Decadal variability in weather regimes and teleconnections in reanalysis datasets and century long hindcasts.

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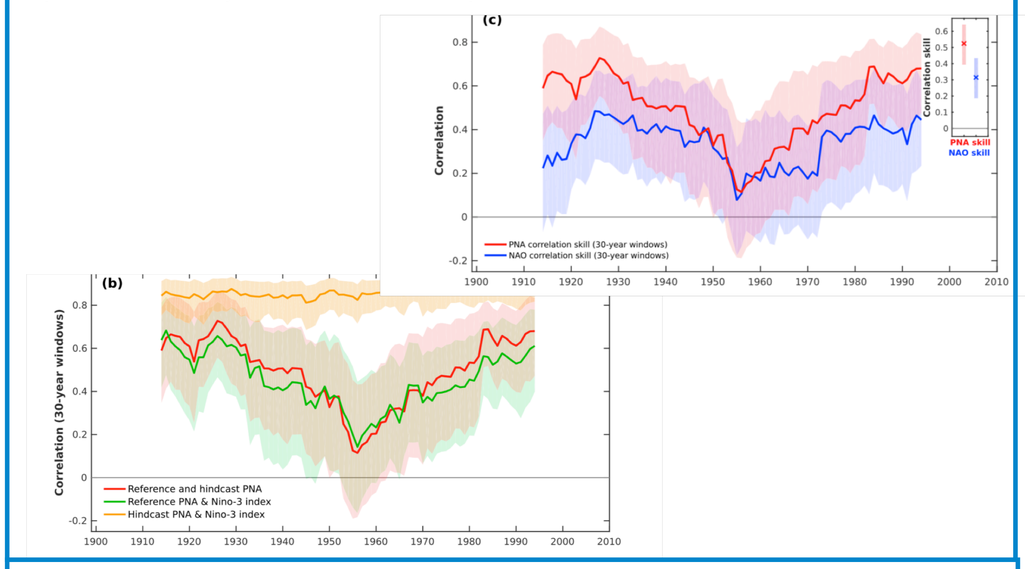
Motivation

Weisheimer et al. QJ 2017
O'Reilly et al. GRL 2017
O'Reilly ClimDyn.2018

Multidecadal changes in PNA and NAO potential predictability and relationship with ENSO



Data and Experiments

ERA-20C [*Poli et al.*, 2016]: Reanalysis product produced by assimilating only surface pressure and marine wind observations over the period 1900–2010. DJF monthly means.

Seasonal AMIP: Hindcast experiments
[*Weisheimer et al.* 2017] performed using the ECMWF cycle 41r1 at T255 horizontal resolution (~80 km), with 91 vertical levels (up to 0.01 hPa) with sea ice boundary conditions from the HadISST 2.1 data set [*Rayner et al.*, 2003] applied throughout each simulation. The hindcasts were initialized with 51 ensemble members on 1 November and run through winter to the end of February, for each year from 1900 to 2009.

Concluding remarks

- PNA and NAO relationship has a decadal variability which might be related to both internal and forced variability. A positive PNA and negative NAO combined pattern (NHE1 hemispheric pattern − reminiscent of the Arctic Oscillation) was more prominent in the 20-year period centred in the 40s. While in the 20-year period centred in the 70s a more local NAO pattern is found.
- The relationship with the SSTs consistently presents a NAO-Niña positive connection in the early 20-year periods and no signal in the later period.
- In the last 40 years NAO is more related to the hemispheric NHE2 pattern which is more consistent with a positive-positive PNA-NAO relationship. NHE2 pattern is reminiscent of the COWL (Cold Ocean Warm Land) pattern consistent with both SSTs (positive AMO and PDO) and climate change radiative forcing.
- Centennial seasonal AMIP hindcasts reproduce well the patterns and −to a reasonable extent- the multi-decadal variability. However they don't seem to reproduce well the multidecadal change in teleconnections between ENSO and those patterns.

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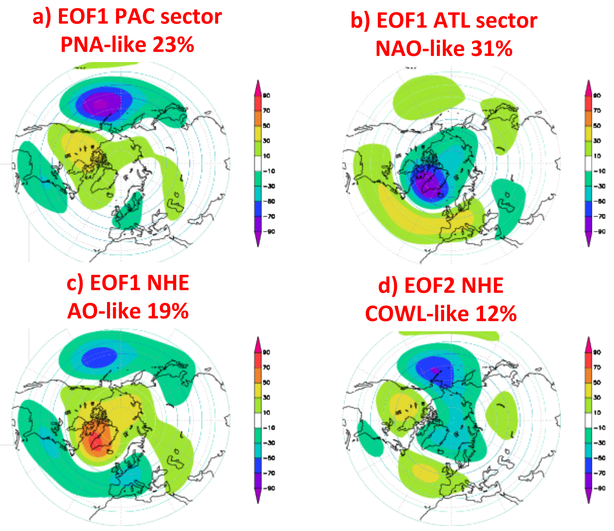
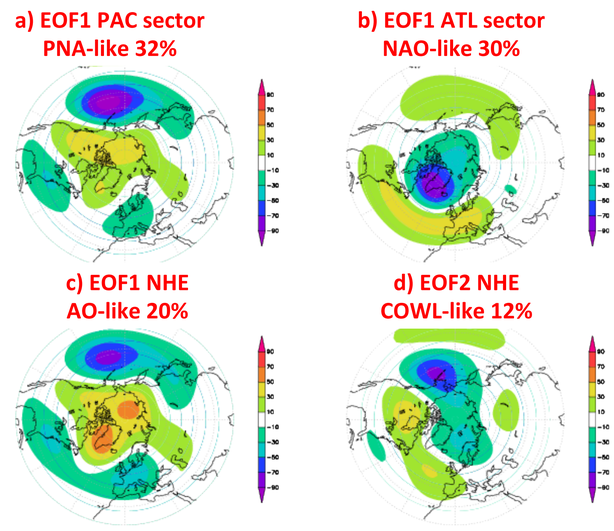
DJF – Euro–Atlantic / Pacific–American & Northern Hemisphere Variability

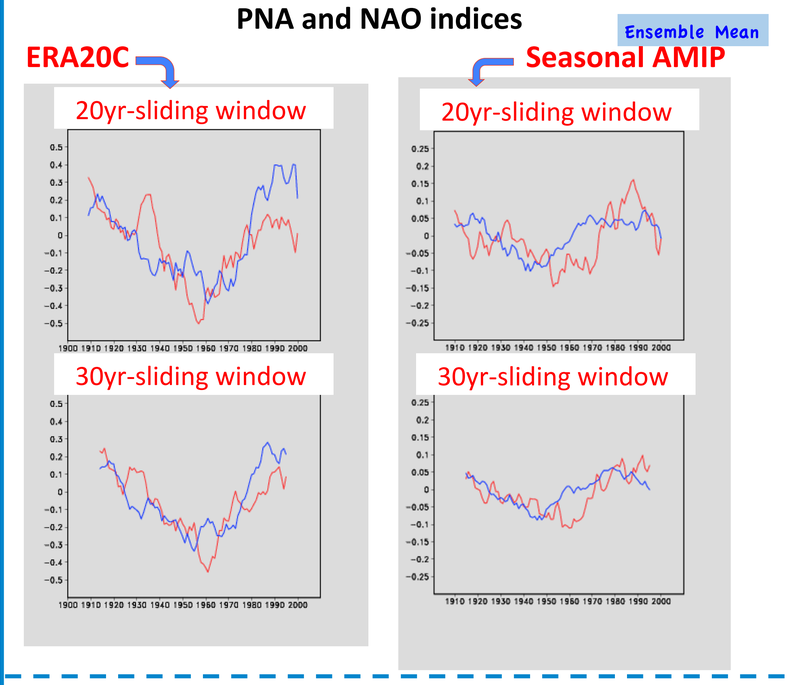


ERA20C 500 hPa geopotential heights. Empirical Orthogonal Functions computed over monthly means for a) Euro-North Atlantic Sector; b) American Pacific sector; c) and d) Northern Hemisphere

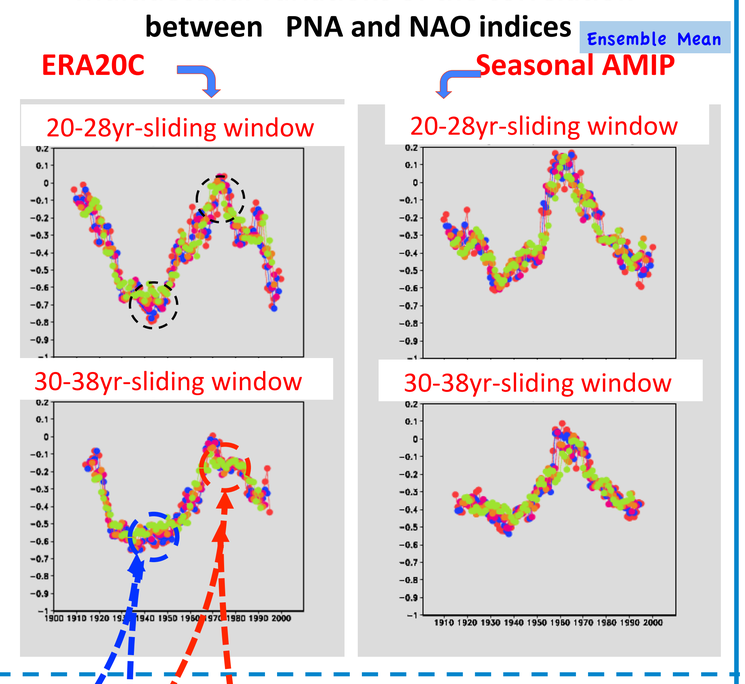


Seasonal AMIP 500 hPa geopotential heights. Empirical Orthogonal Functions computed over monthly means for a) Euro-North Atlantic Sector; b) American Pacific sector; c) and d) Northern Hemisphere

Multidecadal variations of the average PNA and NAO indices



Multidecadal variations of the correlation between PNA and NAO indices



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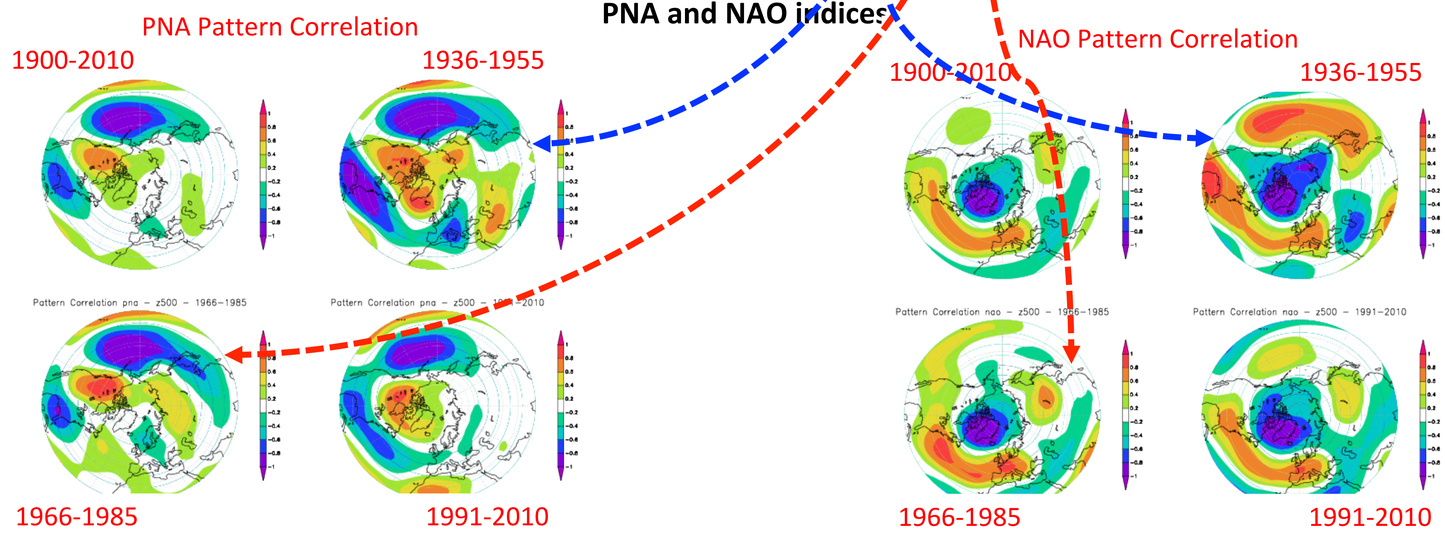

Correlation with SSTs over the three periods