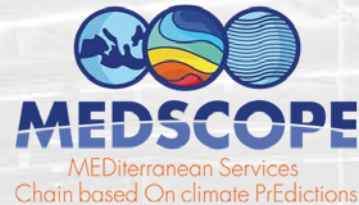




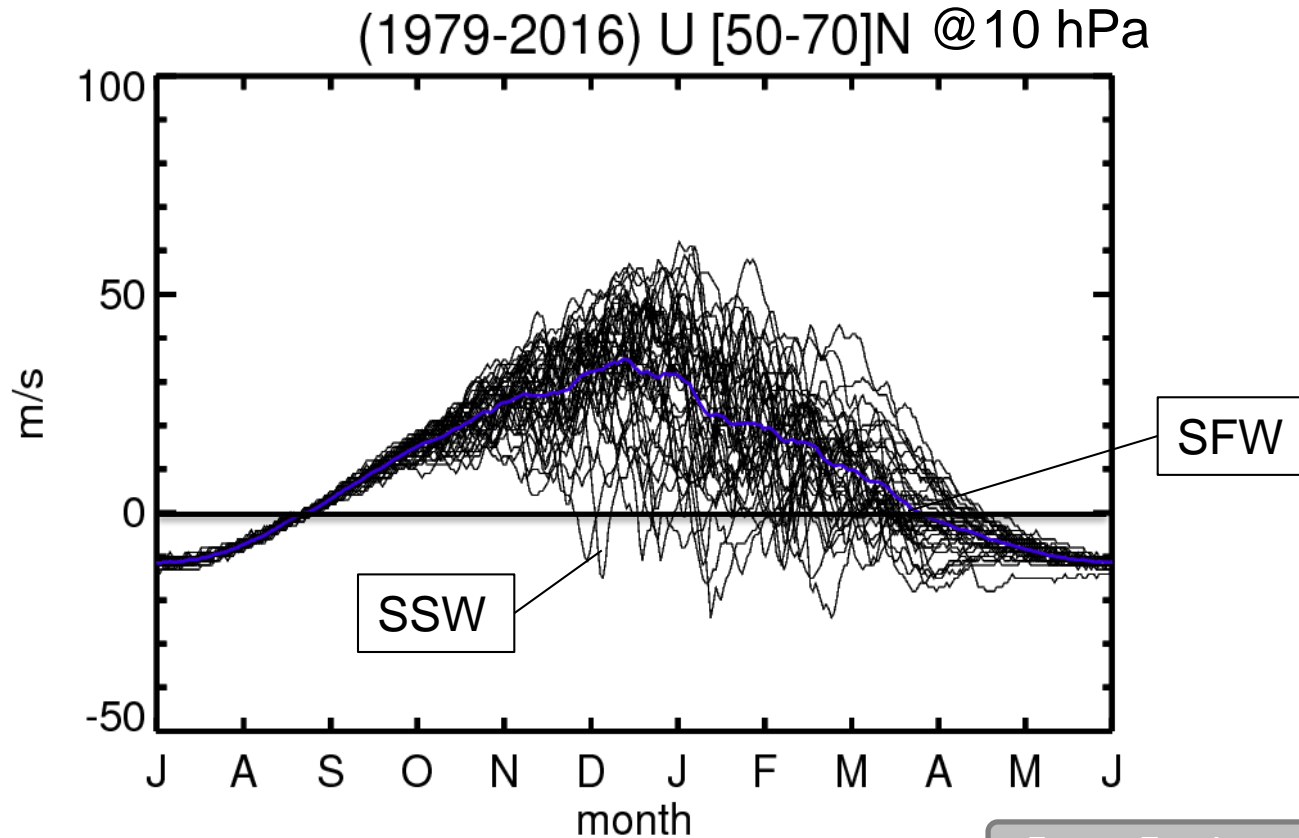
**Barcelona
Supercomputing
Center**
Centro Nacional de Supercomputación



ENSO and PDO modulation of sudden stratospheric warmings (some preliminary results)

Froila M. Palmeiro

The Northern Stratospheric Polar Vortex



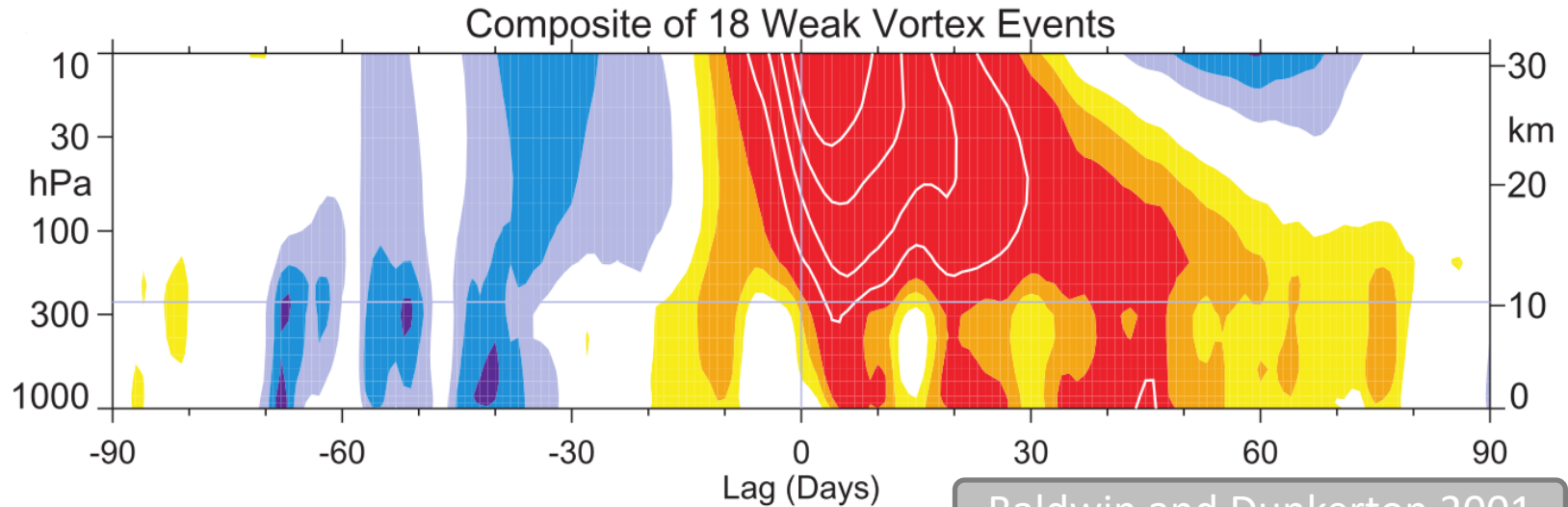
Black: years' daily series / Blue: climatology

From Era Interim

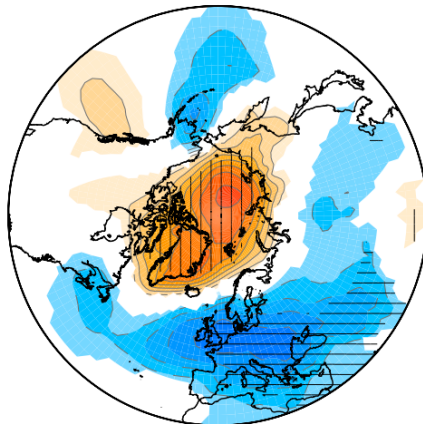
→ Sudden Stratospheric Warmings are the main source of variability in the polar winter stratosphere.

Stratosphere-Troposphere coupling

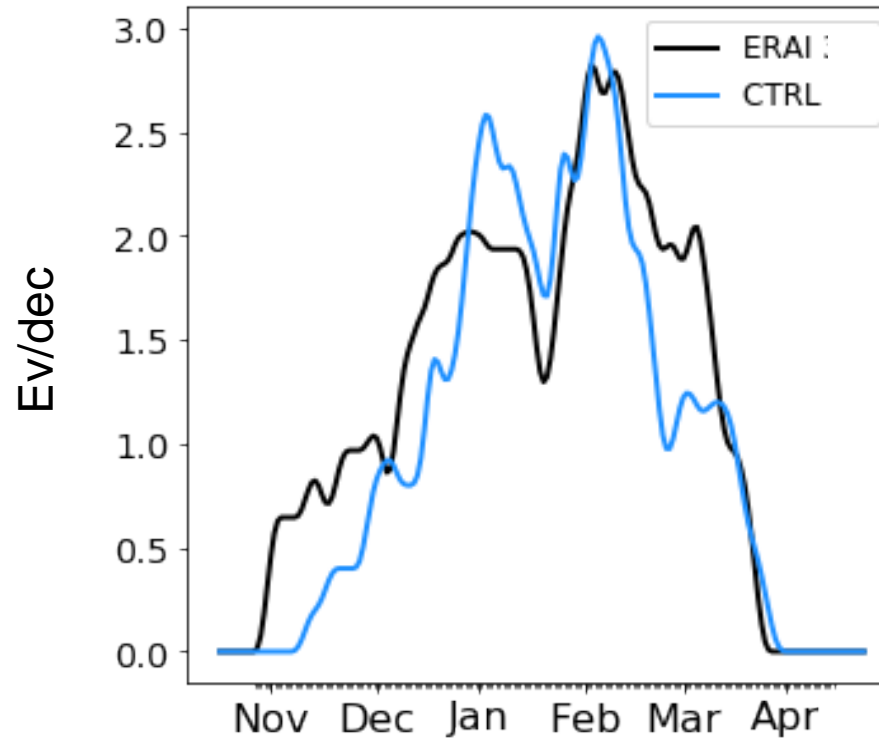
→ Impact on the troposphere -> **Seasonal prediction**



SLP anomalies after SSWs

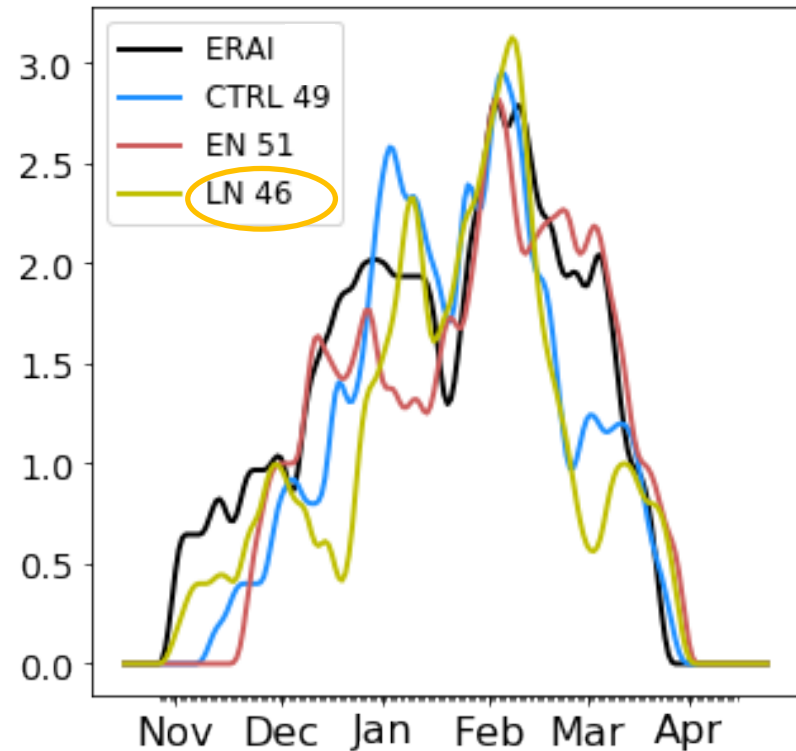
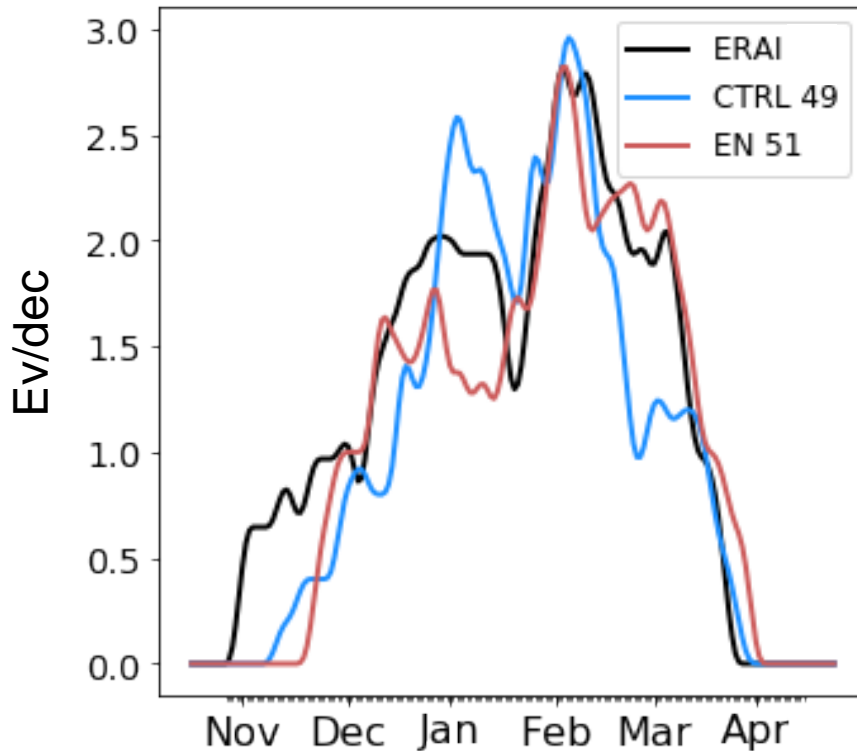


SSW seasonal distribution



-> EC-Earth shows similar SSW distribution to ERA-Interim

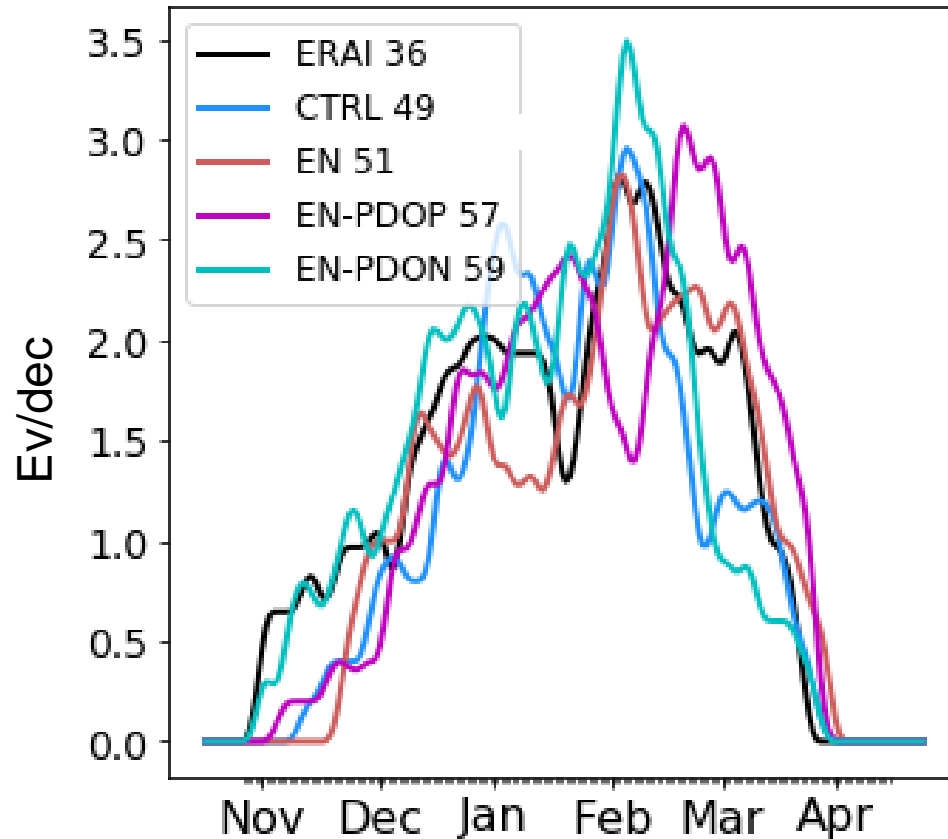
Does ENSO modulate SSW occurrence?



EN -> SSWs tend to occur in late winter

LN -> SSWs are less frequent and mostly occur in Jan-Feb

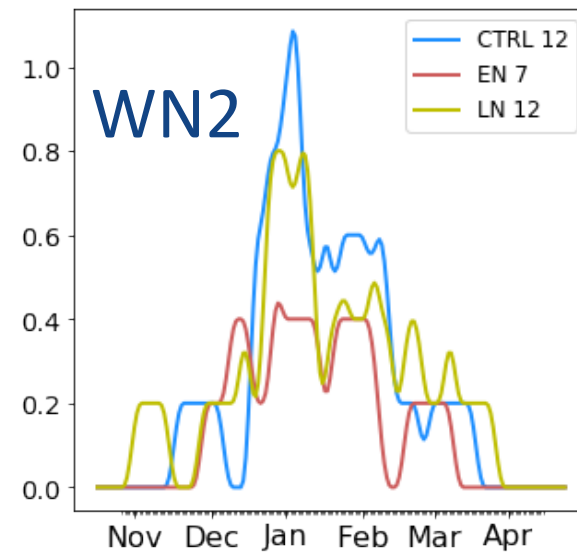
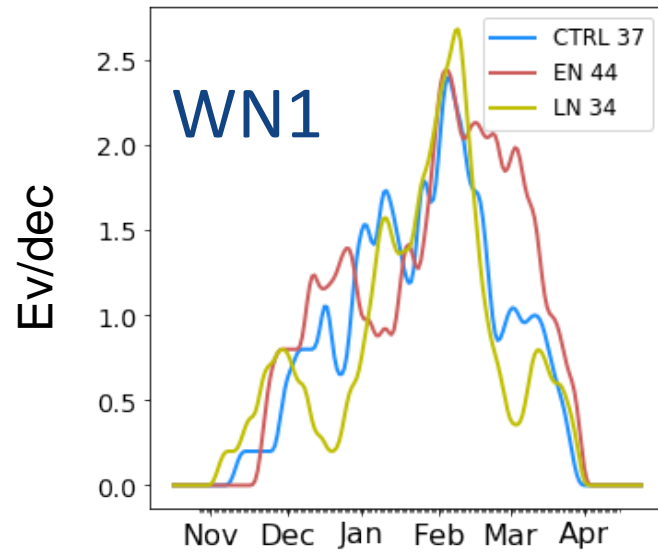
Does the PDO influence the ENSO modulation?



EN/PDO(both) increase SSWs

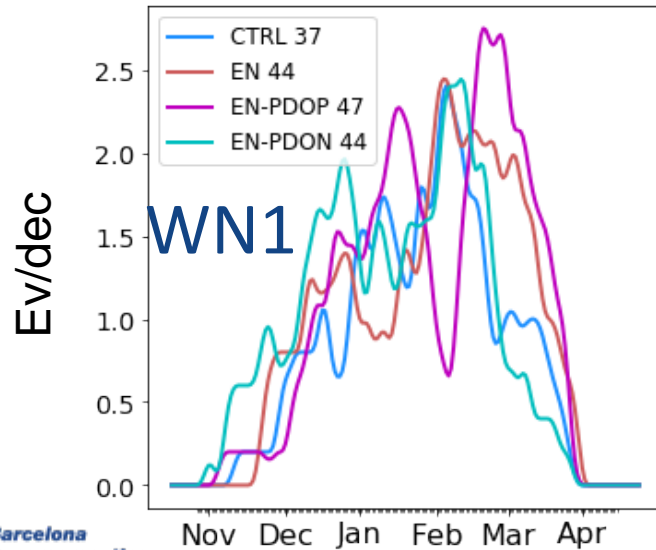
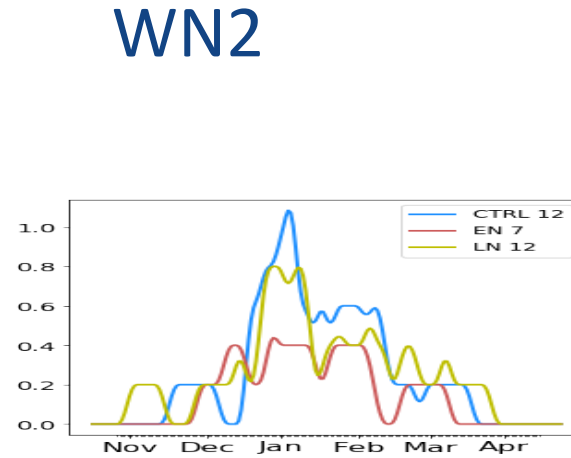
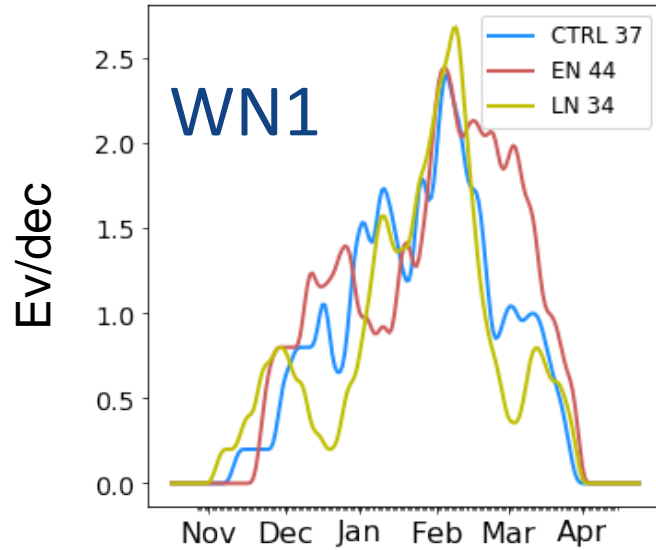
EN/PDO+ : Impact the seasonality- SSWs occur later

Wave number impact on seasonal distribution



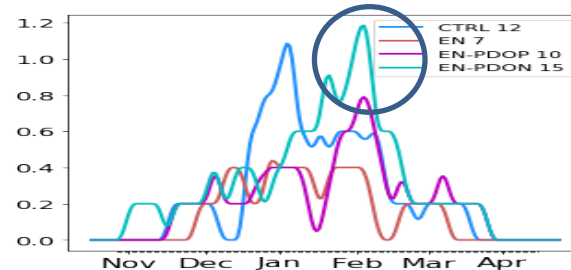
-> Most of the WN2 SSWs occur around January

Wave number impact on seasonal distribution



WN2

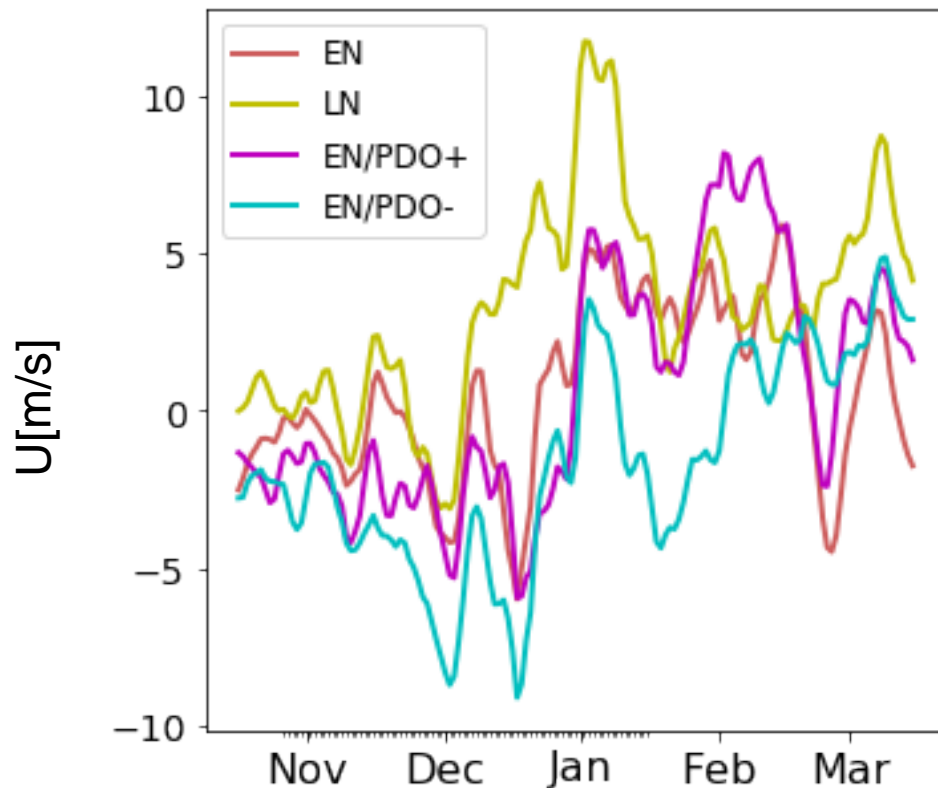
- For EN/PDO- WN2
SSWs are more prone
in late winter



Impact on the stratospheric polar vortex strength

Differences: CASE minus CONTROL

Daily differences of U_{zm} @ 10hPa and 65°N



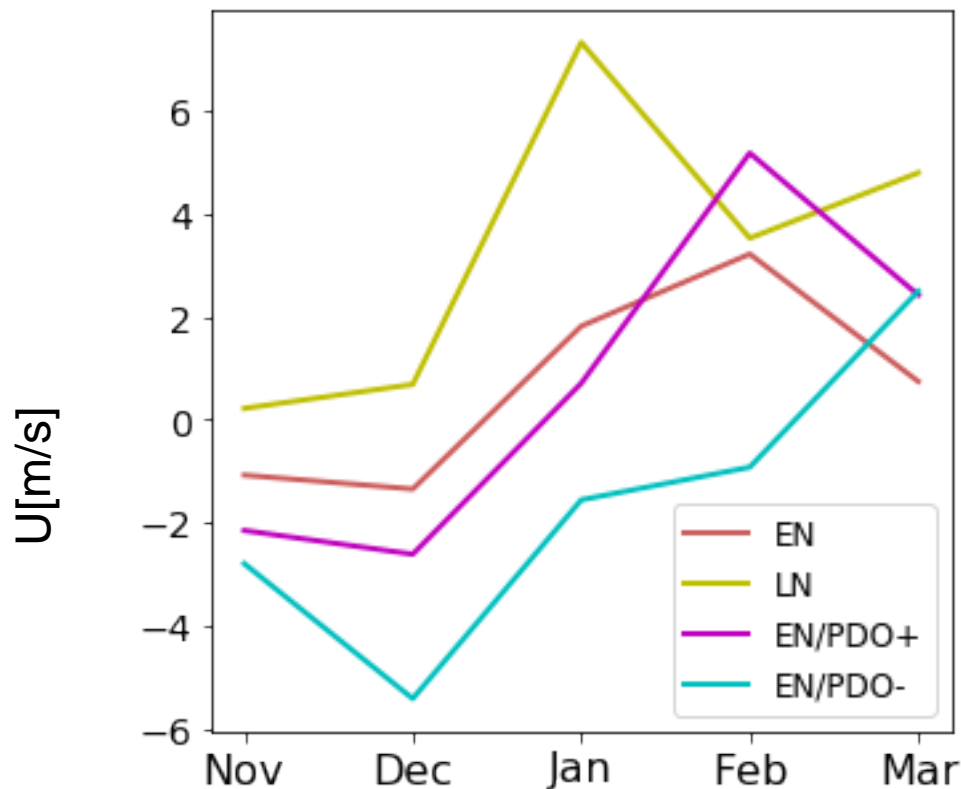
-> Stronger polar vortex during LN (yellow)

-> Weaker vortex during EN/PDO- (blue)

Impact on the stratospheric polar vortex strength

Differences: CASE minus CONTROL

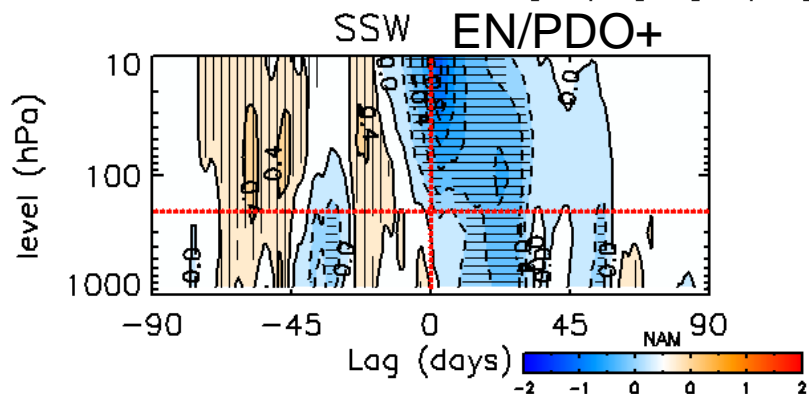
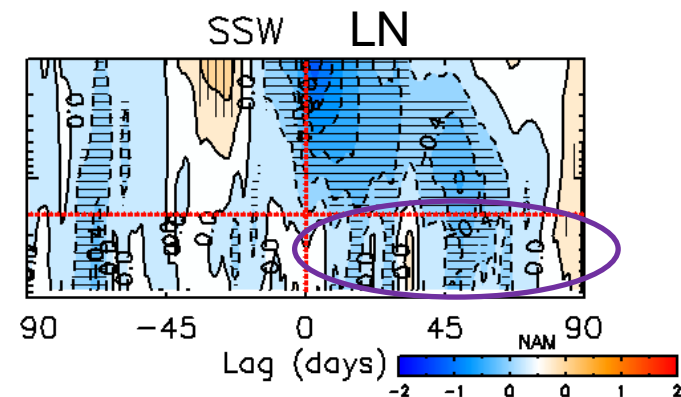
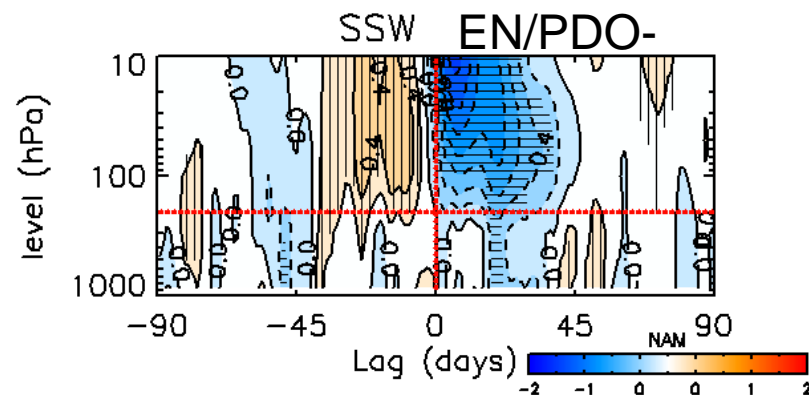
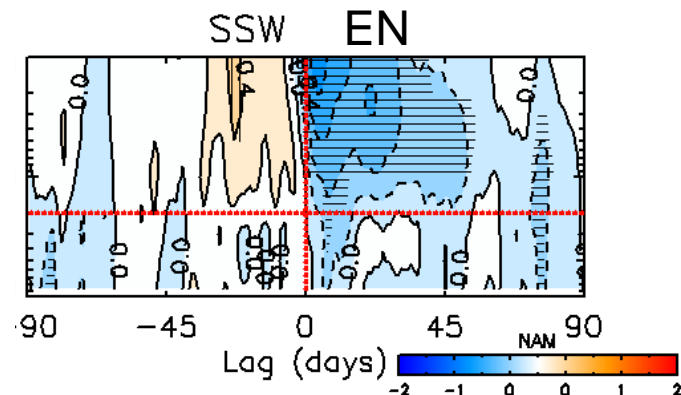
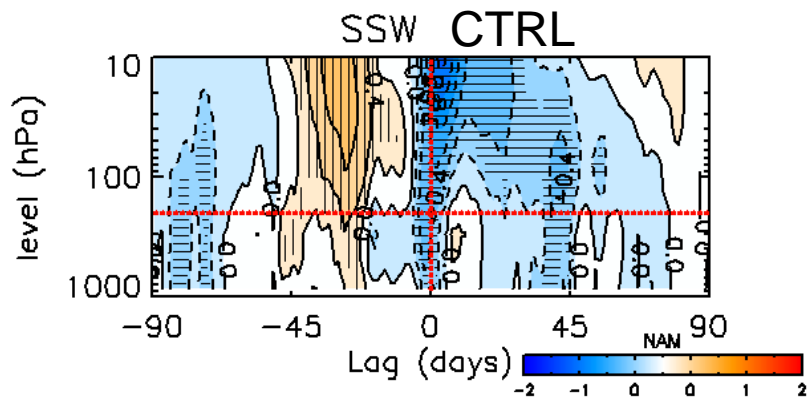
Monthly differences of U_{zm} @ 10hPa and 65°N



-> Stronger polar vortex during LN (yellow)

-> Weaker vortex during EN/PDO- (blue)

Stratosphere-Troposphere coupling (Z-index)



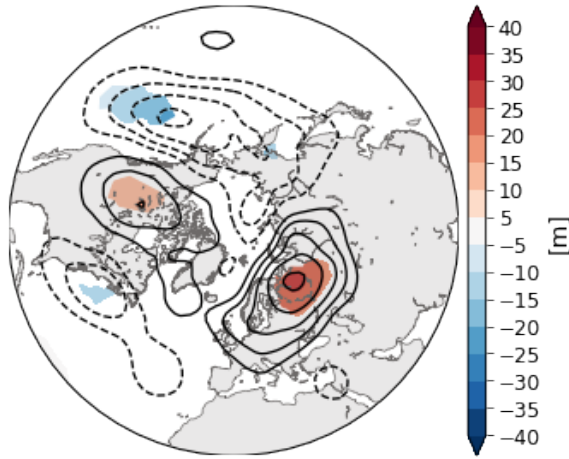
- Stronger S-T coupling for SSWs during La Niña

Future work

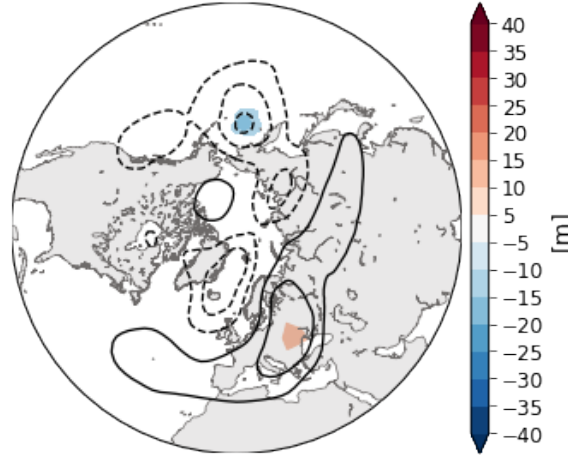
- Explore the modulation of ENSO/PDO on the SSWs impact: influence on stratosphere-troposphere coupling.
- Repeat the analysis for strong vortex events.
- QBO modulation of the troposphere-stratosphere coupling.
- Compare the results on EC-Earth with those from other partners: potential differences in the EN/PDO experiments.

SSW precursor signal

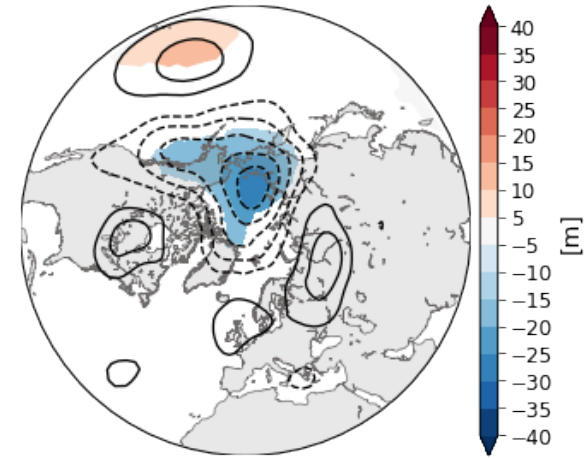
[-30,0] CTRL



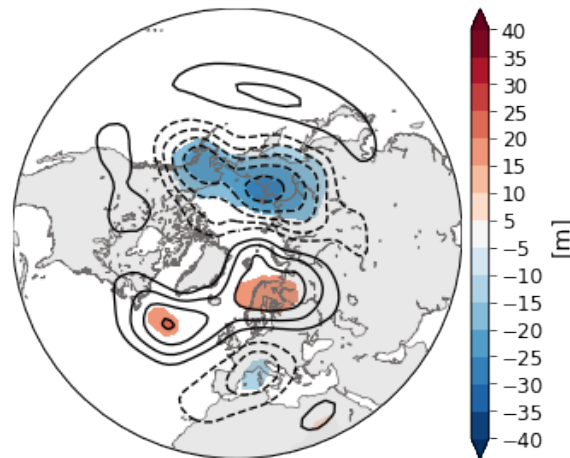
[-30,0] EN



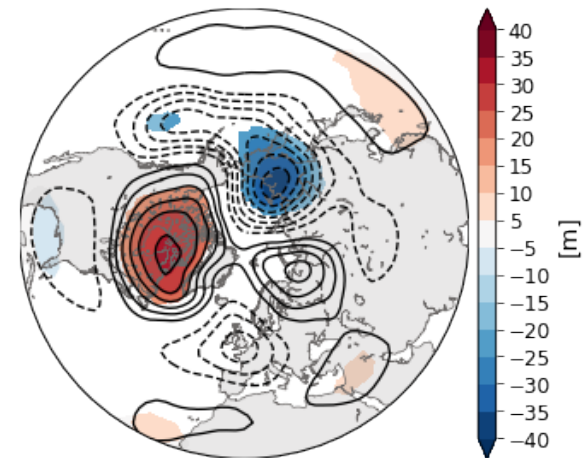
[-30,0] EN/PDO+



[-30,0] EN/PDO-

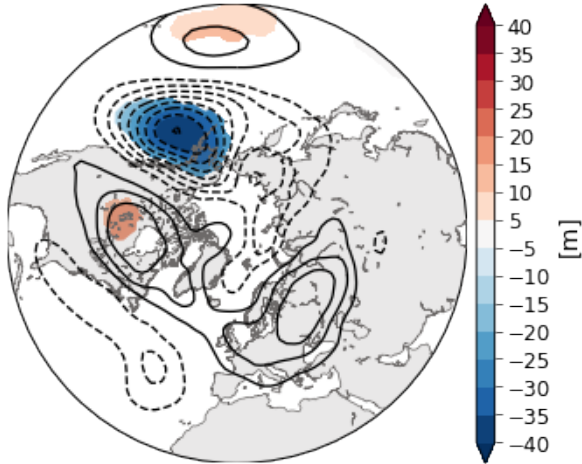


[-30,0] LN

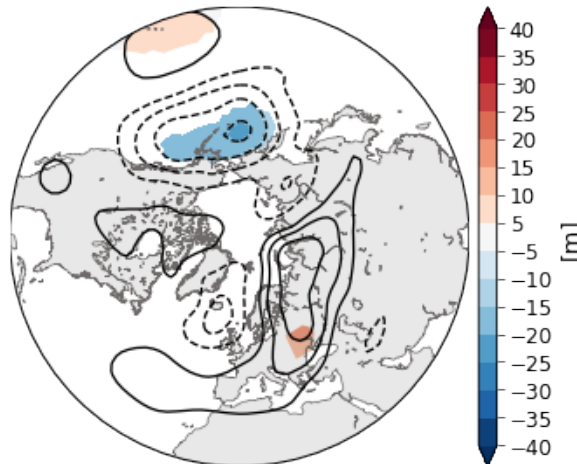


SSW precursor signal- WN1

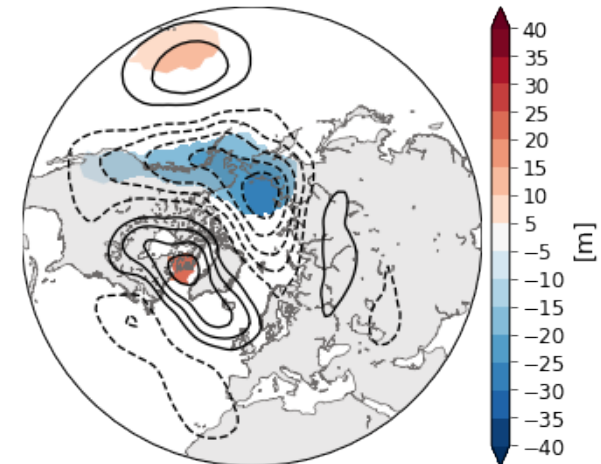
[-30,0] CTRL (37)



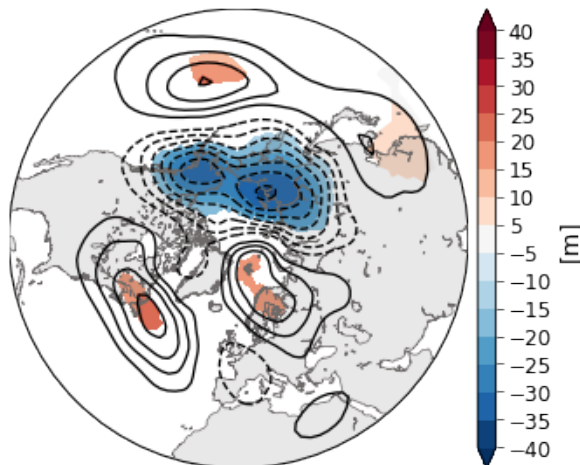
[-30,0] EN (44)



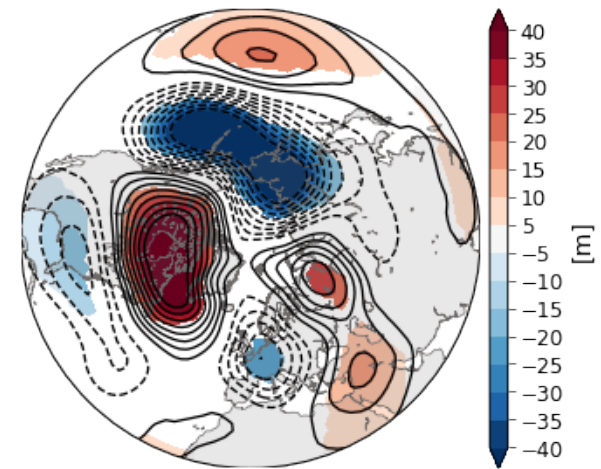
[-30,0] EN/PDO+ (47)



[-30,0] EN/PDO- (44)

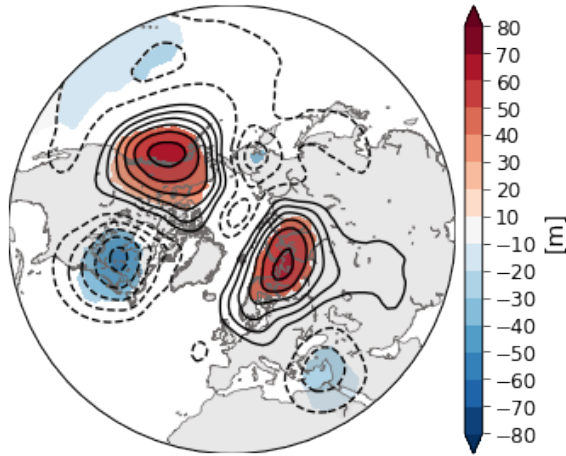


[-30,0] LN (34)

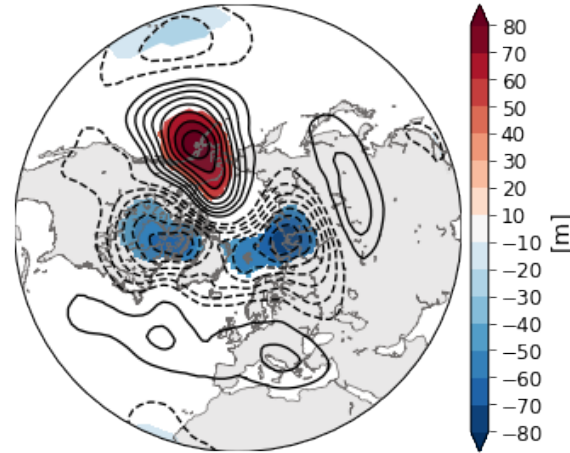


SSW precursor signal- WN2

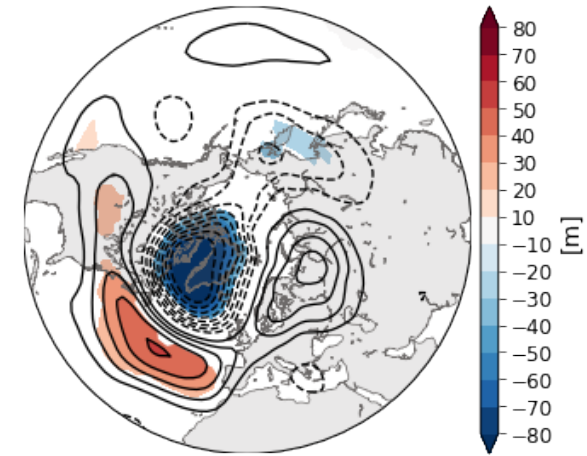
[-30,0] CTRL (12)



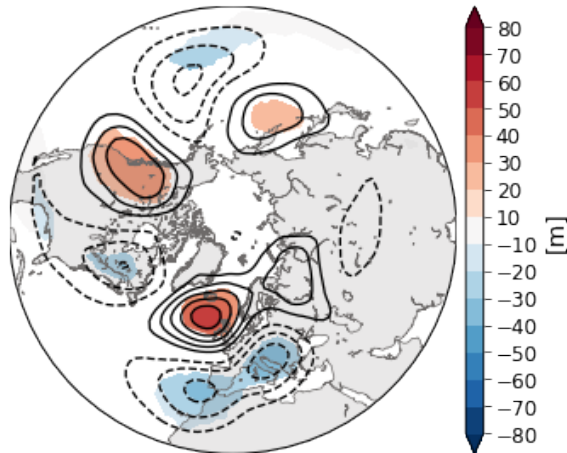
[-30,0] EN (7)



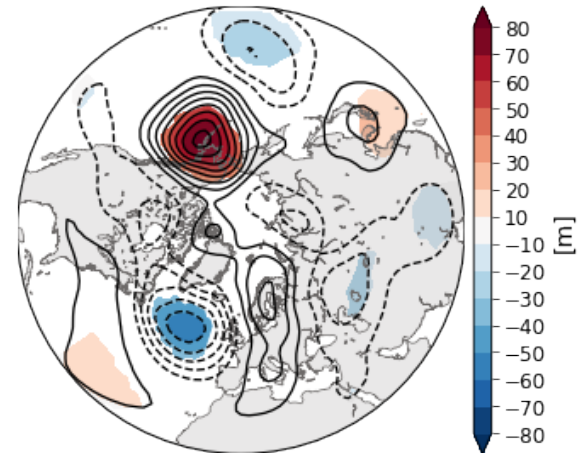
[-30,0] EN/PDO+ (10)



[-30,0] EN/PDO- (15)

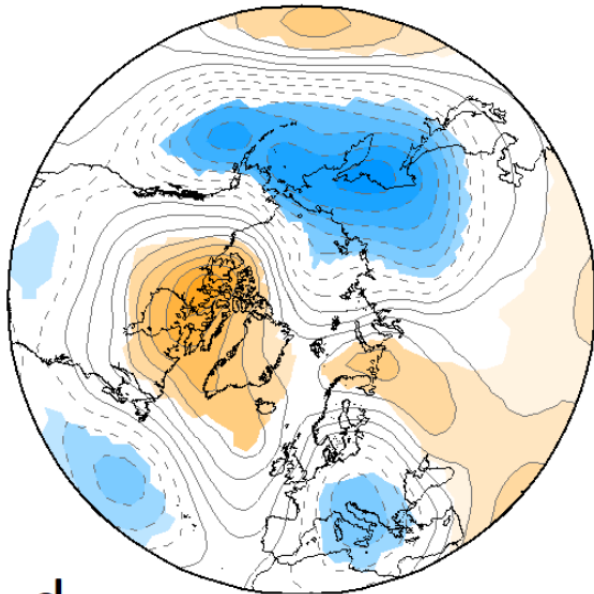


[-30,0] LN (12)



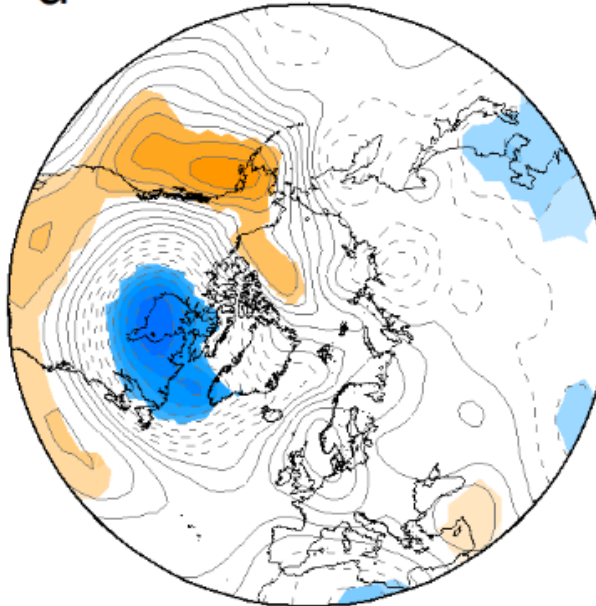
WN1
PRECURSOR

a

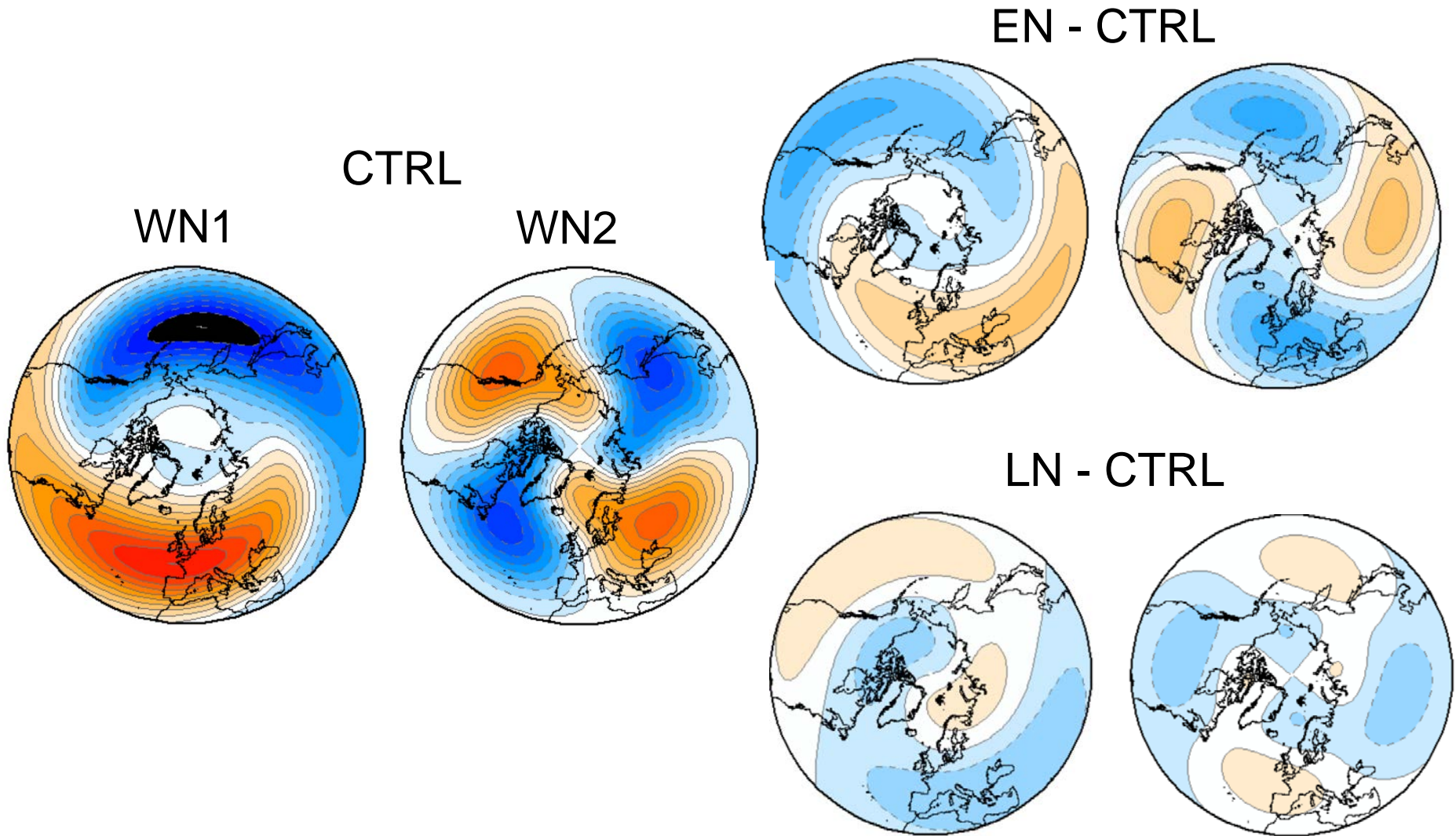


WN2
PRECURSOR

b

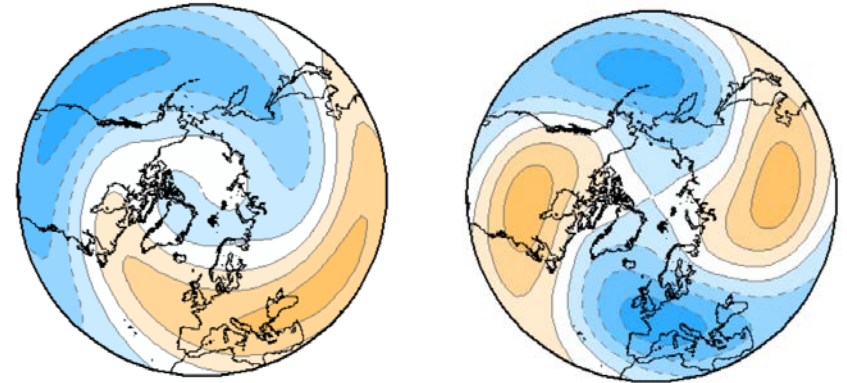


NDJFM Climatological waves @ 500 hPa



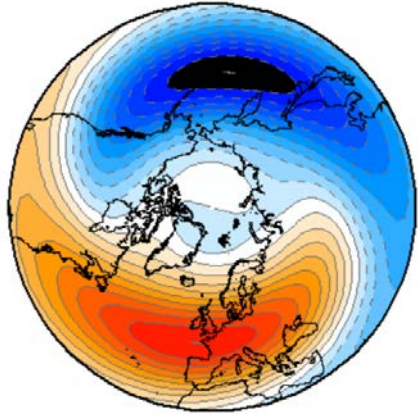
NDJFM Climatological waves @ 500 hPa

EN minus CTRL

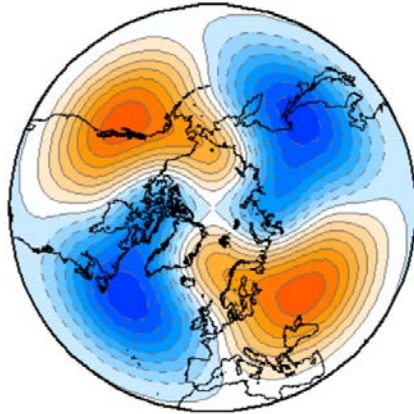


CTRL

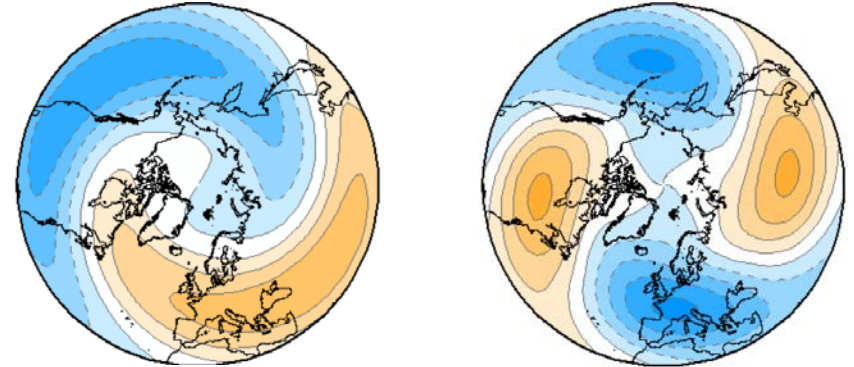
WN1



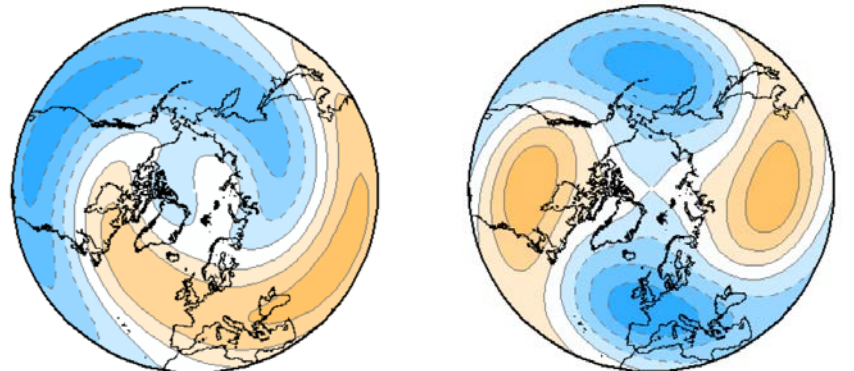
WN2



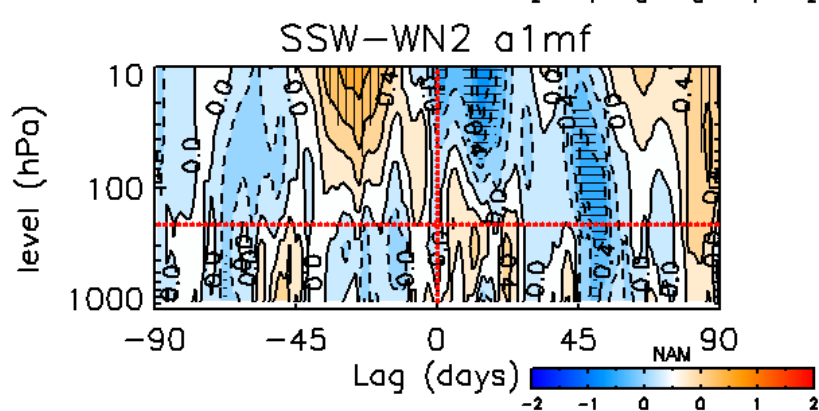
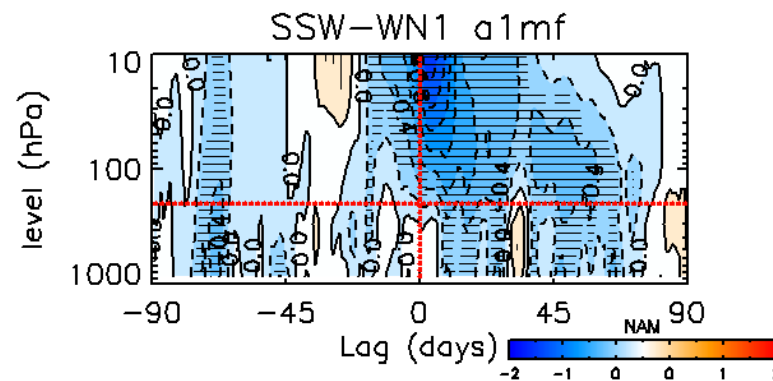
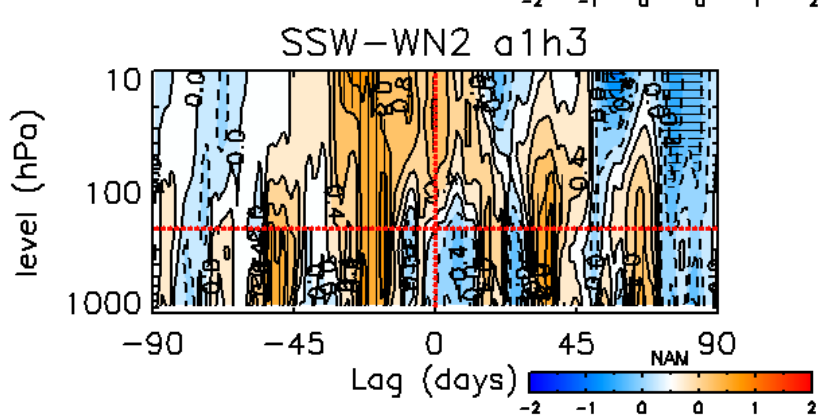
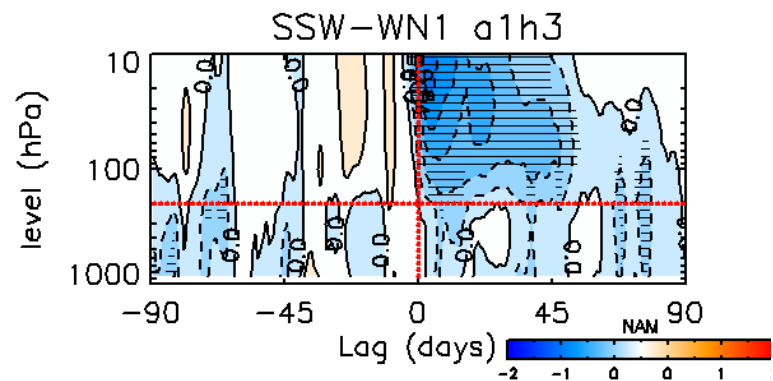
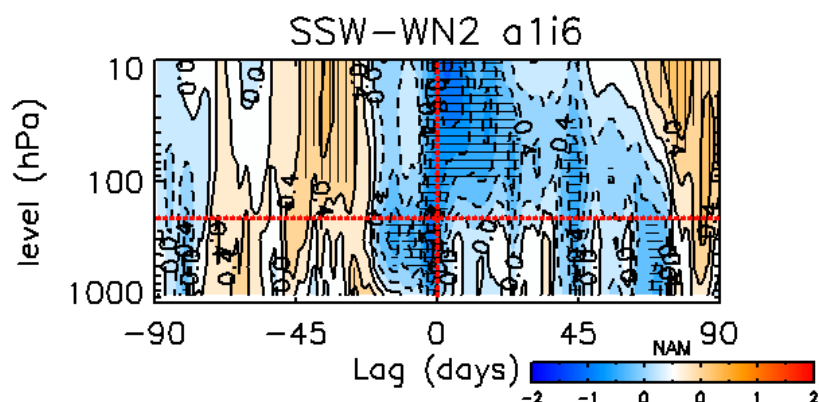
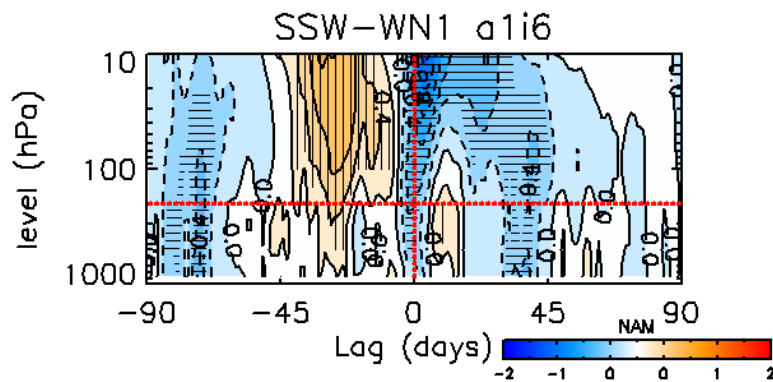
EN/PDO+ minus CTRL



EN/PDO- minus CTRL

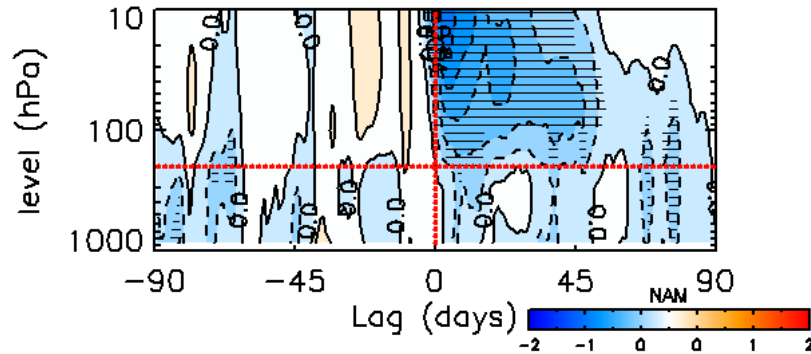


Stratosphere-Troposphere coupling (Z-index)

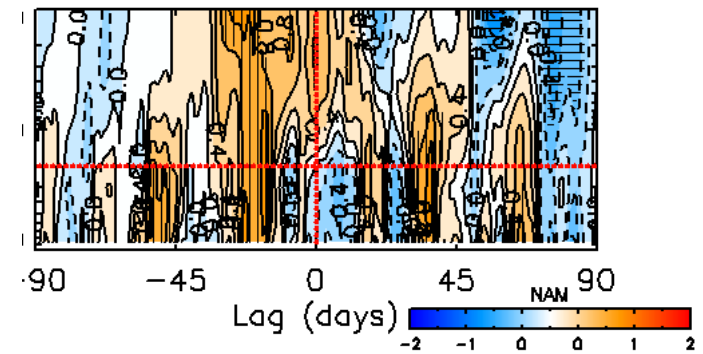


Stratosphere-Troposphere coupling (Z-index)

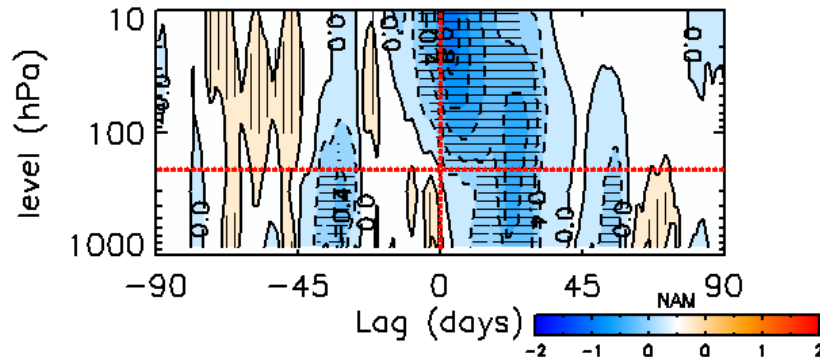
SSW-WN1 a1h3



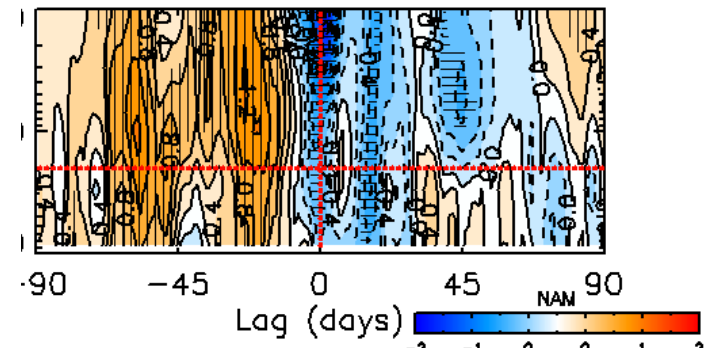
SSW-WN2 a1h3



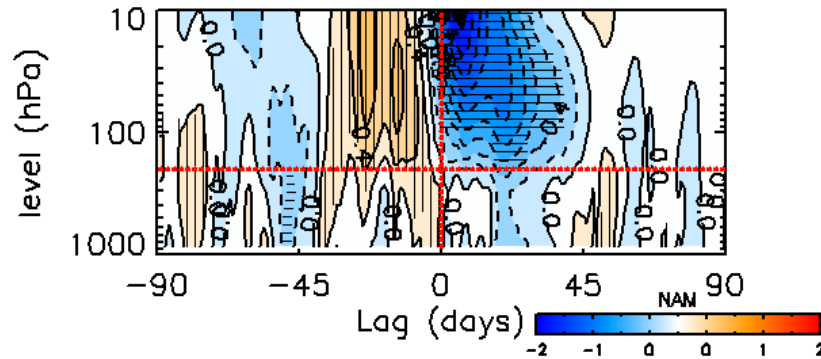
SSW-WN1 a1h4



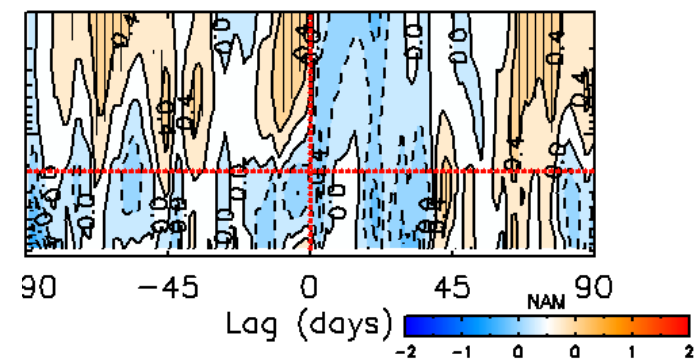
SSW-WN2 a1h4



SSW-WN1 a1h5



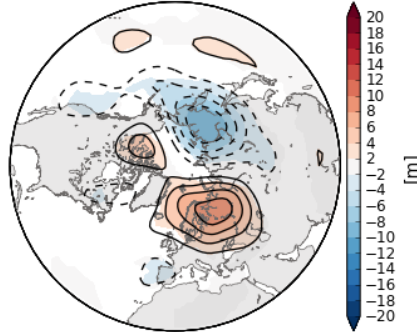
SSW-WN2 a1h5



SSW signal in the troposphere

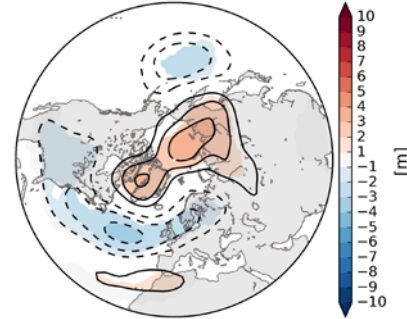
Precursors

HT Z300 [-10]-days

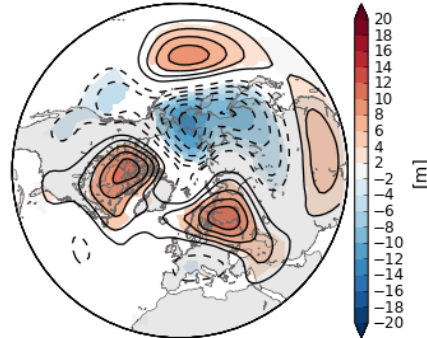


Impact

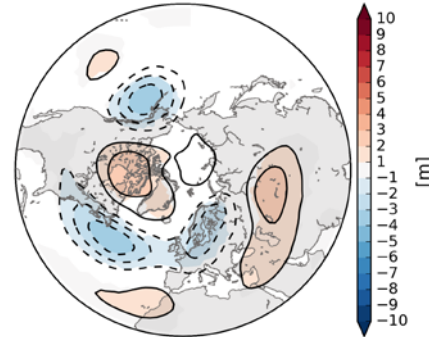
HT Z300 [5,35]-days



LT Z300 [-10]-days



LT Z300 [5,35]-days



High-Top

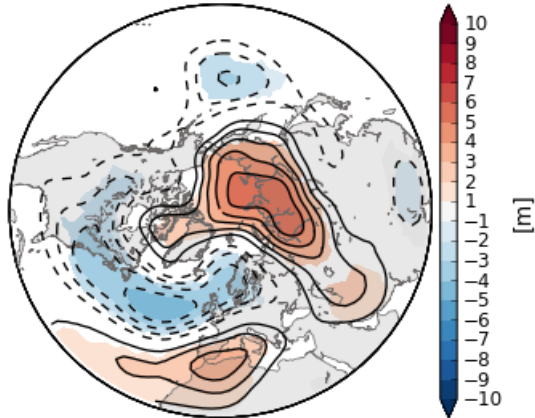
Low-Top

Reanalysis

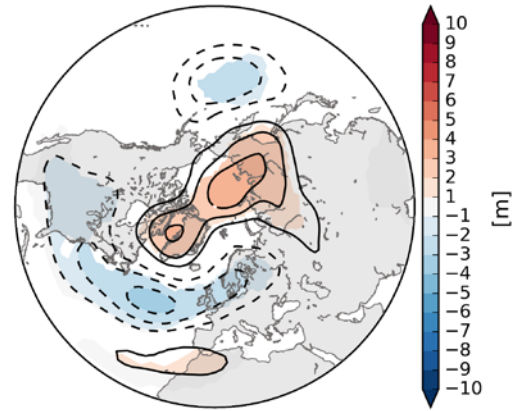
(Limpasuvan et al. 2004)

Different time periods

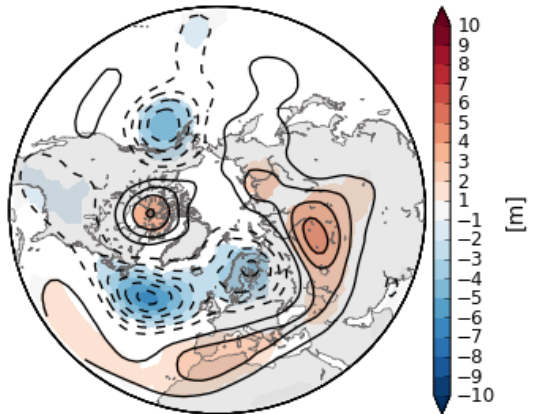
HT Z300 [5,15]-days



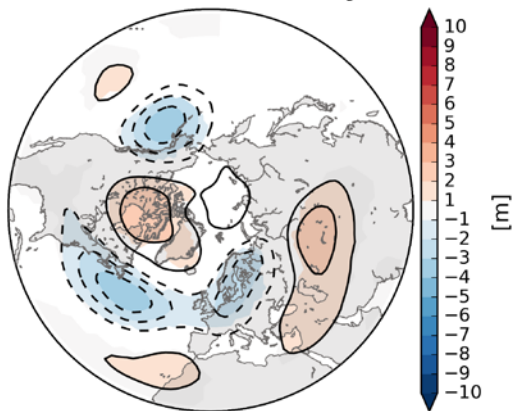
HT Z300 [5,35]-days



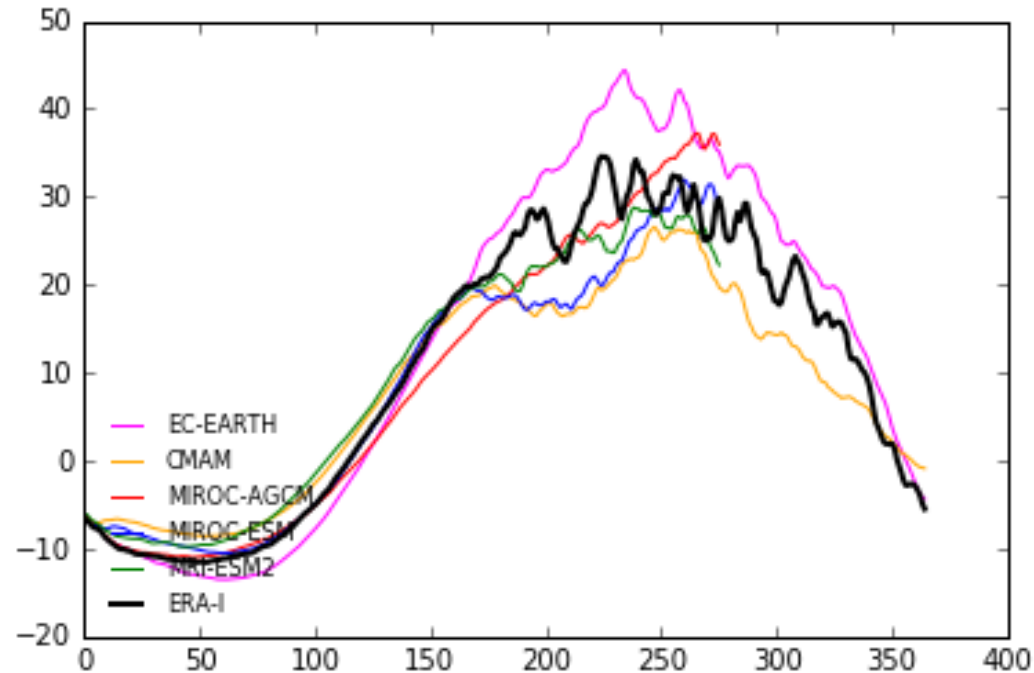
LT Z300 [5,15]-days



LT Z300 [5,35]-days



Polar Vortex climatology in EC-Earth



Sudden Stratospheric Warmings in EC-EARTH

SSW impact on different time-periods

