

Studying of temperature behavior dynamics in Siberia based on in-situ observed and Reanalysis data

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Introduction

- Nowadays substantial progress has been achieved in studying climatic changes.
- However, analysis of spatial-averaged climatic parameters is not sufficient for qualitative assessment of climate change.
- It is necessary to extend the set of climatic characteristics and to study the it spatial behavior.
- Methods of mathematical statistics are widely used for meteorological data processing and analysis.

Object: Comparative analysis of surface air temperature behavior for Siberian territory over the 20th century.

Problem statement

Climatic characteristics:

- Annual and seasonal averaged temperature;
- Climatic indices:
 - Number of frost days ($T_{\min} < 0 \text{ }^{\circ}\text{C}$),
 - Number of icing days ($T_{\max} < 0 \text{ }^{\circ}\text{C}$),
 - Number of summer days ($T_{\max} > 25 \text{ }^{\circ}\text{C}$),
 - Number of tropical nights ($T_{\min} > 20 \text{ }^{\circ}\text{C}$);

Data:

- Stations over the former Soviet Union territory
(Global Synoptic Climatology Network; time period: 1901-2000; stations: Tobolsk, Enisejsk, Olekminsk, Yakutsk);
- ECMWF ERA-40 Reanalysis data
(time period: 1958-2000; spatial resolution: $2.5^{\circ} \times 2.5^{\circ}$).

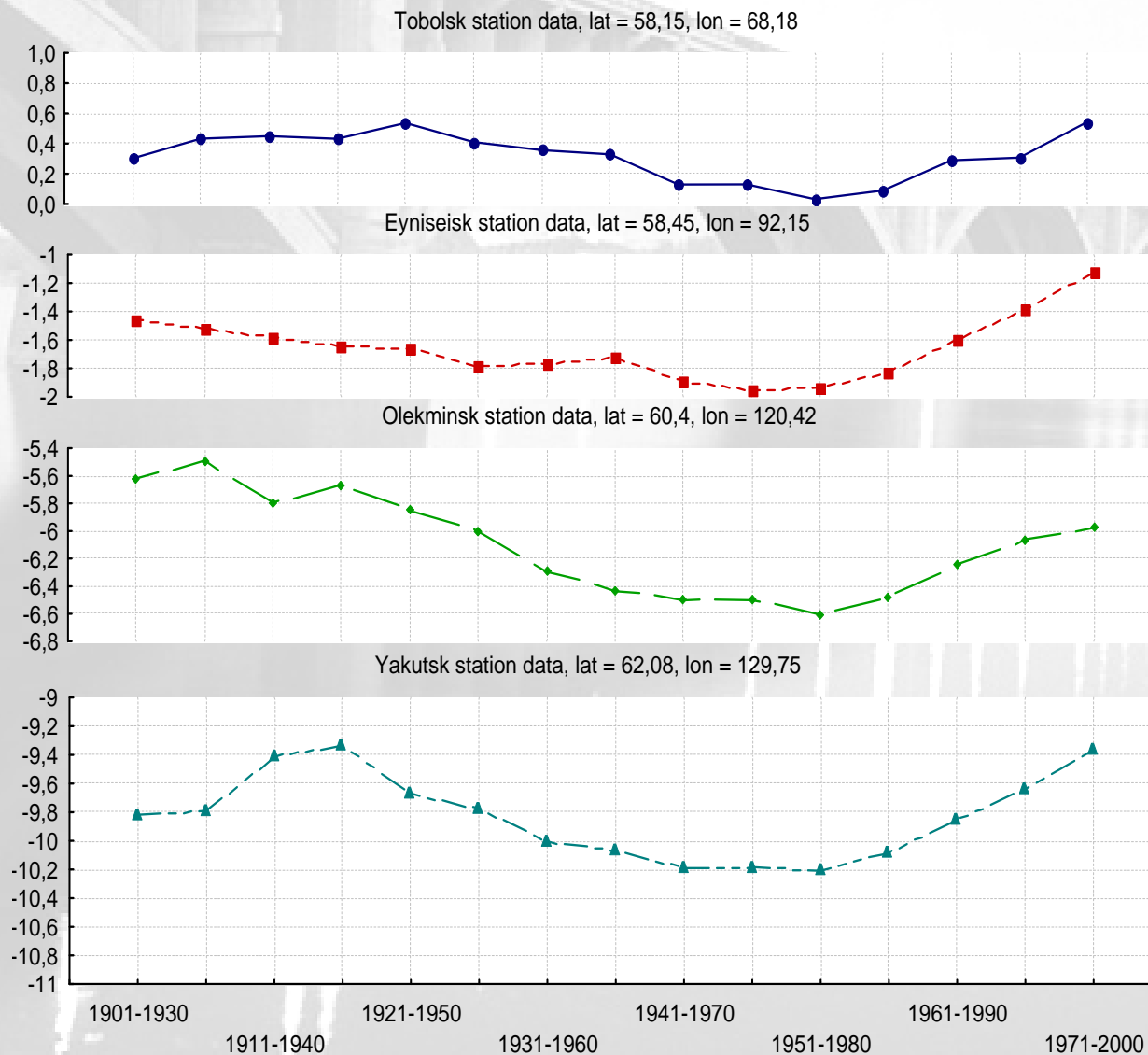


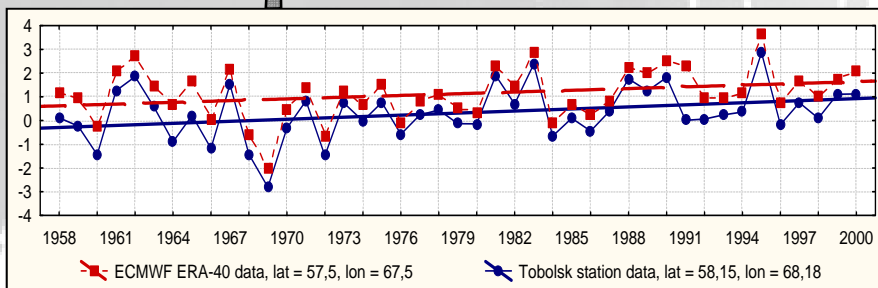
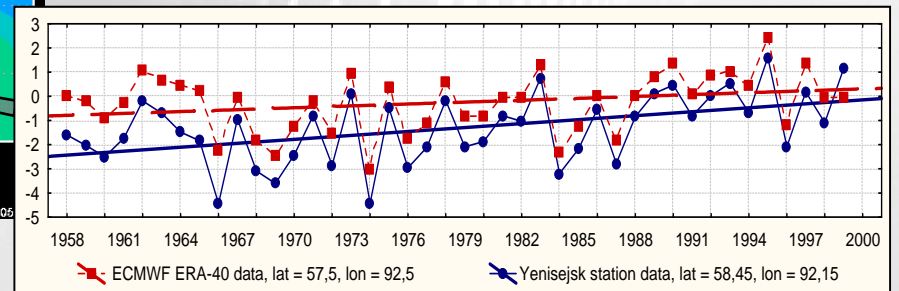
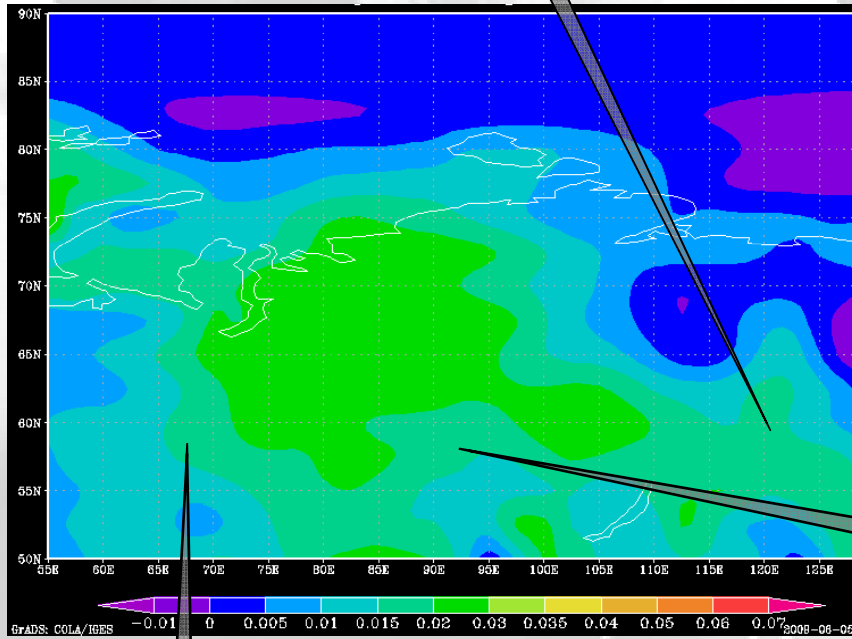
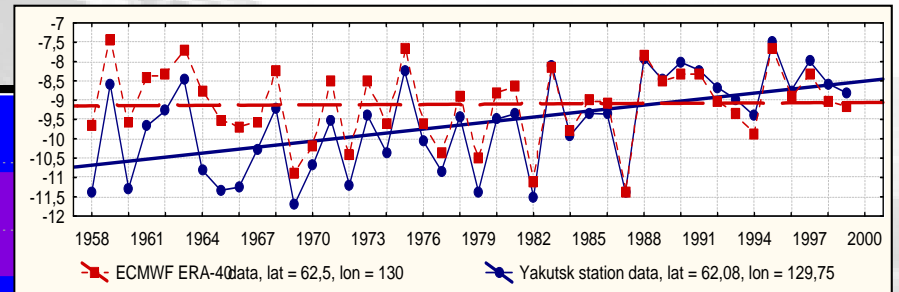
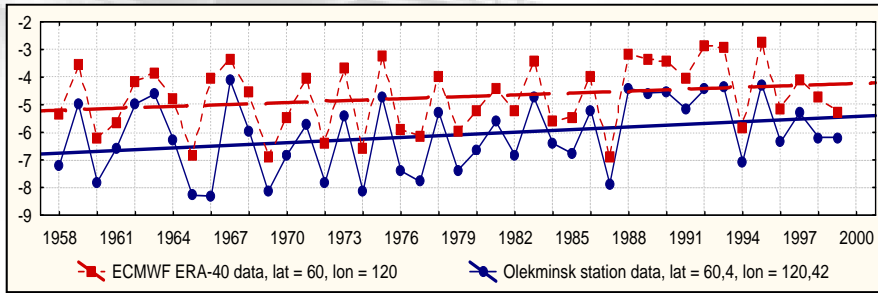
The results

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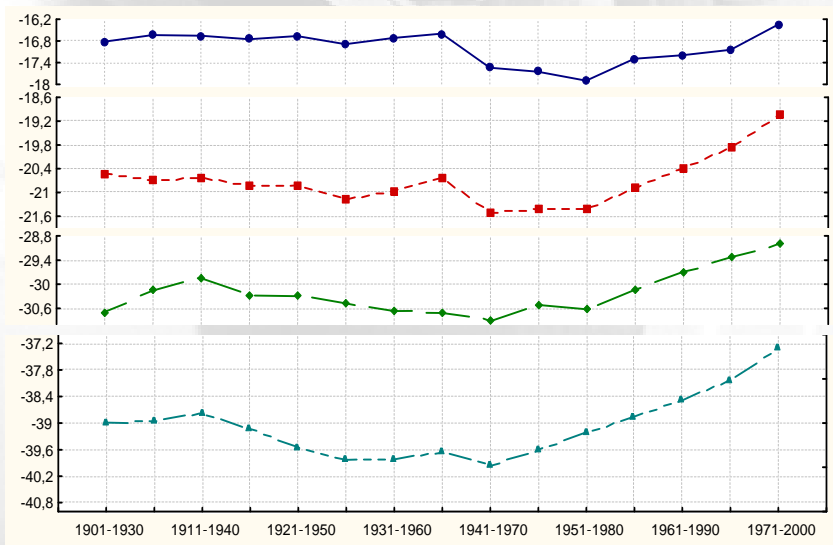
Dynamics of the annual averaged temperature behavior





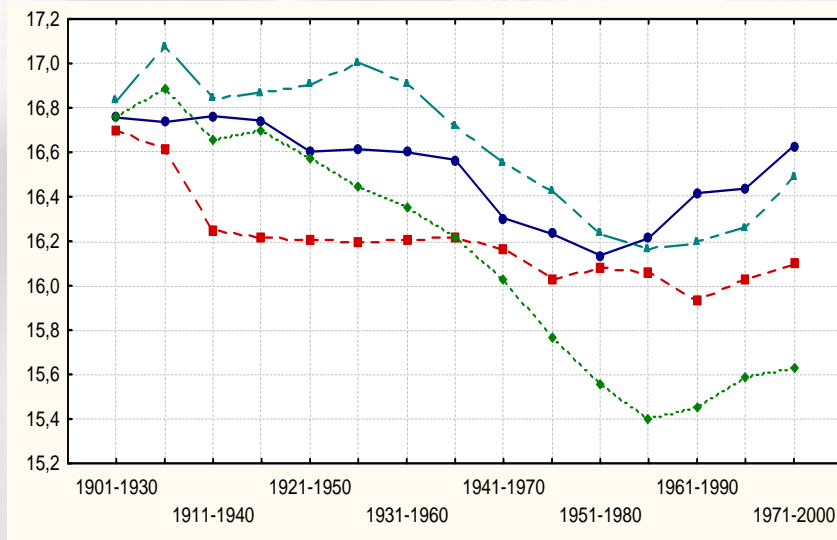
Annual averaged temperature trend over the Siberian territory, 1958-2000

Dynamics of the seasonal averaged temperature behavior



Winter, 1901-2000

- Tobolsk station data
- Yenisejsk station data
- ◆ Olekminsk station data
- ▲ Yakutsk station data



Summer, 1901-2000

Linear trend of the seasonal mean temperature

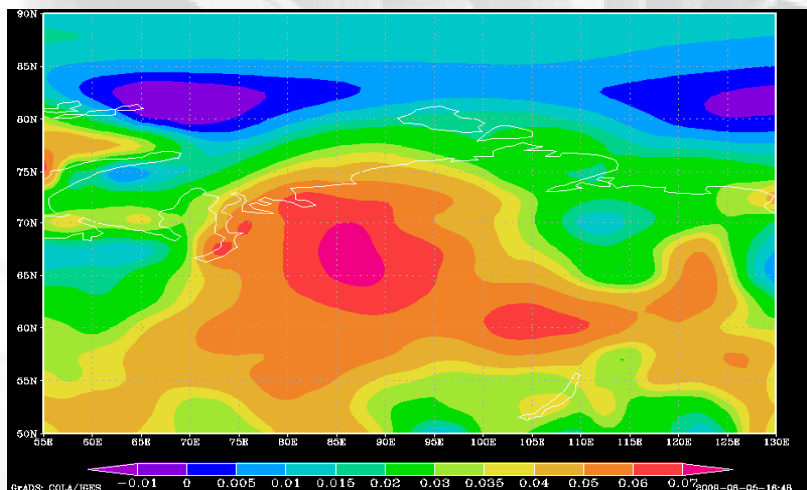


Fig.1. Winter, 1958-2000

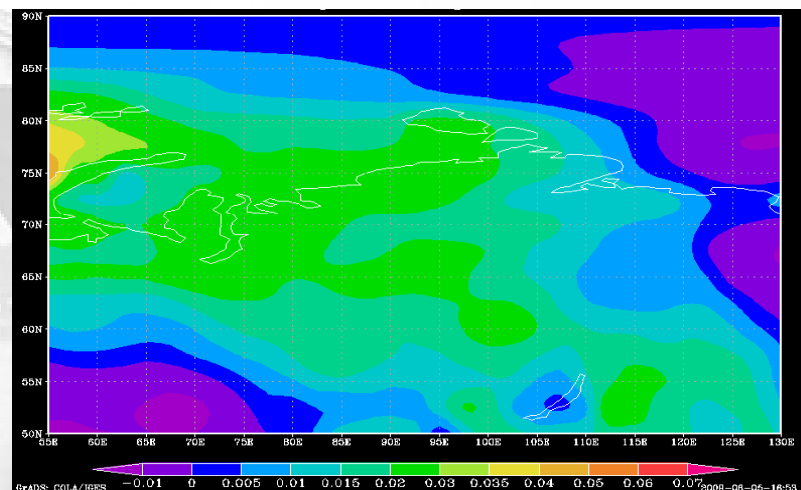


Fig.2. Spring, 1958-2000

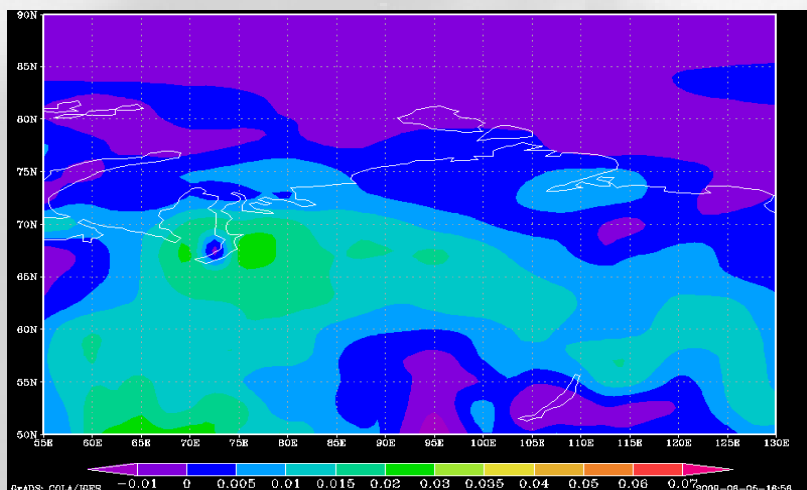


Fig.3. Summer, 1958-2000

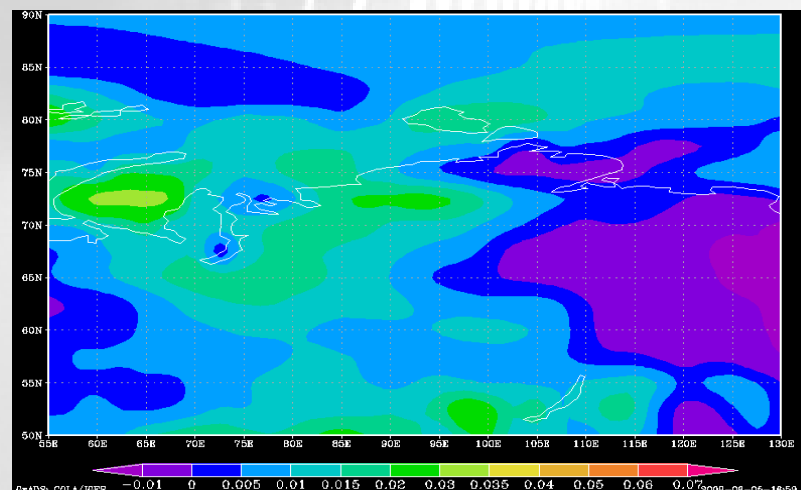


Fig.4. Autumn, 1958-2000

Number of frost and summer days

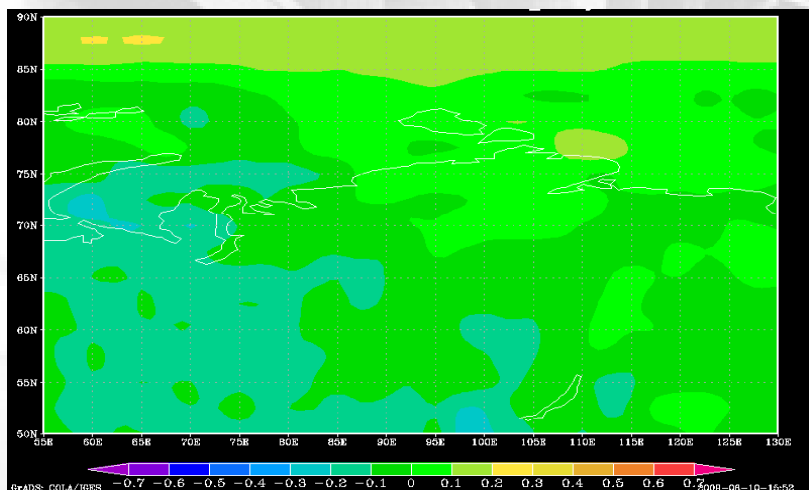


Fig.5. Trend of "Number of frost days" index

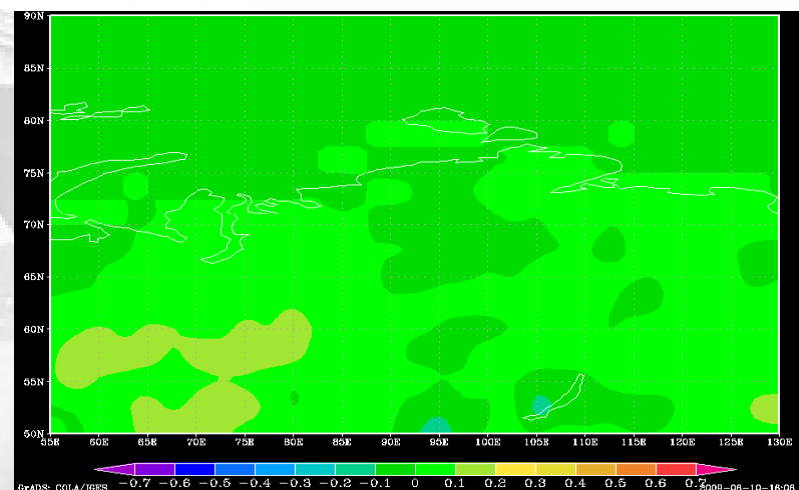


Fig.6. Trend of "Number of summer days" index

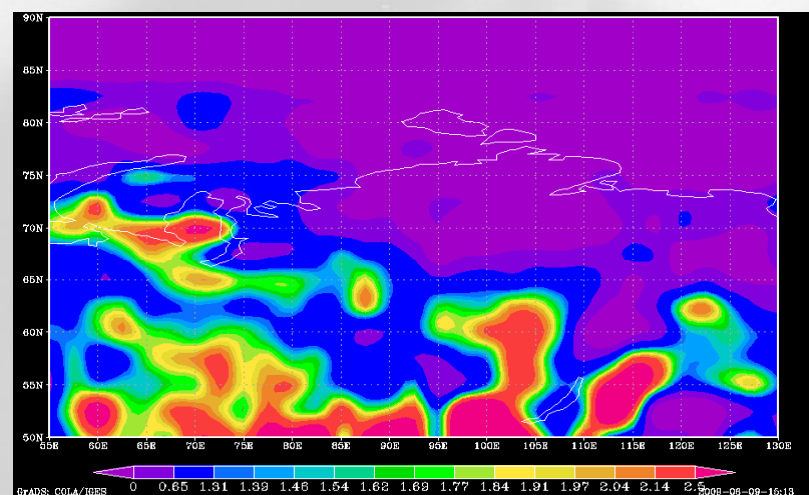


Fig.7. Student statistics of "Number of frost days" index

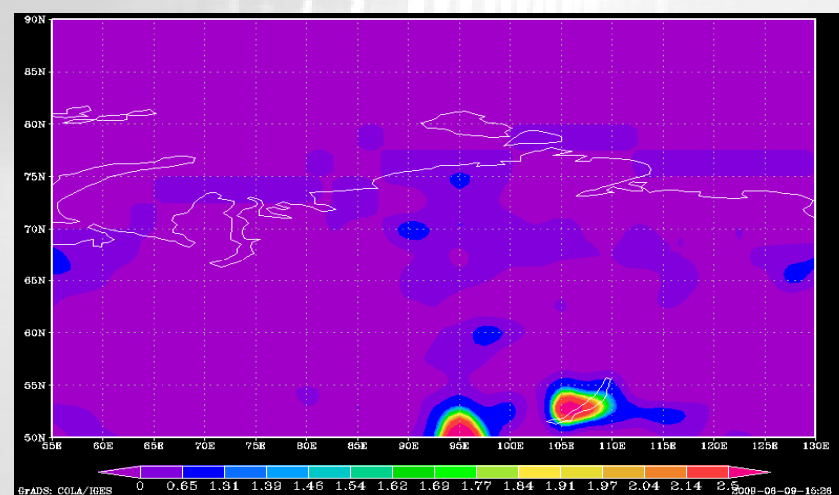


Fig.8. Student statistics of "Number of summer days" index

Conclusion

- Fields of long-term trends have inhomogeneous spatial structure over the Siberian territory;
- Regions with maximum warming rates are located mostly in West Siberia;
- Spatial distribution of seasonally mean temperature changes is specific for seasons. Winter and spring seasons made the main contribution to climate warming.
- Comparison of in-situ and reanalysis data shows that reanalysis data has higher values than data from meteorological stations.

Plans:

- Development of meteorological model for calculation of meteorological parameters by interpolation methods based on weather stations' and reanalysis data with the aim to get fields with the higher-resolution grids for more qualitative analysis of climate variability.

Acknowledgments

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Thank you for your attention!