Droughts and moistening periods in South Siberia at the end of XX and the beginning of XXI centuries

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Outline

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Introduction

Traditionally, aridity is assessed in a manual or semi-automatic mode for a given territory with data from weather stations (observational data).

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This significantly reduces the reliability of the obtained results for Siberia and Far East where data is high sparsity.

Introduction

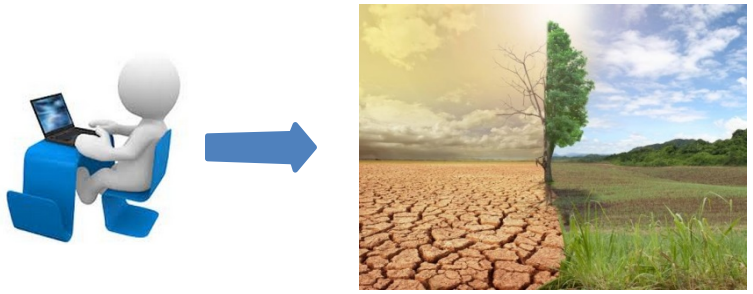
The use of global retrospective analysis data (reanalysis) is also difficult:

- big volumes of data (up to several terabytes) require powerful computing complexes for their processing and large storage space;

- dedicated file formats used for storing data require specific programming skills.

Main goal

Analysis of droughts and moistening periods in South Siberia at the end of XX and the beginning of XXI centuries using web-GIS system called “Climate”.



Web-GIS system “Climate”

- is based on a combined use of web and GIS technologies;
- is a part of a hardware and software complex for “cloud” data analysis using:
  - various climatic data sets;
  - dedicated algorithms for their searching, extraction, processing, and visualization.
- significantly facilitates and accelerates analysis of big volumes of geospatial data.

System “Climate” allows researchers to perform **complex climate data analysis** using desktop PCs with internet connection.

Calculation

The droughts and moistening periods were analyzed using new program module of previously developed **web-GIS system "Climate"** with data from reanalysis.

The assessment algorithm of hydrothermal conditions is based on **Ped' index** (**Si**):

$$S_i = \frac{\Delta T_i}{\sigma_T} - \frac{\Delta P_i}{\sigma_P},$$

where $\Delta T_i = T_i - T_{norm}$ *– temperature anomaly in the i-th period,* σ_T *– standard deviation of temperature. For precipitation is similar.*

Calculation

Input data: ERA Interim Reanalysis, 0.75×0.75°.

Period: 1979-2010 years.

Territory: South Siberia (50°-65° N, 60°-120° E).

Facts: ERA Interim reanalysis and observation data comparison show a slight difference in the temperature values (an average -0.86°C) and a significant discrepancy (an average 49%) in the precipitation.

So…

Calculation

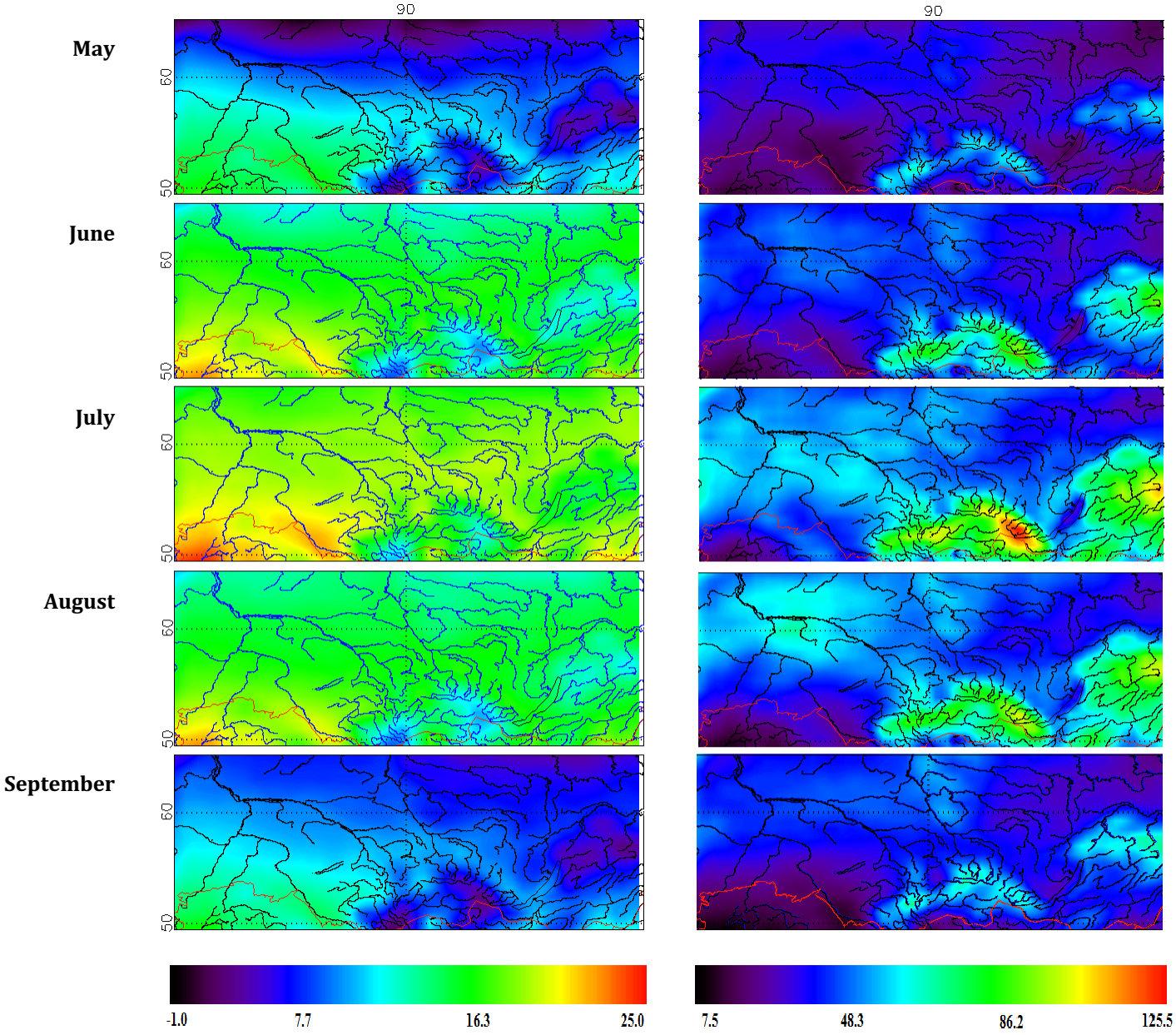
To improve precipitation reanalysis data:

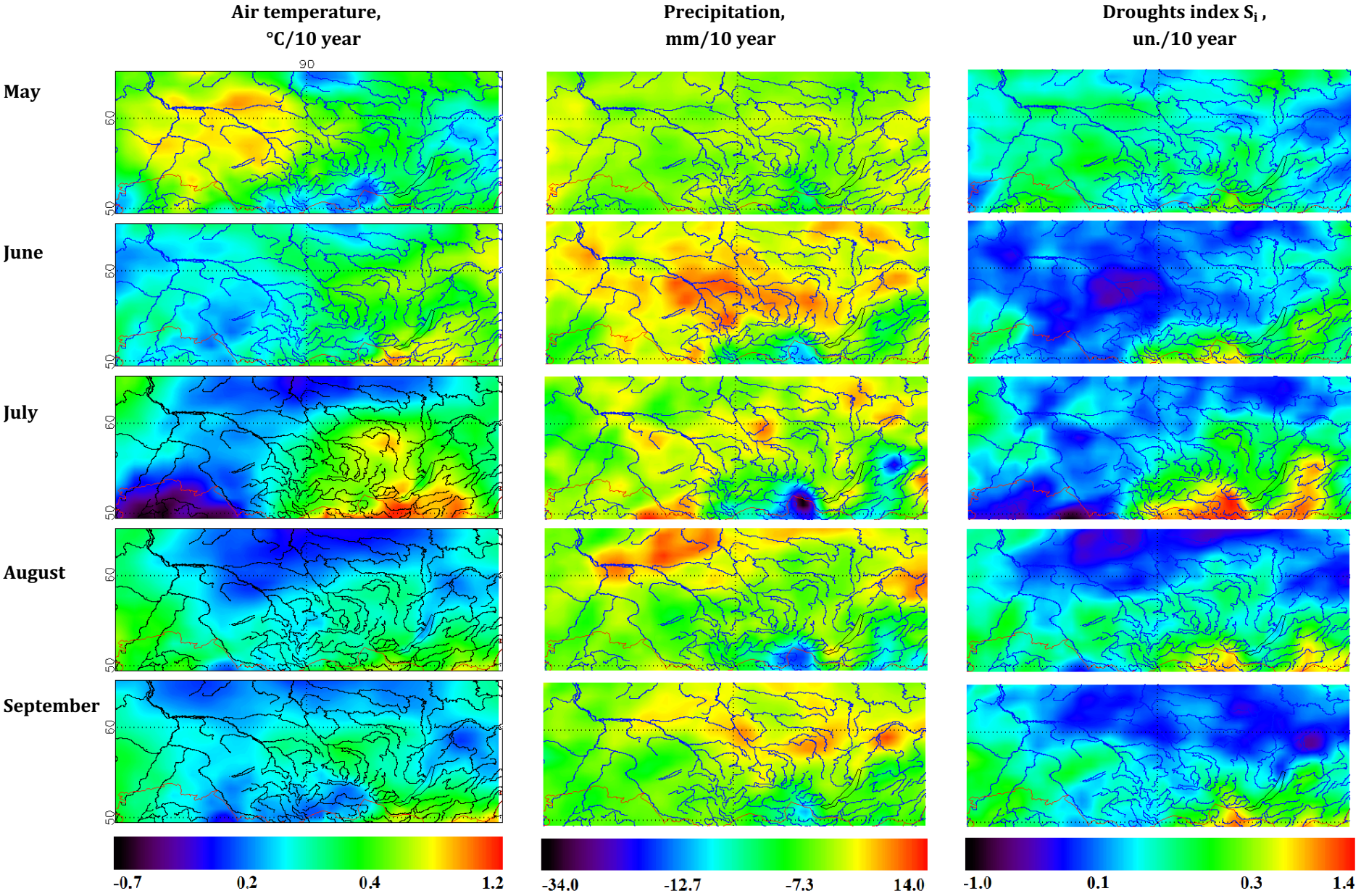
- daily precipitation reanalysis data are interpolated from the reanalysis grid to the coordinates of the weather stations;
- add-on module: correction of the precipitation reanalysis data is performed using linear regression for each year and month of vegetation period (from May to September).

Analysis are performed for both hydrothermal Ped' index and its components (average monthly temperature and corrected monthly precipitation).

Long-term average of air temperature, 1979-2010 years, °C

Long term average of precipitation, 1979-2010 years, mm




Air temperature,
°C/10 year
Precipitation,
mm/10 year
Droughts index S_i ,
un./10 year
May
June
July
August
September
90
60
50
-0.7
0.2
0.4
1.2
-34.0
-12.7
-7.3
14.0
-1.0
0.1
0.3
1.4

Conclusion

The developed software module of the system “Climate”:

— significantly facilitates and speeds up the calculations of droughts indices,

— allows to assess the spatial distribution of hydrothermal conditions of the region,

— allows to check quality input data.

The results of the works of the module:

— are represented by netCDF files, georeferenced maps and layers,

— can be easily transferred to online and desktop GISs for further cross-analysis with other spatial products.

Thank you for attention!