

Variability of planetary high-altitude frontal zone and jet stream in the Northern hemisphere from 1991 to 2019 in the summer period

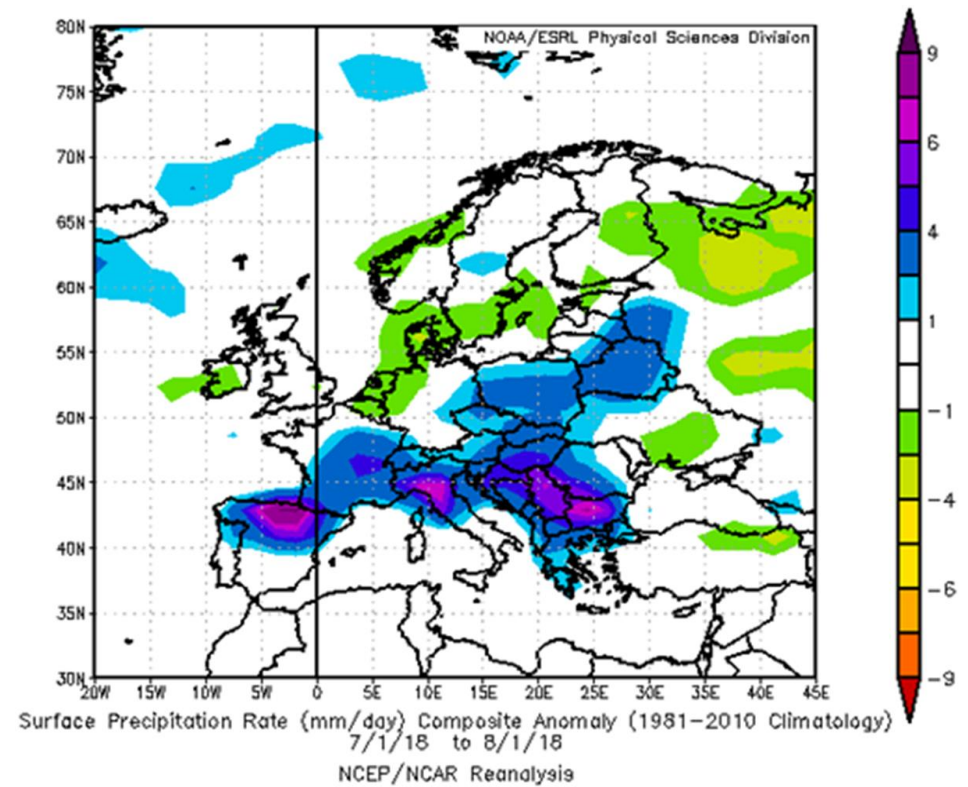
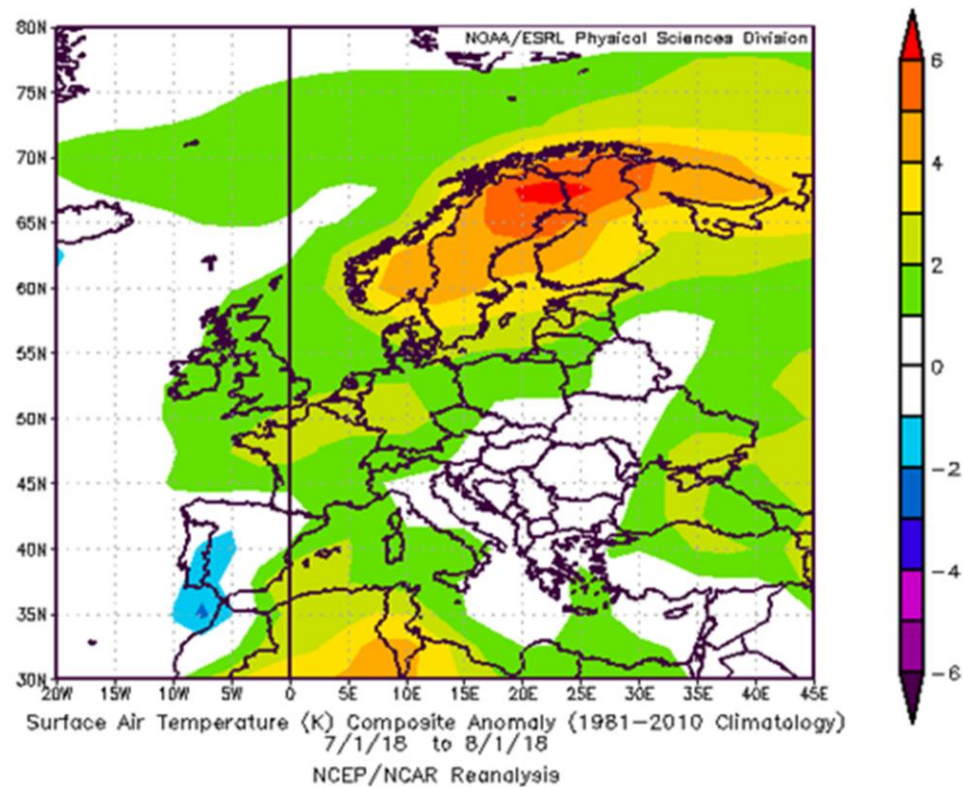
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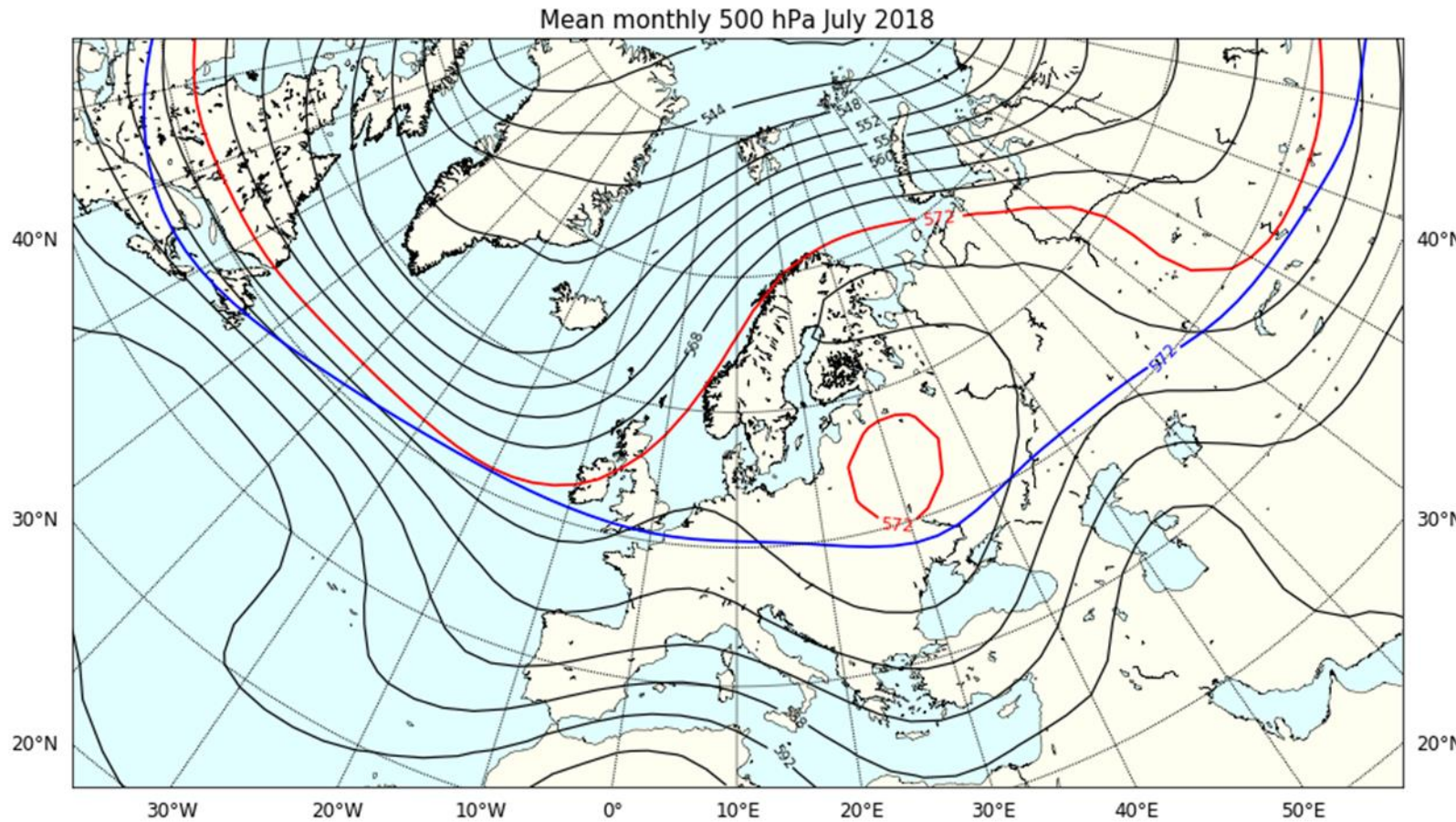
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Anomaly summer in July 2018 in Scandinavia and northern part of European part of Russia



The anomalous high surface air temperature was observed in Scandinavia, northern part of European Russia and in Saint-Petersburg too, anomalous amount of precipitation – in Central Europe.
The reason – blocking in atmospheric circulation, in case of 2018 year anticyclone over Barents Sea, cyclone over Central Europe.

Location of high-altitude frontal zone and jet stream in July 2018



On mean monthly isobaric surface of 500 hPa the high-altitude frontal zone has observed over the Barents Sea. By the second half of July the high-altitude anticyclone has formed over Scandinavia and Barents Sea coast.

Mean monthly isobaric surfaces 500 hPa of data reanalysis NCEP NCAR $2.5^\circ \times 2.5^\circ$ were analyzed from 1991 to 2019 years every summer month – June, July and August.

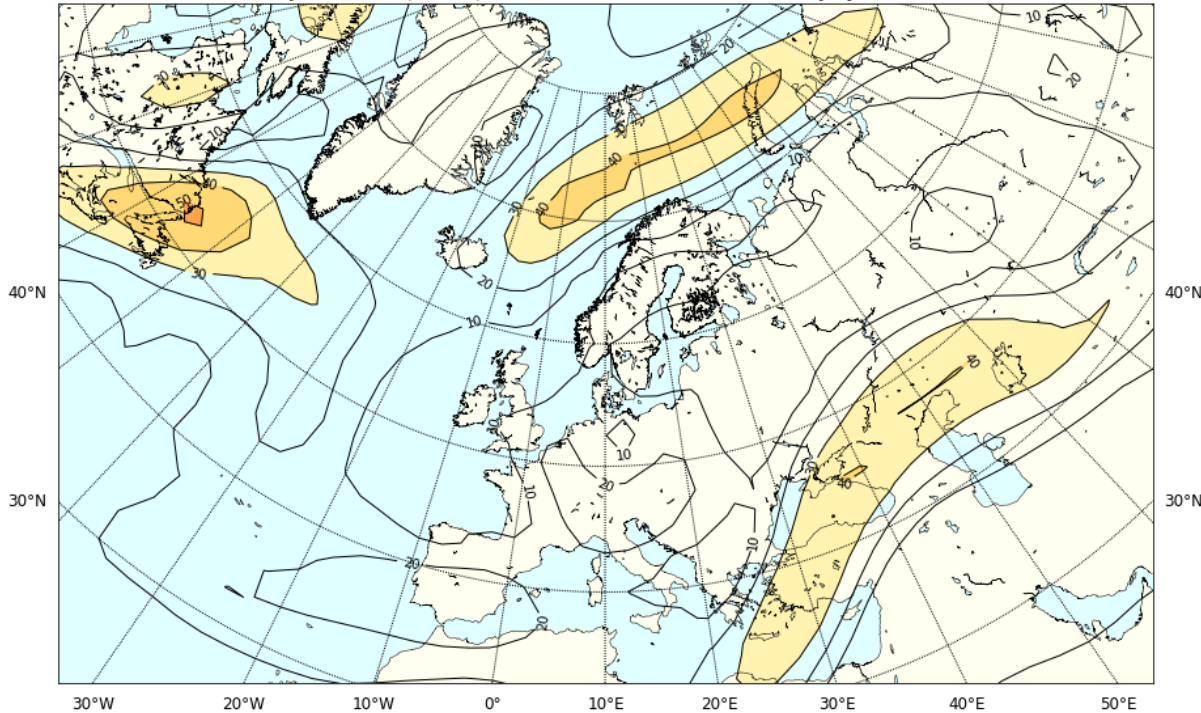
For each summer months was defined one isohyps which characterizes the middle location of high-altitude frontal zone.

For June this isohyps equals **560 hPa**, for July and August **572 hPa** (method used in some Hydrometeorological offices of Russia).

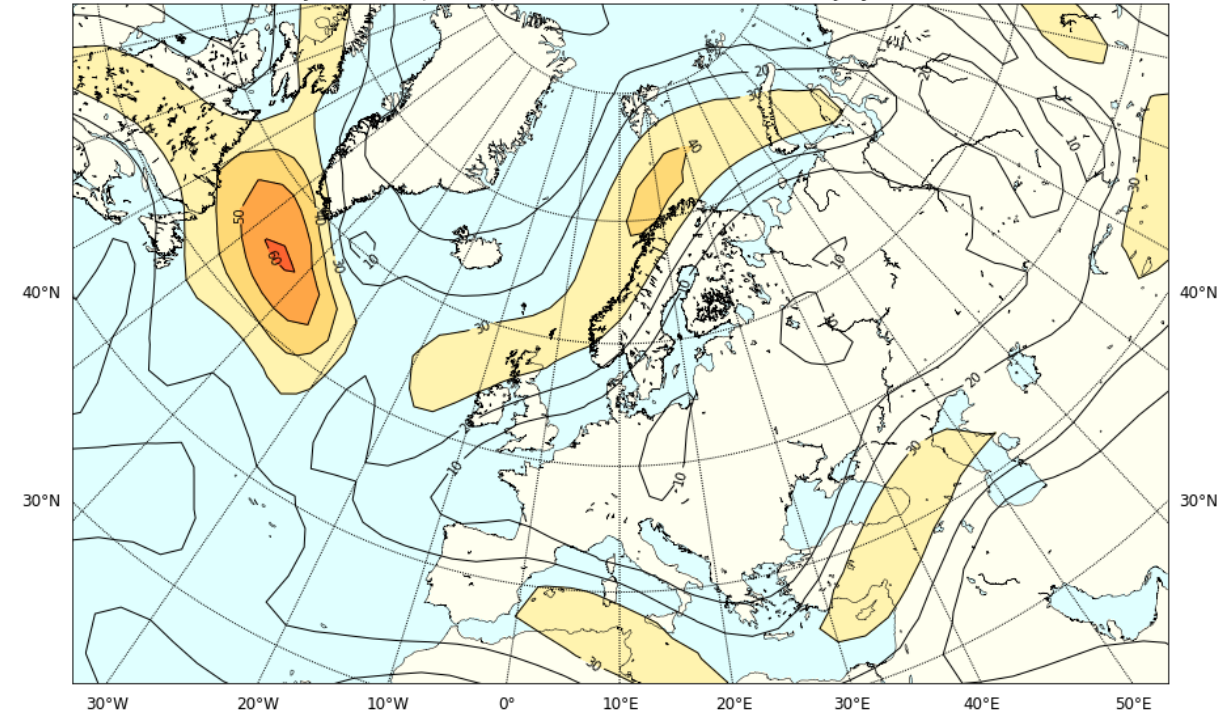
Isohyps of each months has compared with climatological norm (1961-1990 years).

Location of high-altitude frontal zone and jet stream in July 2018

Jet stream (m/sec) isobaric surface 300 hPa on 11 July 2018



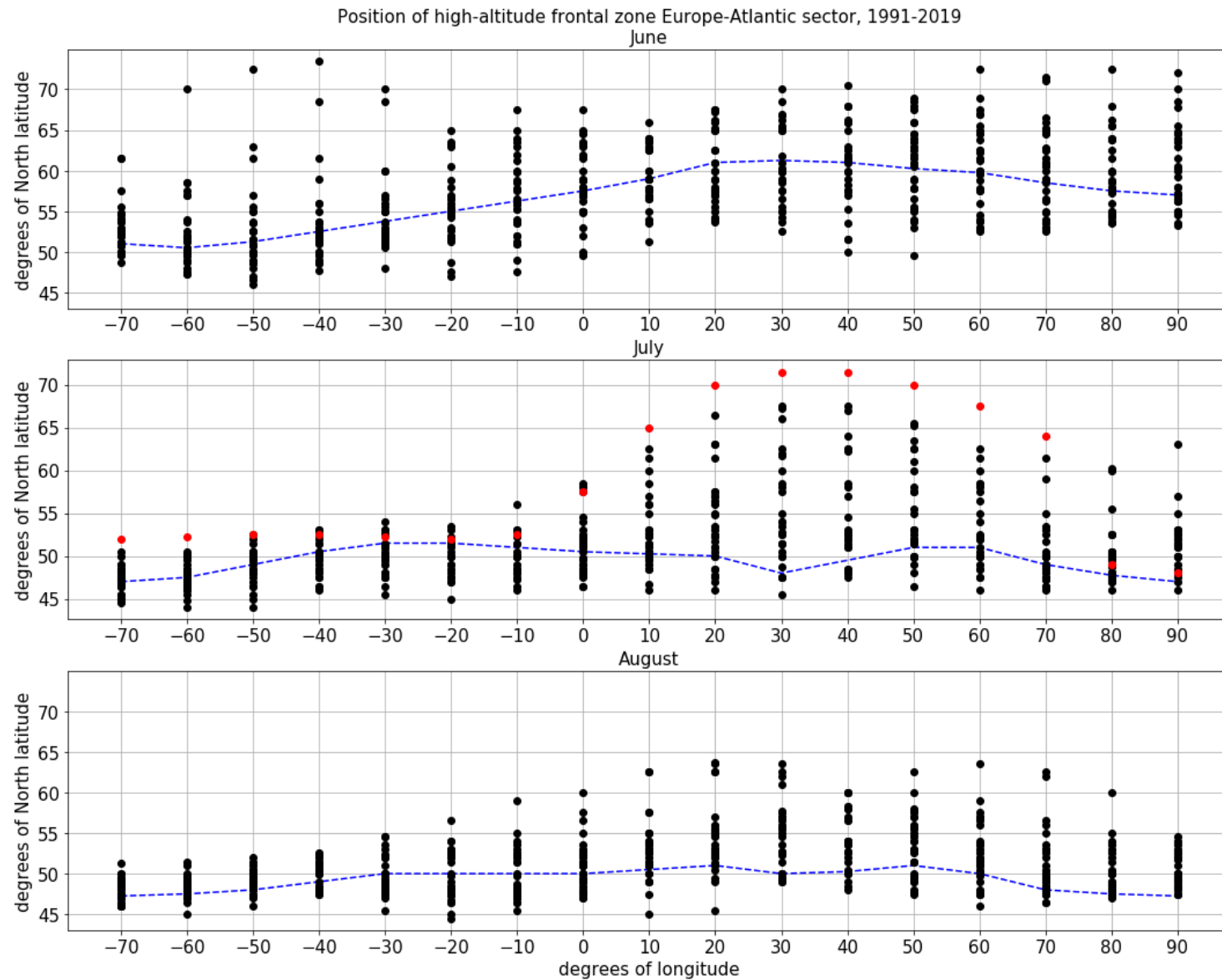
Jet stream (m/sec) isobaric surface 300 hPa on 25 July 2018



During July the location of polar front jet stream has noted through North Atlantic, Iceland and the Barents Sea. This poleward moving related with strong warm advection in the rear of high-altitude ridge over Scandinavia and European part of Russia (previous slide).

The form of jet stream had a strong meandering structure and weak wind near jet core - 30-40 m/sec over Barents Sea, maximum over North Atlantic at some days to 60 m/sec (NCEP NCAR reanalysis).

Variability of position planetary high-altitude frontal zone in summer period (JJA) from 1991 to 2019 years.



The location of the high-altitude frontal zone in July 2018 (red dots) was the most northern position for the period from 1991 to 2019 (black dots) in relation to climatological norm 1961-1990 years (dashed blue line).

The most events of poleward location of frontal zones and jet streams are observed over Europe with maximum in July (central fig) but not over the North Atlantic, where the location of frontal zone is noted within $\pm 5^\circ$ latitude from climatological norm.

In June deflection $>10^\circ$ latitude from norm is observed rarely, except June 2012, where frontal zone over Eastern coast of North America reached Greenland (top fig).

In August high-altitude frontal zone has low amplitude over North Atlantic and poleward moving over Europe and European part of Russia like in July but smaller deflection (bottom fig).

Summary

- The disturbance in zonal atmospheric circulation is a reason of anomalous local weather event;
- The meridional circulation with spreading of high-altitudes ridges from south becomes more frequent on summer period, particularly on July, over Europe and European part of Russia during 1991-2019;
- Polar front jet stream in these cases has more meandering form and weaker wind near jet core and can lead to the blocking regime and amplification and duration of anomalies.