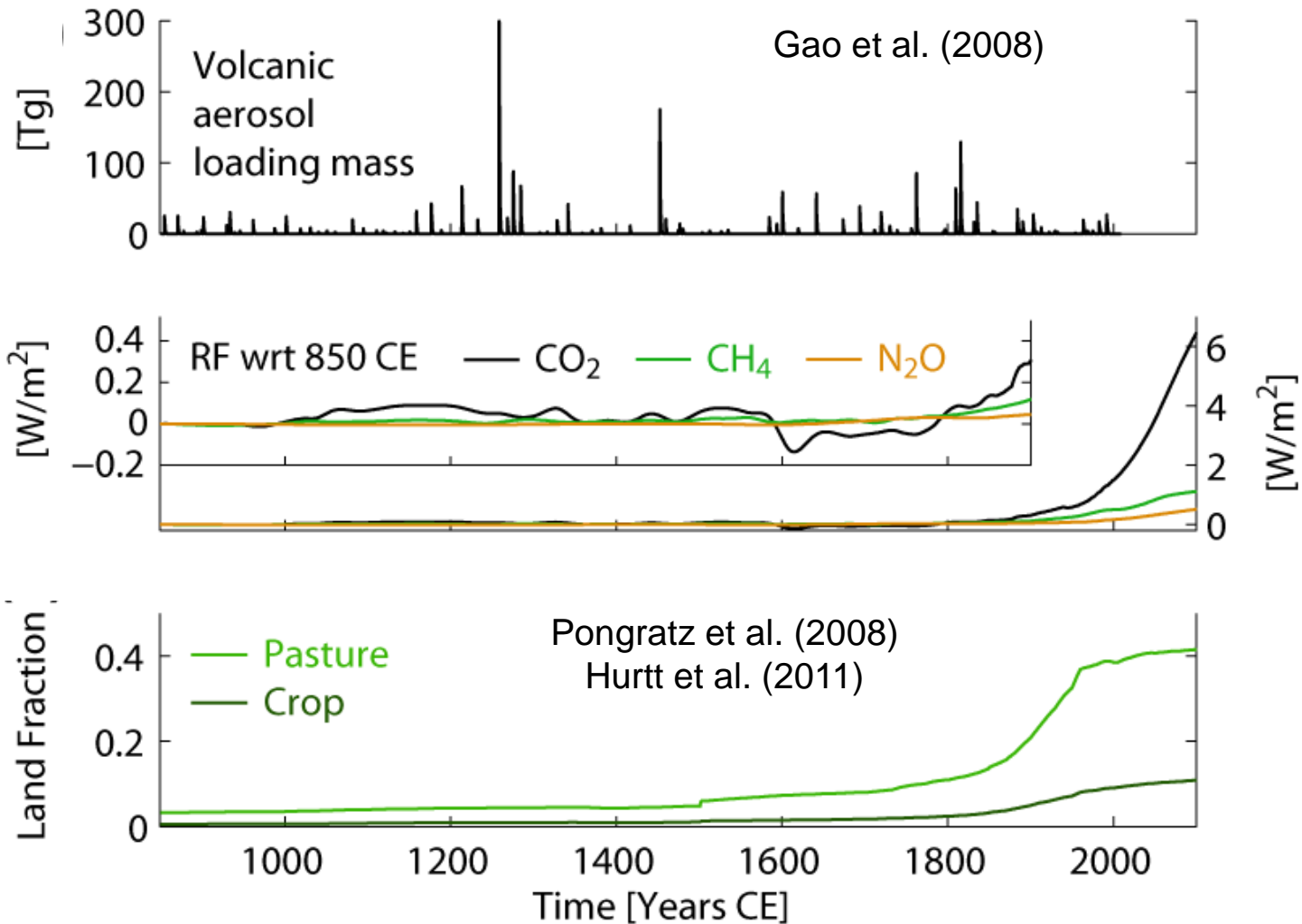
Experiments:

- 500 year control 850, branched from piControl (1850)
- Transient simulation from 850 to 2100 with RCP8.5 with **12 h output data**

Experimental setup: solar forcing



Experimental setup: other forcing

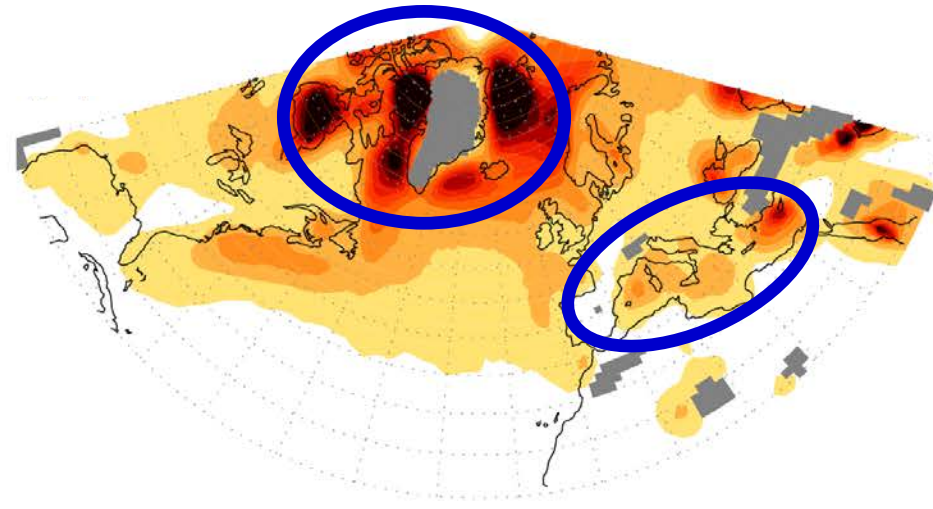
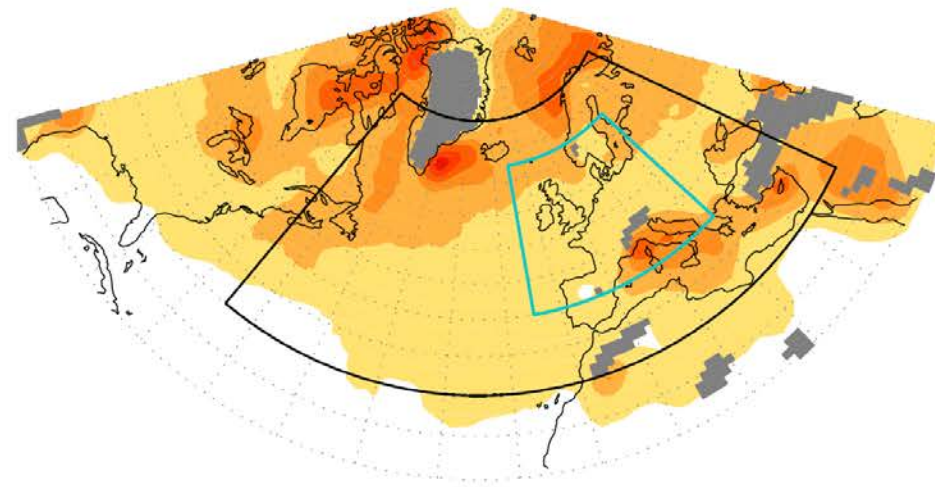


Evaluation of CESM during 1980-2009

Cyclone frequency (%) 1980-2009

Era interim

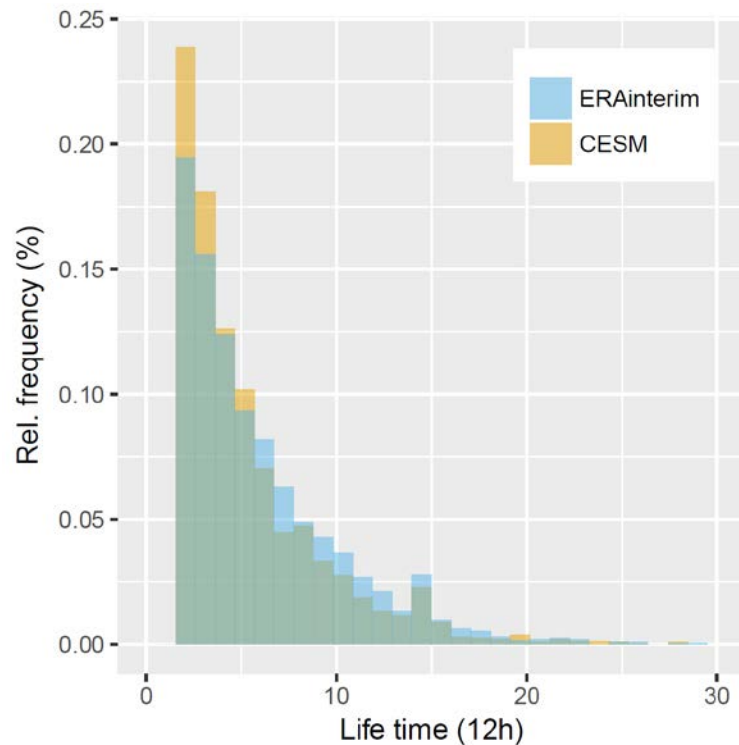
CESM



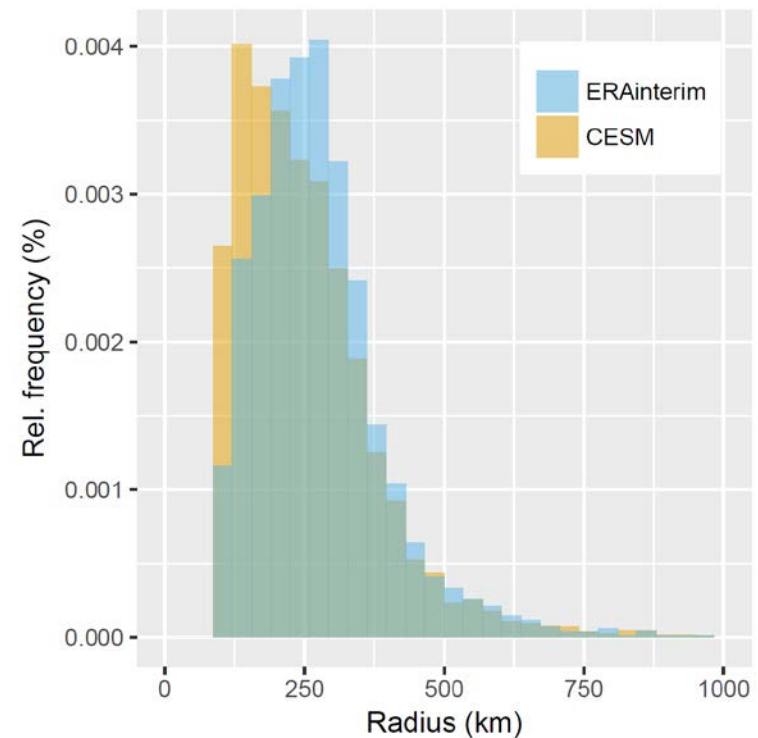
Evaluation of CESM during 1980-2009

Central Europe including GB

Life time



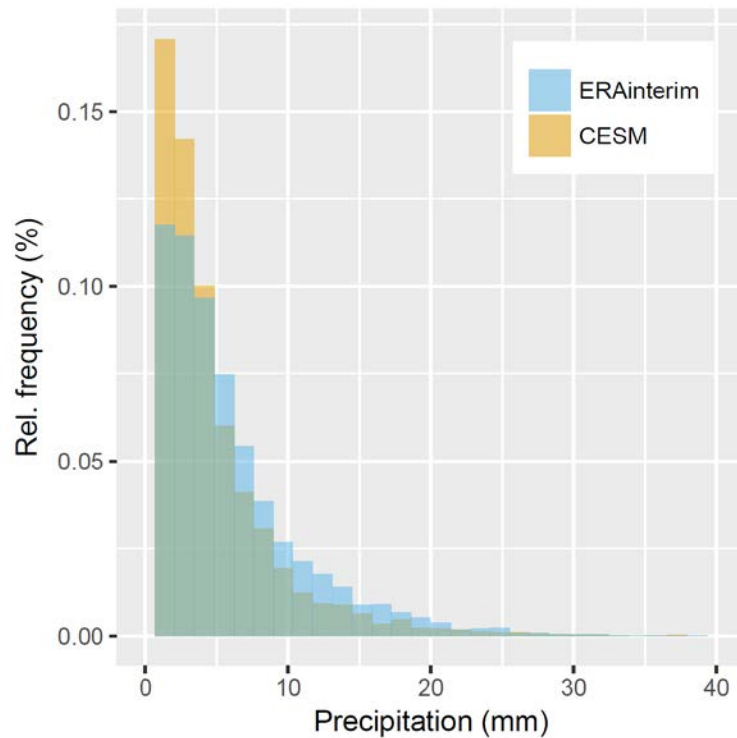
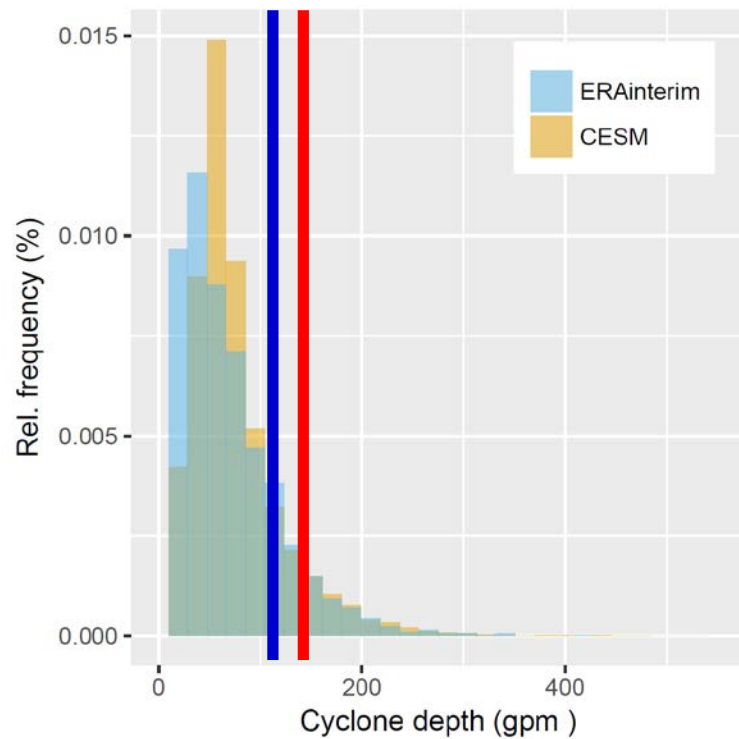
Median radius



Evaluation of CESM during 1980-2009

Central Europe including GB

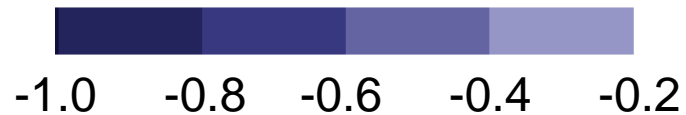
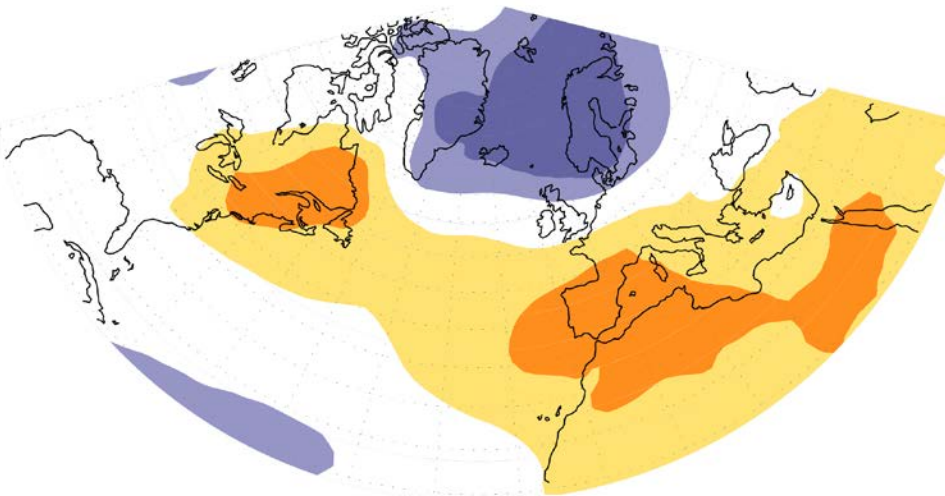
90th Percentiles of



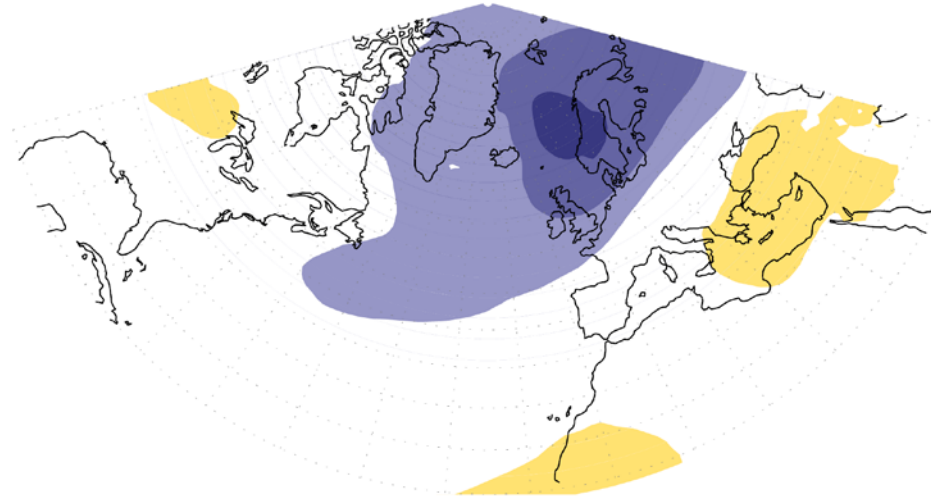
Evaluation of CESM during 1980-2009

Correlation of 90th percentile of cyclone depth measure with Z1000

ERAinterim

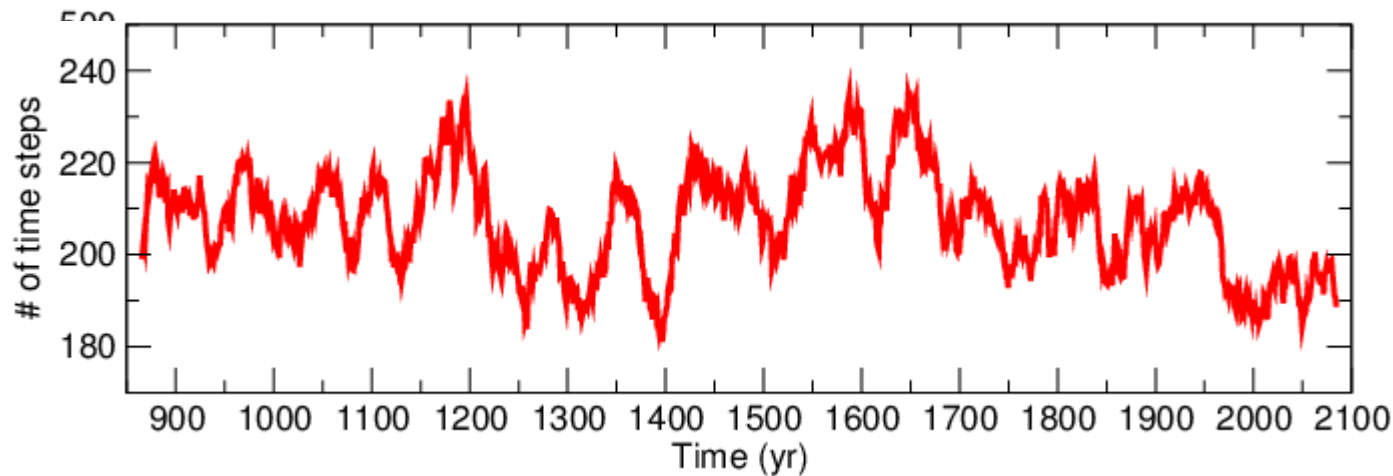


CESM

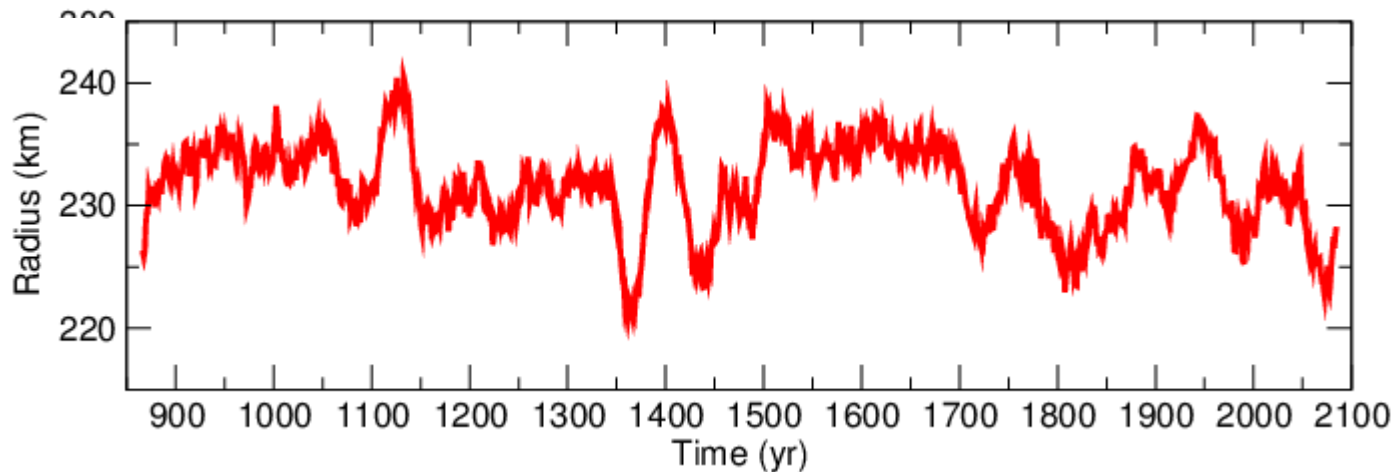


Variability of mean cyclone characteristics

Number of time steps with cyclones centers in winter (DJF)

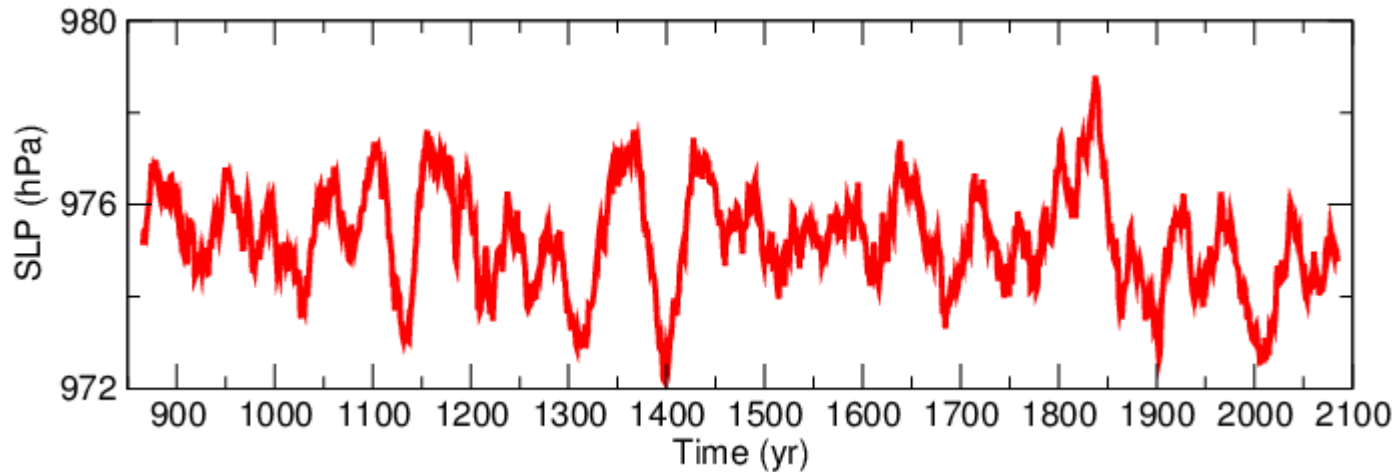


Median radius of cyclones per winter

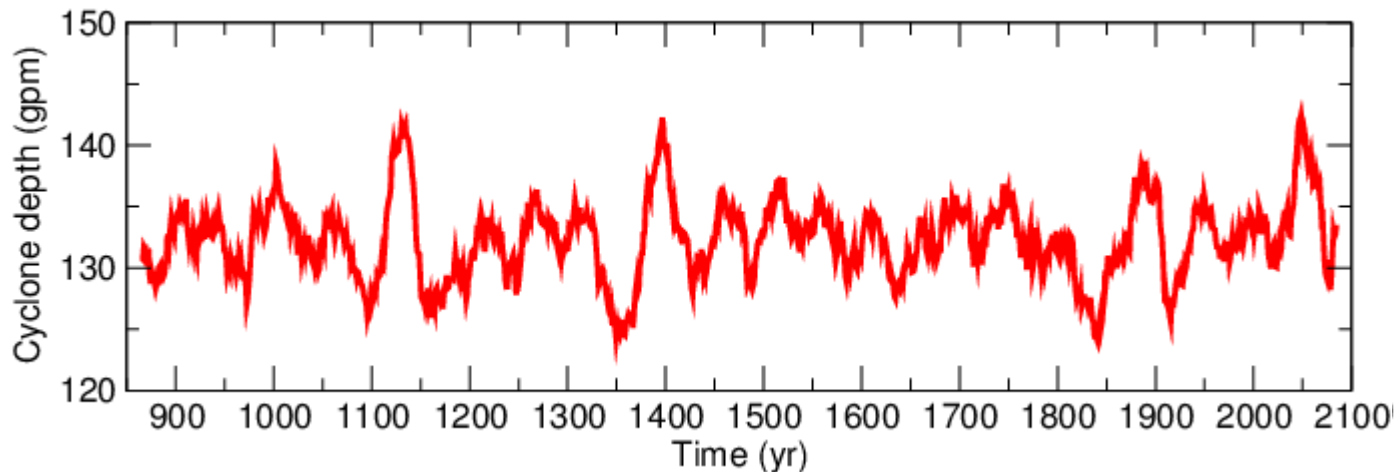


Variability of extreme cyclone characteristics

90th percentile of SLP in winter (DJF)

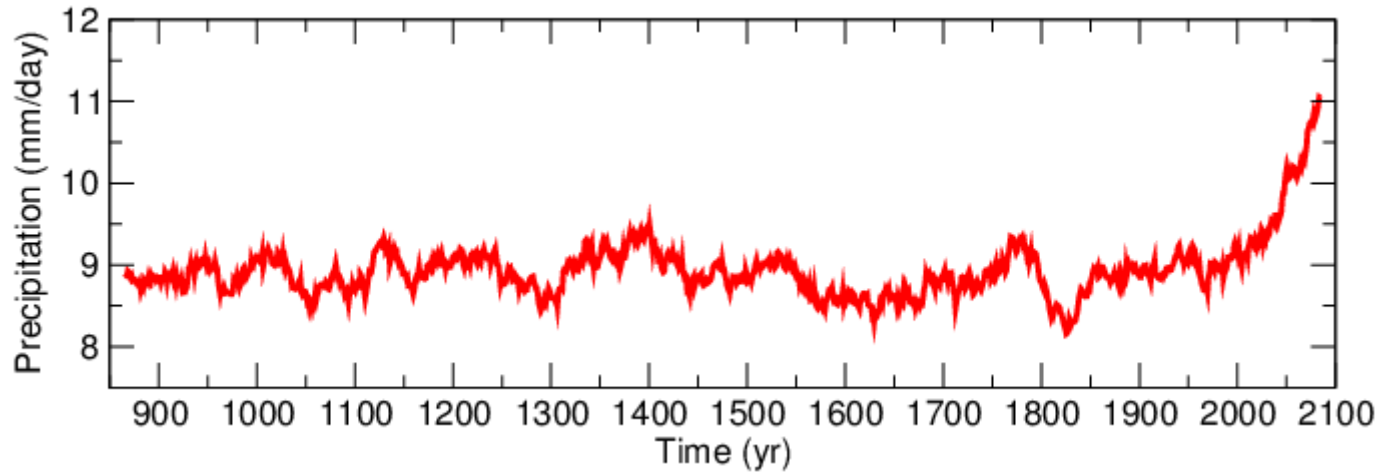


90th percentile of cyclone depth per winter

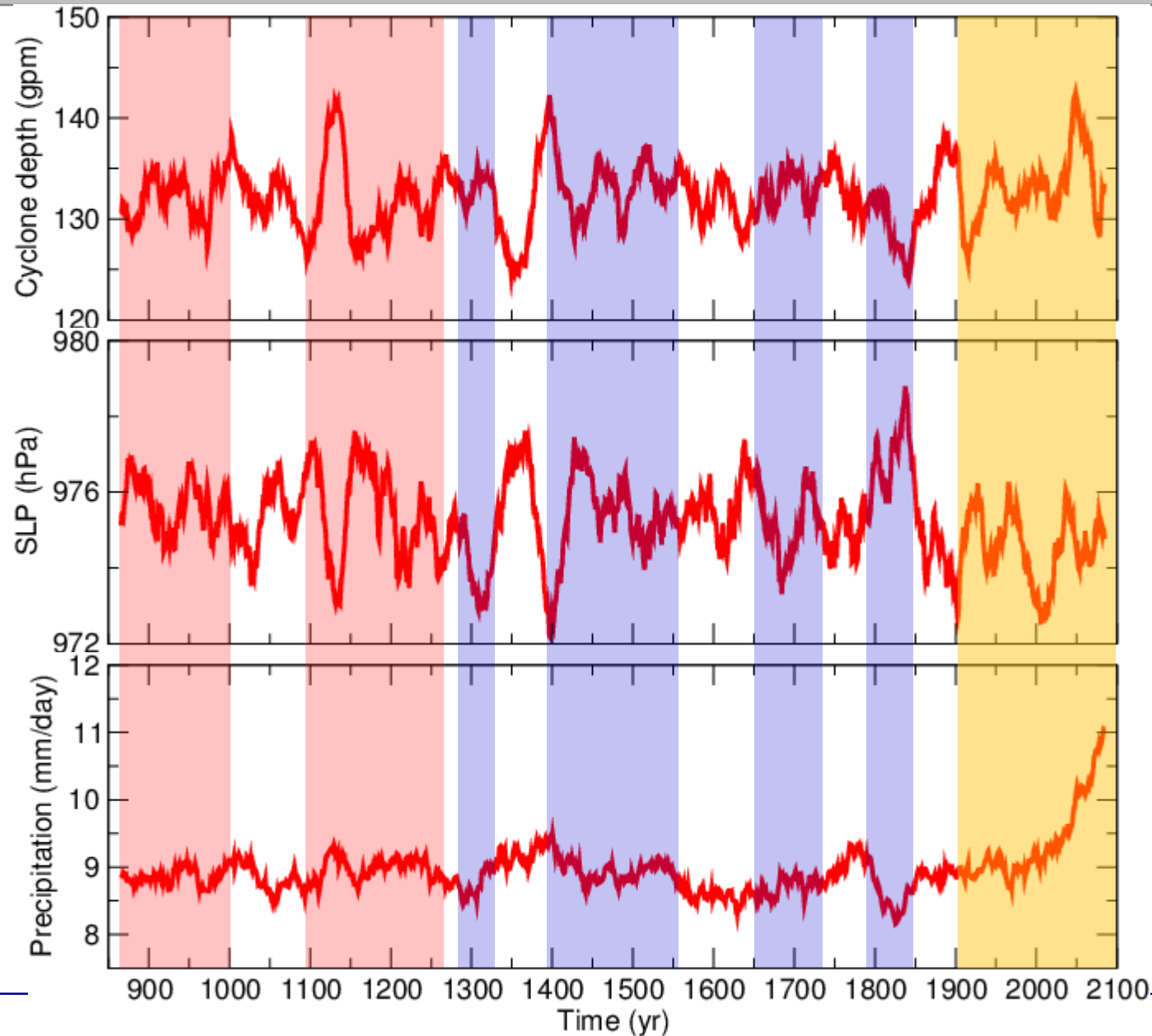


Variability of extreme cyclone characteristics

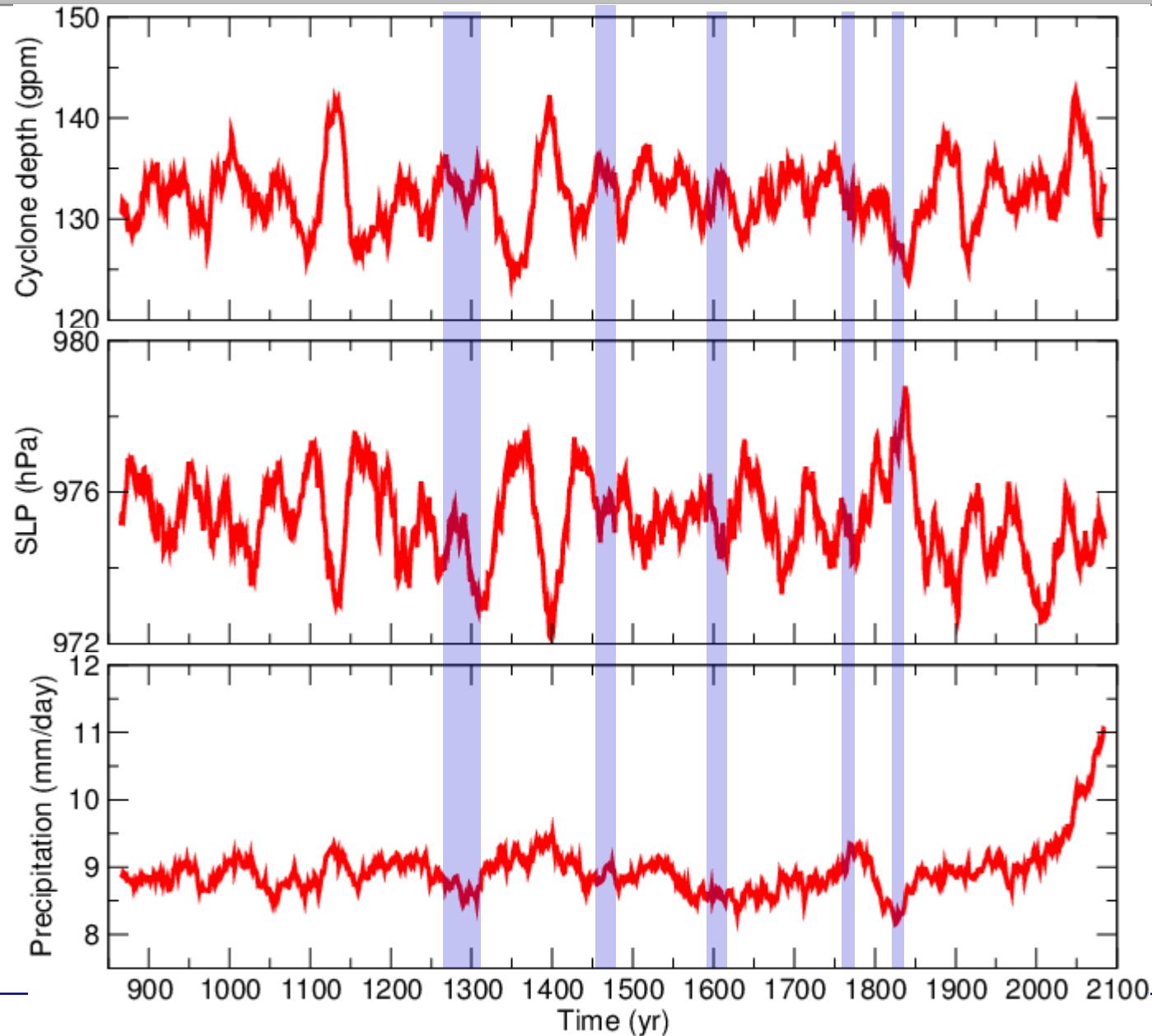
90th percentile of cyclone-related precipitation in winter (DJF)



Forcing influence on cyclone characteristics



Forcing influence on cyclone characteristics



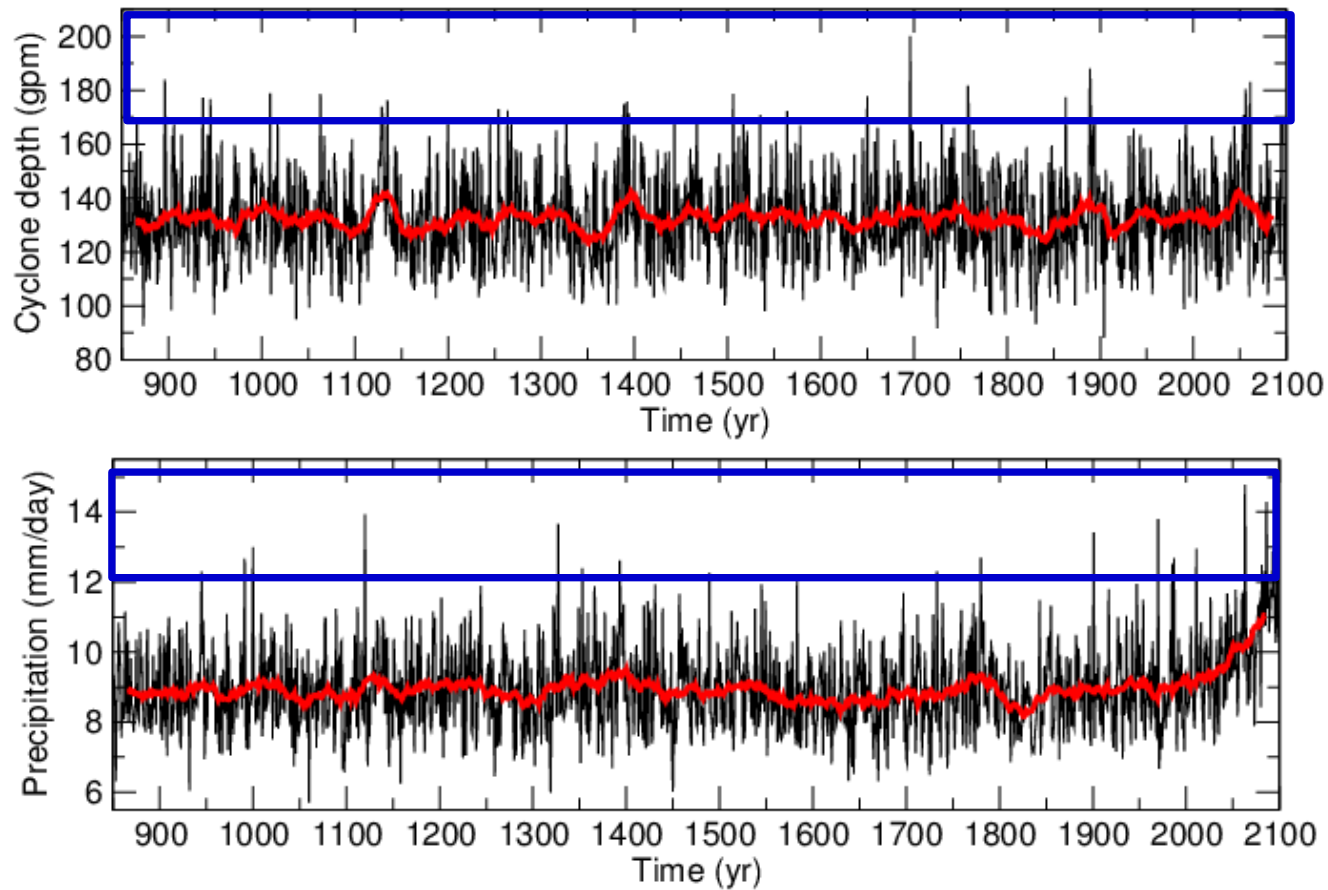
- Is CESM able to realistically simulated winter cyclones over the North Atlantic?
 - Yes, but some biases remain, like underestimation of Mediterranean cyclones, underestimation of cyclone length and cyclone related precipitation
- How do cyclone characteristics change in a seamless simulation from AD 850 -2100?
 - Pronounced interannual and decadal scale variability
 - Interesting extreme cyclone seasons
- Has external forcing an influence on cyclone characteristics?
 - At a first glance – no, but a detailed analysis is still pending

Perspective



- Detailed analysis of forcing imprint?
 - Correlation/Composite with respect to solar forcing
 - Superposed epoch analysis for volcanic forcing
- Mechanisms for decadal variations?
- Analysis of extreme winter season with respect to wind and precipitation intensity focusing over Europe

Perspective



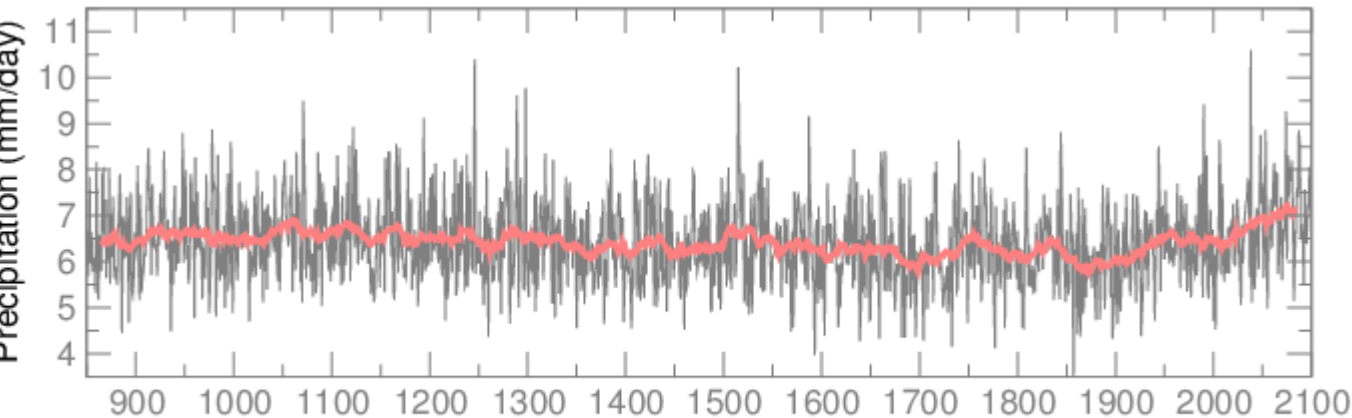
«The blessing hand of the abbess» Victor Hugo (1802–1885)

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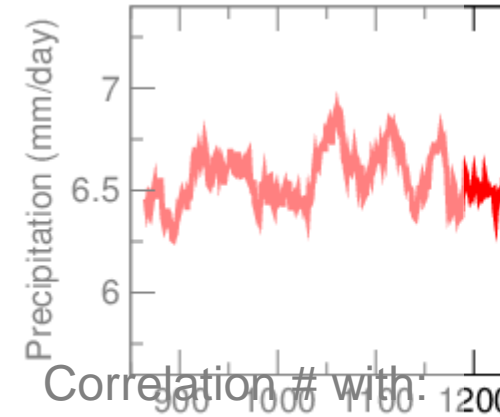
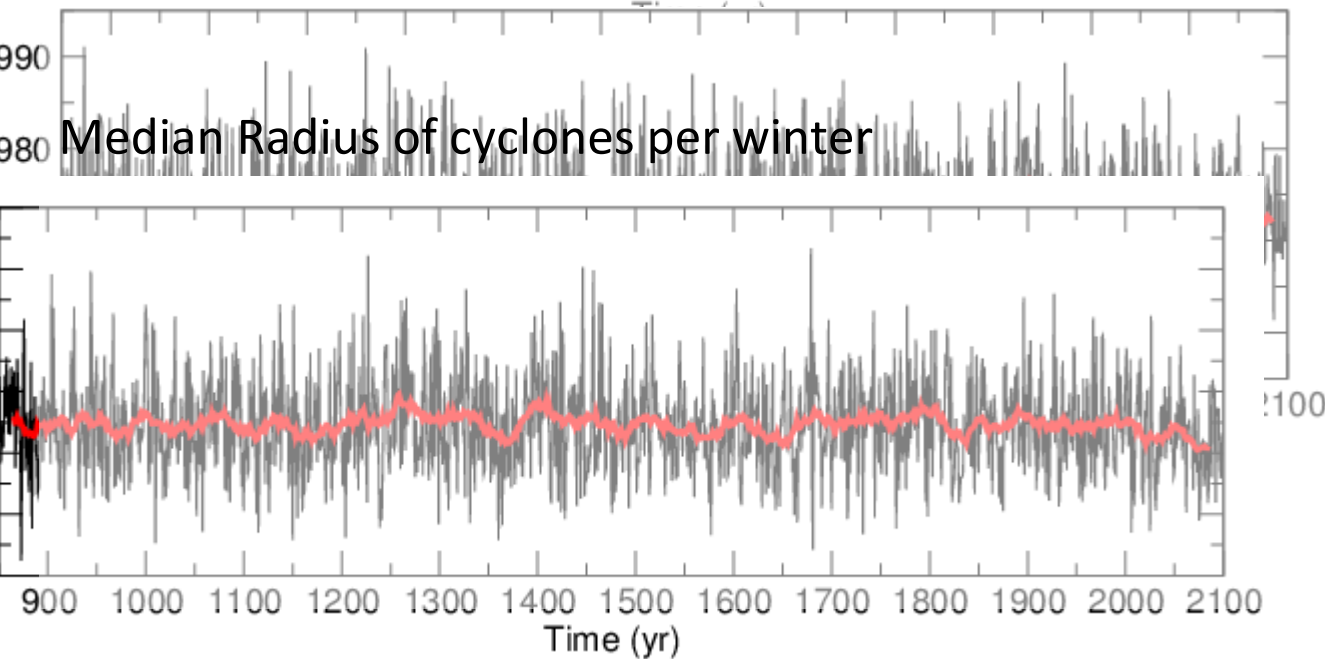
- Analysis of extreme winter season with respect to wind and precipitation intensity focusing over Europe

Variability of extreme cyclone characteristics

Number of time steps with cyclones centers in winter (DJF)



Median Radius of cyclones per winter



Correlation # with:

Rad:

Grad Z1000:

Central SLP:

Prec:

