FUTURE Open Science Meeting
Kohala Coast, Big Island, Hawaii, USA
April 15-18, 2014

Role of North Atlantic climatic variability in recent North Pacific warming

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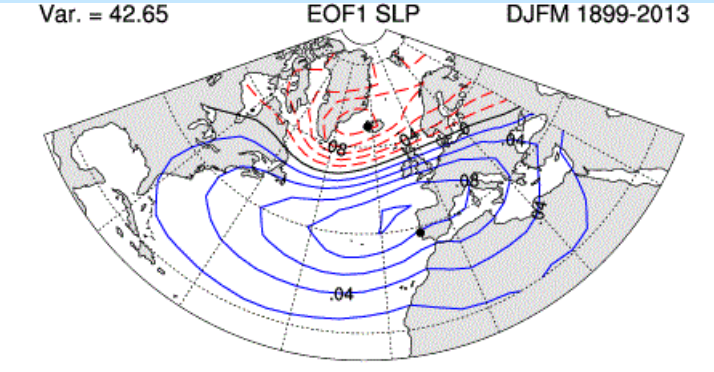
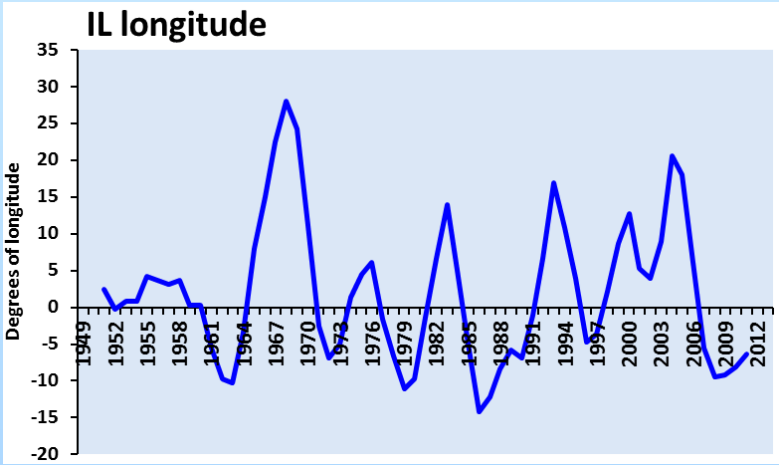
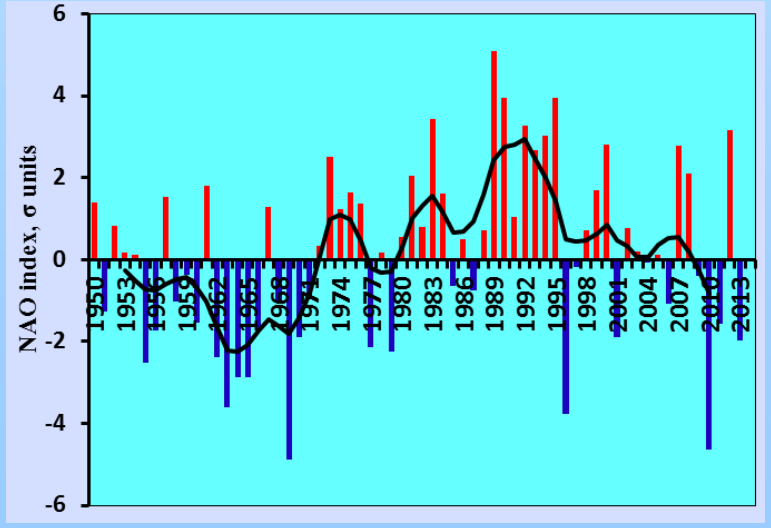
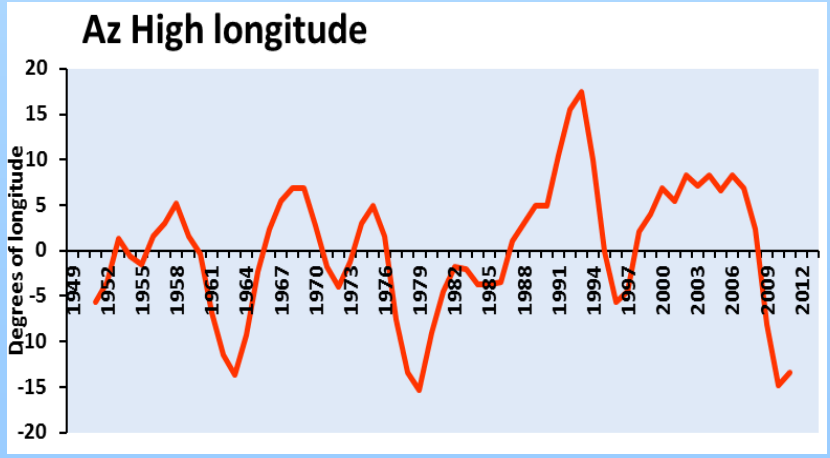
Some characteristics of the winter North Atlantic Oscillation (1950-2013)



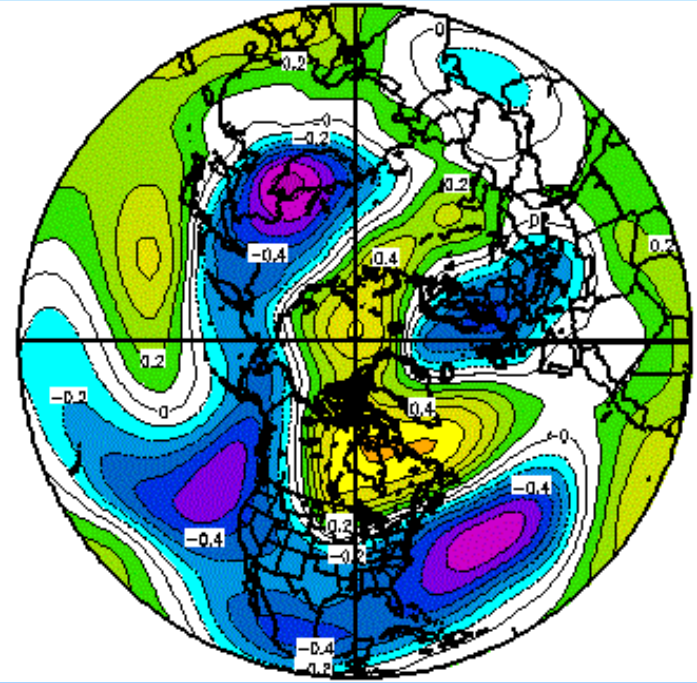
https://climatedataguide.ucar.edu/climate-data



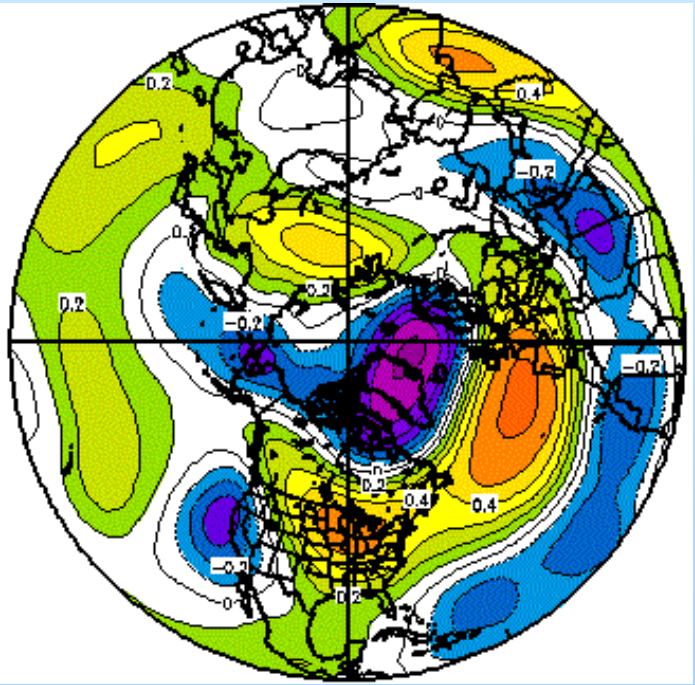




Correlation patterns between sum of normalized anomalies of Azores High and Icelandic Low longitudes and winter (DJF) H500 field in the NH

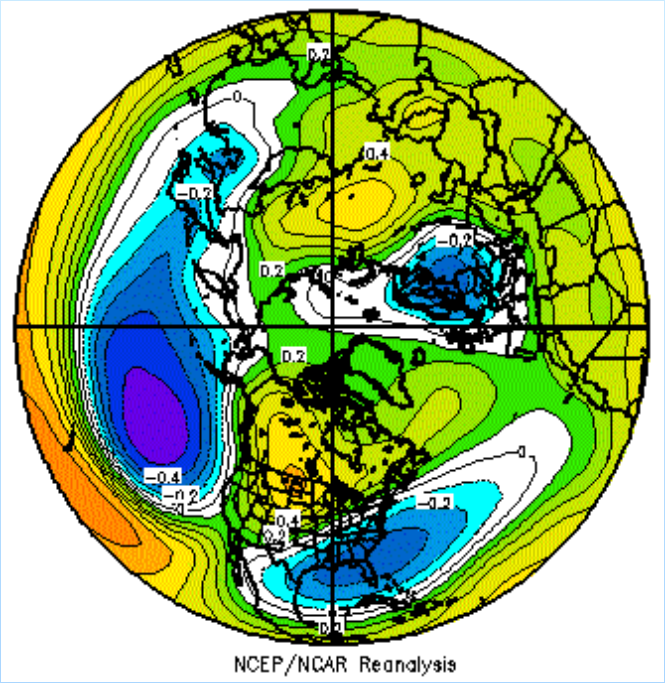


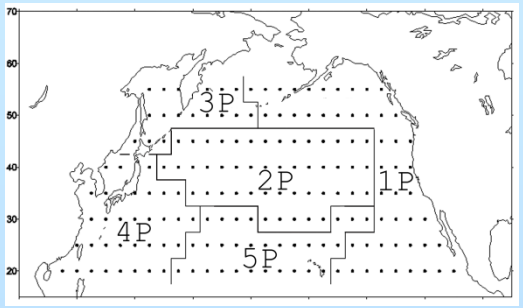
1950-1977

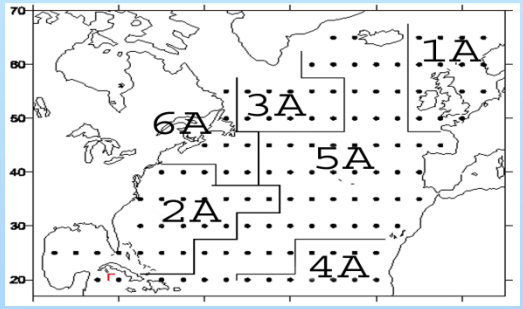


1978-2005

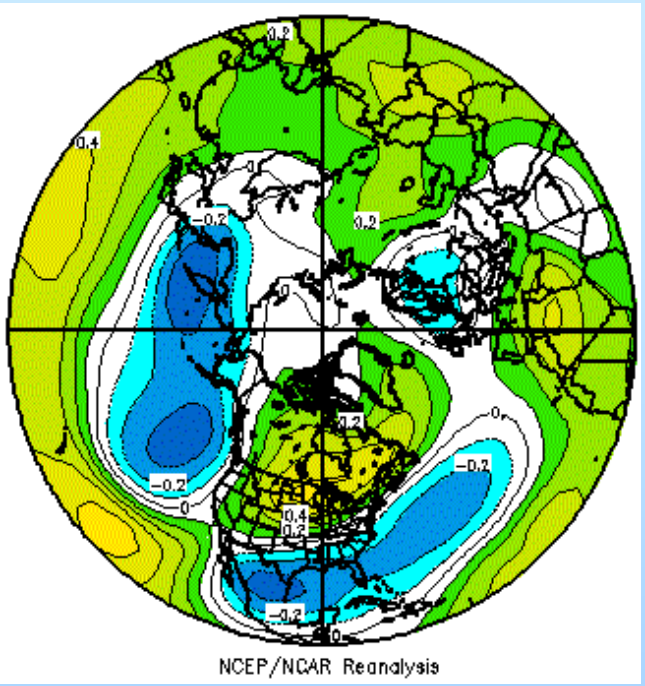
Association between eastern NP and central NA (1958-1991)



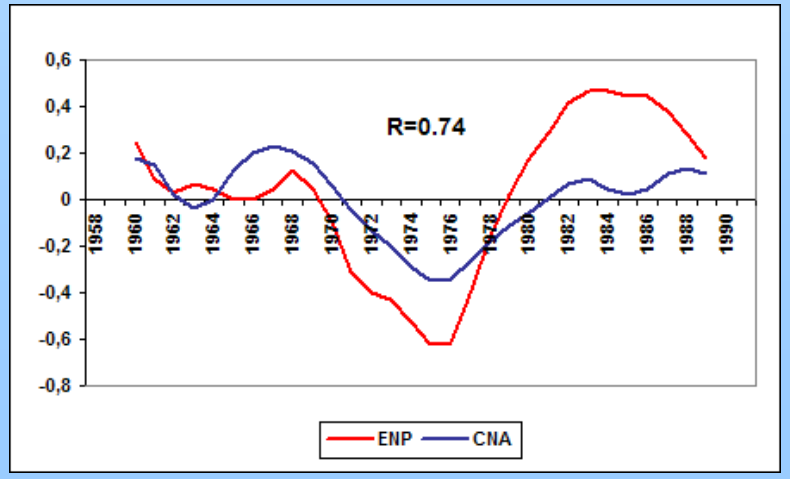




5-yr running SSTA means

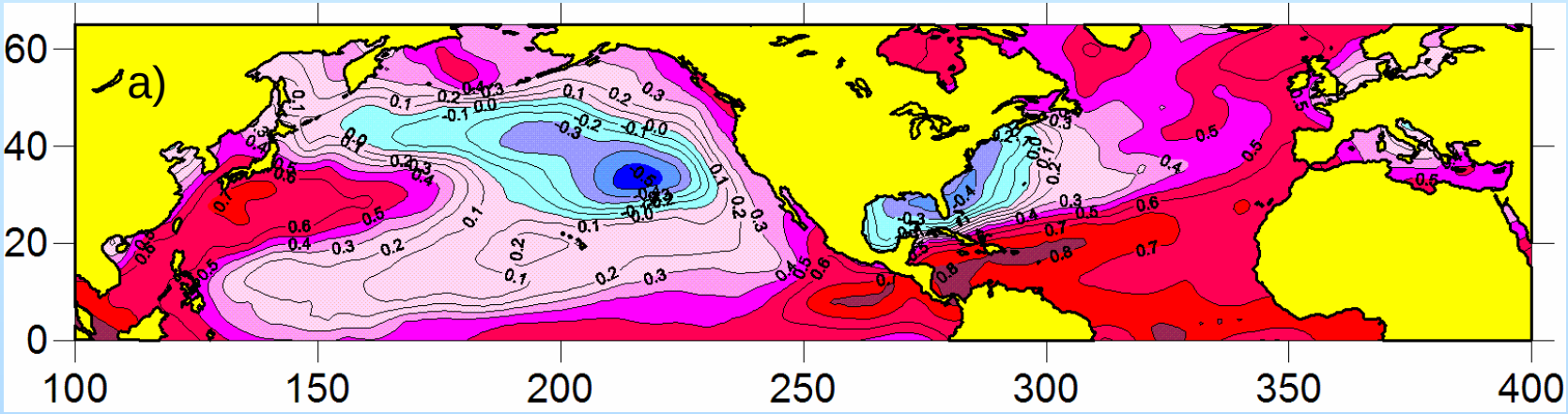


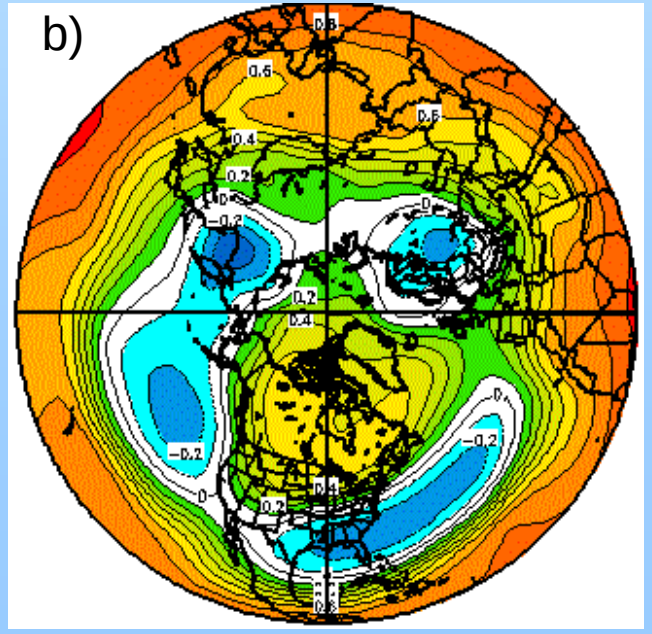
Correlation:
Eastern NP (region 1P)
to H500

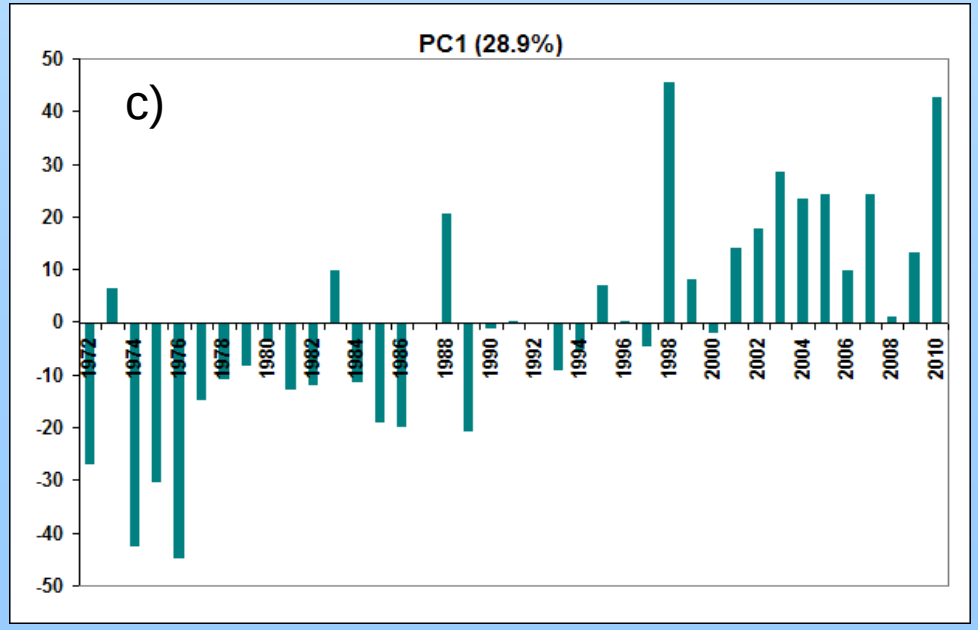


Correlation:
Central NA(region 5A)
to H500

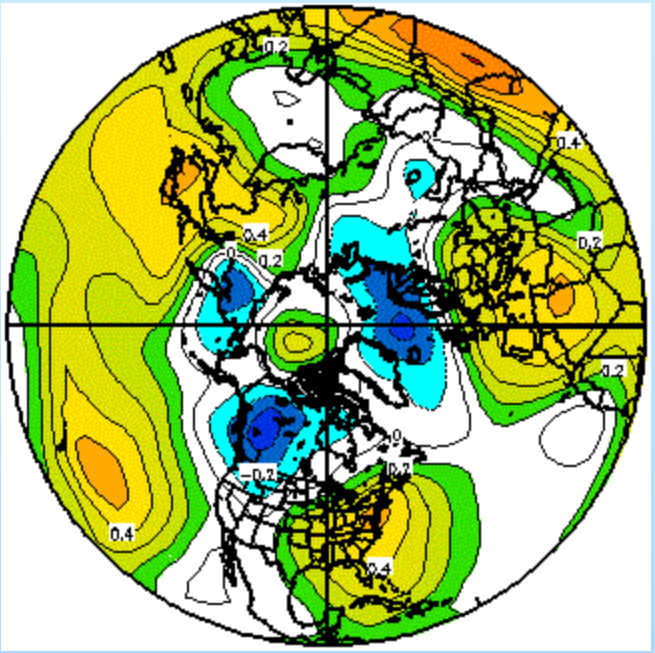
Correlation patterns between EOF1 PC (28.9%) of combined SSTA and mean winter: SSTA field in the NA and NP (a), H500 heights (b); PC1 scores (c) for 1972-2010

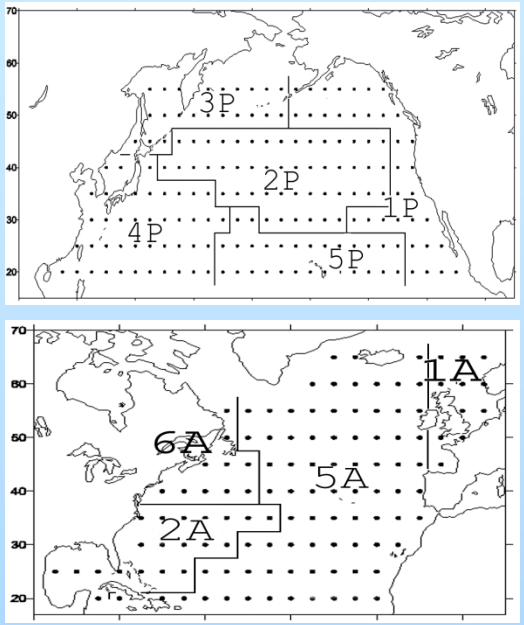


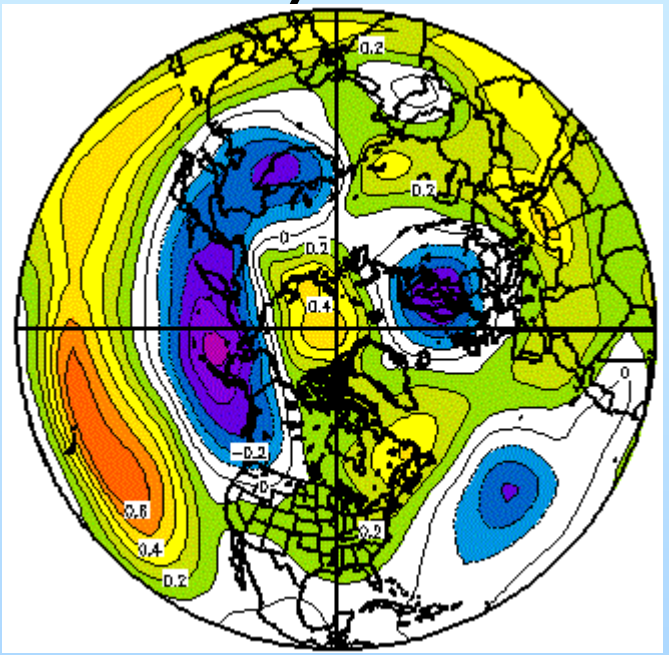




Association between northeastern NA and southwestern NP (1986-2012)

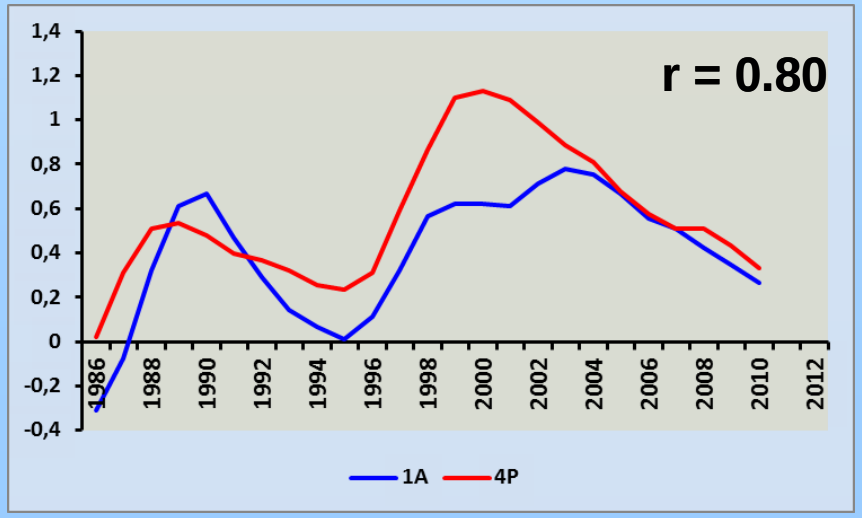






5-yr running SSTA means

Correlation: northeastern NA (region 1A) to H500



Correlation: southwestern NP (region 4P) to H500

OUTLINE

- **Two periods for analysis: 1950-1976 and 1977-2005 (DJF);**
- **Examine leading modes of atmospheric variability in the North Atlantic basin and Eurasian sector;**
- **Consider the effects of atmospheric variability in the Atlantic-Eurasian sector on the SST in the North Pacific and their changes between two periods under consideration;**
- **Summarizing and conclusion**

Data (1950-2013)

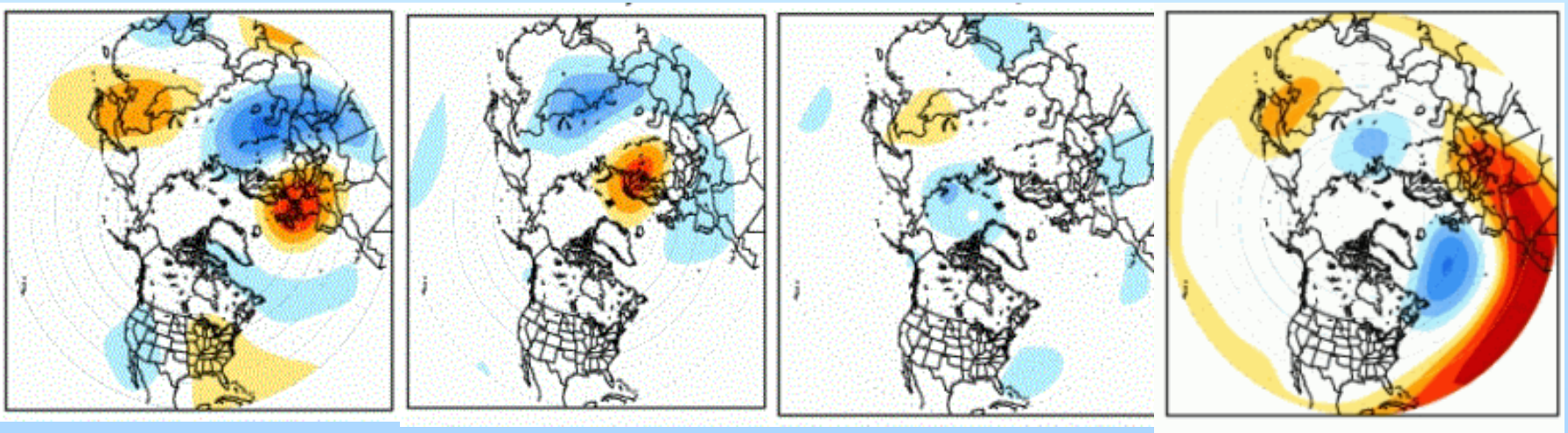
- Commonly used spatiotemporal datasets of monthly values SST, SLP and H_{500}

(www.esrl.noaa.gov/psd/data/gridded/ data.ncep.reanalysis.html)

- SST dataset from the Russian Hydrometeorological Centre (used for the cluster analysis);

- Time series of indices of main teleconnection patterns in the North Atlantic and Eurasian sectors (NAO, EA, SCA, EA/WR, POL/EUR) from http://www.cpc.ncep.noaa.gov/data/teledoc/telecontents.shtml

Spatial patterns of main Eurasian TP in January (positive phase)

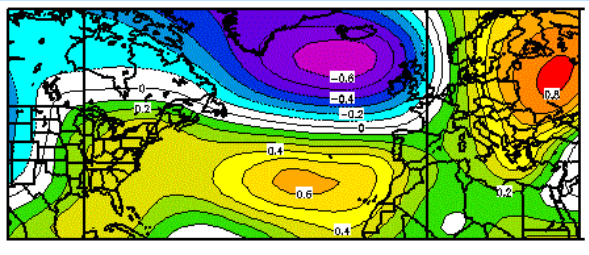


EA/WR SCA POL/EUR EA

http://www.cpc.ncep.noaa.gov/data/teledoc/

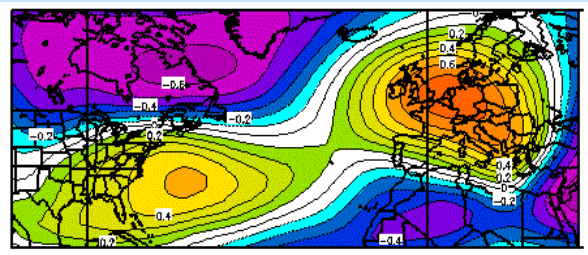
First 3 EOF's of mean winter (DJF) H500 field in the NA basin (20-70° N, 110° W-40° E): 1950-1976 (top) and 1977-2005 (bottom)

EOF1 (25.9%)



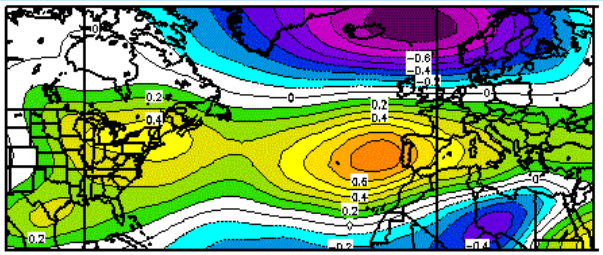
R(PC1; SCA) =0.78

EOF2 (16.4%)



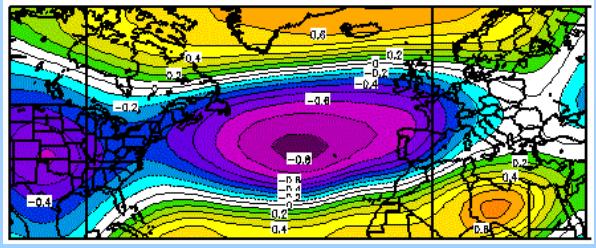
R(PC2; EA/WR) =0.52

EOF3 (15.4%)



R(PC3; NAO) =0.69

EOF1 (29.3%)

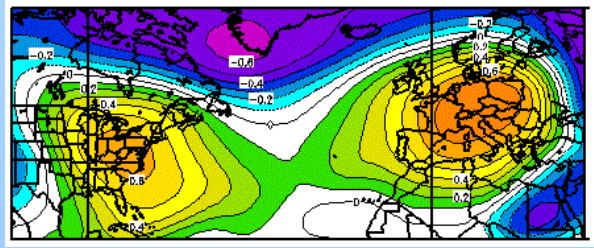


R(PC1;SCA) =0.58

R(PC1;NAO) = -0.80

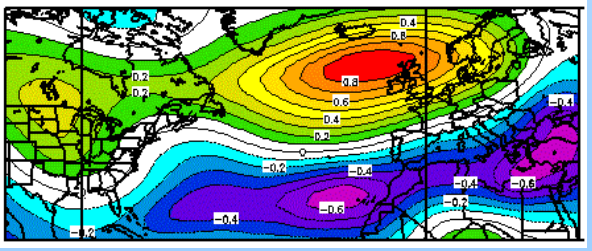
R(PC1;EA) =0.53

EOF2 (25.2%)



R(PC2; EA/WR) =0.70

EOF3 (13.1%)

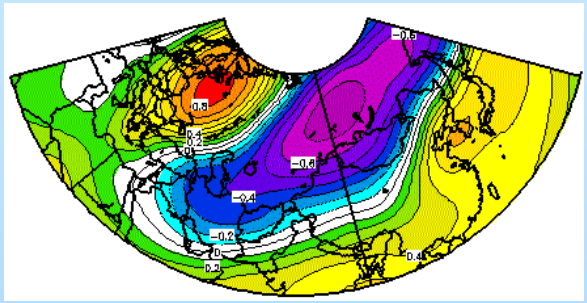


R(PC3; EU) =0.45

R(PC3;EA) = -0.48

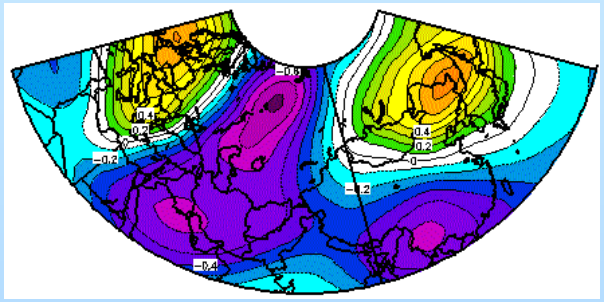
First 3 EOF's of mean winter (DJF) H500 field in the Eurasian sector (20-70° N, 0° E-150° E): 1950-1976 (top) and 1977-2005 (bottom)

EOF1 (33.8%)



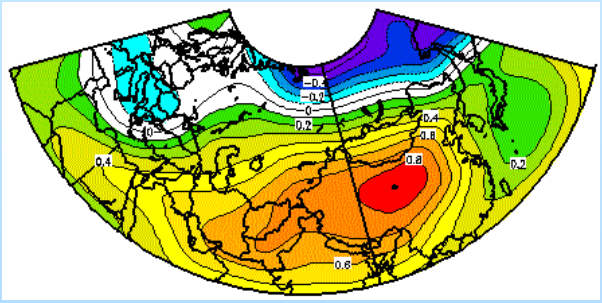
R(PC1; SCA)= 0.72

EOF2 (19.9%)



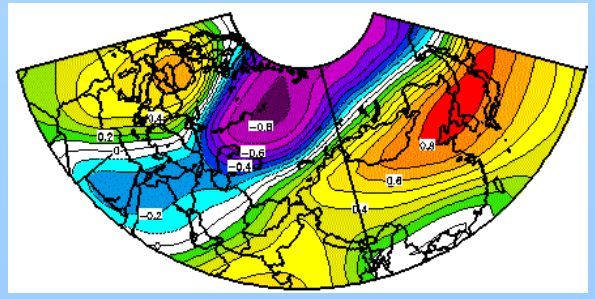
R(PC2; EA/WR)= 0.62

EOF3 (11.5%)



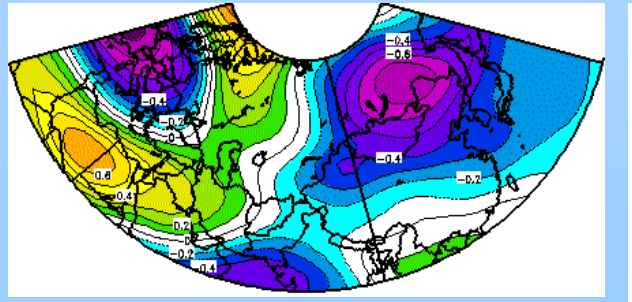
R(PC2; EU)= 0.16

EOF1 (38.5%)



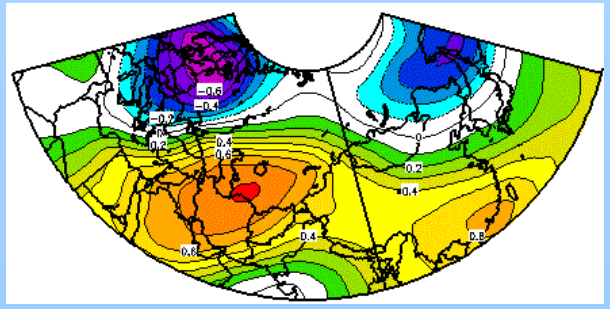
R(PC1; EA/WR)= 0.64

EOF2 (20.2%)



R(PC2; SCA)= 0.80

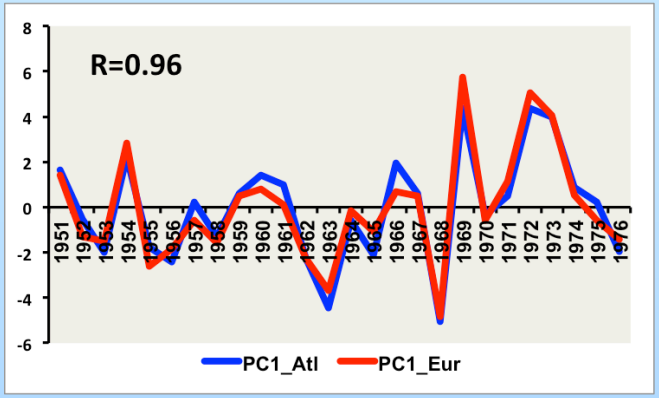
EOF3 (12.1%)

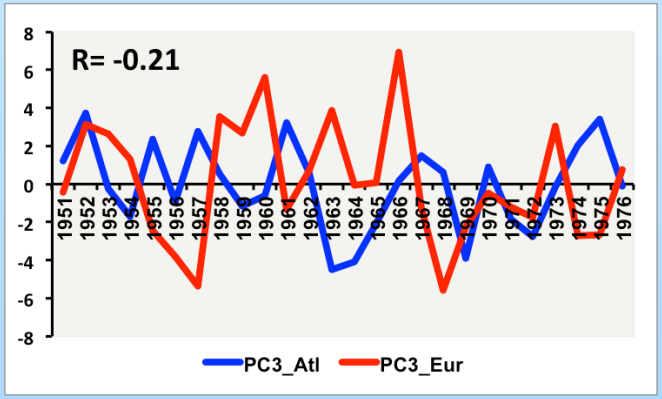


R(PC3; EU)= -0.50

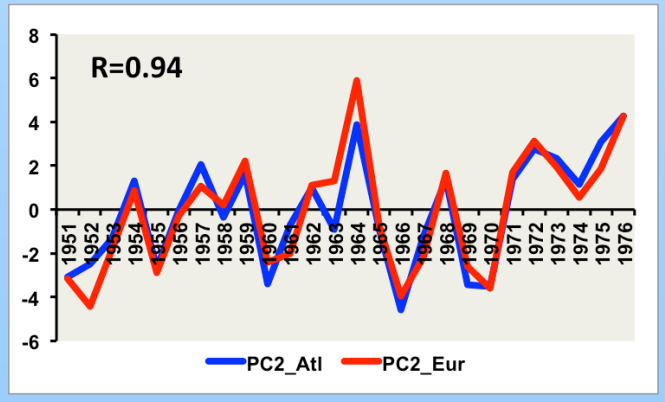
Association between first 3 PCs of 500 hPa heights in the Atlantic and Eurasian sectors (1950-1976)

Scandinavian Type



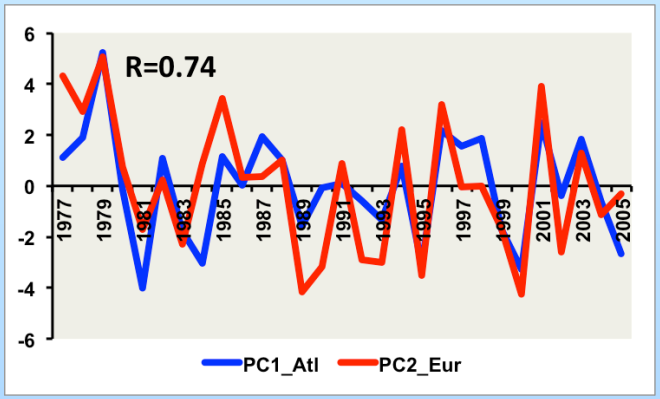


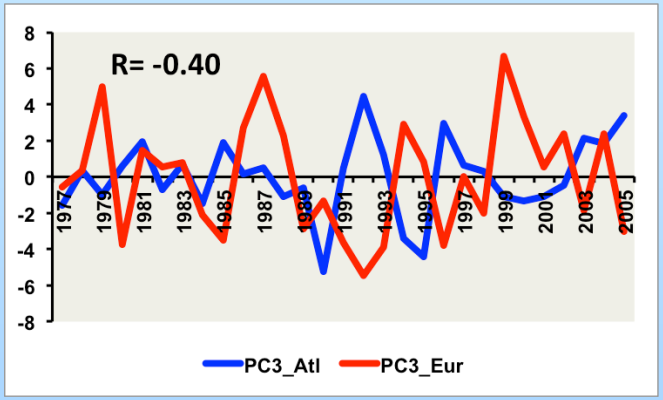
East Atlantic/West Russia Type



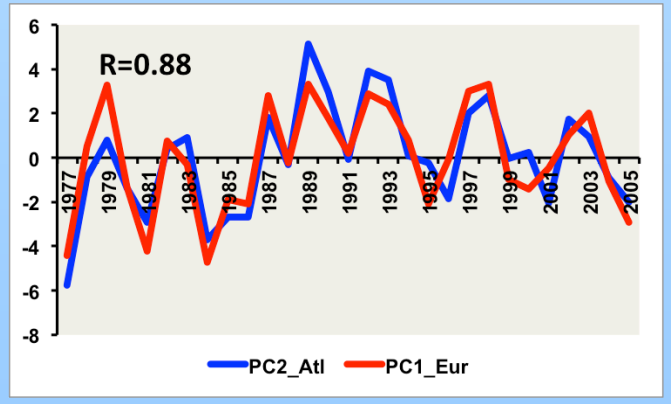
Association between first 3 PCs of 500 hPa heights in the Atlantic and Eurasian sectors (1977-2005)

Scandinavia Type

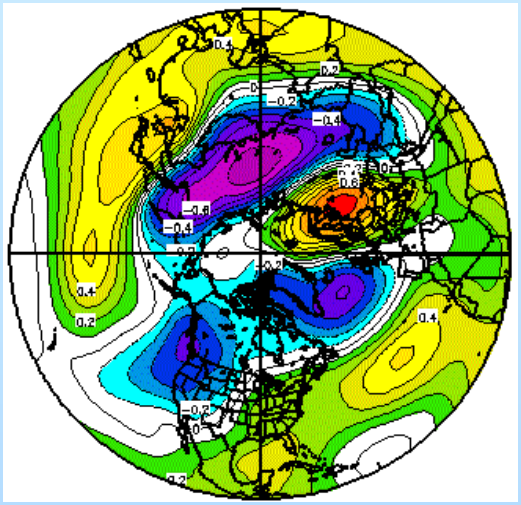


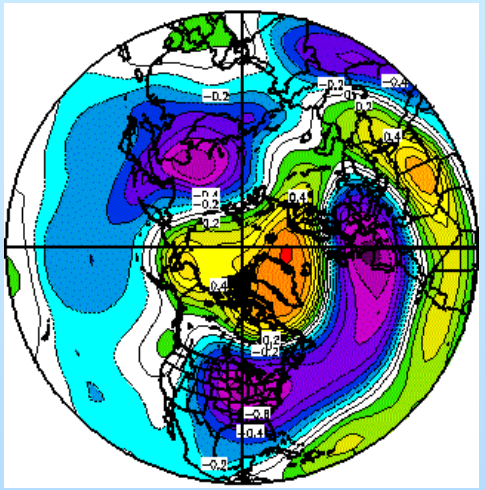


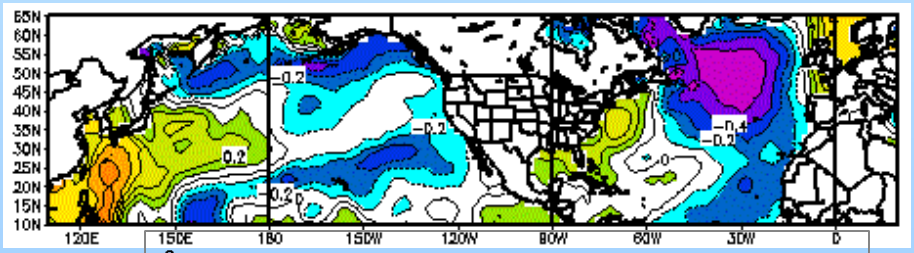
East Atlantic/West Russia Type

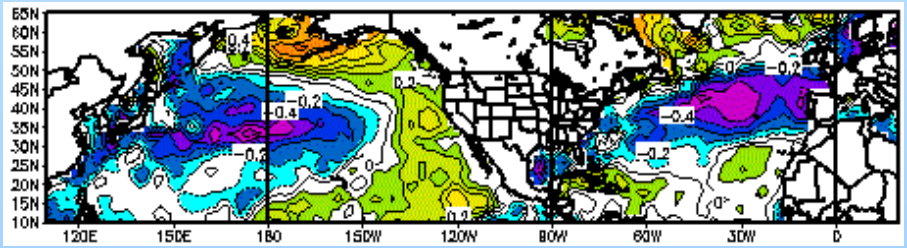


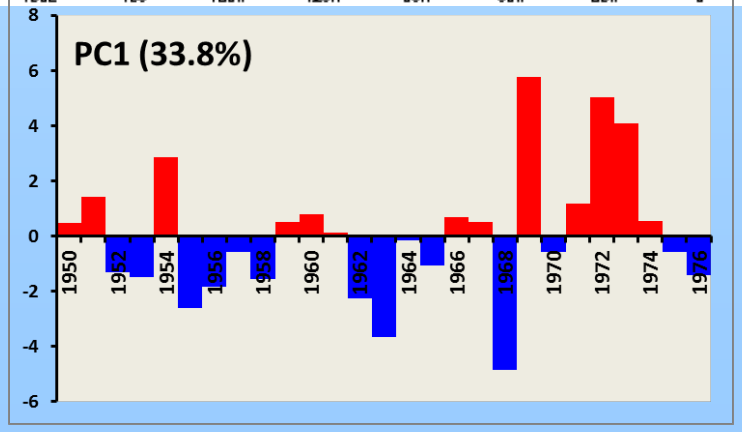
Effects of of climatic variability in the Atlantic – Eurasian sector associated with the Scandinavian-type pattern, on the North Pacific SST: 1950-1976 (left) and 1977-2005 (right)

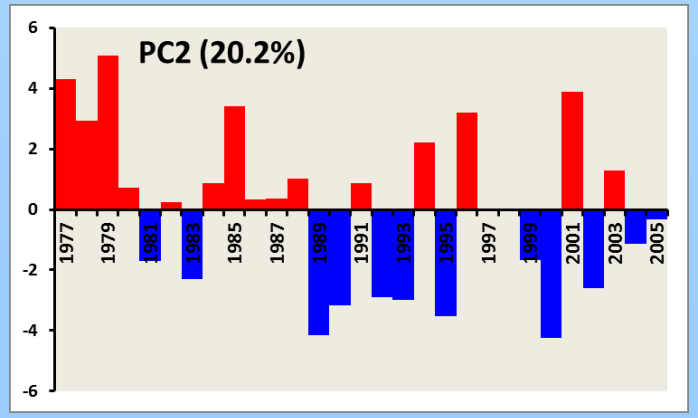




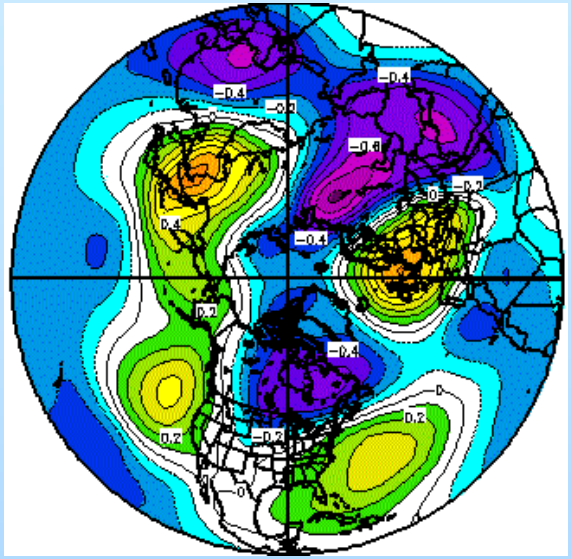


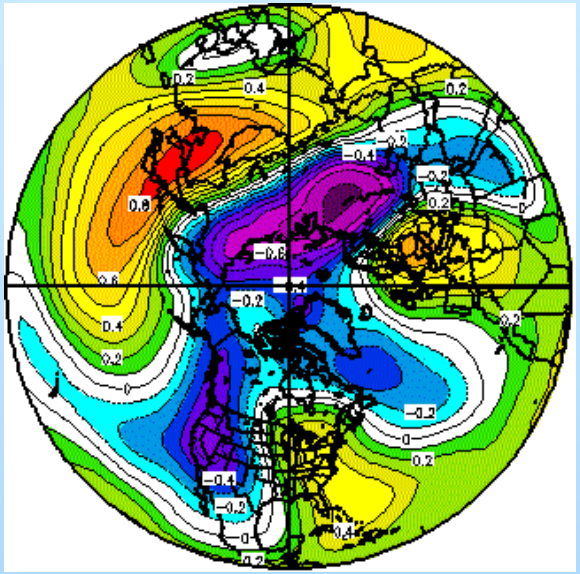


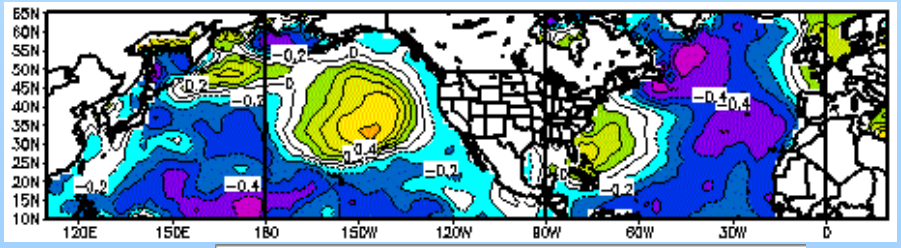


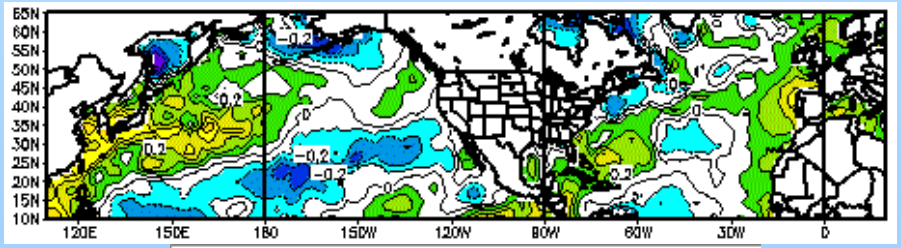


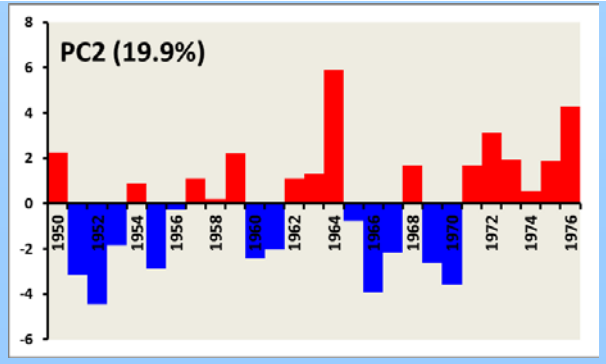
Effects of of climatic variability in the Atlantic – Eurasian sector associated with the EA/WR pattern, on the North Pacific SST: 1950-1976 (left) and 1977-2005 (right)

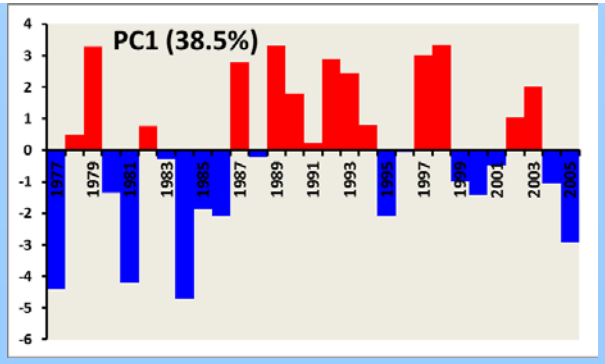








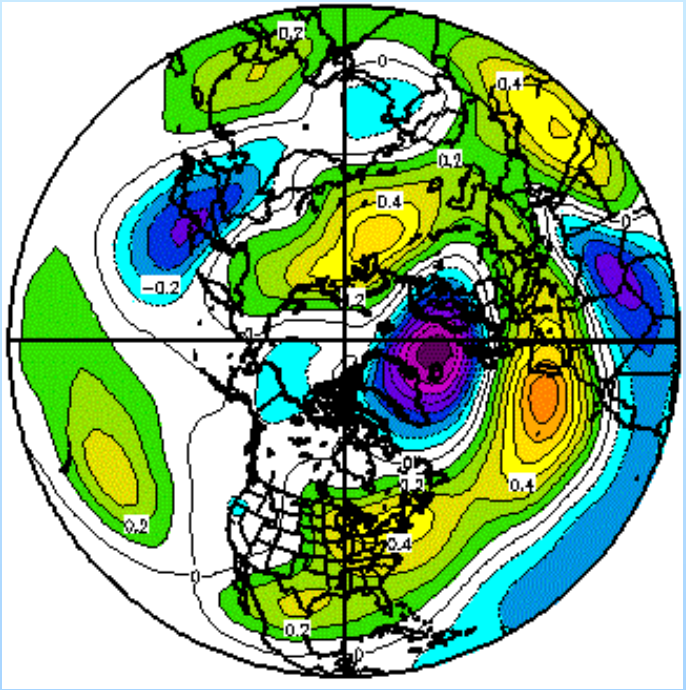


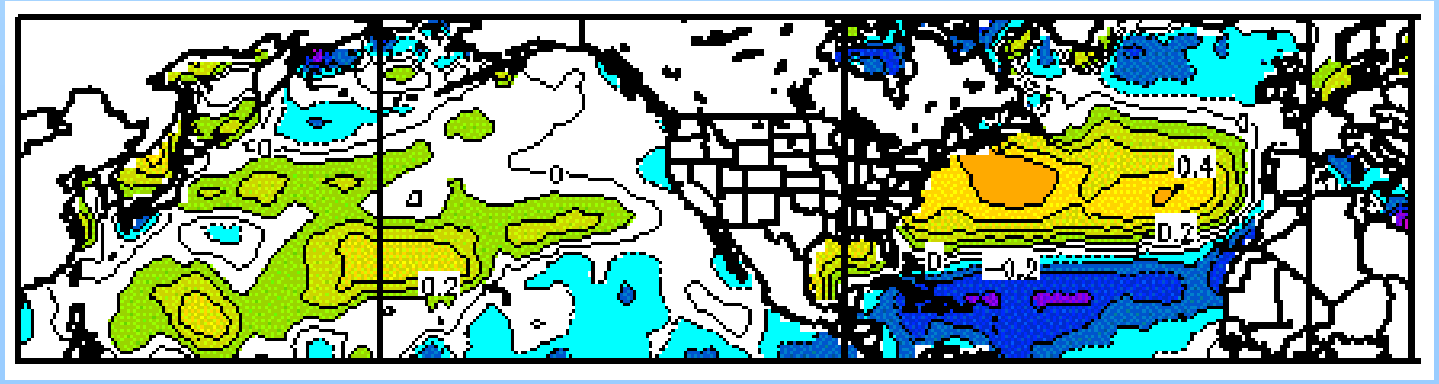


Association of EOF3 PC of H500 field in the Atlantic sector with the North Pacific SST (1950-1976)

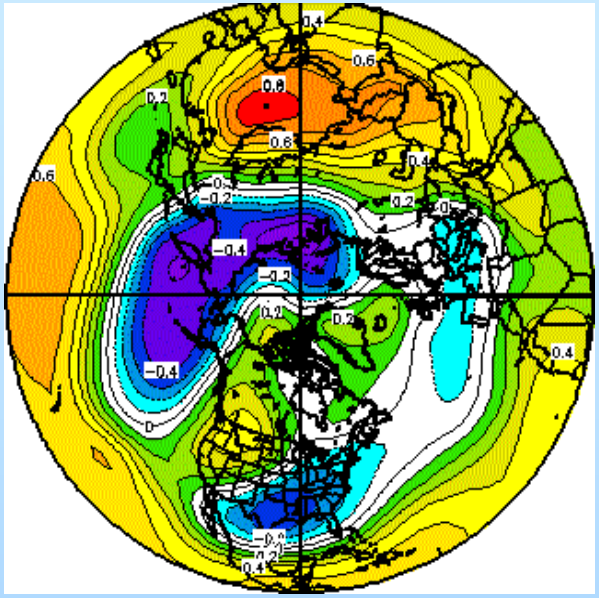
PC3
(15.4%)

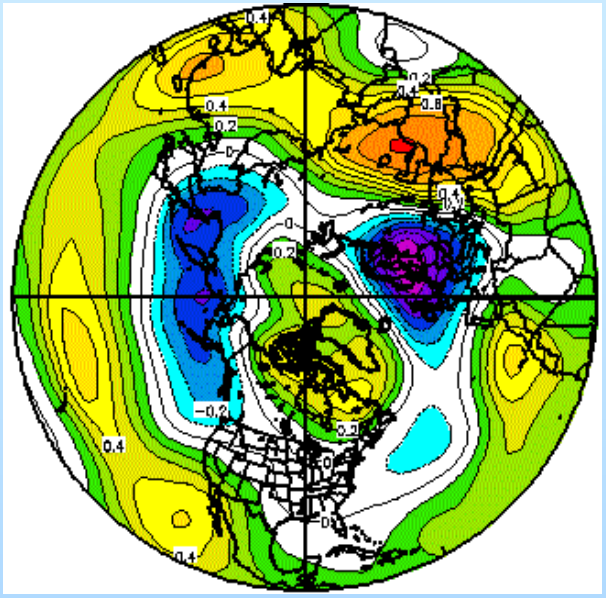
R(PC3; NAO) =0.69

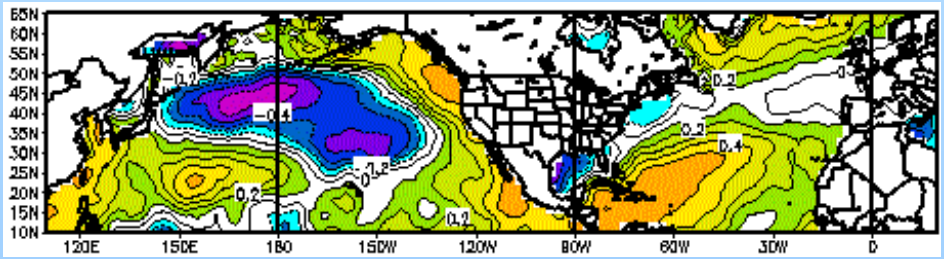


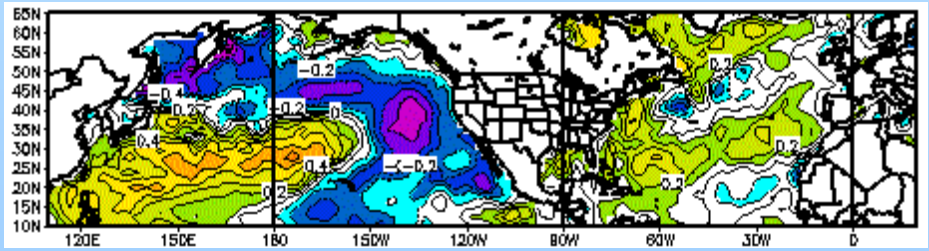


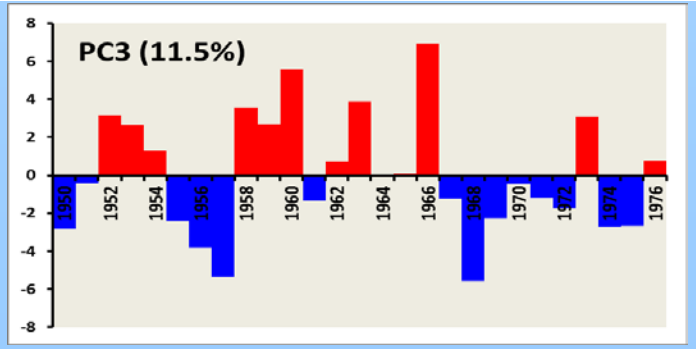
Effects of of climatic variability in the Eurasian sector associated with its EOF3, on the North Pacific SST 1950-1976 (left) and 1977-2005 (right)

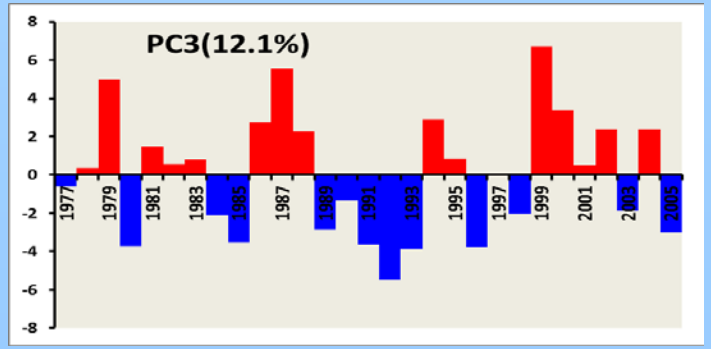




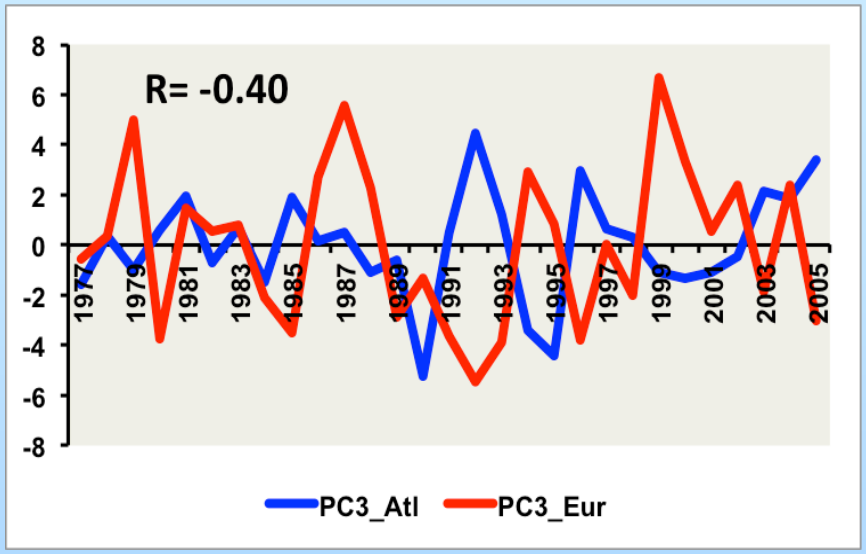


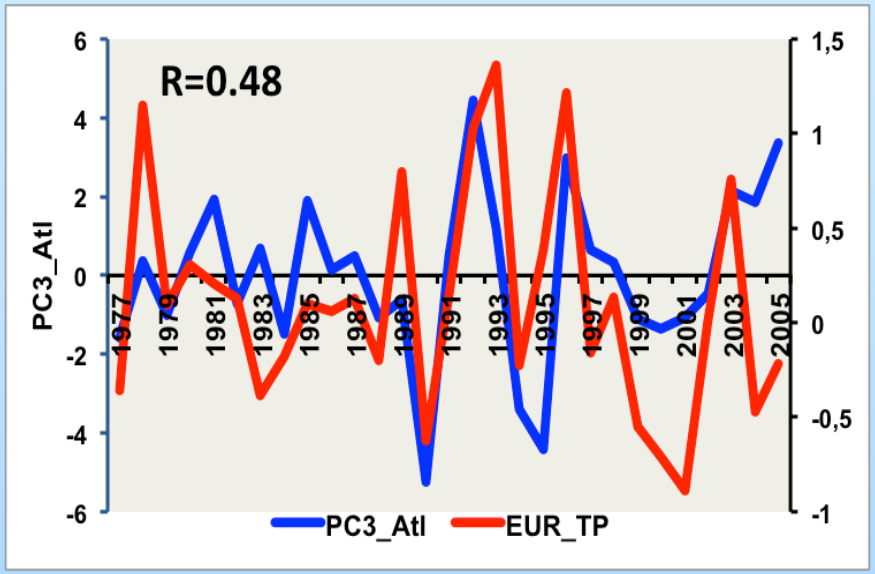


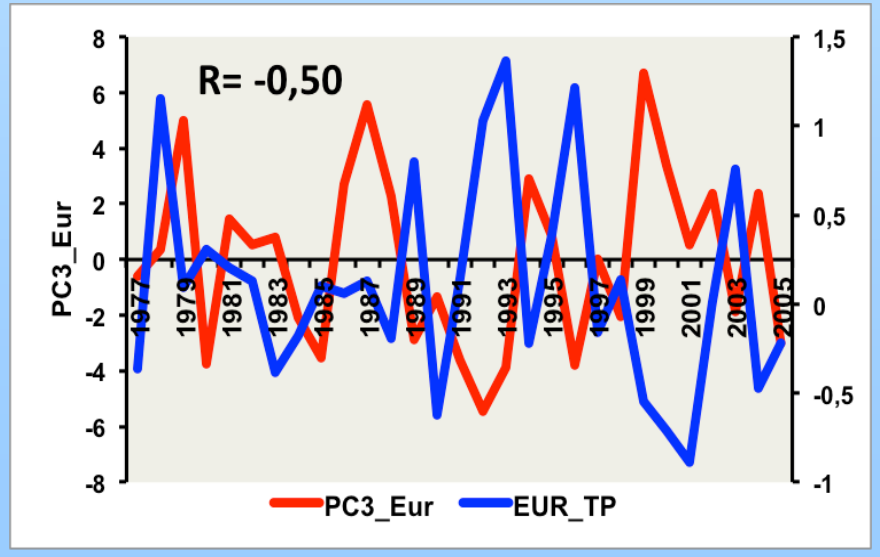


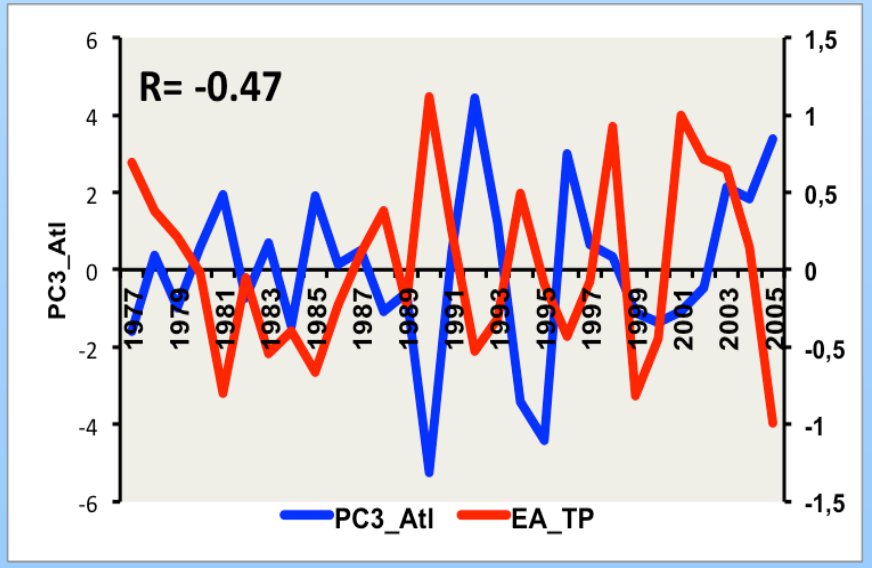


Association between indices of atmospheric variability in the Atlantic and Eurasian sectors (1977-2005)

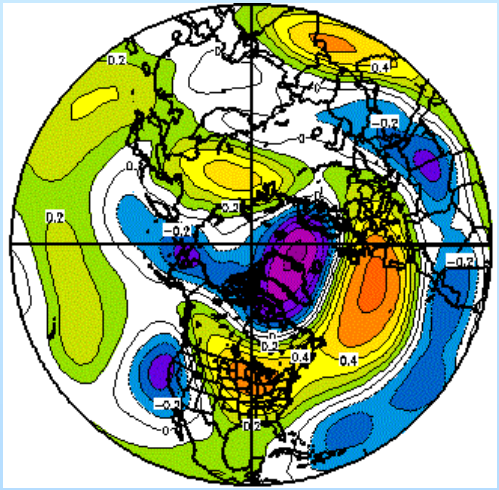








Lagged correlations between sum of normalized winter anomalies of Azores High and Icelandic Low longitudes and H500 (1978-2005)



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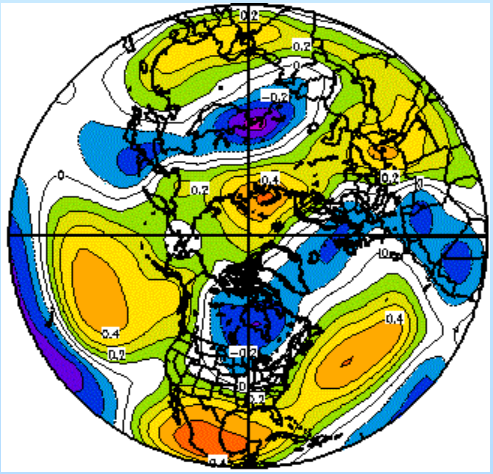

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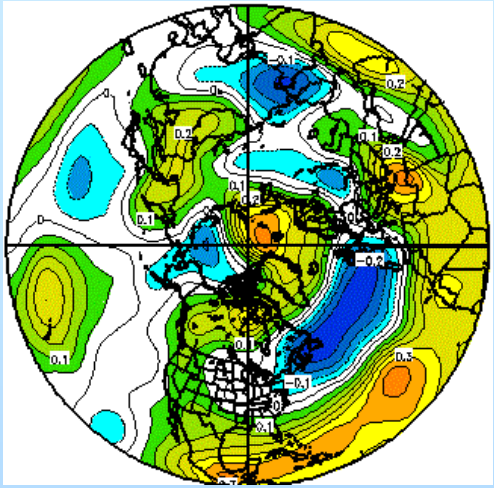

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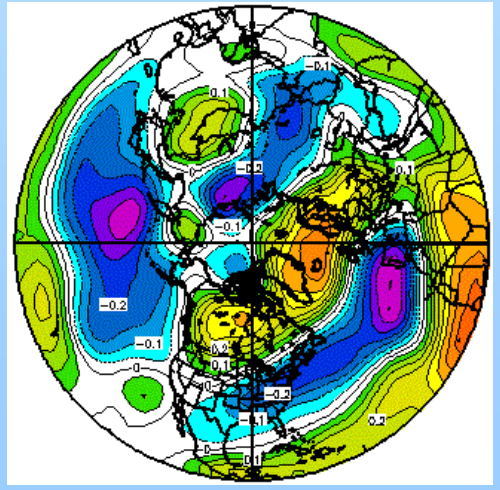

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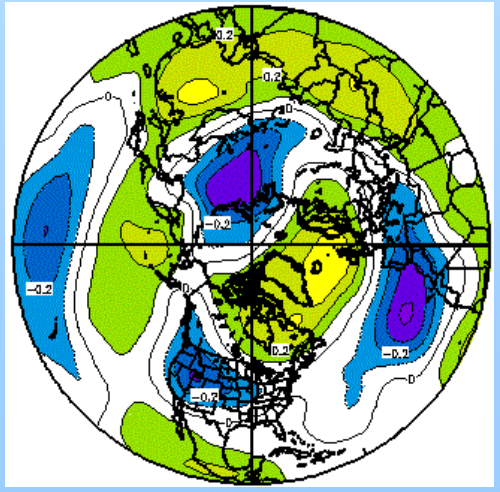

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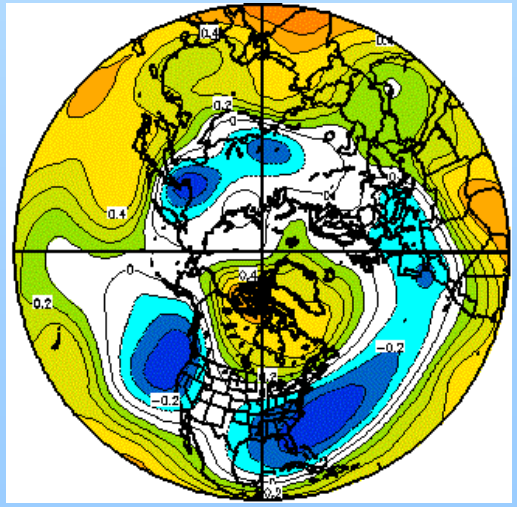

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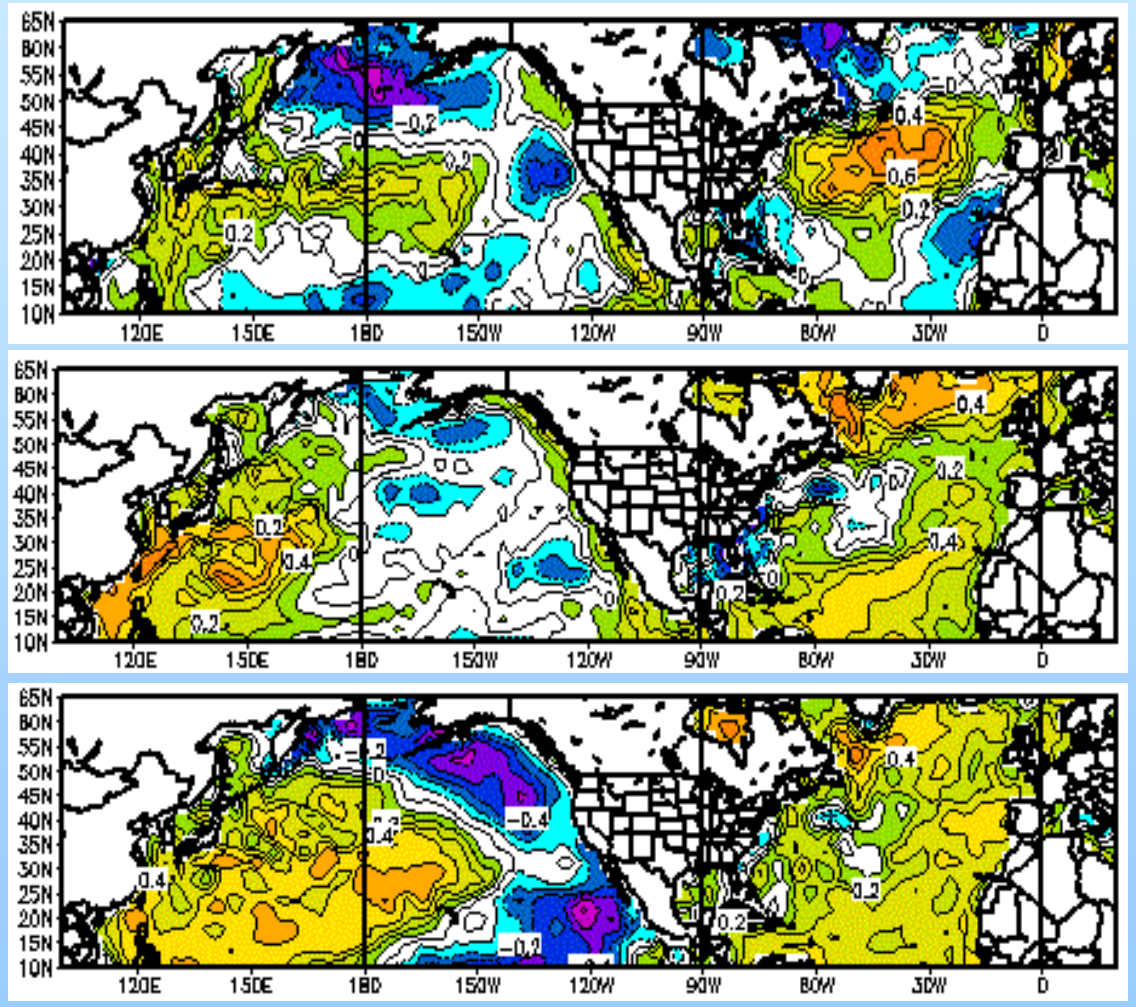
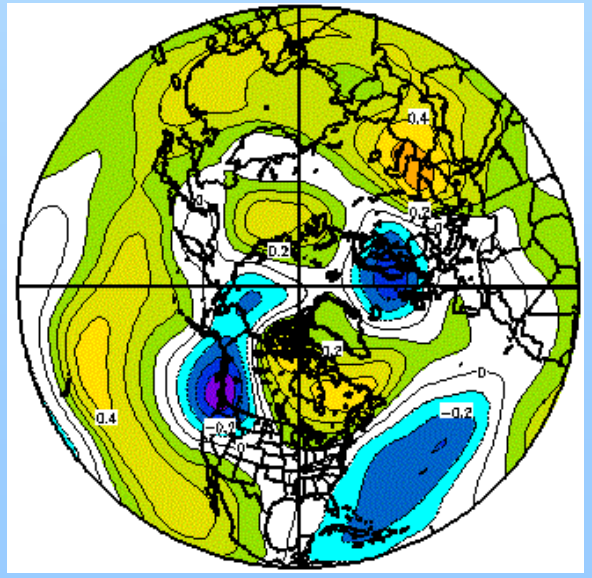
Lagged correlations between sum of normalized winter anomalies of Azores High and Icelandic Low longitudes and winter (DJF) SST (1978-2005)





Conclusions

(1) Effects of the North Atlantic climate variability on the North Pacific SST are realized via the teleconnection patterns over the Eurasian sector;

(2) There is an evidence of strengthening of the North Atlantic impact on the western NP since the late 1970s, associated with the eastward shift of the NAO centers. The shift to warmer SST regime in the western NP in the late 1980s corresponded well to shifts in the state of the Eurasian teleconnection patterns;

(3) Also, there is evidence of lagged response of the North Pacific on longitudinal shift in the NAO centers. And

(4) recent warming in the North Pacific, especially pronounced in its western half, may be, at least partly, associated with the intensification of the East Atlantic mode of variability that was accompanied by increase in 500 hPa heights over southern Europe- northern Africa and its propagation into the western NP.


Thank you for attention