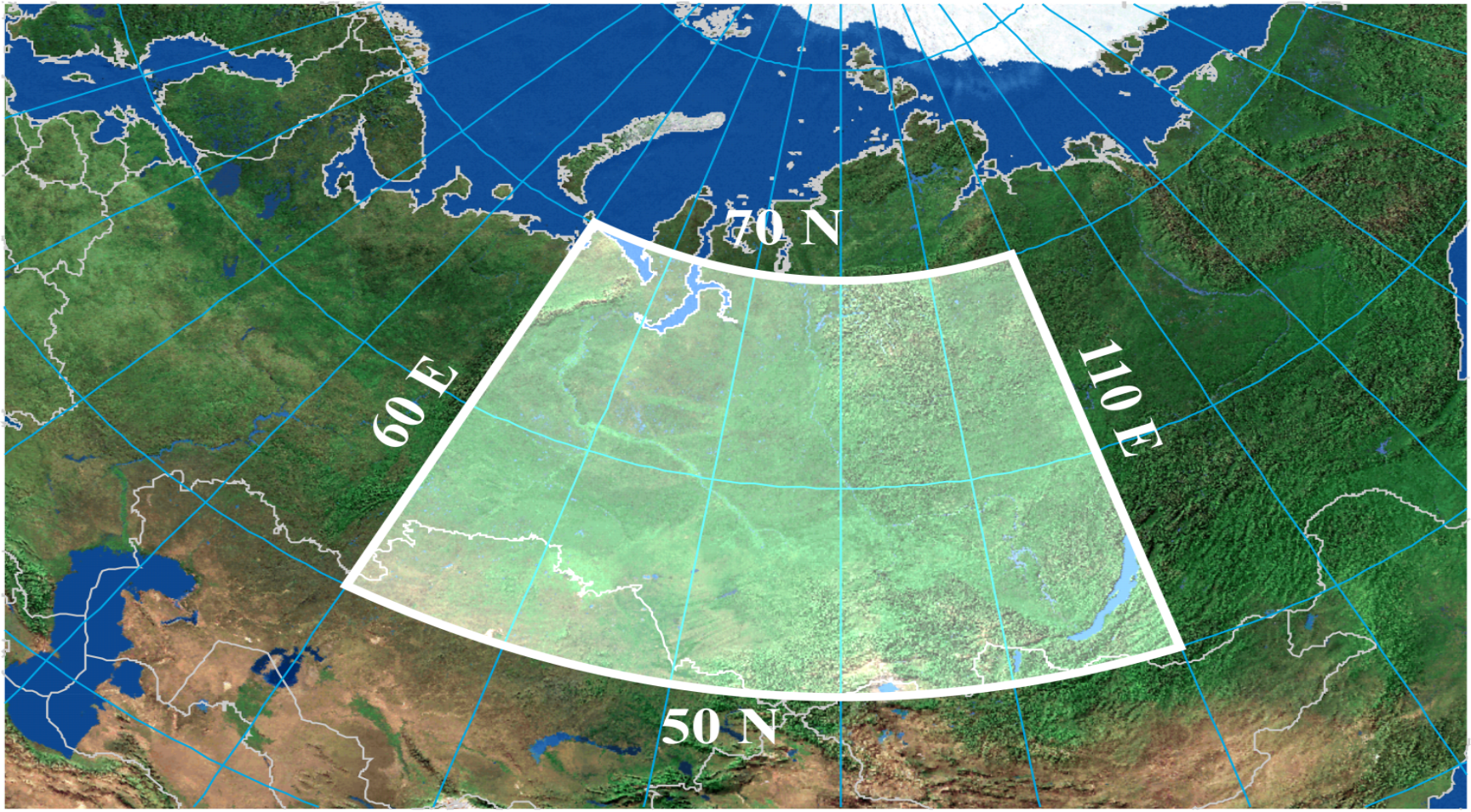



Area-study

# DATA

- the daily observational data (ftp://ftp.cdc.noaa.gov/pub/data/gsod/) at 169 stations during 1976–2006
- the SCAND, NAO and ENSO teleconnection indices (http://www.cpc.ncep.noaa.gov) describing the global circulation
- 6-hours surface synoptic maps from the archive of West-Siberian Interregional territorial Administration of Federal Service for Hydrometeorology and Environmental Monitoring (West-Siberian AHEM)
- 6-hours data from Reanalysis 20th Century v2 during 1891–2008 (http://www.esrl.noaa.gov/psd/data/gridded/data.20thC_ReanV2.html)

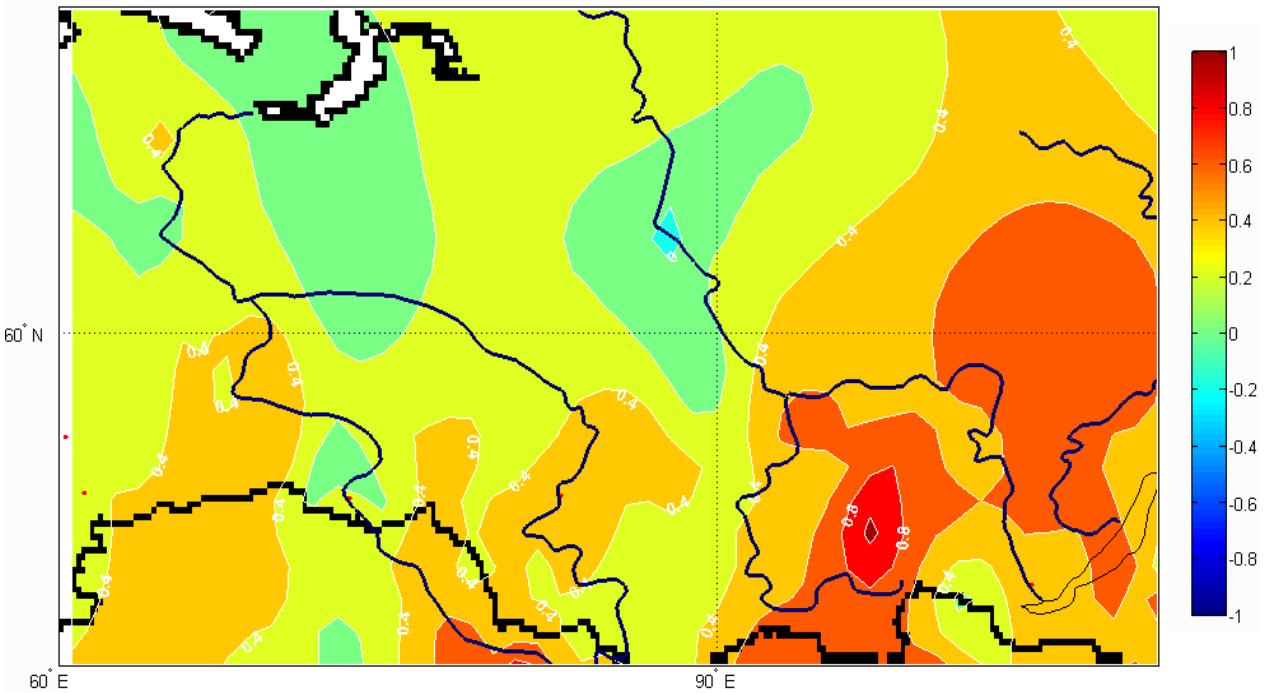
# The Influence of Atmospheric Circulation on the Temperature Regime of Siberia at the time of Current Global Warming

*[1]Ippolitov I.I., [2]Gorbatenko V.P., [1]Kabanov M.V., [1]Loginov S.V., [1]Podnebesnych N.V.*

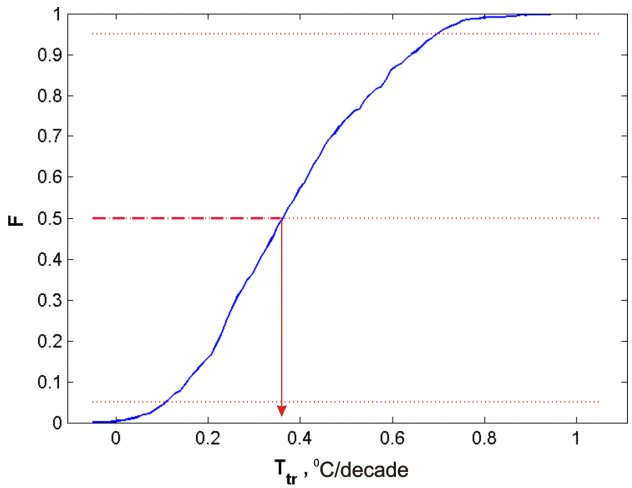
[1]Institute of Monitoring of Climatic and Ecological Systems, SB RAS, Tomsk, Russia

[2]High voltages research institute at Tomsk Polytechnic University, Tomsk, Russia

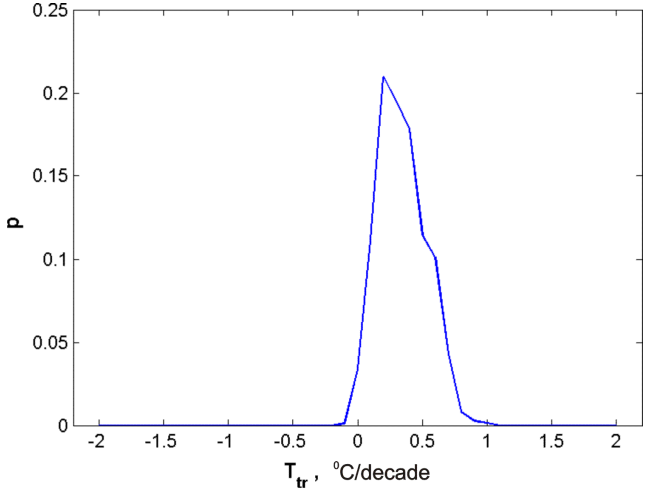
# The spatial distribution of annual temperature trend $T_{tr}$ ($^0$C/decade) on Siberian region in 1976-2006



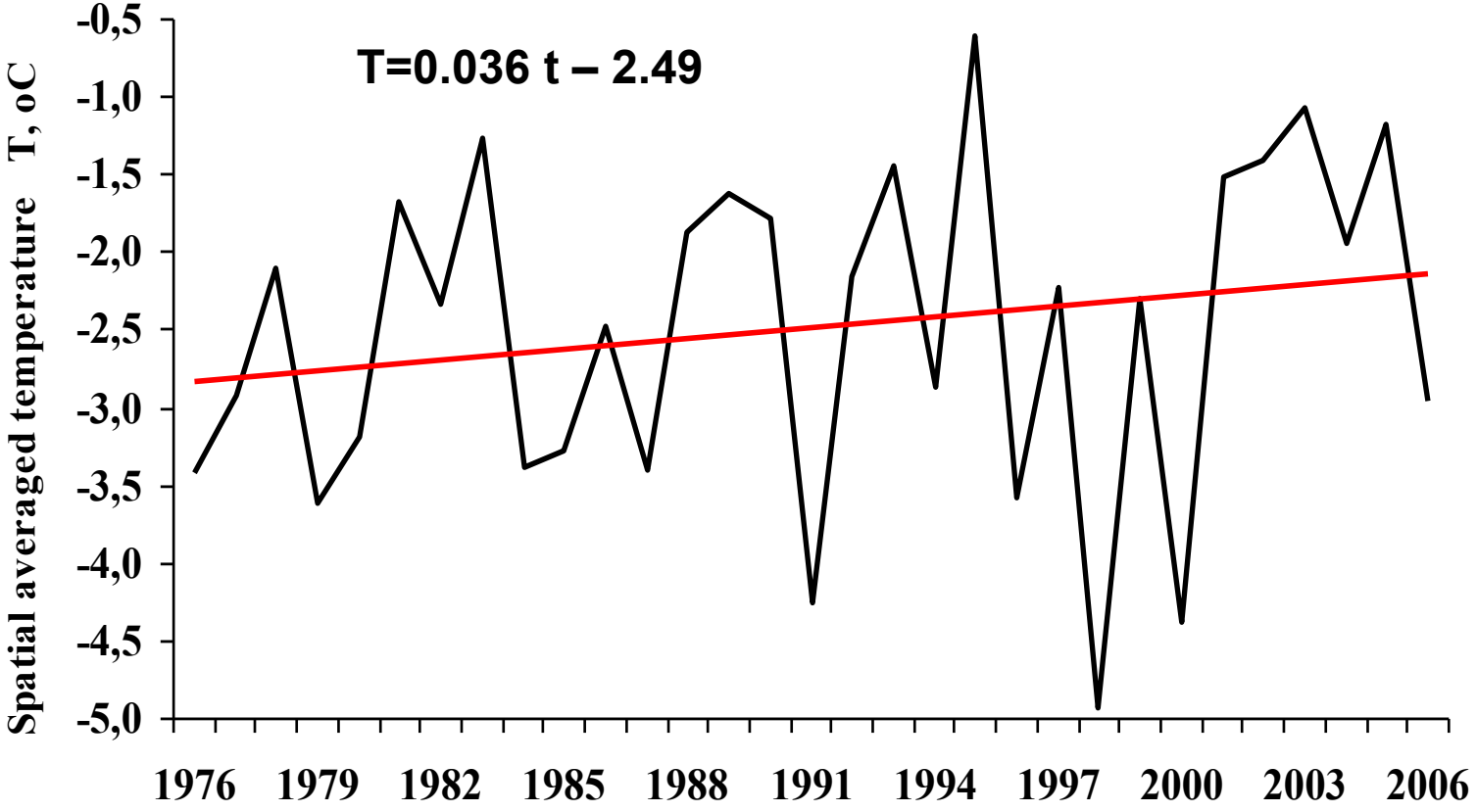

169 Station




The distribution function of $T_{tr}$



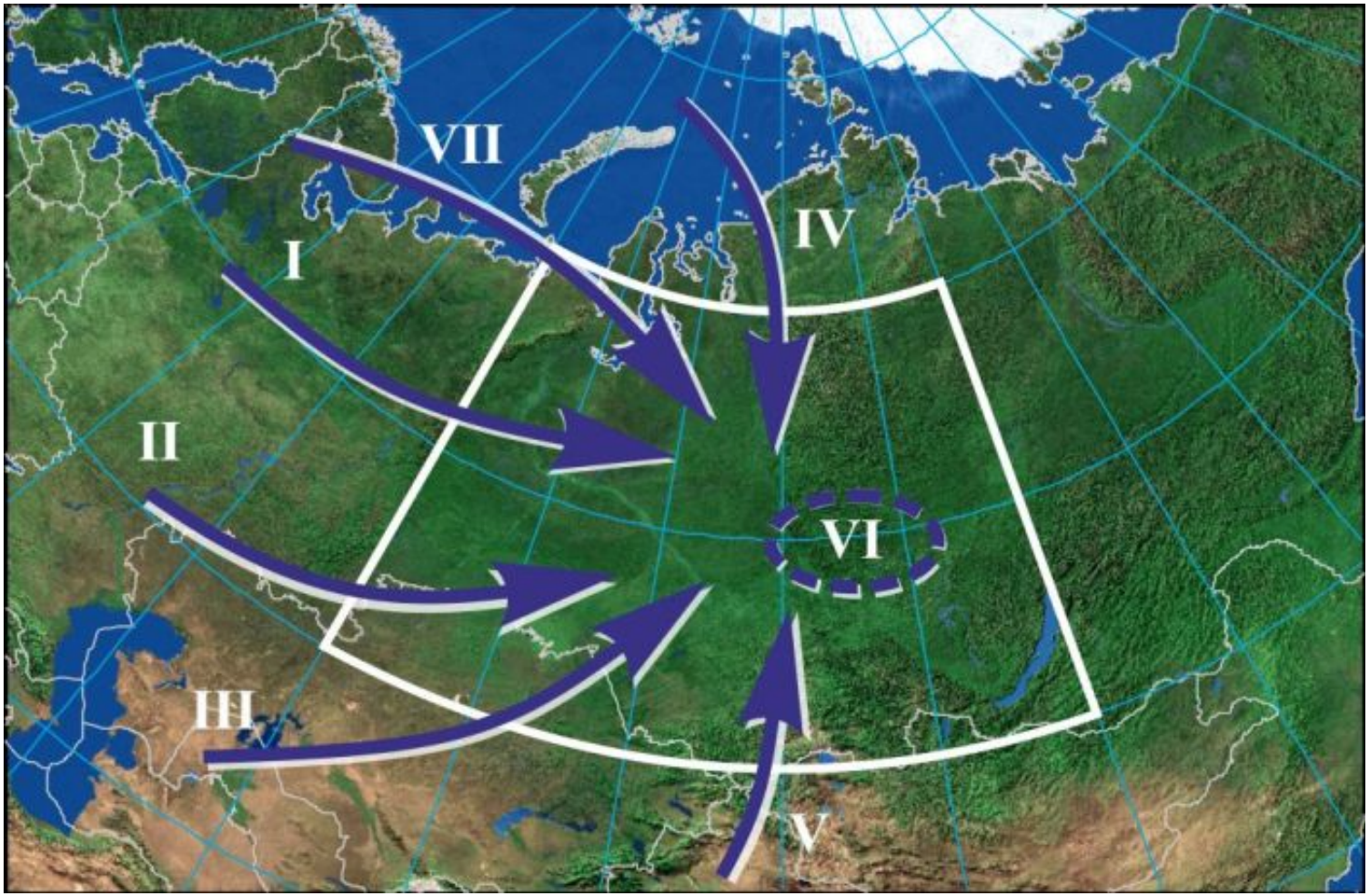

The probability density function of $T_{tr}$



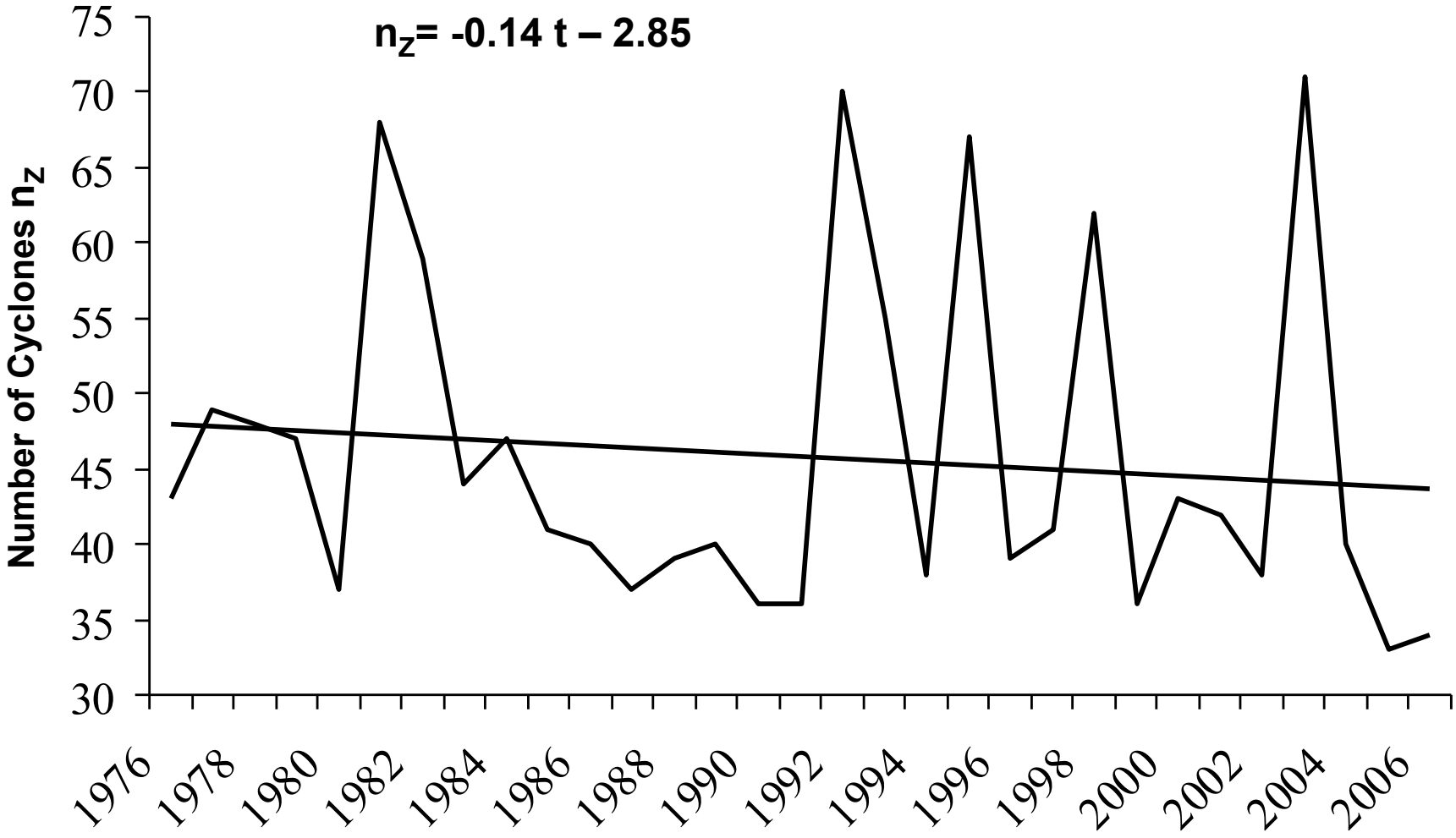

**Year-to-year changes in the spatial averaged annual temperature T and its trend $T_{tr}$. Trend is significant in terms of** 0.05

# Spatial averaged temperature and its linear trends for each month

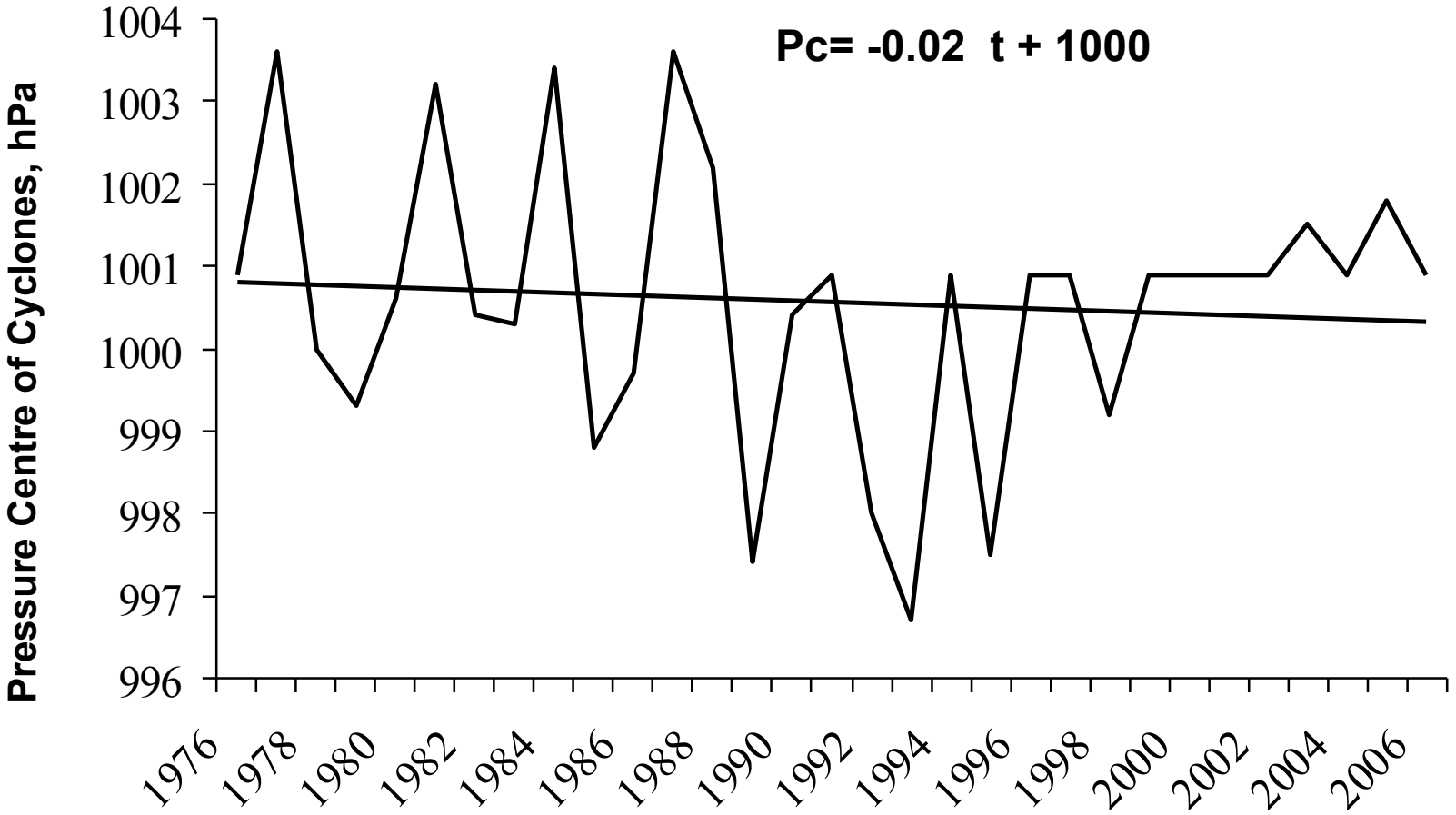
| Month | $\bar{T}$ ,°C | $\sigma_{\bar{T}}$ ,°C | $\overline{T_{tr}}$ ,°C/decade | $\sigma_{\bar{T}\,tr}$, °C/ decade |
|---|---|---|---|---|
| Jan | -22.23 | 5.86 | 0.19 | 0.53 |
| Feb | -19.71 | 5.30 | **0.83** | 0.50 |
| Mar | -10.79 | 4.94 | **0.**77 | 0.34 |
| Apr | 1.83 | 5.28 | 0.01 | 0.41 |
| May | 6.64 | 4.66 | **0.73** | 0.27 |
| Jun | 14.23 | 3.13 | **0.30** | 0.25 |
| Jul | 17.52 | 1.99 | 0.29 | 0.30 |
| Aug | 14.09 | 1.91 | 0.21 | 0.28 |
| Sep | 6.94 | 2.17 | 0.01 | 0.16 |
| Oct | -1.68 | 3.64 | **0.60** | 0.30 |
| Nov | -12.47 | 5.40 | -0.26 | 0.51 |
| Dec | -19.38 | 5.64 | 0.04 | 0.32 |
| Year | -2.70 | 4.07 | **0.36** | 0.18 |



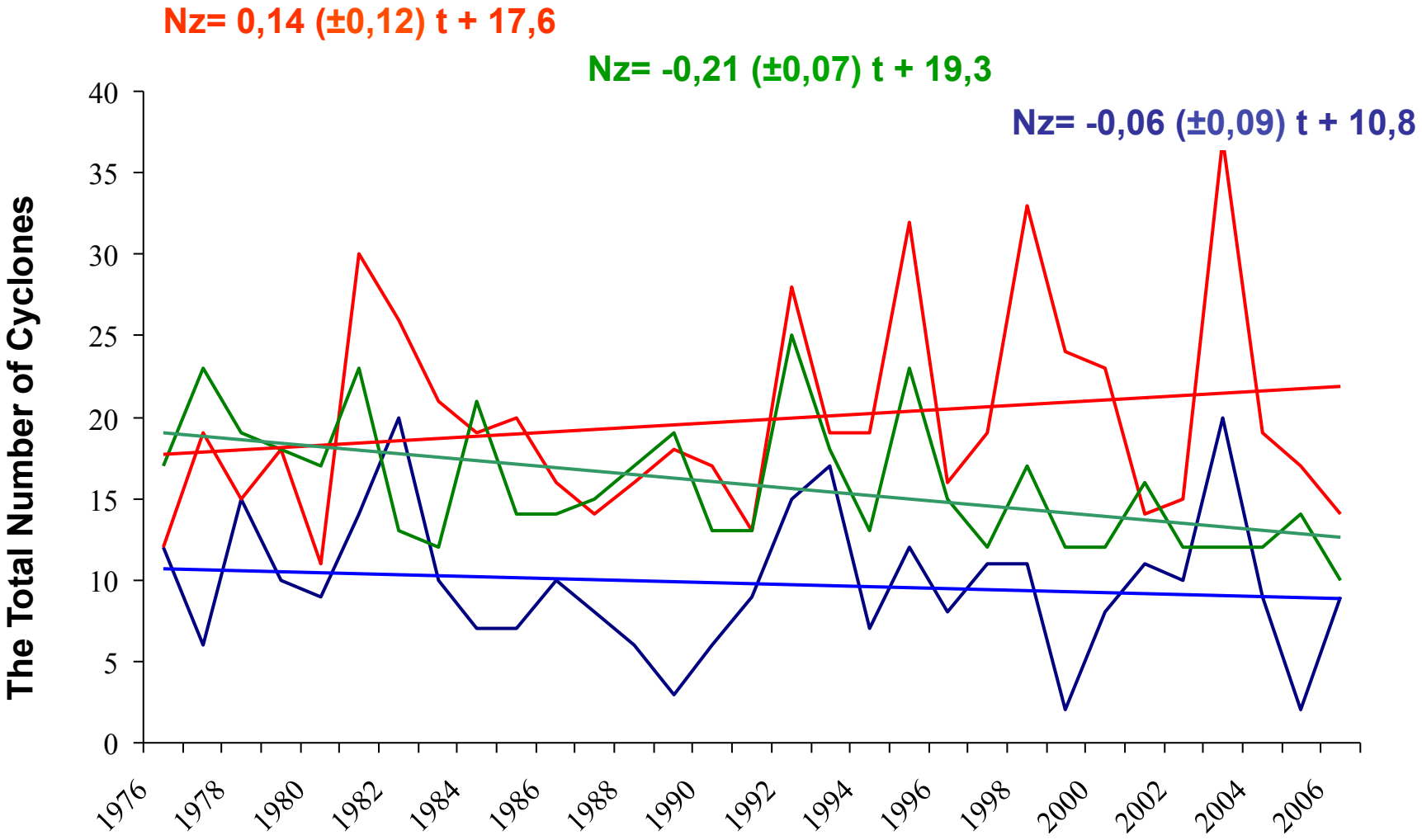

The selected trajectories of cyclones (I÷VII)
entrance to the region ‘Sib’ (white line)




**The total number of cyclones $n_z$, which income to the region 'Sib' by synoptic maps. Trend is significant in terms of** 0.05

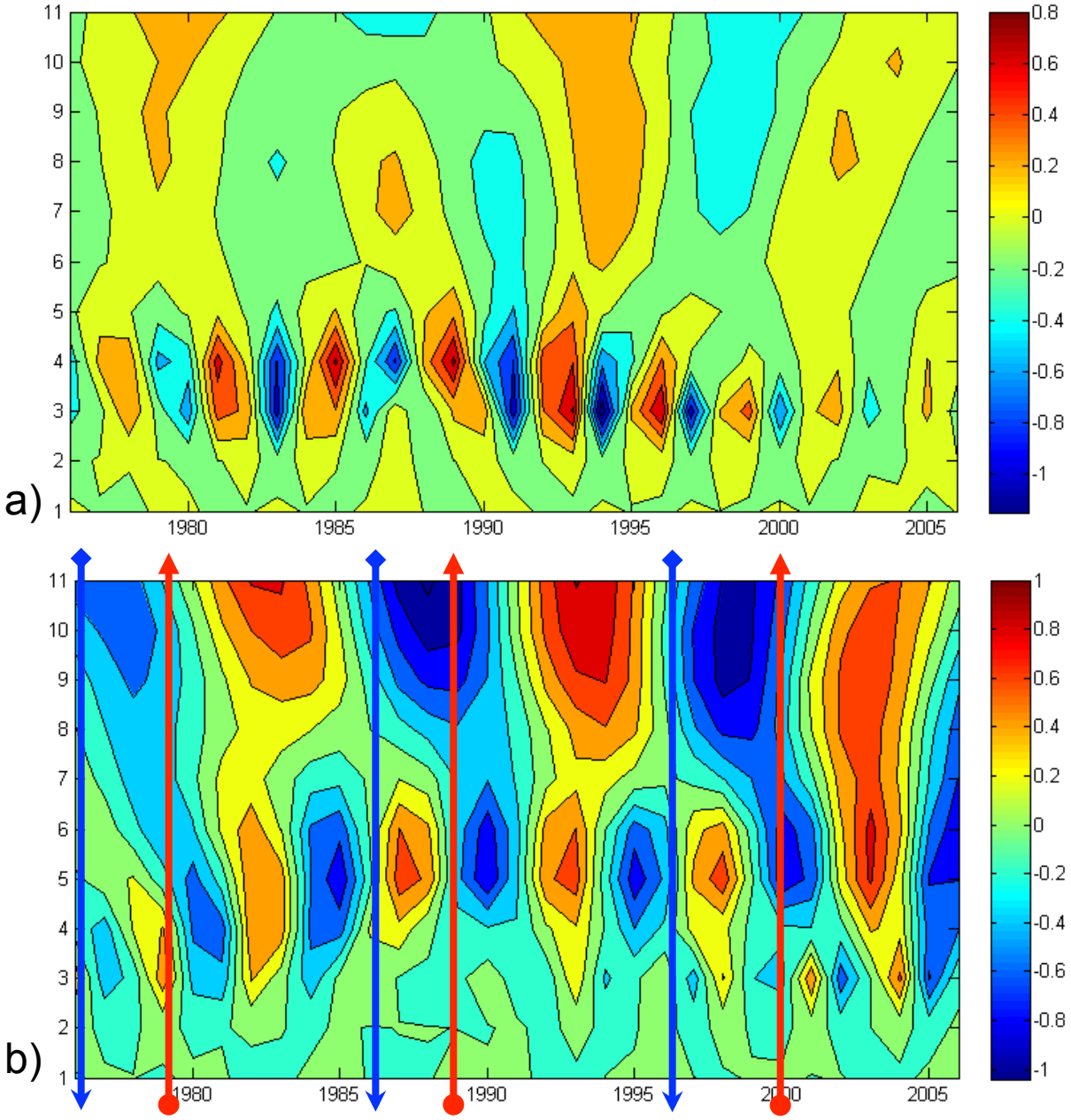


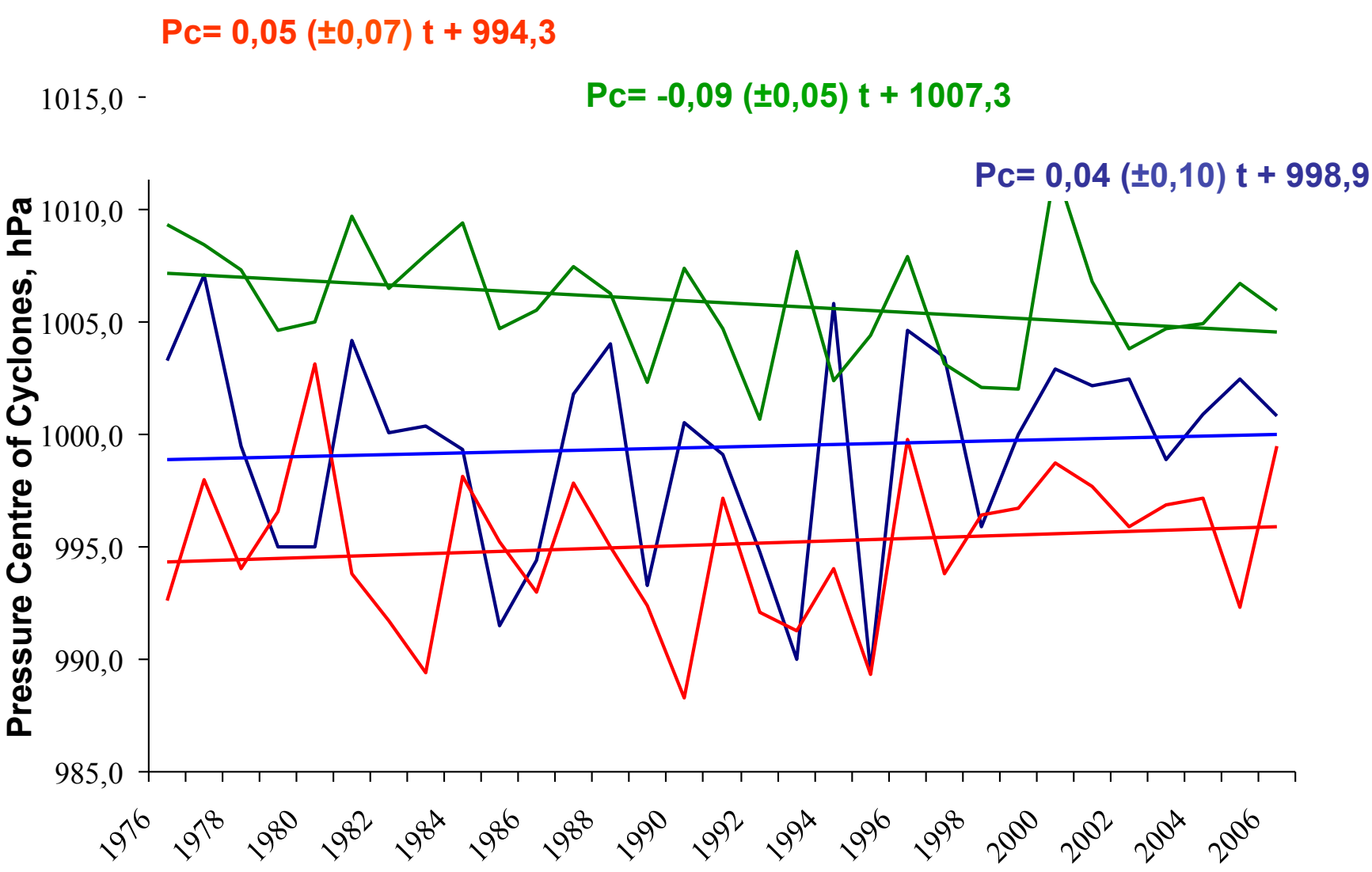

**Year-to-year changes in the spatial averaged annual pressure centre of cyclones Pc and its trend $Pc_{tr}$ Trend is not significant in terms of** 0.05




**Variability in the number of cyclones for West (blue), North (red) and South (green) direction. The equations of regression are shown**

**wavelet spectra of the Variabilities of cyclones for South (a) and West (b) direction.**






**Variability in the pressure centre of cyclones for West (blue), North (red) and South (green) direction. The equations of regression are shown**

**Table 1** Estimates of linear trends (events per decade) in the number of cyclones of different intensity for different regions together with statistical significance (*t*-test)

| Intensity | Northern Hemisphere | Atlantic sector | Pacific sector | Arctic |
|---|---|---|---|---|
| All cyclones | −12.4** | −8.9*** | −3.3* | −0.2 |
| 980–1000 hPa | −13.1** | −6.2*** | −4.0** | −2.8 |
| < 980 hPa | 0.7 | −2.7*** | 0.7 | 2.7* |

*$P$ = 90% level; **$P$ = 95% level; ***$P$ = 99% level

Gulev S.K. et al Climate Dynamics, 2001, 17, 795-809

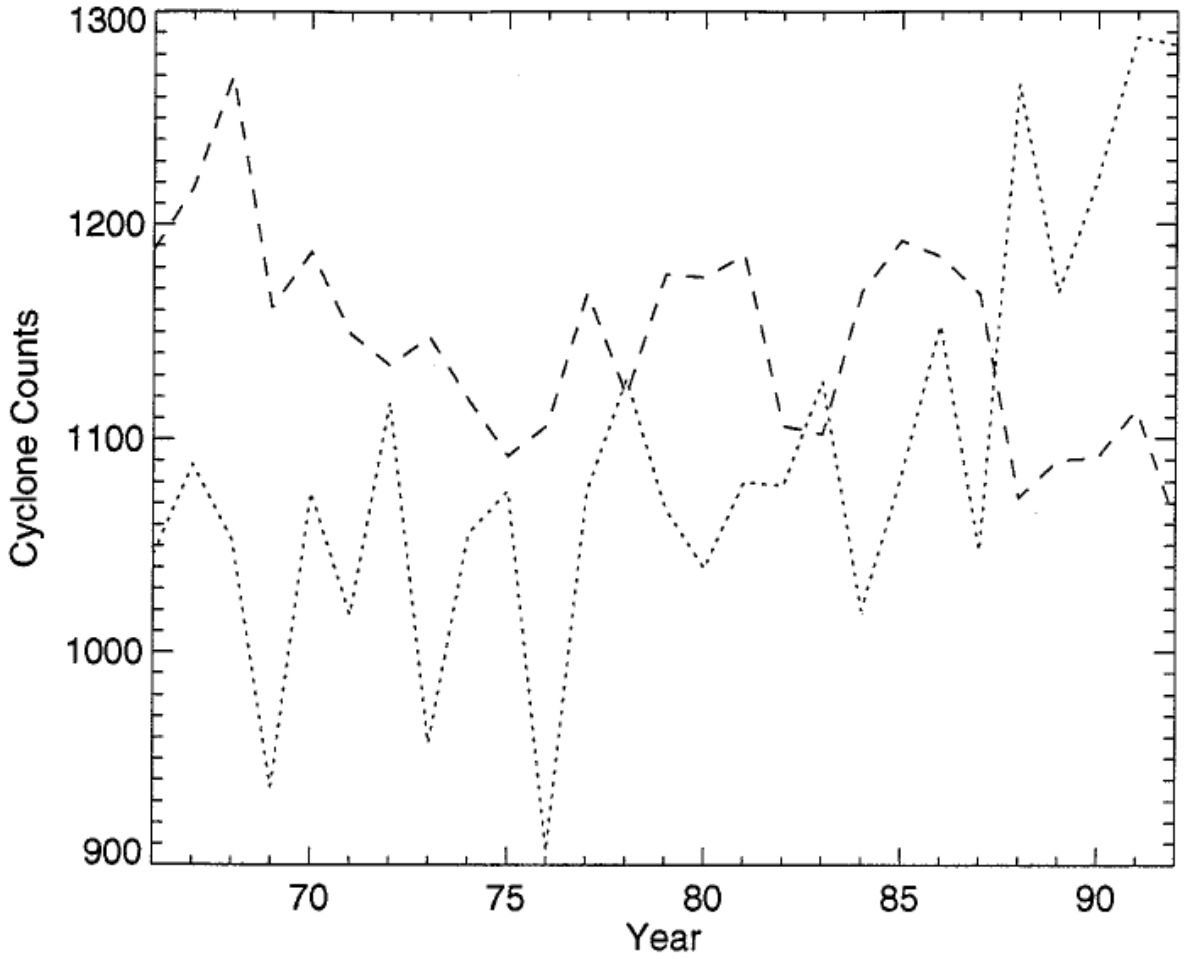
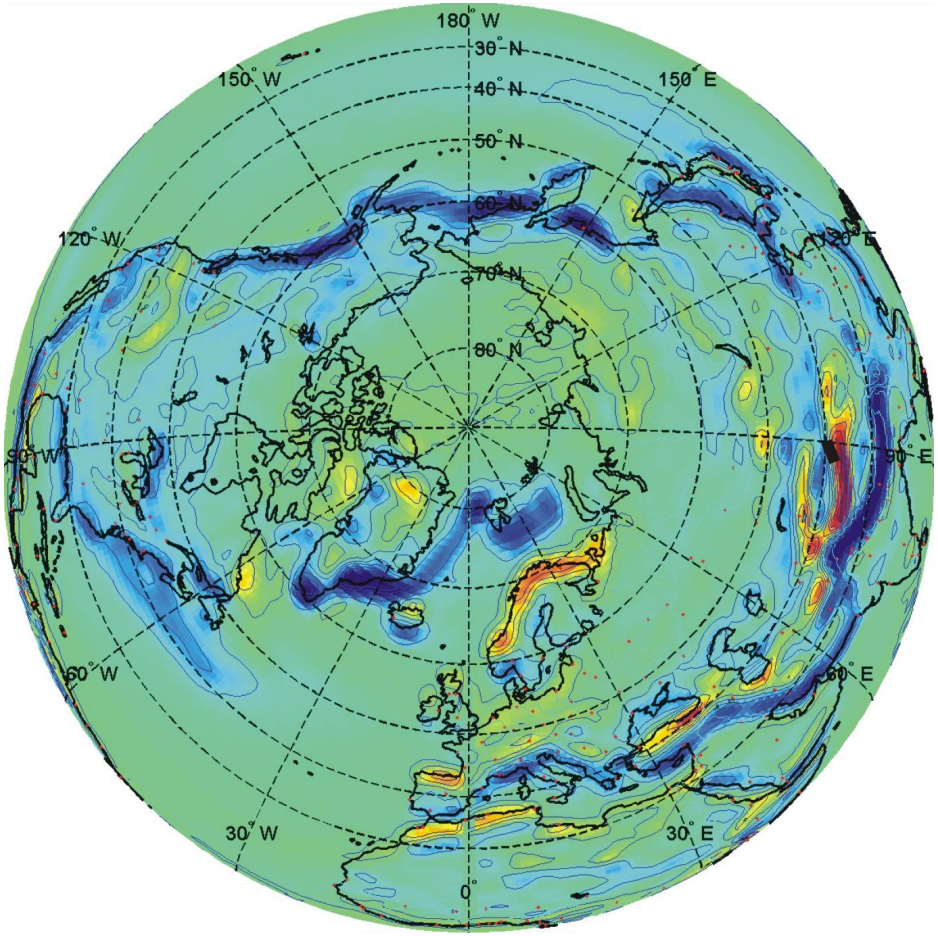


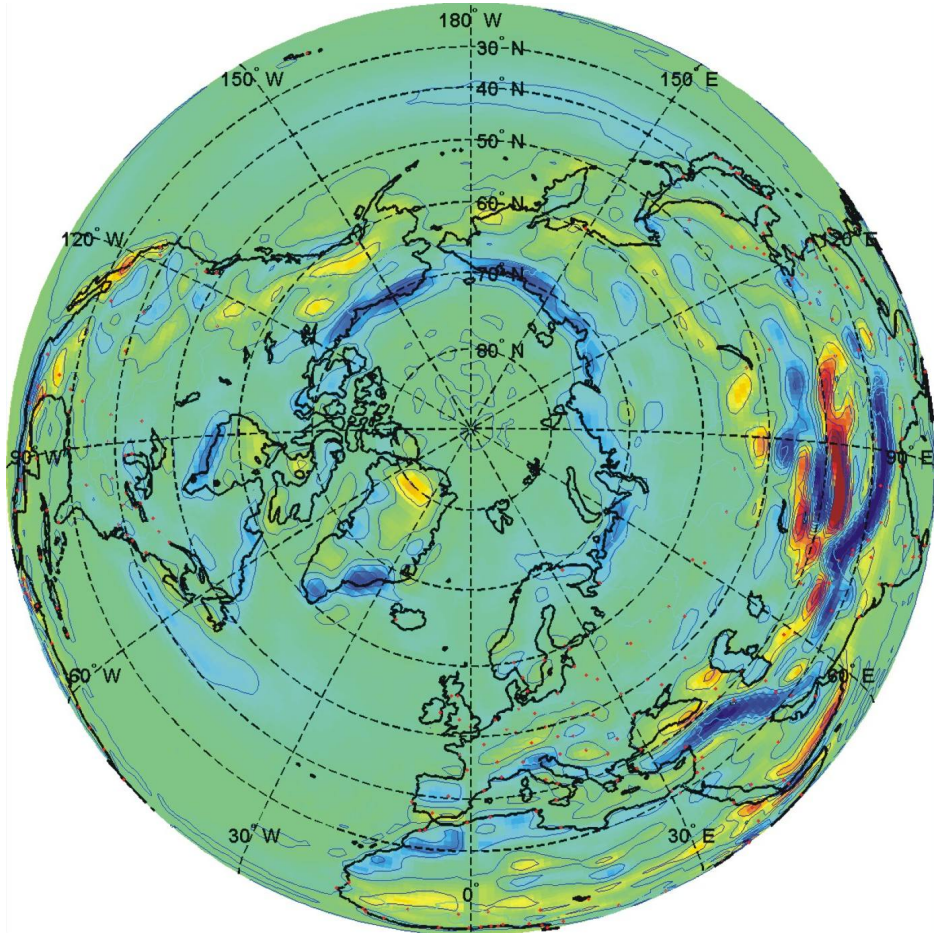

FIG. 9. Time series of cold season cyclone counts (1966/67 to 1992/93) for north of $60^0$N (dotted lines) and for $30^0$–$60^0$N (dashed lines). To display both time series on the same scale, counts for the $30^0$–$60^0$N zonal band have been divided by two.

Serreze M.C. et al *J. Climate,* 1997,*v***10, 453**–464

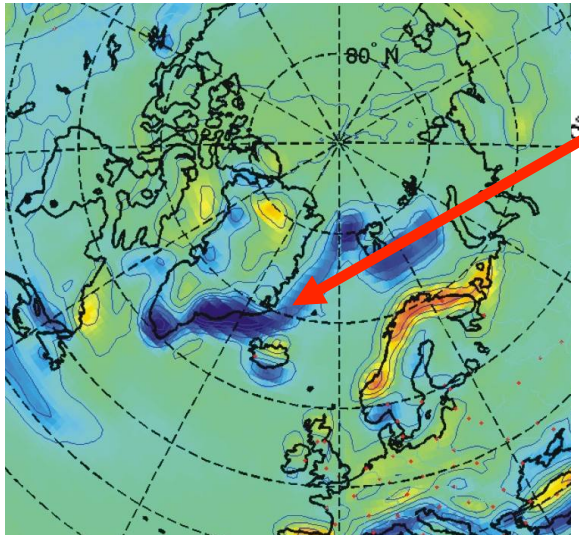
The mean climatological locations of zones baroclinity between 1979-2008, obtained by calculating grad T at the grid 995gPa 1.125 ° x 1.125 °

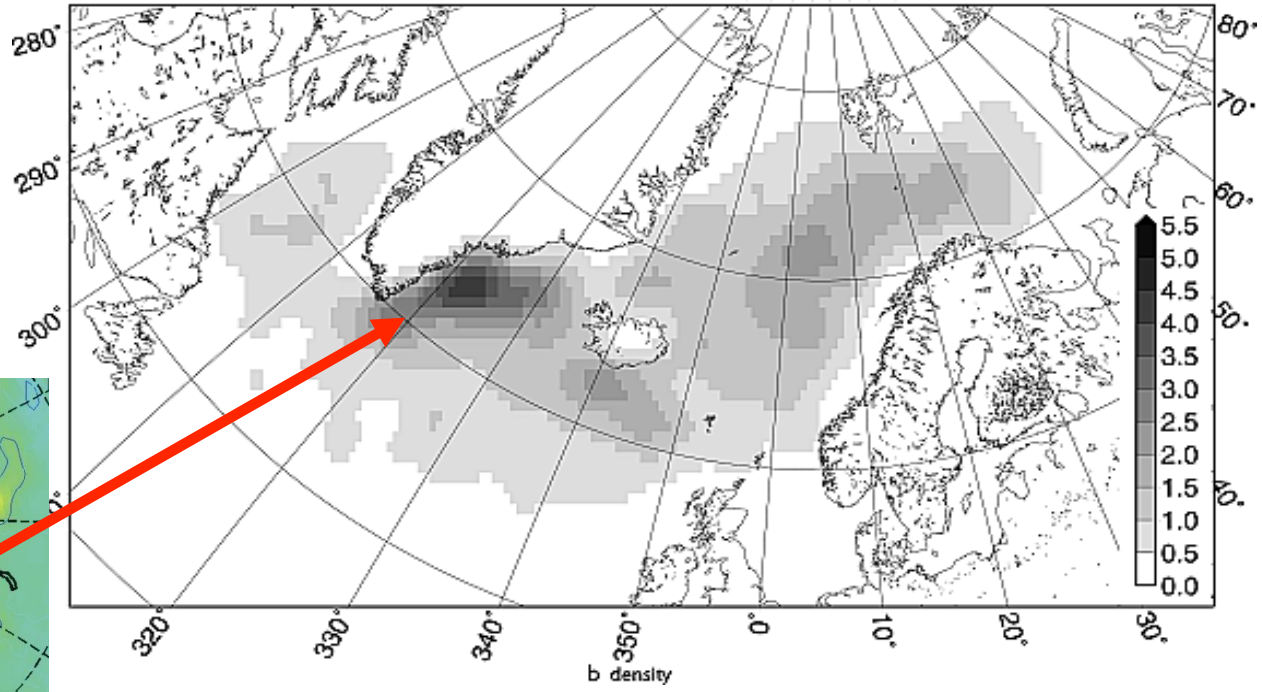



**January**




**Jule**




Polar low density distribution. Detected polar lows per 250 km$^2$

Matthias Zahn, and Hans von Storch, Geophysical Research Letters, 2008, v. 35, L22702

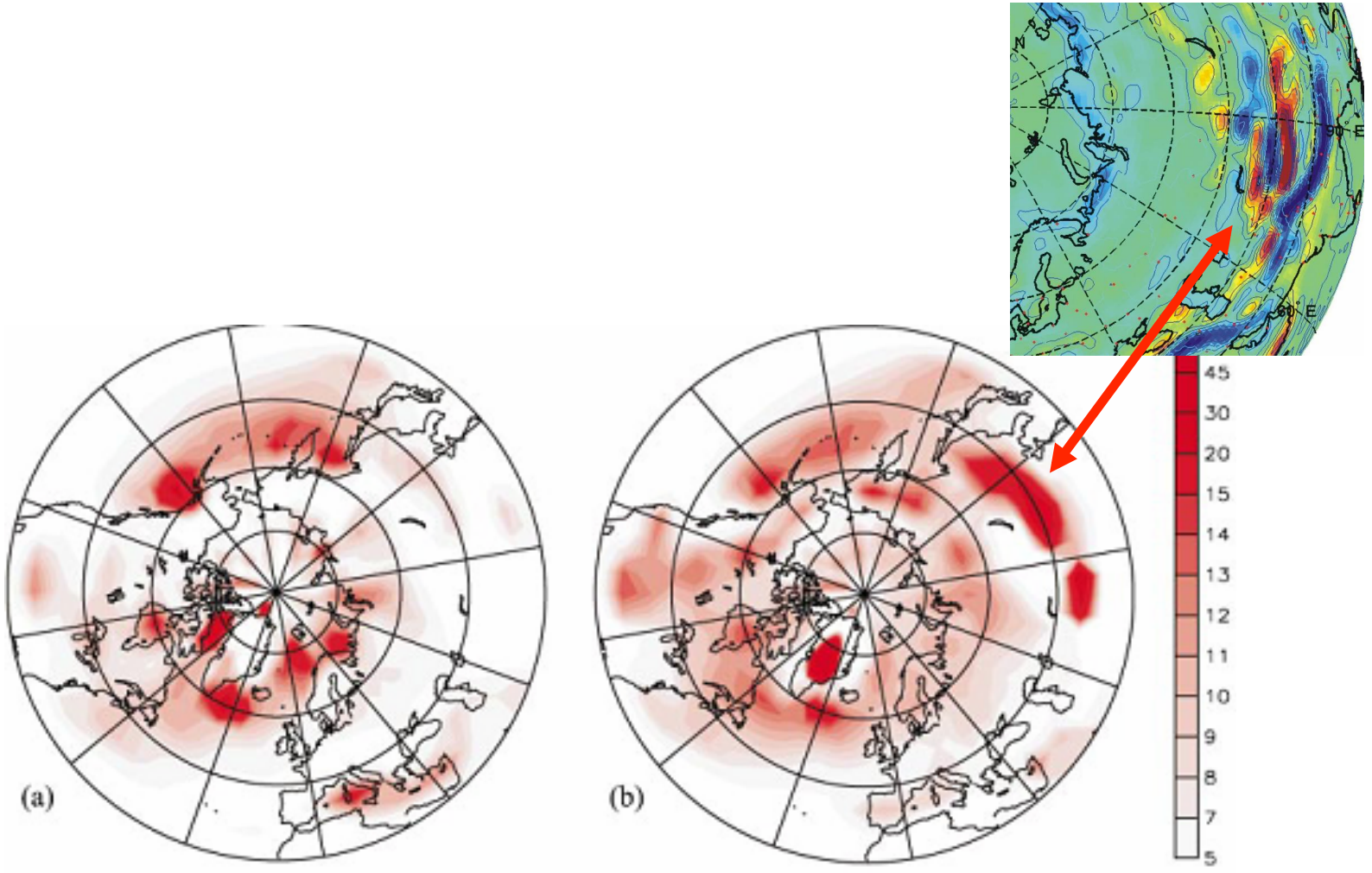
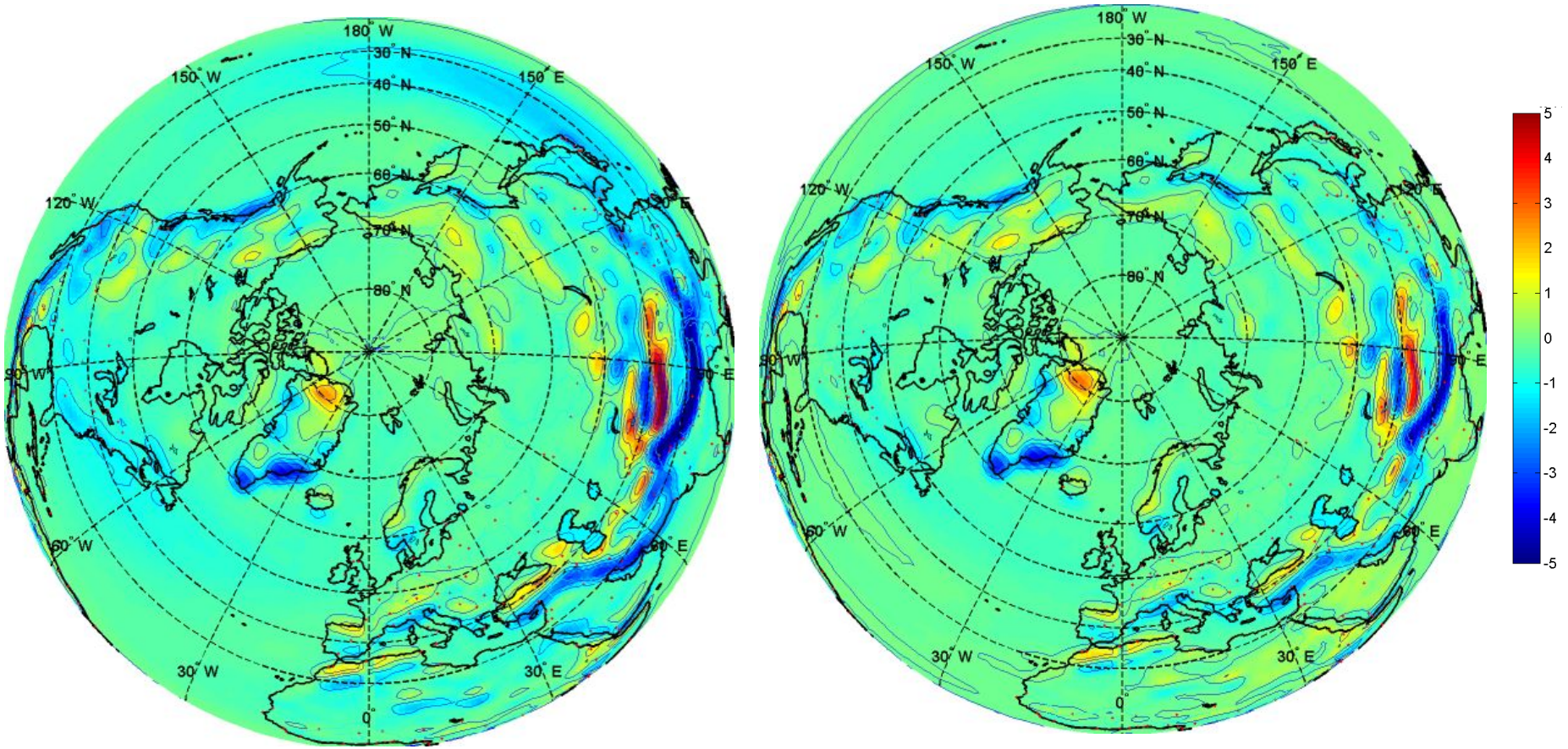



FIG. 2. The long-term mean cyclone center count in (a) winter and (b) summer. (counts per $10^5$ km$^2$)

*Xiangdong Zhang*, *et al*, ***Journal of Climate,*** *Volume 17, Issue 12 (June 2004)* 2300–2317

The mean climatological position of the Arctic and polar fronts between 1979-2008, obtained by calculating grad T at the grid 497gPa 1.125 ° x 1.125 °




**January** **Jule**

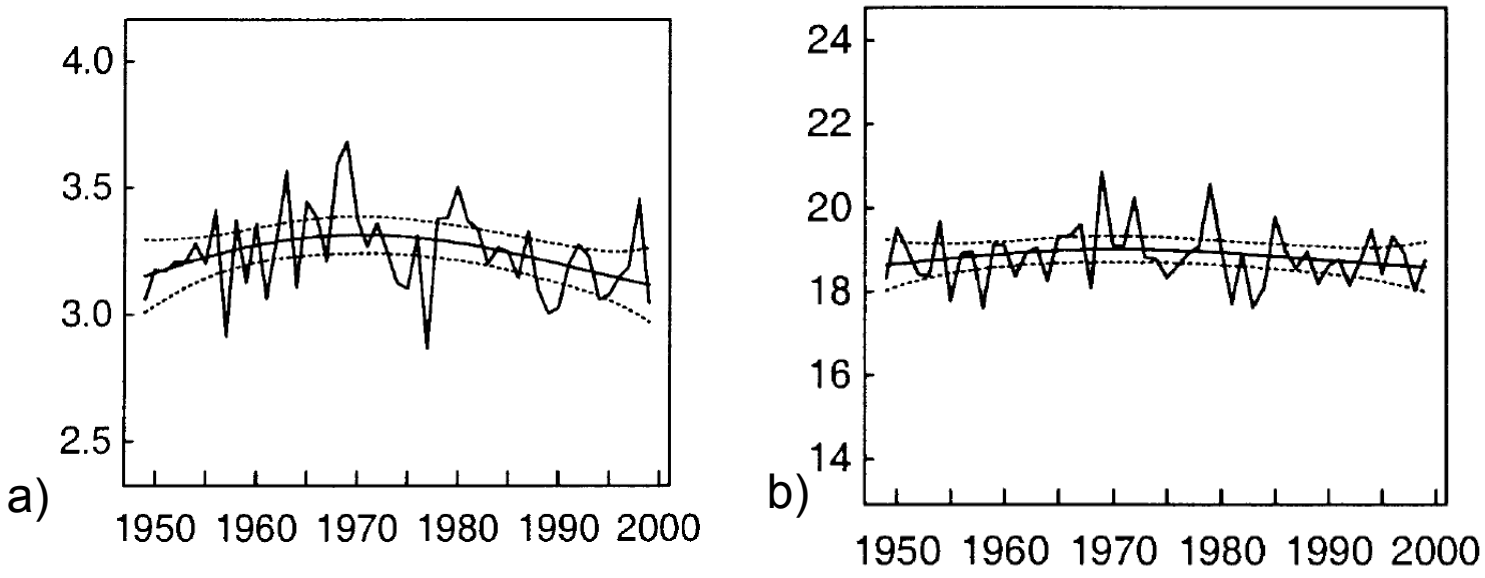
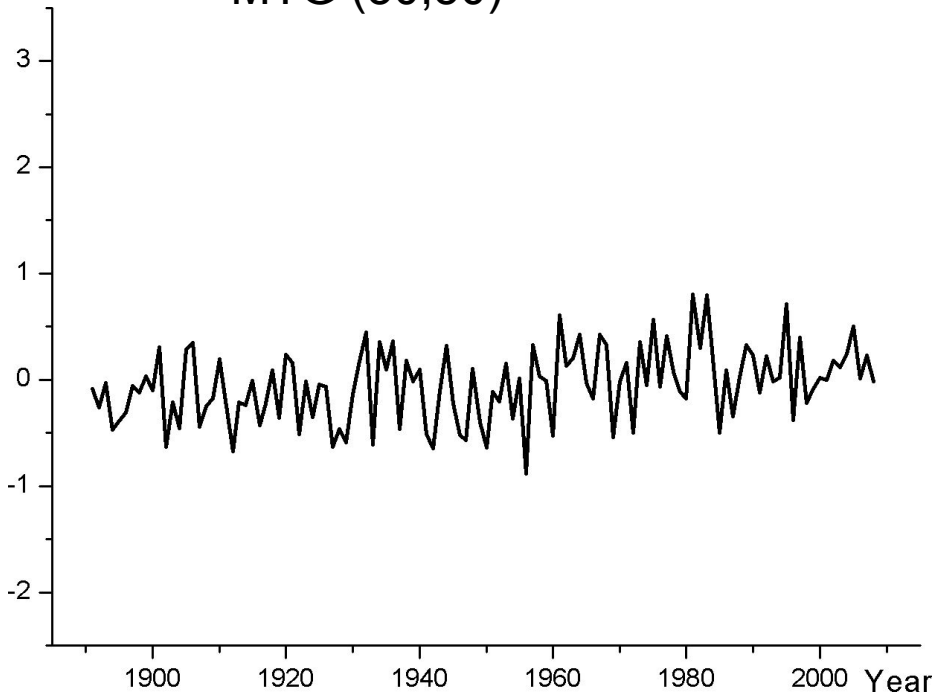



FIG. 3. Time series plots of the area-weighted averages over the NH, $20^0$–$70^0$N for a) cyclone count (no. of events), b) MTG

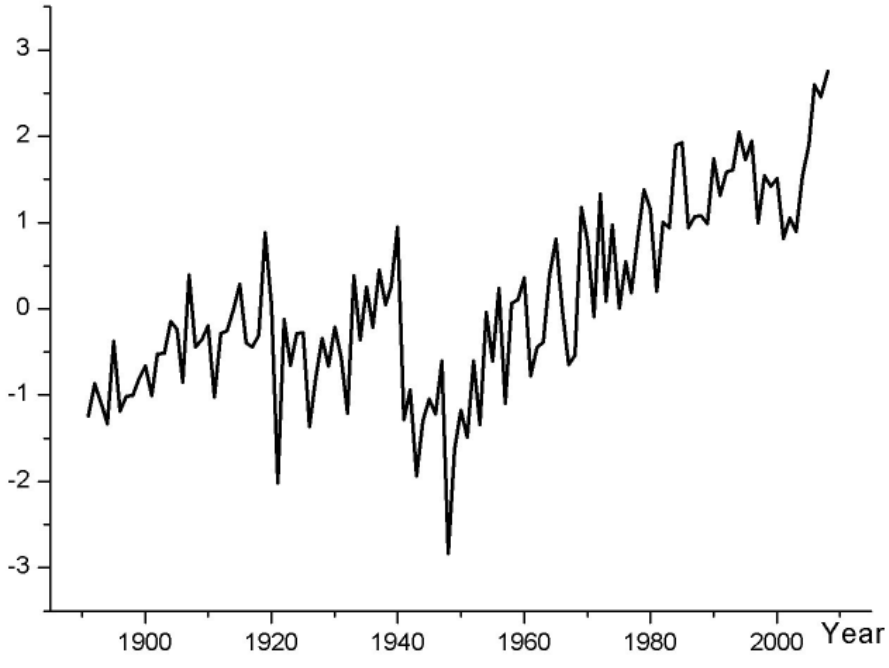
Paciorek C. J. et al J. Climate, 2002, v15, 7, 1573-1990

MTG (30,50)




Polar front

MTG (60,80)




Arctic front

MTG indices are calculated by data from Reanalysis 20th Century

Table 2 Correlation between temperature and selected teleconnection indices

| Month | Scand | NAO | AO | POL | SOI | SLP |
|---|---|---|---|---|---|---|
| Jan | **-0.56** | **0.51** | **0.47** | **0.42** | **-0.37** | **-0.47** |
| Feb | **-0.61** | **0.45** | **0.49** | 0.21 | -0.07 | **-0.54** |
| Mar | **-0.78** | 0.30 | **0.39** | 0.09 | -0.14 | **-0.64** |
| Apr | **-0.72** | 0.00 | **0.38** | 0.29 | -0.06 | -0.08 |
| May | **-0.52** | 0.24 | **0.45** | 0.11 | -0.13 | -0.20 |
| Jun | **-0.69** | 0.32 | 0.30 | **-0.39** | -0.15 | -0.22 |
| Jul | **-0.58** | 0.00 | 0.18 | 0.27 | 0.14 | 0.08 |
| Aug | **-0.73** | 0.20 | 0.28 | -0.31 | 0.22 | 0.23 |
| Sep | -0.55 | 0.28 | **0.47** | **0.41** | -0.19 | -0.01 |
| Oct | **-0.51** | -0.14 | **0.37** | **0.42** | 0.17 | -0.15 |
| Nov | **-0.54** | 0.16 | **0.41** | **0.34** | **-0.37** | **-0.56** |
| Dec | **-0.67** | 0.22 | **0.36** | 0.00 | 0.31 | **-0.45** |

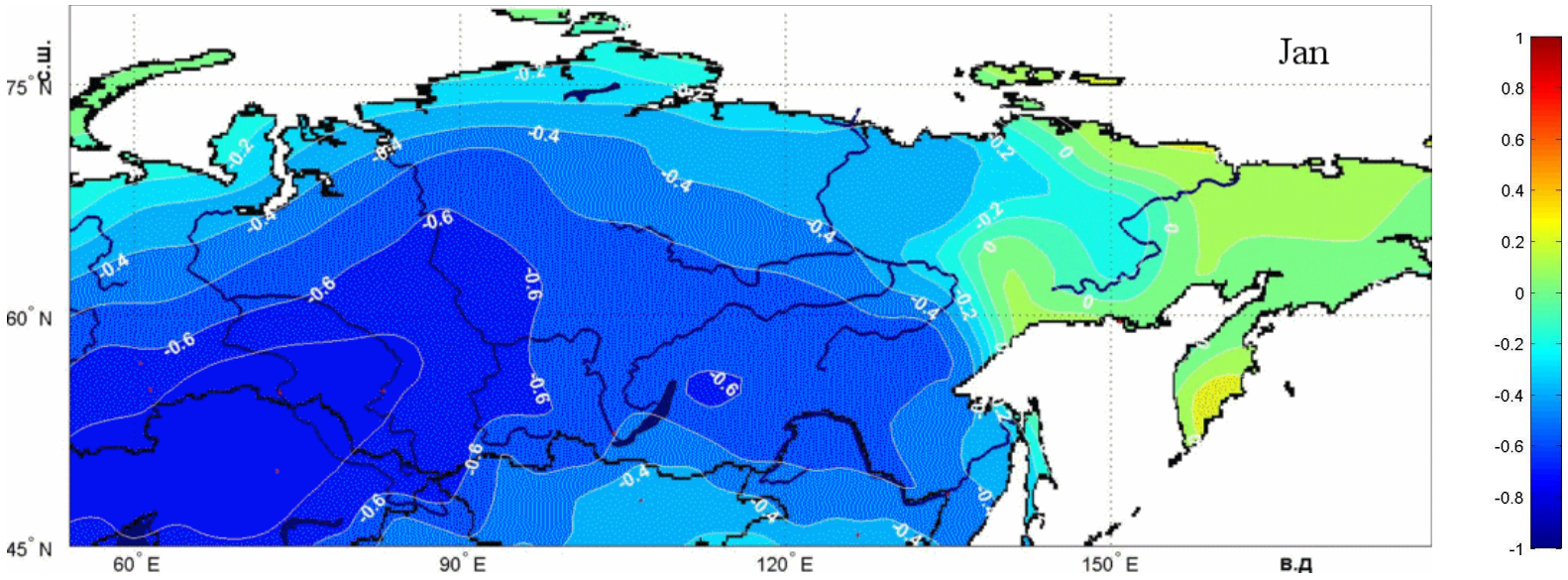
Table 3 Correlation between temperature and selected regional circulation values

| Month | $n_Z$ | $n_A$ | $n_Z^N$ | $P_Z$ | $P_Z^N$ | $P_A^N$ |
|---|---|---|---|---|---|---|
| Jan | 0.19 | -0.20 | -0.16 | **-0.54** | **-0.49** | **-0.50** |
| Feb | -0.15 | 0.09 | 0.25 | **-0.65** | **-0.45** | **-0.35** |
| Mar | -0.01 | 0.05 | -0.13 | **-0.38** | **-0.42** | **-0.37** |
| Apr | 0.12 | 0.10 | 0.22 | **-0.62** | **-0.64** | -0.19 |
| May | -0.24 | -0.09 | 0.08 | -0.28 | -0.01 | **-0.35** |
| Jun | -0.25 | 0.04 | **-0.53** | 0.14 | 0.10 | -0.12 |
| Jul | -0.09 | 0.01 | **-0.37** | 0.09 | 0.06 | -0.08 |
| Aug | 0.04 | **0.46** | 0.15 | -0.02 | 0.06 | 0.14 |
| Sep | -0.34 | **-0.39** | -0.19 | -0.14 | 0.00 | **-0.41** |
| Oct | -0.19 | -0.08 | 0.12 | **-0.39** | -0.31 | **-0.38** |
| Nov | **-0.40** | **-0.40** | -0.31 | **-0.51** | -0.51 | **-0.63** |
| Dec | **0.38** | 0.23 | **0.47** | **-0.32** | -0.19 | 0.02 |

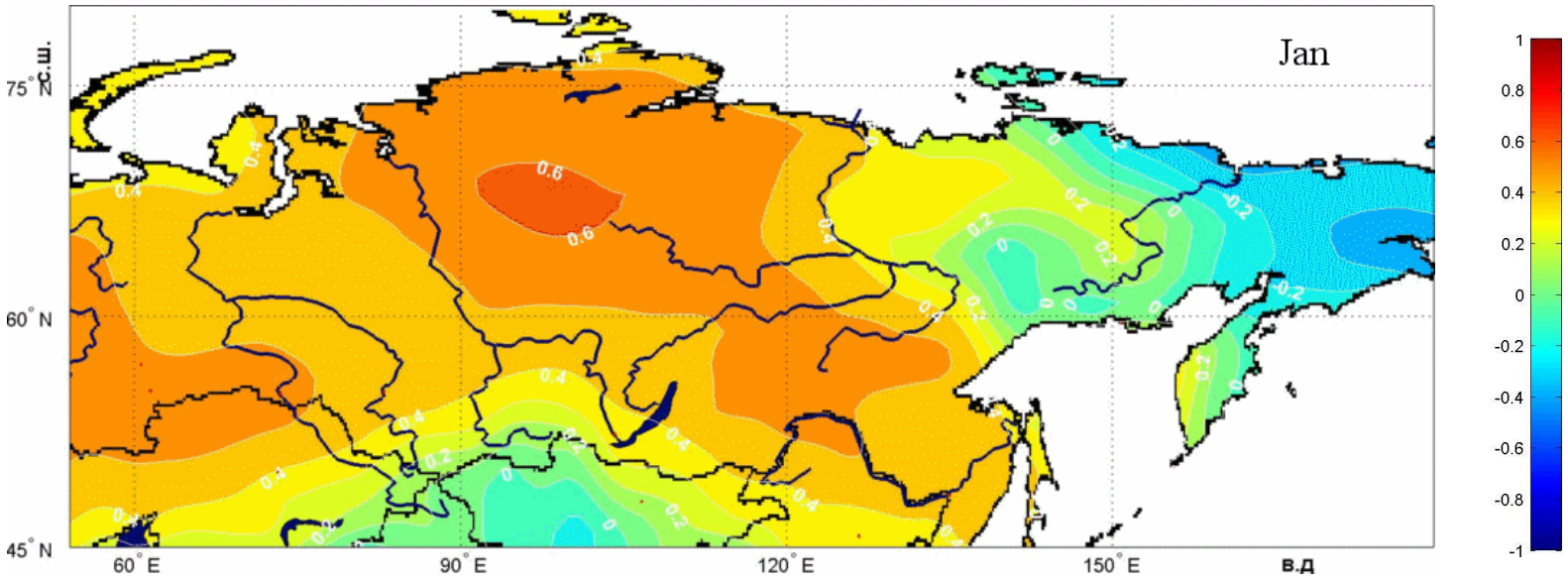
# Coefficient of determination

| Month | $R^2$ |
|---|---|
| Jan | 0,82 |
| Feb | 0,73 |
| Mar | 0,72 |
| Apr | 0,69 |
| May | 0,54 |
| Jun | 0,80 |
| Jul | 0,58 |
| Aug | 0,64 |
| Sep | 0,61 |
| Oct | 0,74 |
| Nov | 0,69 |
| Dec | 0,64 |

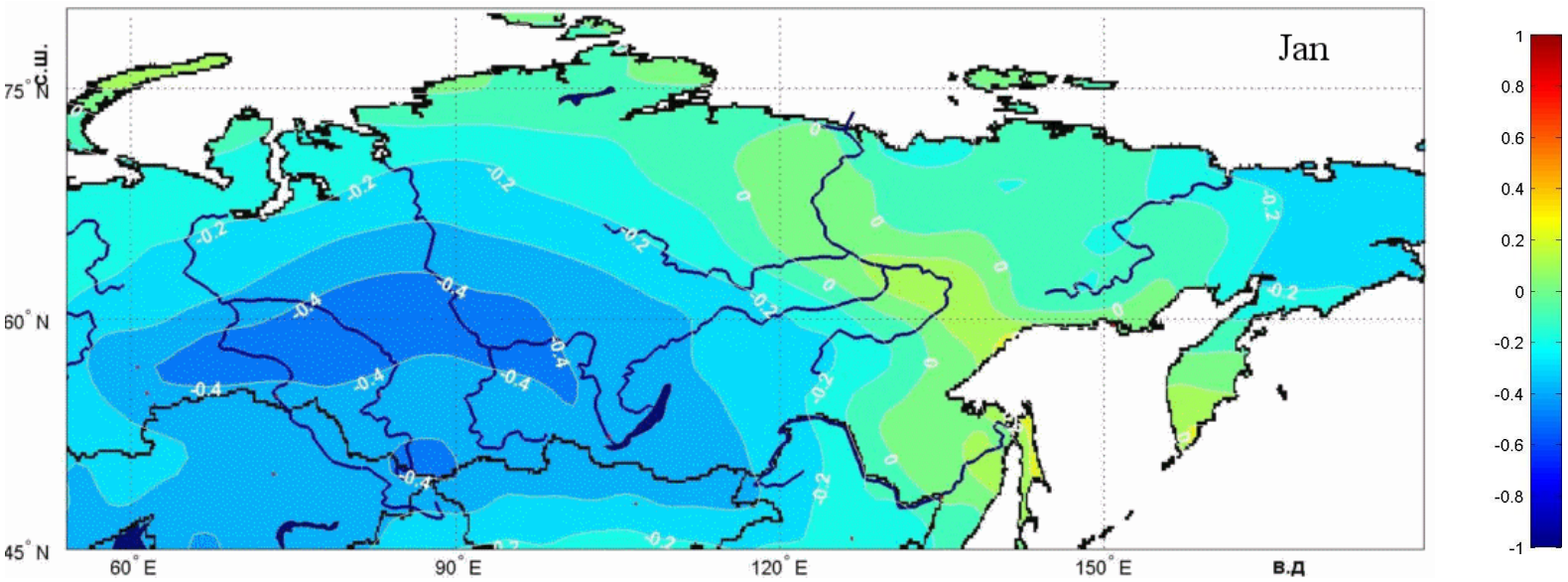
# Correlation between temperature and SCAND



# Correlation between temperature and NAO



# Correlation between temperature and SOI



Thank you for attention!