Long wave of interdecadal oscillation in moderate latitude of the Asian Pacific

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Main goals are :

- to estimate links of ice extent in the Japan (East) Sea and ice thickness in the Baykal Lake with SST anomalies in different Pacific areas and regional surface wind anomalies,

- to compare interdecadal (20-30 years) and semicentennial (Minobe, 1998, 2001) climate oscillations in different Asian Pacific areas and in the Arctic Basin

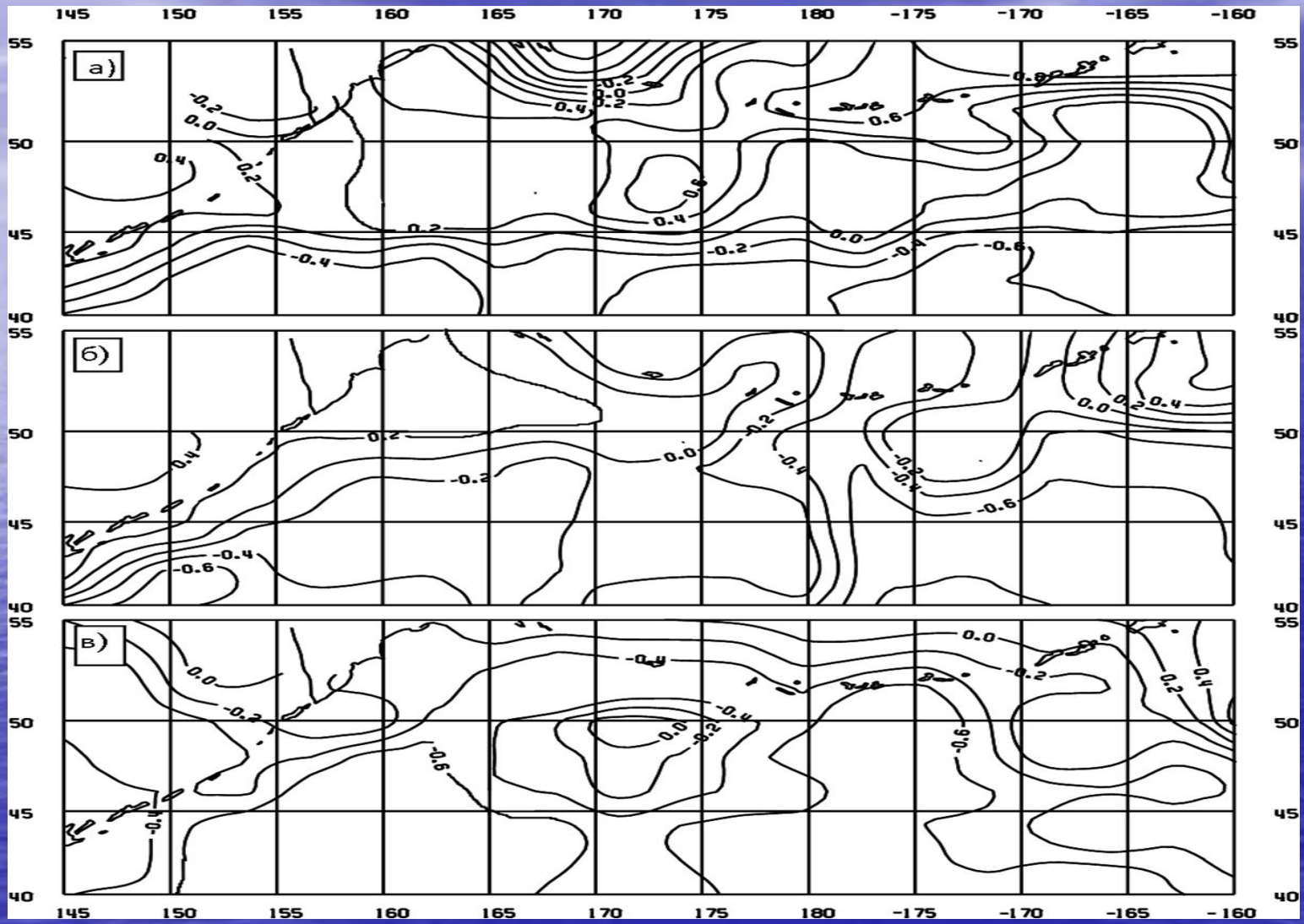
Observation data:

Time series of Pacific SST (Hadley Center,),

surface wind component and surface pressure from NCEP reanalysis (1948-2009),

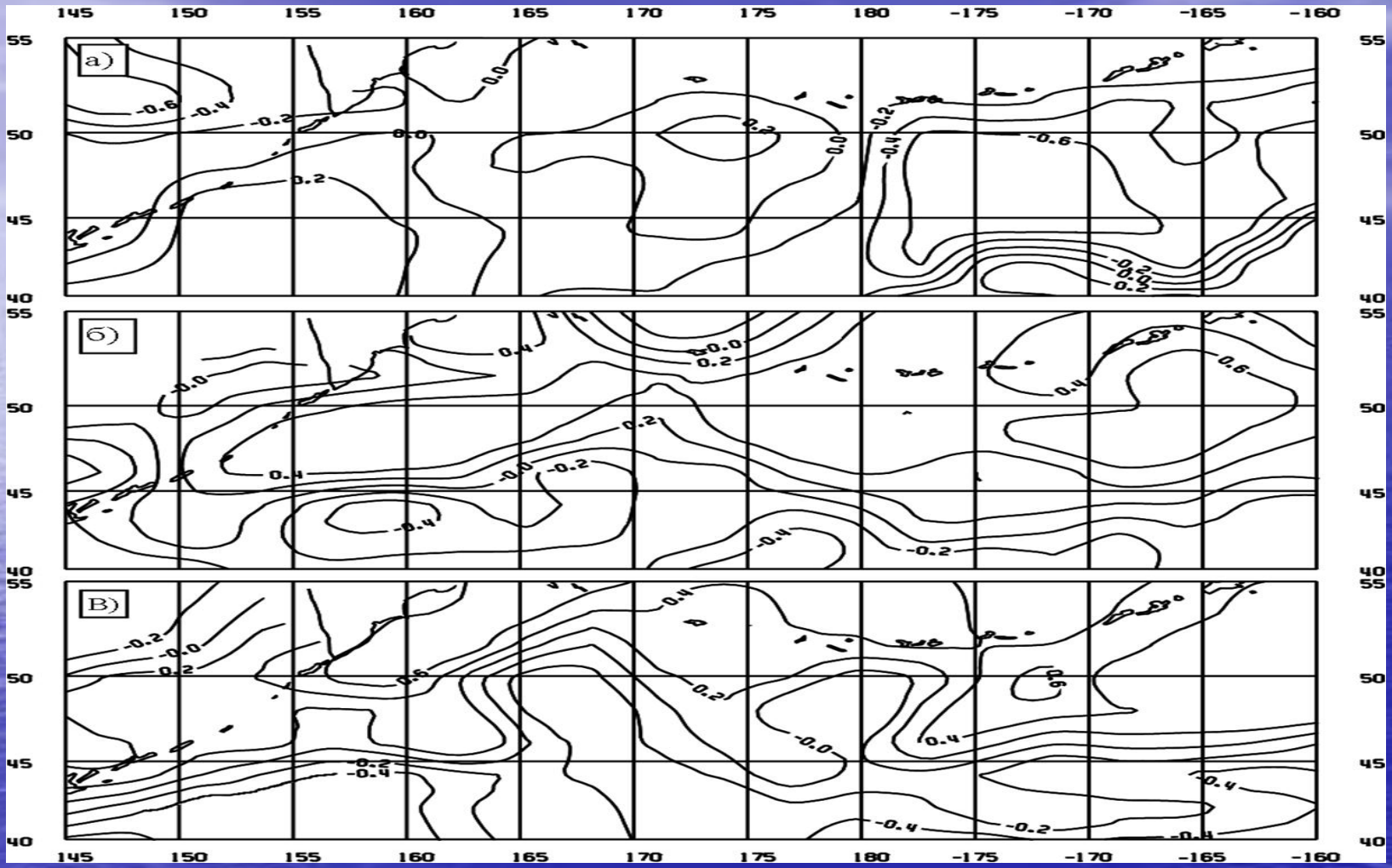
Ice Extent in the Japan (East) Sea and ice thickness in the Baykal Lake (1948-2010) are used as indicators of regional climate variability

Correlations (1981-2008) between anomalies of ice extent the Japan (East) Sea in February and monthly average SSTA in subarctic North Pacific (north of 40°N) in February (a), January (b) of current year, November (c) of previous year. POI data base



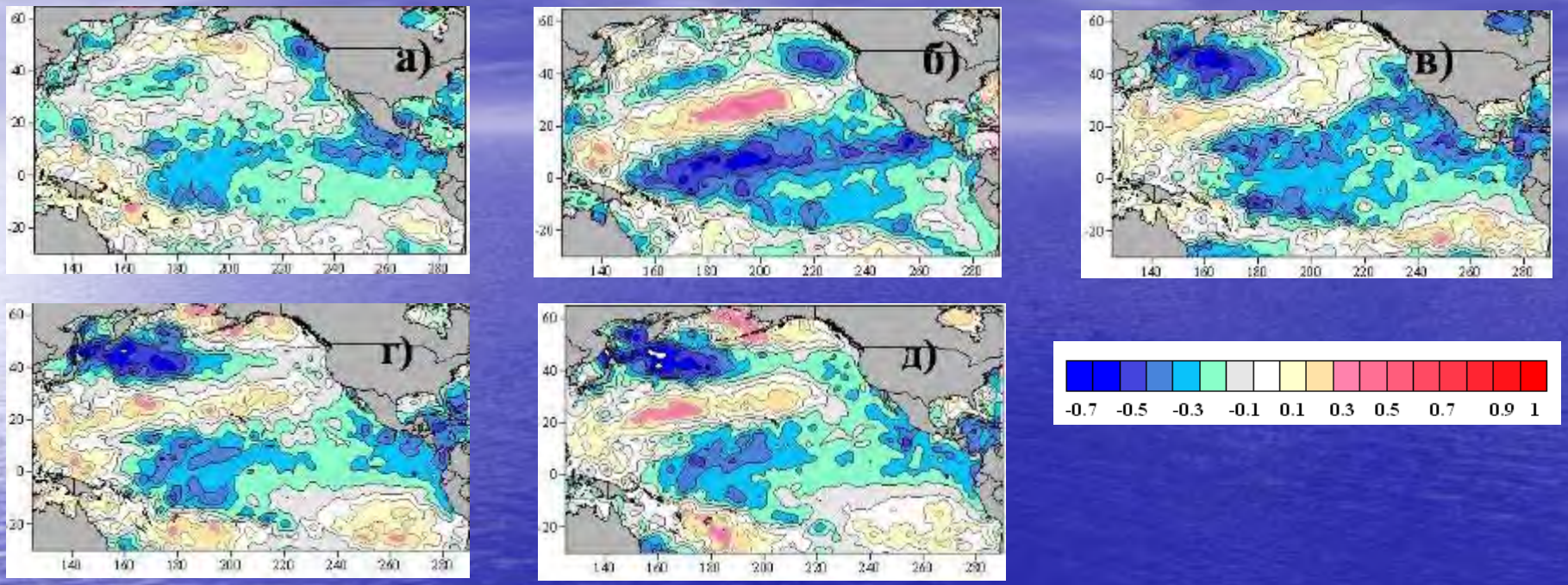
Negative correlation is prevailing in southwestern and central areas of subarctic gyre, positive one occurs in the Bering Sea and Aleusian Pacific region (NE Pacific adjacent to Aleutian Islands and Alaska Gulf).

Correlations (1981-2008) between anomalies of Japan/East Sea ice extent in February and monthly average SSTA in subarctic North Pacific (north of 40°N) in August (a), May (b), February (c) of previous year.



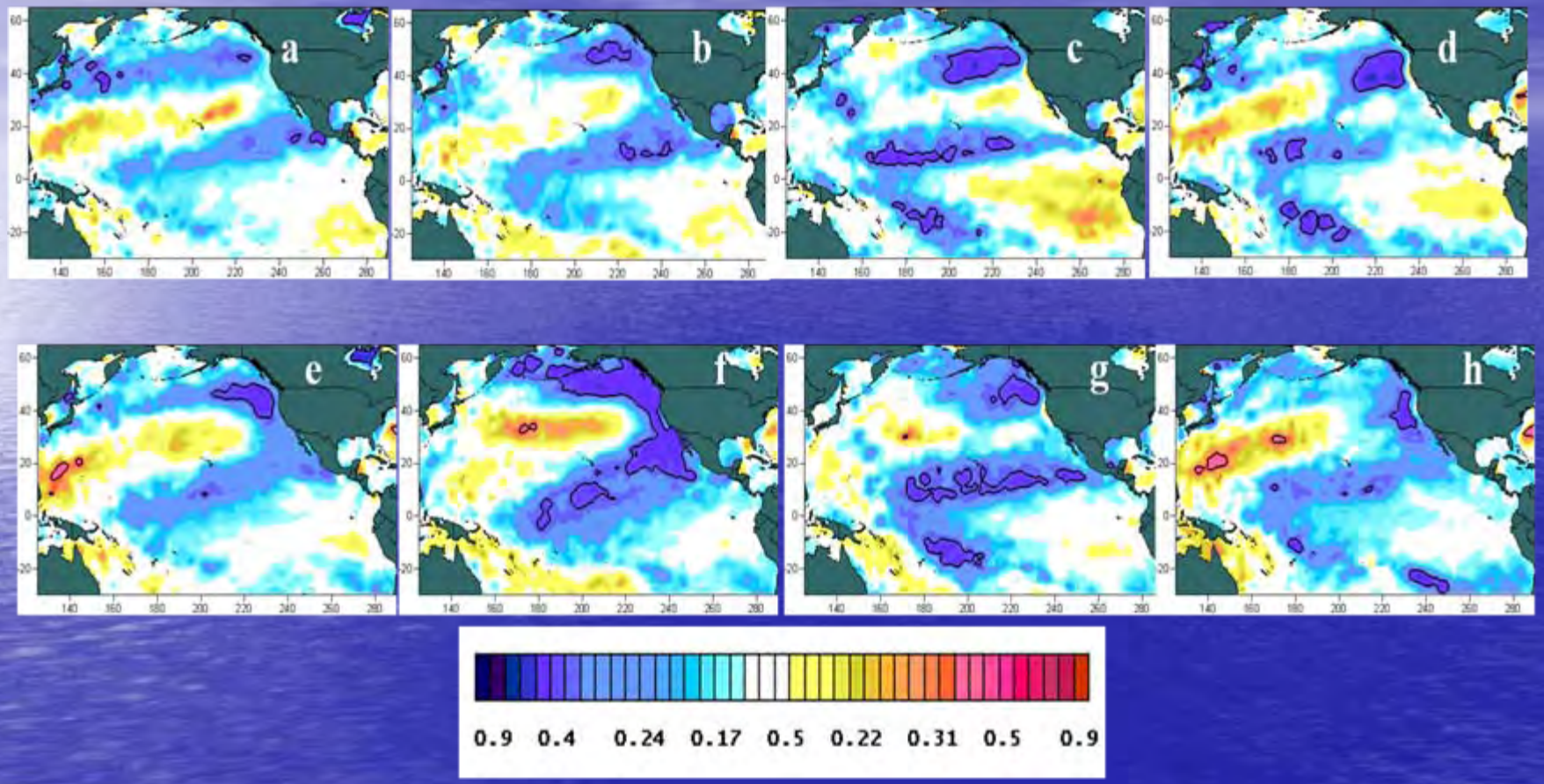
Correlations with SSTA in Aleutian region with seasonal lag is negative while in unlagged case it is positive

Correlations between JES ice extent (1981-2009) in February and Pacific SST anomalies north of 30 S in May (а), August (б), November (в) of previous year, as well as, in January (г) and February (д) of the current year (red is positive, blue is negative correlation) . Hadley SST



The core of maximal negative correlations between JES Ice Extent in February and North Pacific SSTA shifts from the eastern extratropical North Pacific area to the subarctic Northwest Pacific when the lag decreases from 8 to 0 months.

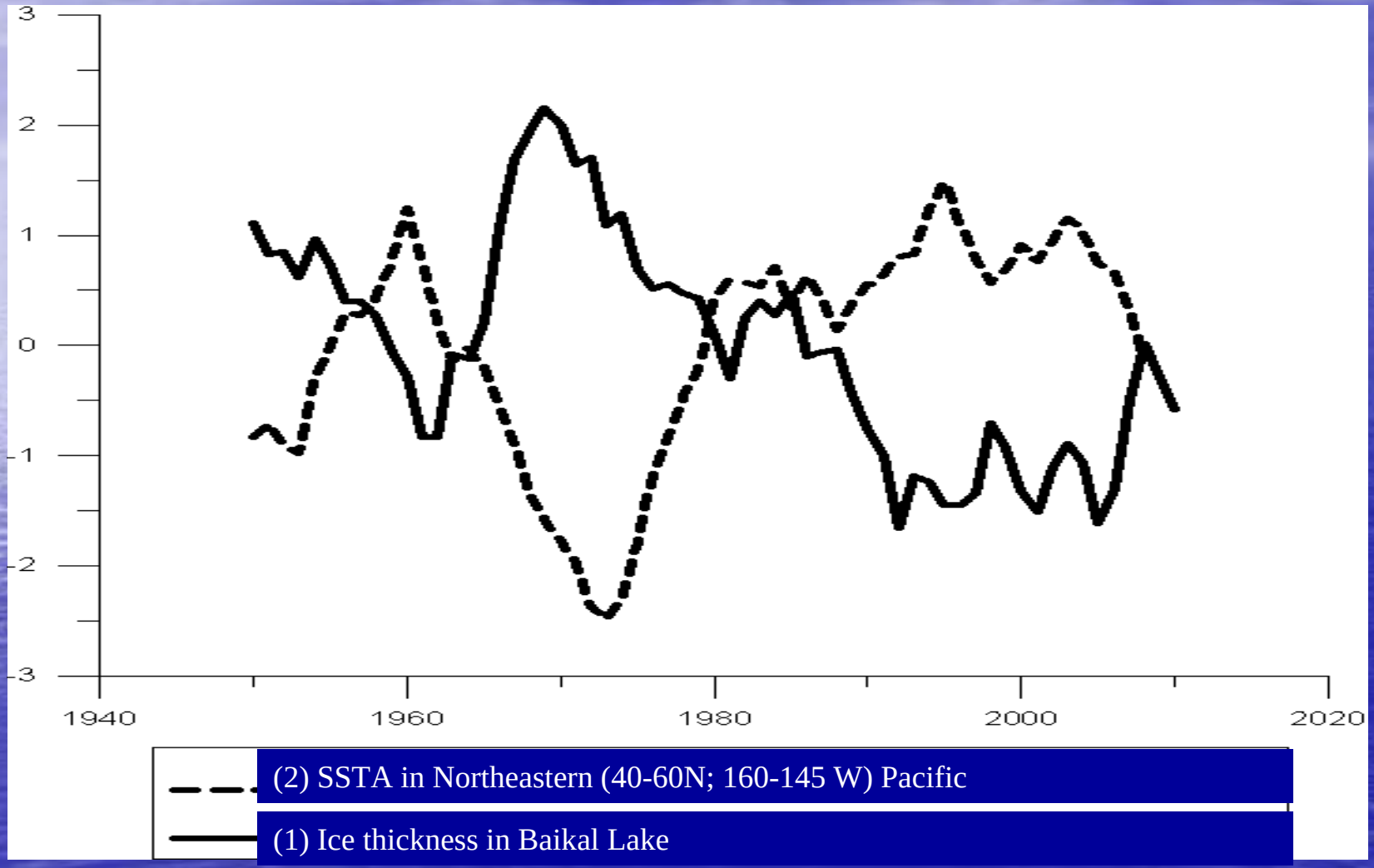
Correlation between ice thickness in Baikal Lake in Febuary and Pacific (north of 30 S) seasonal mean SSTA in JFM (a,e), and in previous year AMJ (b.f), JAS (c,g), OND (d,h) in cold **(1950—1981, a-d)** and warm **(1981-2010, e-h) p**eriods of semicentennial oscillation in South Siberia and Arctic.



Dependence of correlation patterns on seasonal lag in case of Baykal lake is weaker than in case of JES ice extent.

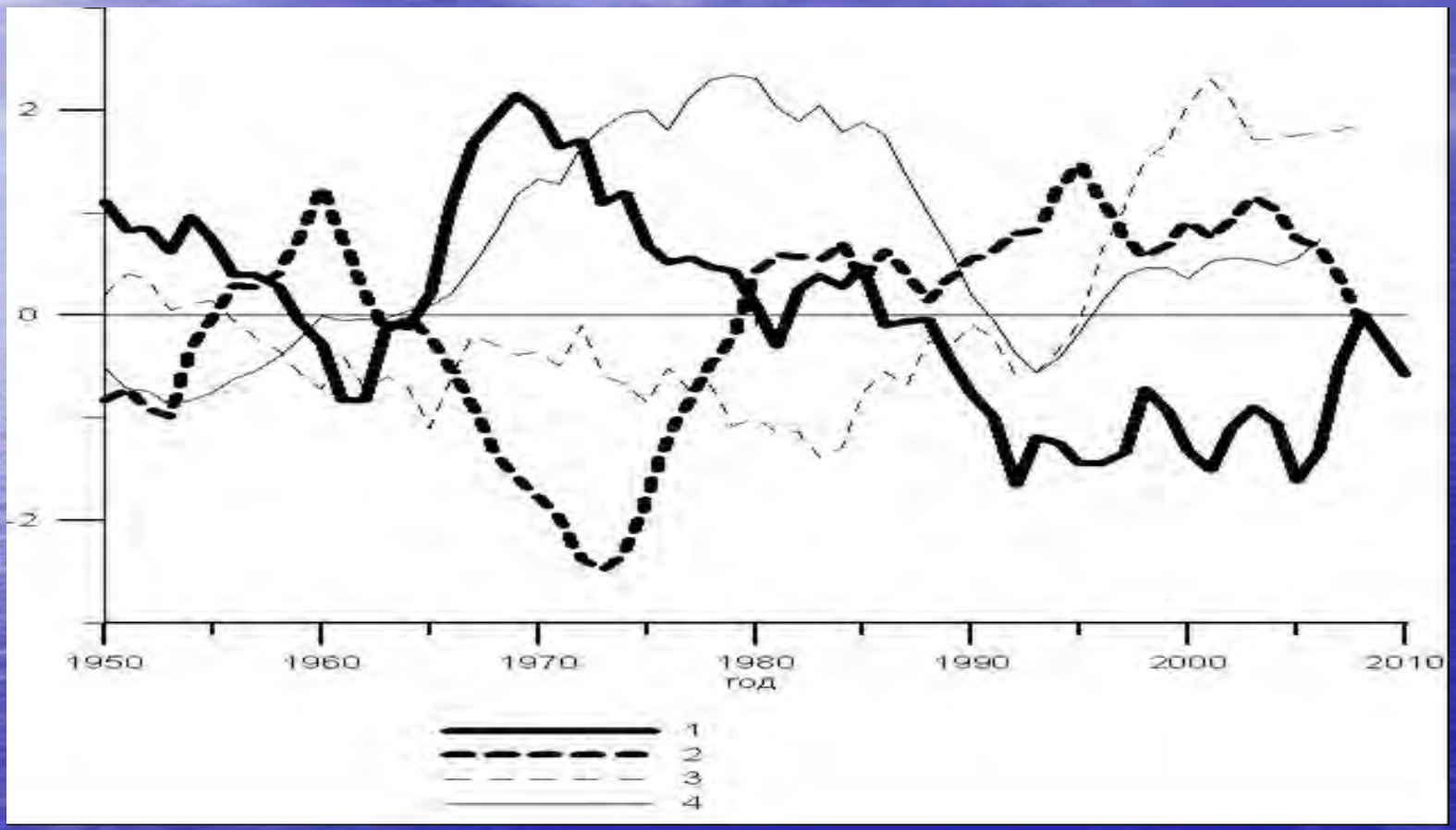
Winter correlation patterns between anomalies of Baykal Lake Ice Thickness and SST in the extratropical North Pacific are inversed in comparison with link between JES ice extent and SSTA

Normalized 11-years running annual mean anomalies of Ice Thickness in the Baykal Lake (1) and SSTA in the Northeastern (40-60N; 160-145 W) Pacific (2) in February.



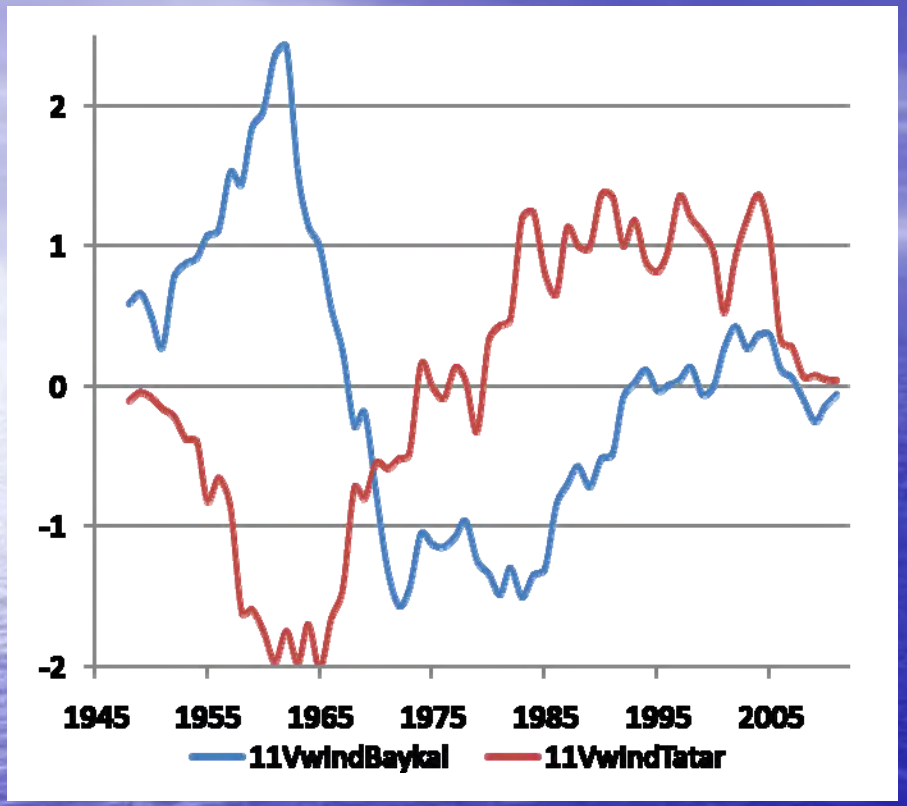
It is shown similar semicentennial oscillations in the NE Pacific and Baykal Lake area. Cooling in the NE Pacific accompanies positive Ice Thickness anomaly and cooling in the Baykal Lake (South Siberia).

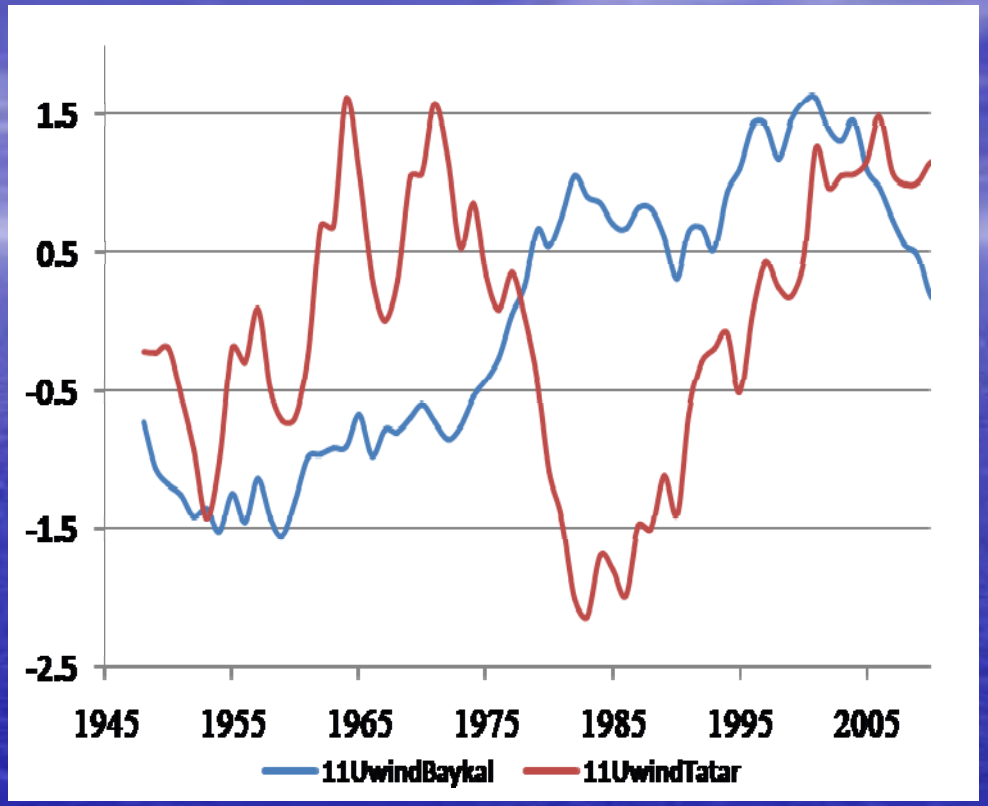
Normalized 11-years running mean time series of the ice thickness in the Baykal Lake in Feb. (1), SSTA in the Northeastern (40-60N; 160-145W) Pacific (2), Kuroshio Current area (3), and anomalies of surface pressure in the center of the Siberian High during the cold period of year (4).



The semicentennial cycle in the Baikal Lake Ice Thickness is clear seen from 1963 to 2008. There is some lag between semicentennial oscillations in Siberian High surface pressure and Baikal Lake Ice Thickness (curve 4 and 1). Semicentennial anomaly of Siberian High from 1950 to 1994 similar to SST anomaly in Kuroshio Current Region (curve 3).

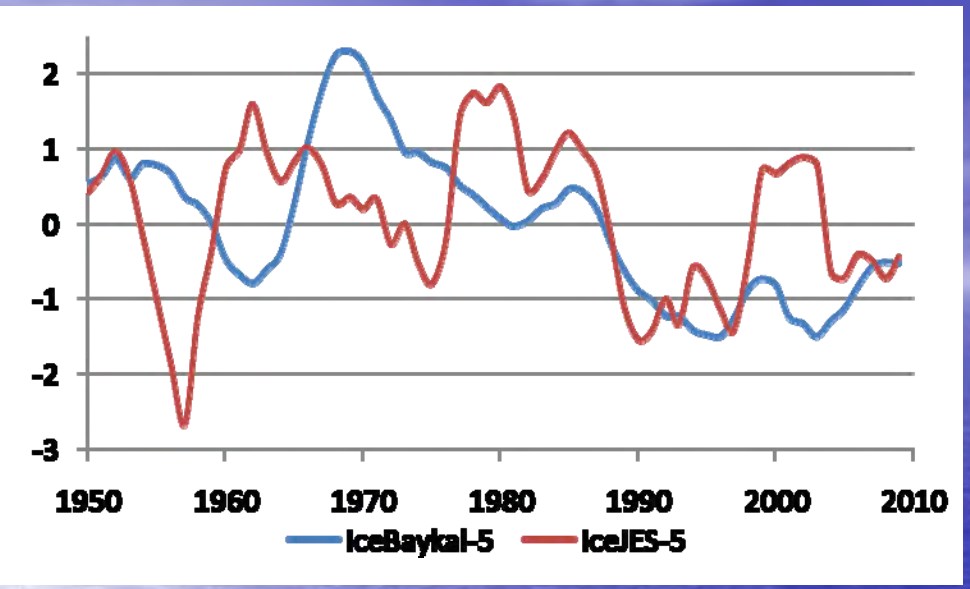
Normalized anomalies of 11-years running mean northern (V) and eastern (U) wind component over Baykal Lake (blue – windBaykal) and Tatarskii Strait (red, windTatar) in the north Japan /East Sea areas in February

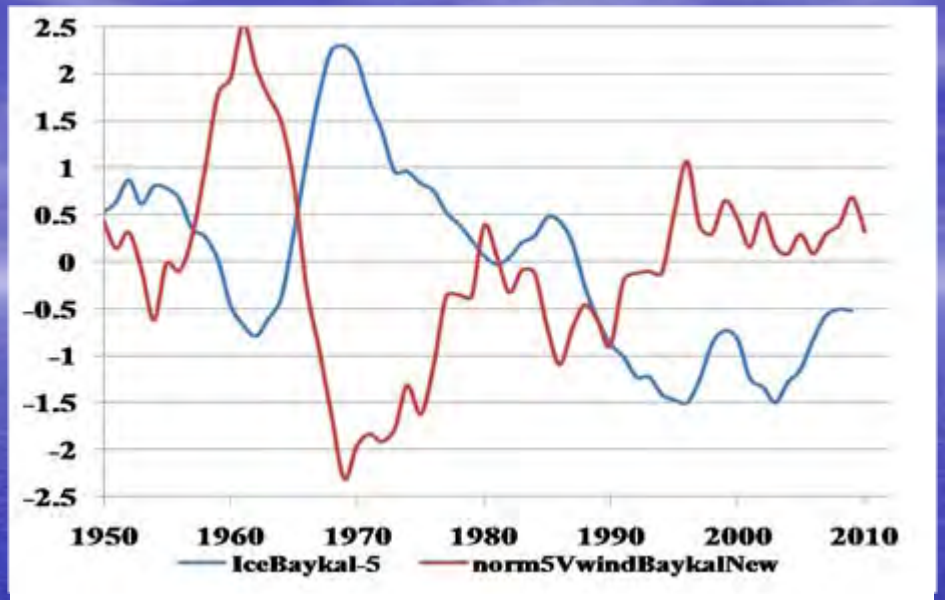




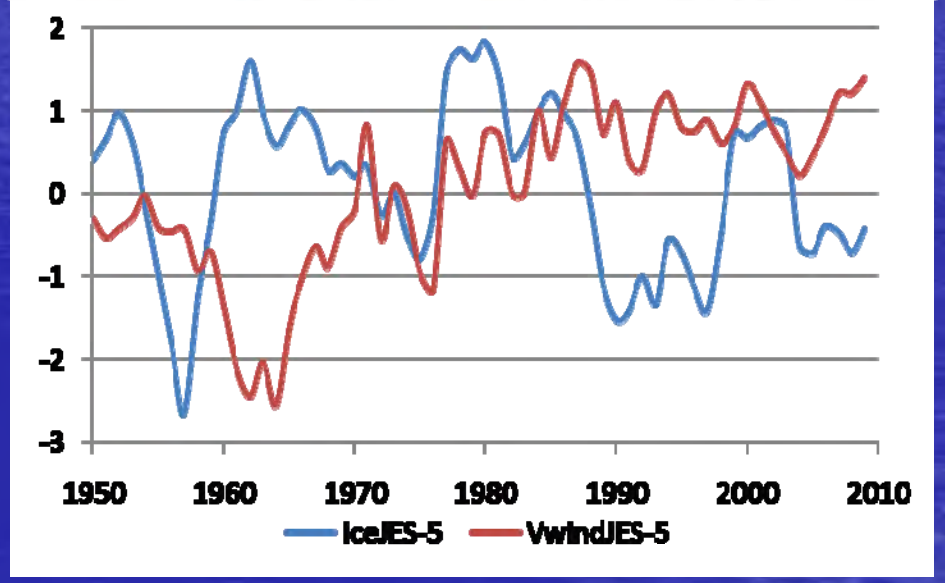
This slide shows inversed semicentennial oscillations of meridional (V) and zonal (U) wind components over the Tatarskii Strait (red curve) and Baykal Lake (blue curve) areas. (NCEP reanalyses)

Normalized anomalies of 5-years running mean Ice Thickness in the Baykal Lake, Ice Extent in the Japan /East Sea, and northern wind component over correspondent areas in February





Anomalies of interdecadal climate oscillation in the Baikal Lake and North Japan Sea are usually inversed with exception of large scale warming period in 90s .



It is shown inversed interdecadal oscillations of meridional (V) wind component over Baykal Lake and Ice Thickness in the Baykal Lake, as well as similar link between northern wind and Ice Extent in the Tatarskii Strait of the Japan /East Sea

Conclusion on relationship with Pacific SST anomalies

- The significant correlations of both Japan Sea Ice Extent and Baykal Lake Ice Thickness with SST anomalies in the North Pacific are revealed with lags from 0 to 12 months.

- The core of maximal negative correlations between JES Ice Extent in mid February and North Pacific SSTA shifts from the eastern extratropical North Pacific area to the subarctic Northwest Pacific when the lag decreases from 8 to 0 months.

- The cores of positive correlation with SSTA take place in the north eastern subarctic Pacific and Bering Sea in case of unlagged relationship and relationship with annual lag.

- Negative correlation of both JES Ice Extent and Baykal Lake Ice Thickness is found with SST anomalies in tropical-equatorial Pacific being prevailing with seasonal lag.

- Positive SST anomaly in previous summer in central and western tropical-equatorial Pacific foregoes negative anomalies of northern wind and Ice Extent in the Tatarskii Strait in January-February.

- Positive SSTA in central and eastern tropical-equatorial Pacific accompanies negative anomalies of northern wind and Ice Extent in the Tatarskii Strait.

Conclusion on links of Interdecadal and semicentennial oscillations

- Both Interdecadal and Semicentennial oscillations of Ice Extent in the Japan (East) Sea are in inversed phase with similar scale oscillations of Baykal Lake Ice Thickness and SST anomalies in the Northeast Pacific.

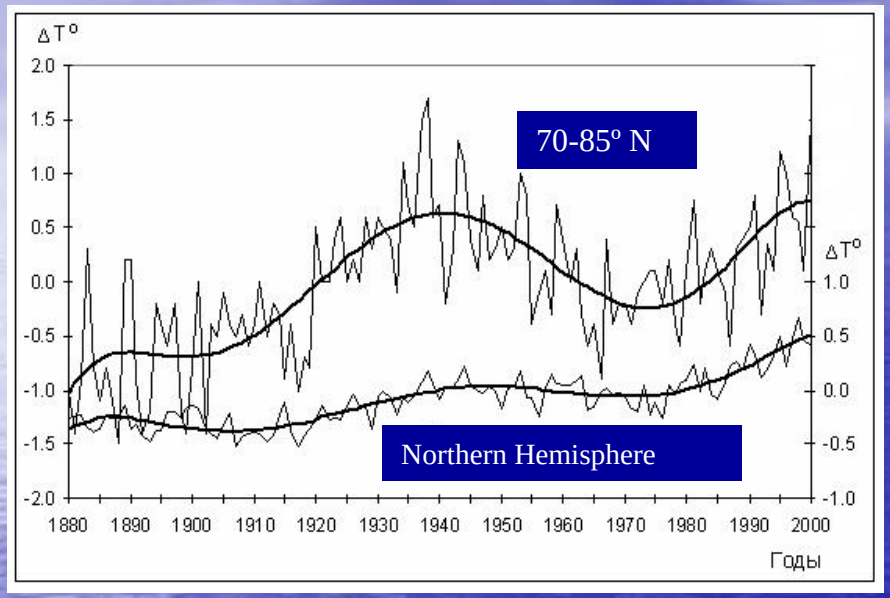
- The semicentennial oscillation in south Siberia - Baikal Lake region is in phase with similar climate oscillation in Arctic Basin. (Gudkovich, Karklin, Smolyanitskii. Frolov, 2009).

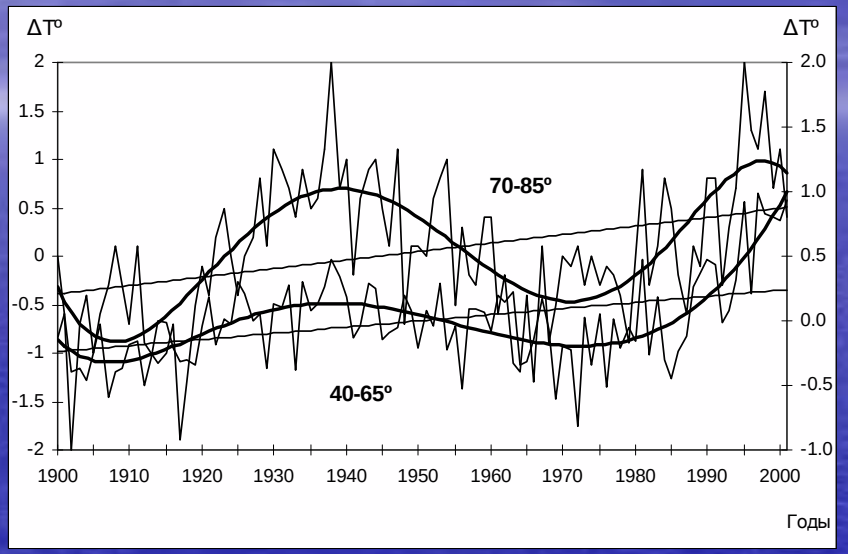
- Alternation of multi-decadal cold / warm periods in studied longitude zones of moderate latitudes is related to similar alternation of negative / positive meridional wind anomalies.

Summary

- The spatiotemporal alternation of inversed multi-decadal anomalies in studied longitude zones of the North Pacific and North Asia looks like climatic wave in moderate latitudes .

Semi-centennial oscillation (with period 50-60 years) in the annual mean surface air temperature in the Arctic latitude zone 70-85º N, Northern Hemisphere and moderate latitude zone (40-65 N) (Gudkovich, Karklin, Smolyanitskii. Frolov, 2009)





Semi-centennial oscillation (with period 50-60 years) in South Siberia (Baikal Ice Thickness) is in phase with similar oscillation in Arctic. The Semi-centennial oscillation in zonal average surface air temperature (SAT) of moderate latitudes and Northern Hemisphere SAT is very weak due to inversed phases of this oscillation in Siberia and North-Eastern Pacific outlined in our presentation.