3rd PannEx workshop on the climate system of the Pannonian basin
Cluj-Napoca, Romania
20-22 March 2017

Synoptic conditions for cold waves and cold spells occurence in Romania

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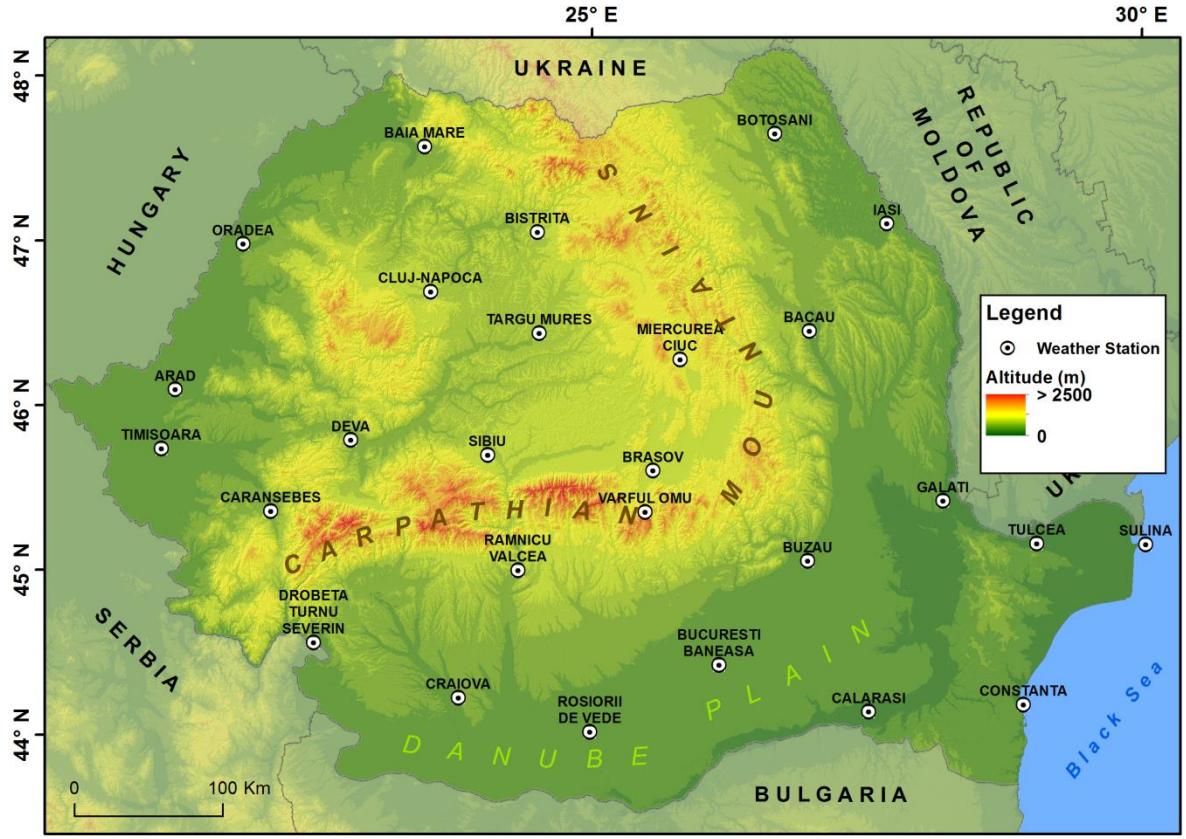
A. Methodology for the identification of cold waves and cold spells:

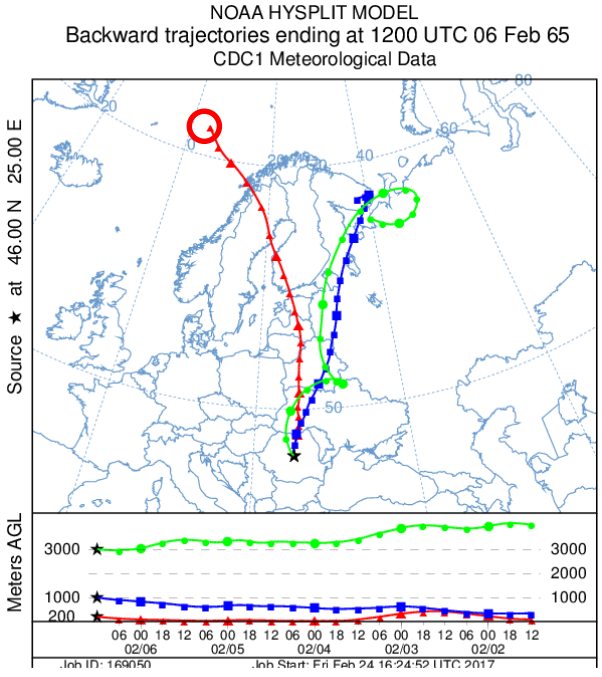
CWs and CSs were identified at 28 weather stations in Romania over the period 1961-2015.
Intensity threshold of CWs and CSs: 10th percentile using the reference period 1961-1990

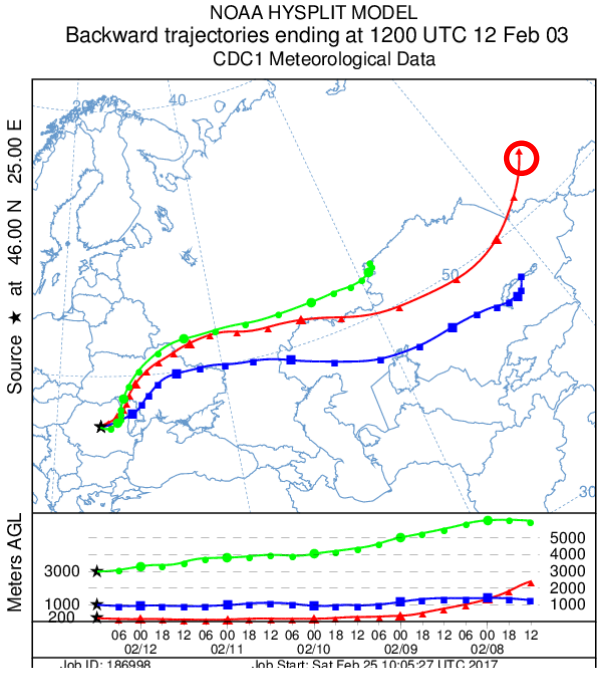


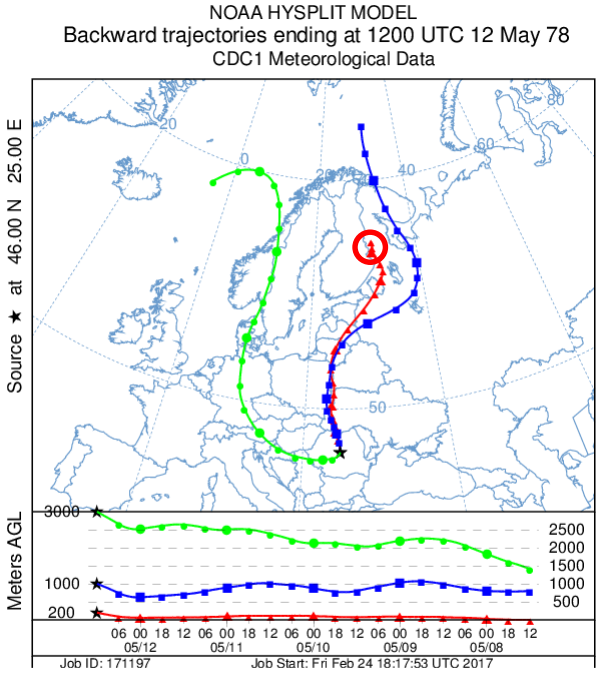
Duration threshold: three or more consecutive days.
For synoptic analysis we considered only those events which were recorded simultaneously by at least 75 % of the weather stations considered for at least two days.

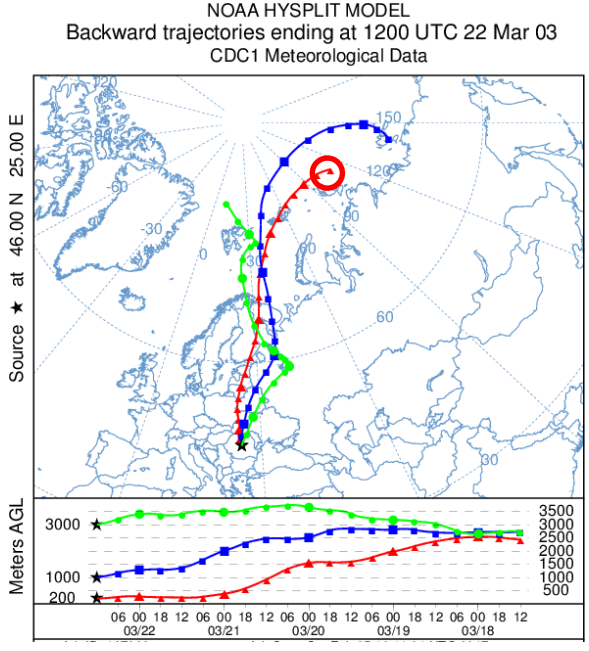
A total number of 76 CSs and CWs were analyzed, cumulating 291 days.

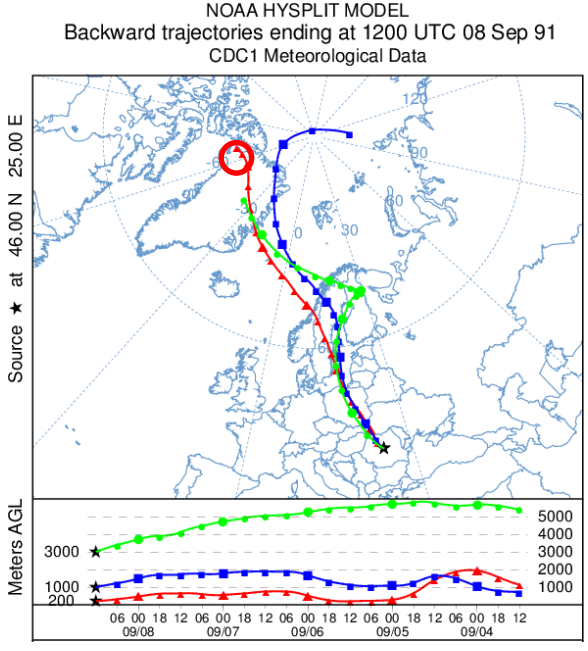
B. Methodology for the classification of cold waves and cold spells:

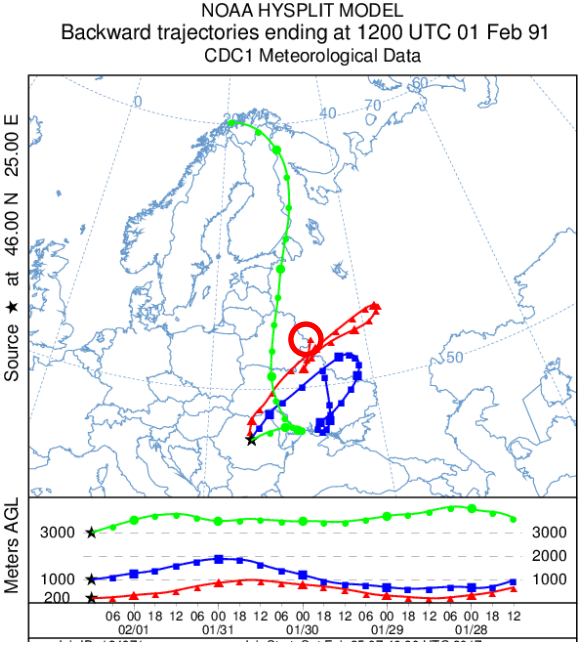




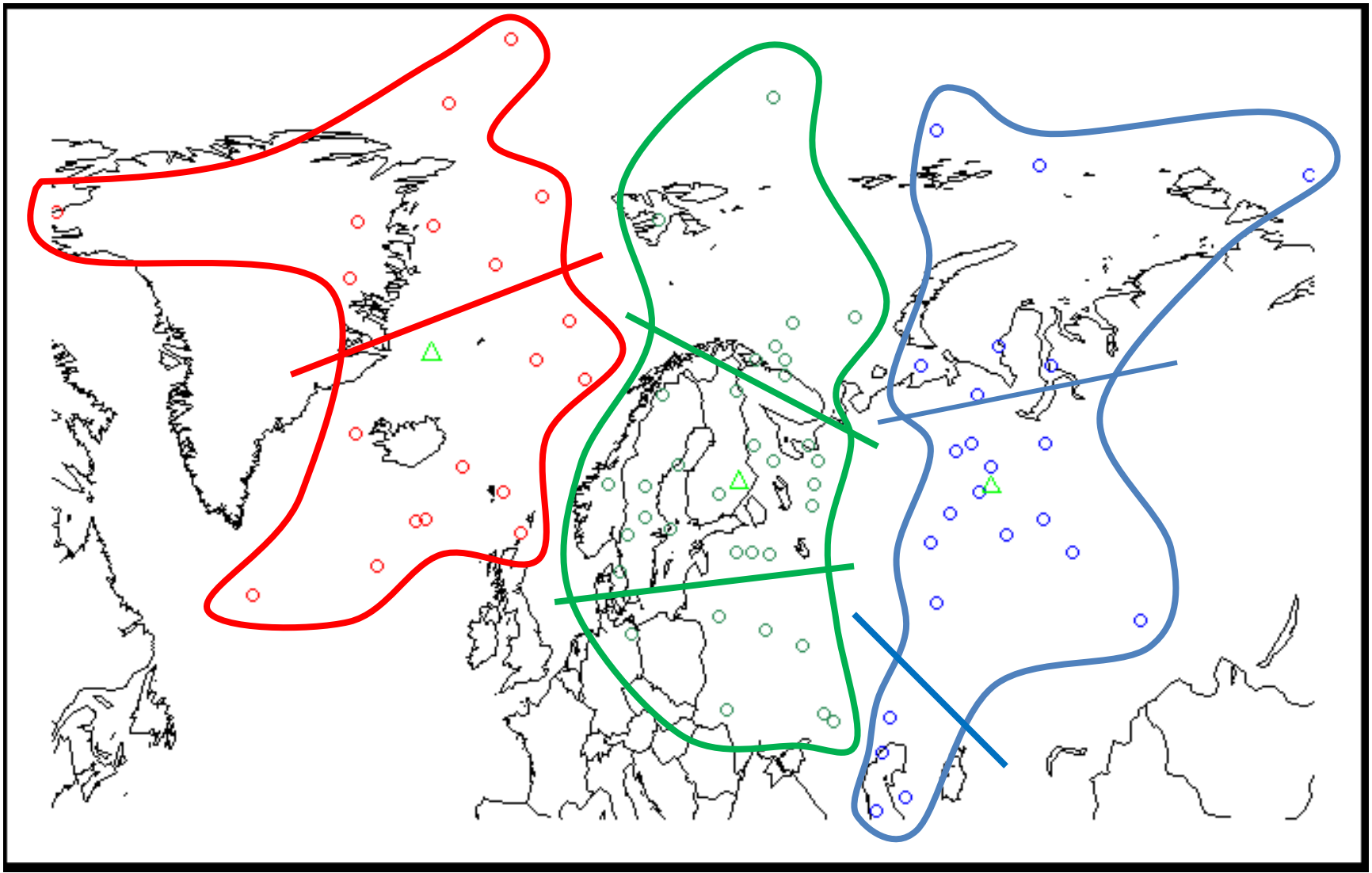




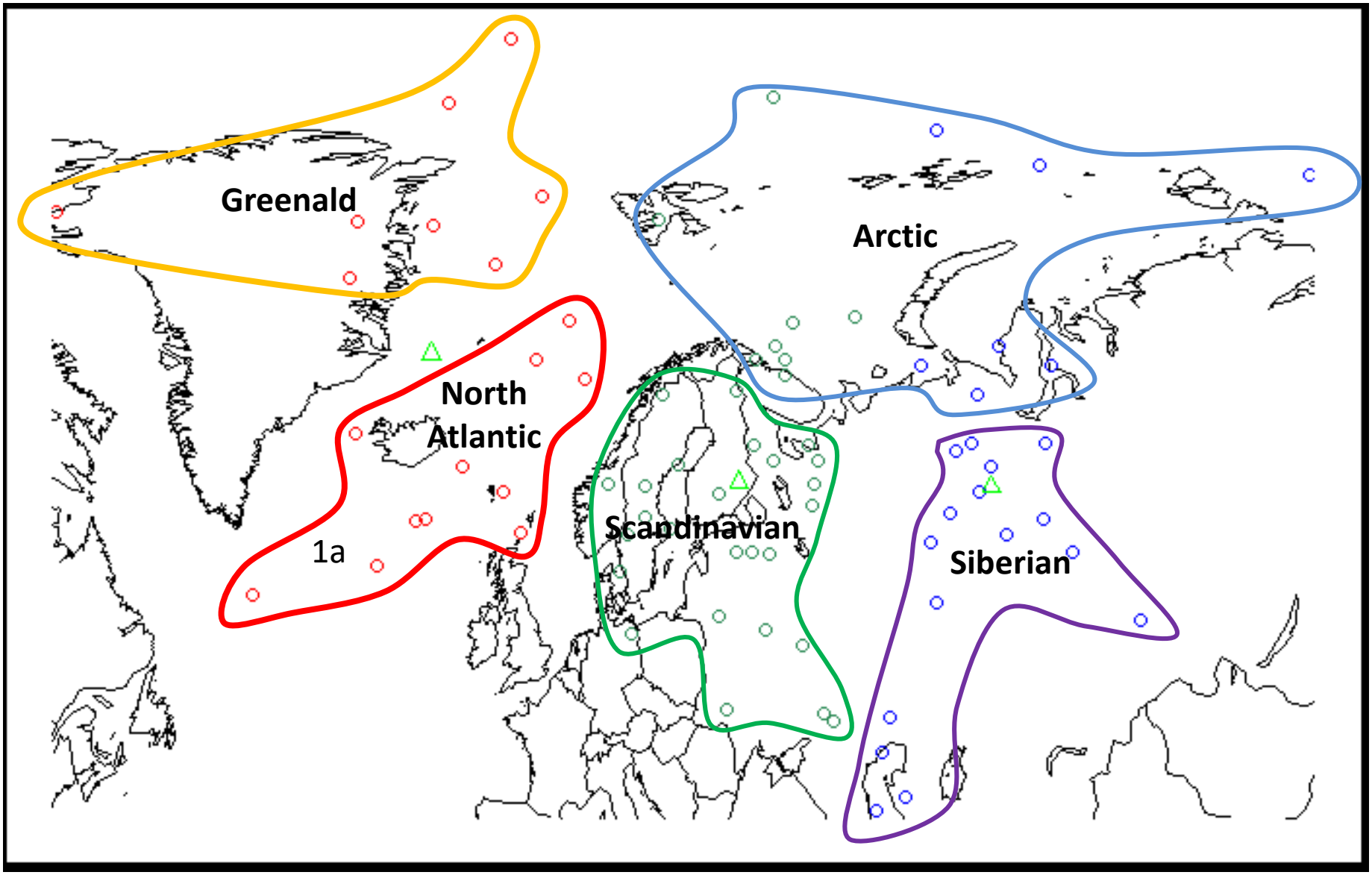




1. k-mean clustering of all the air mass advection generating CW and CS
2. geographical subclustering of the 3 main clusters
3. regrouping of the subclusters on the basis of the similar composites maps of synoptic parameters;

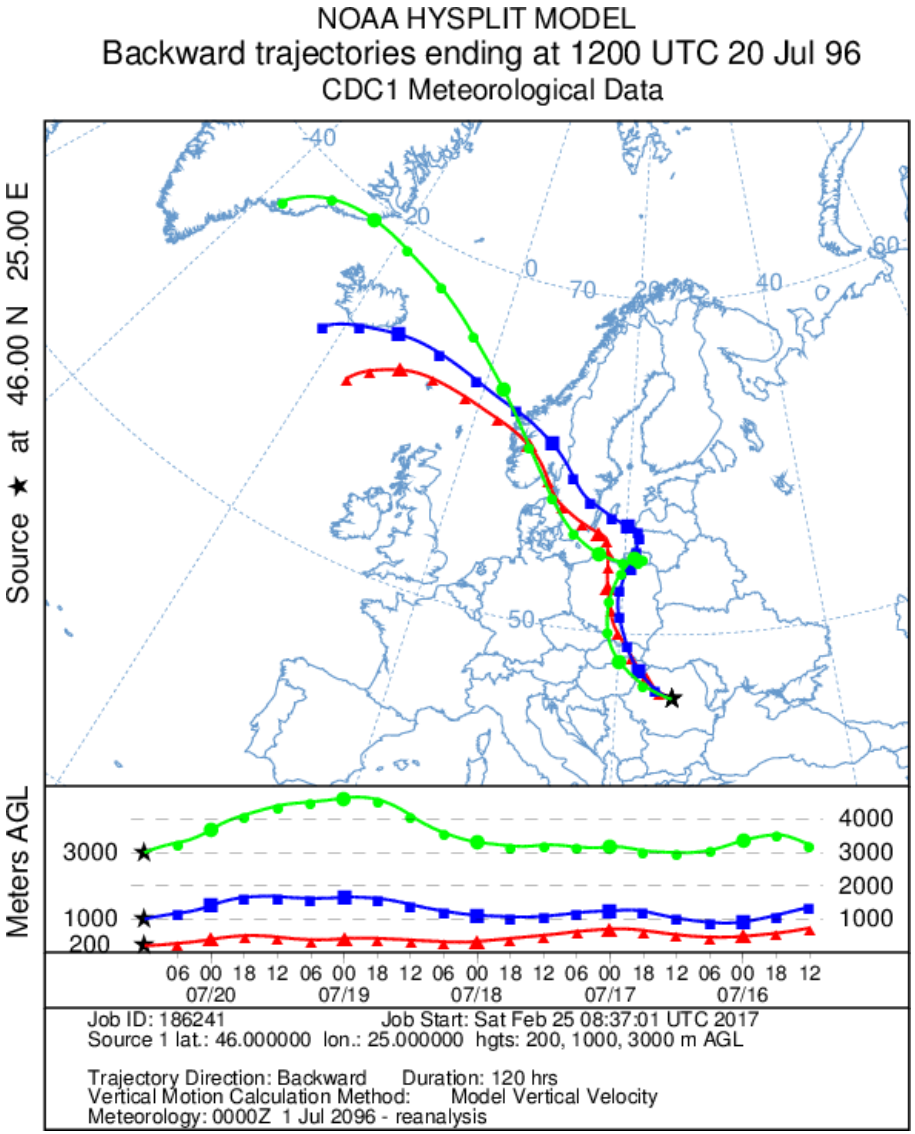


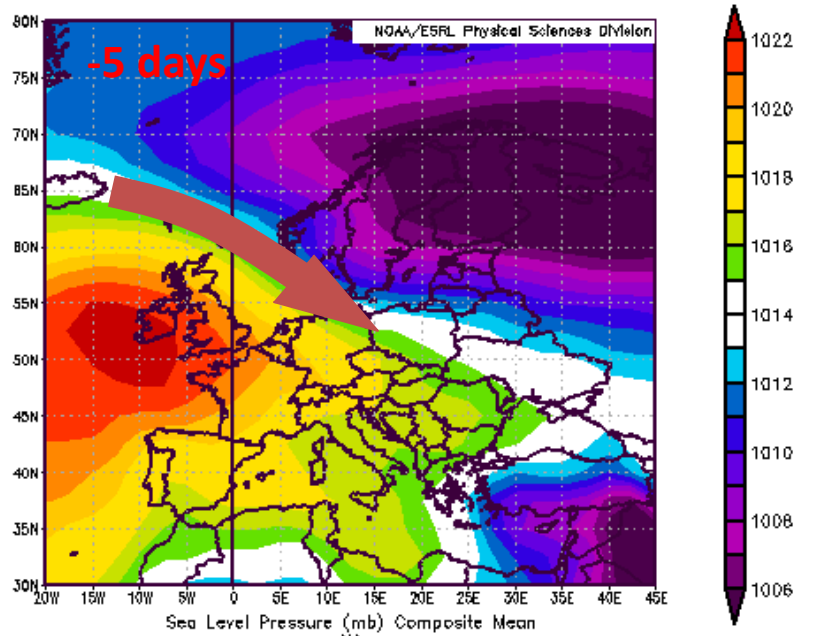
4. delimitation of 5 main synoptic circulation types generating cold waves

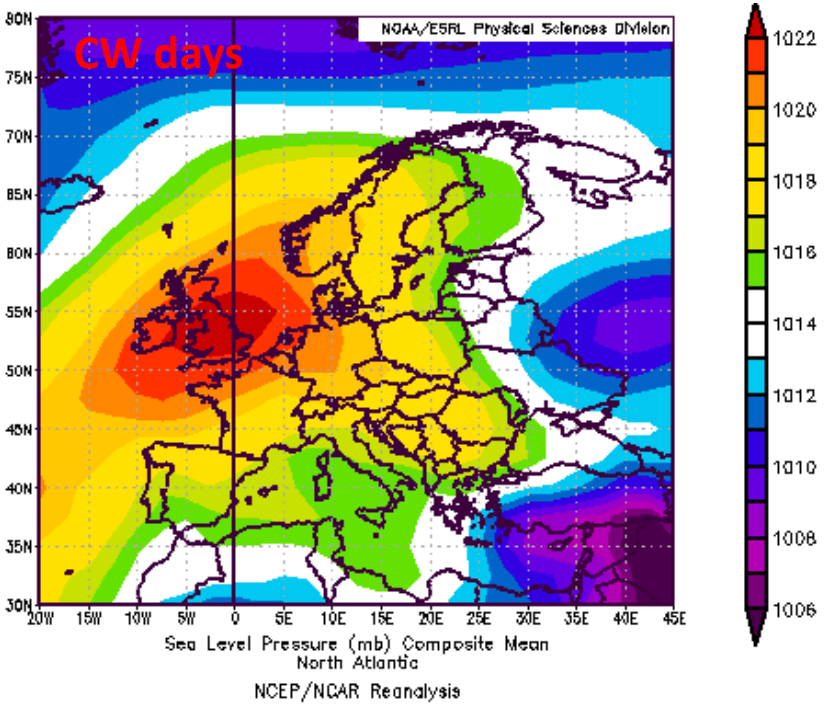


Other source of data: NCEP/NCAR Reanalysis, Rocada database

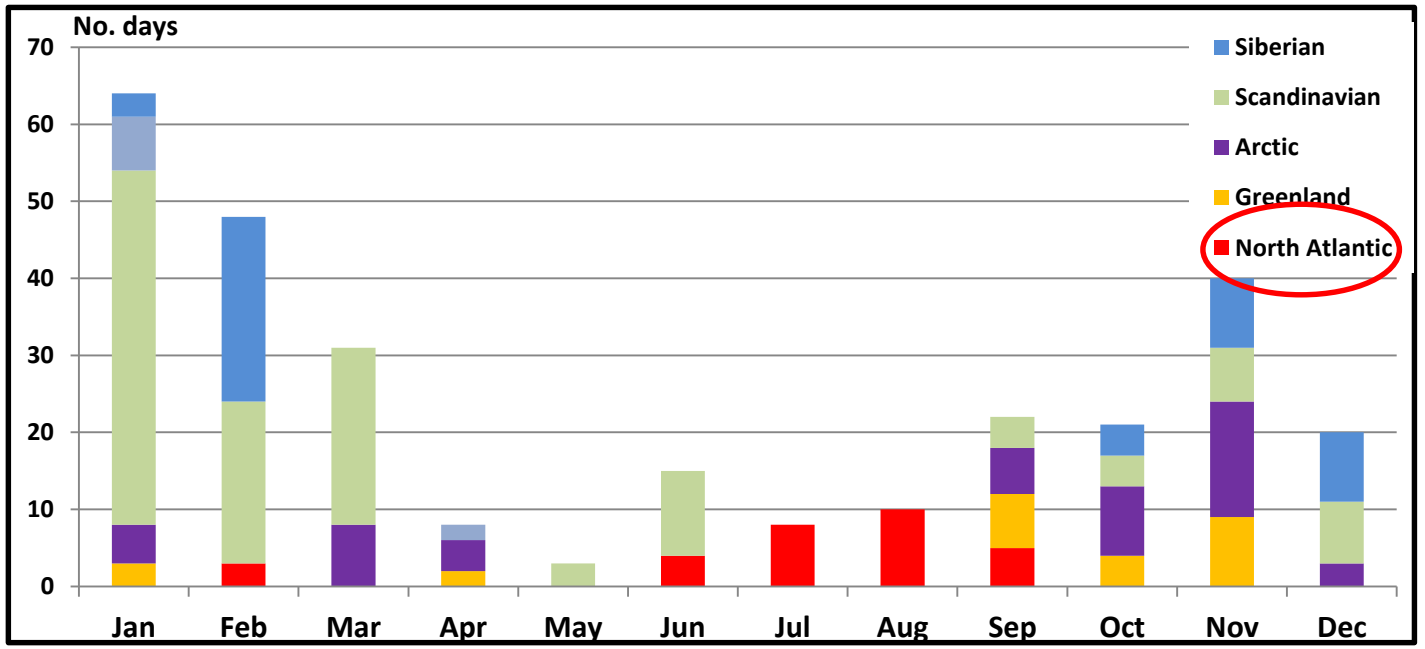
1a. North Atlantic CSs (12 events; 30 days)



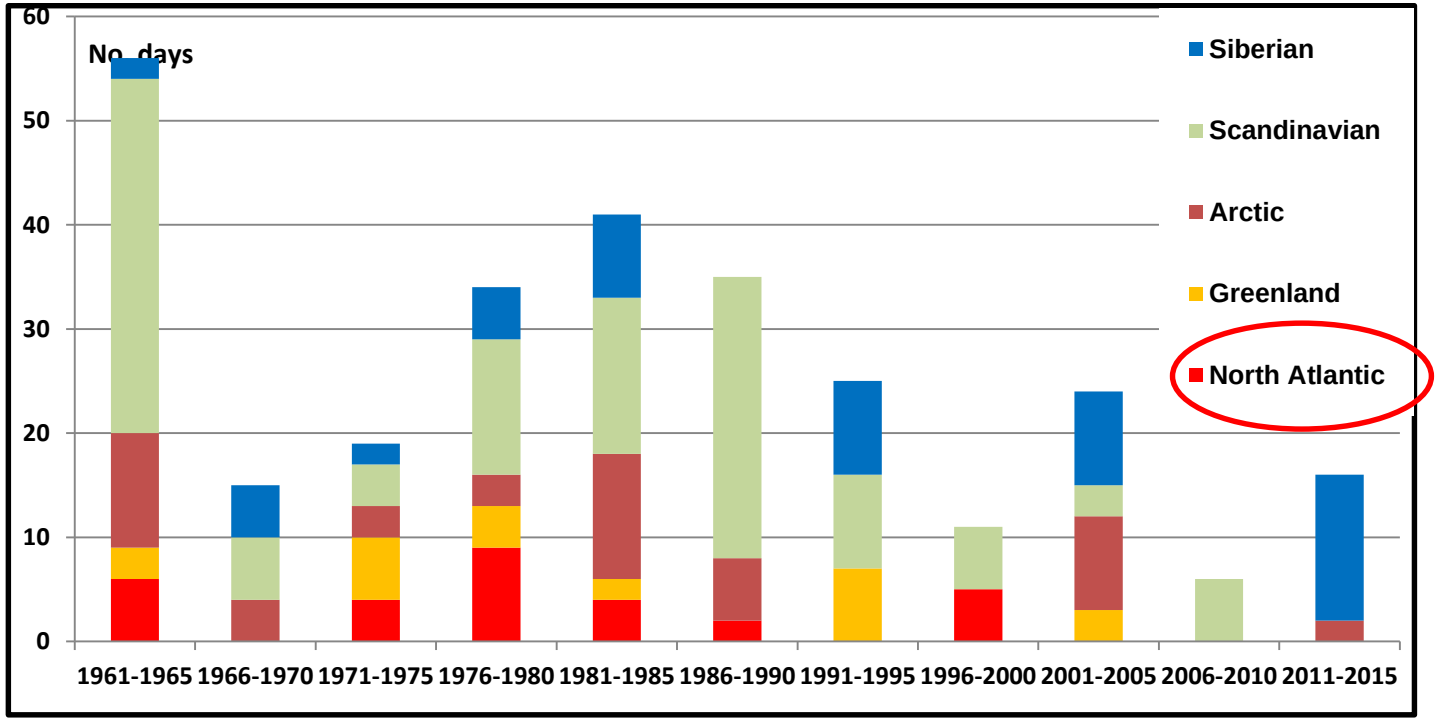


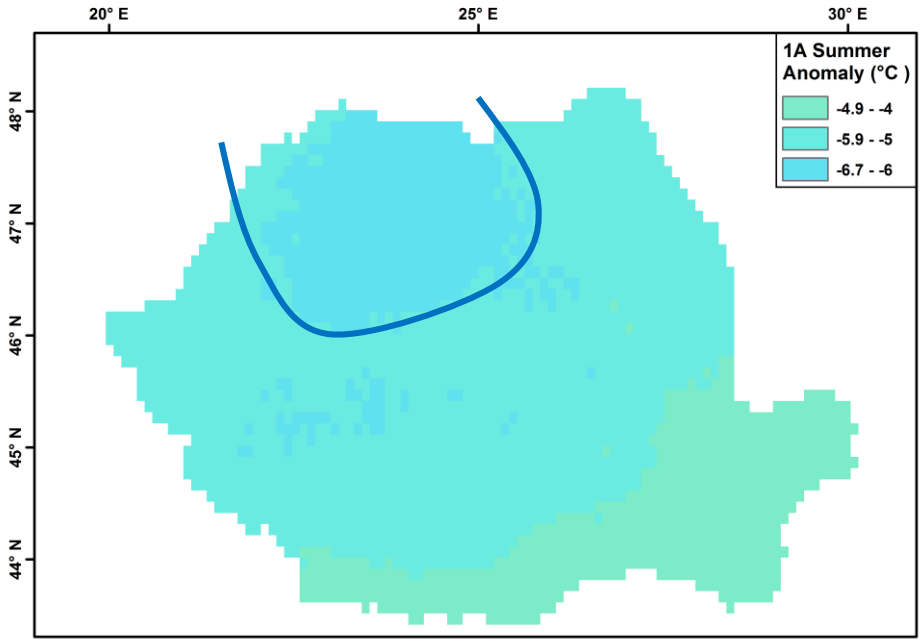


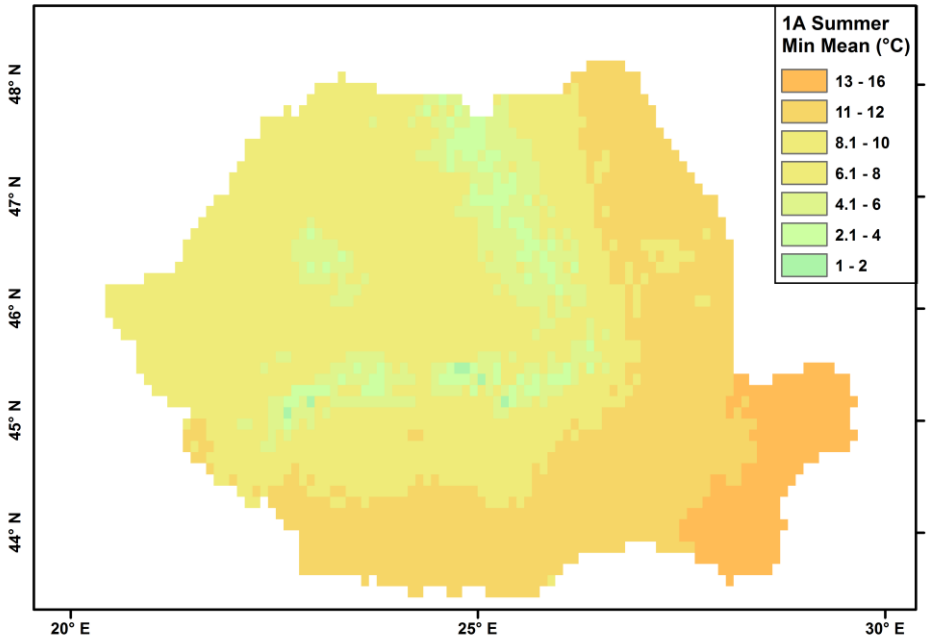
Monthly regime:



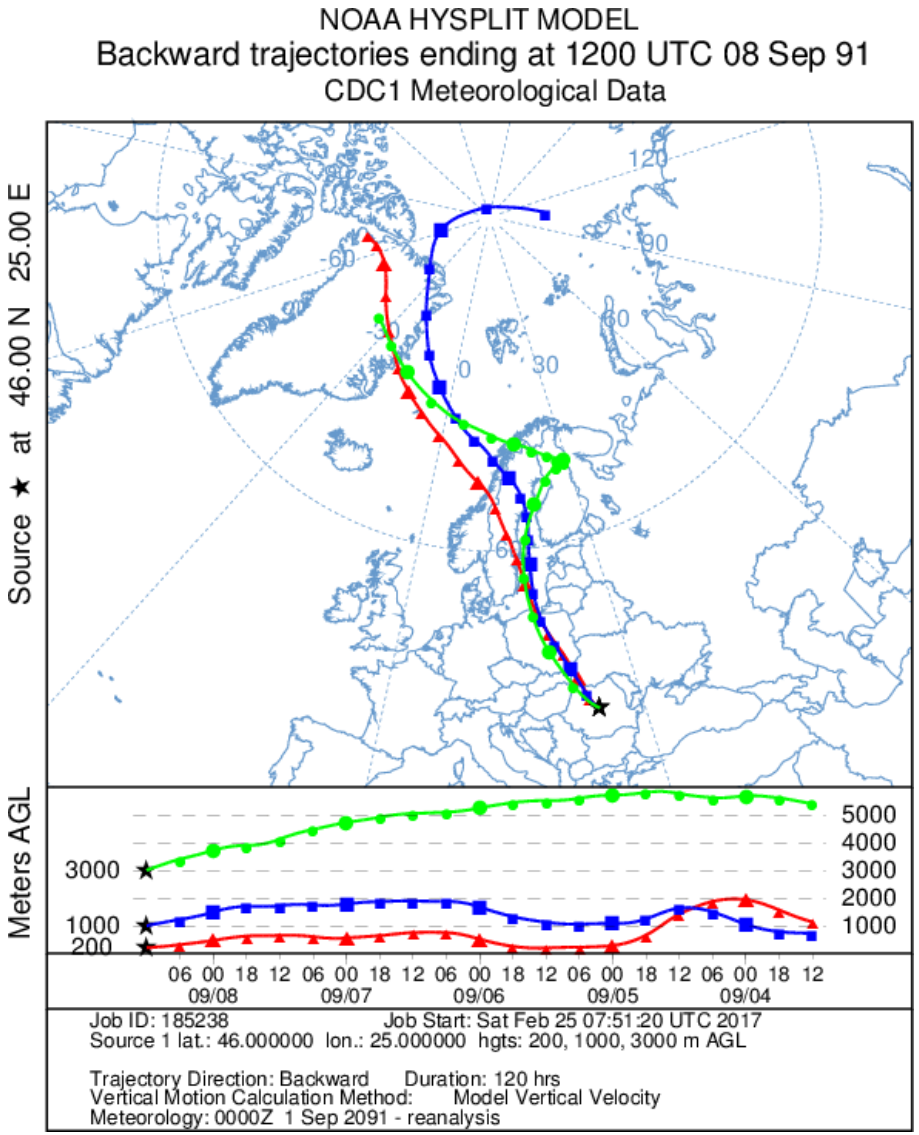
Multi-annual variations:

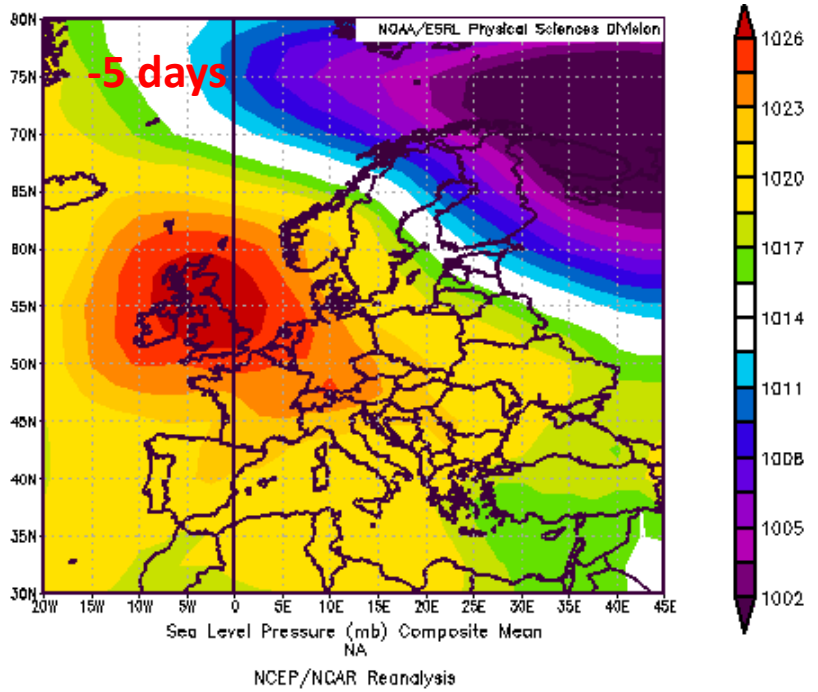


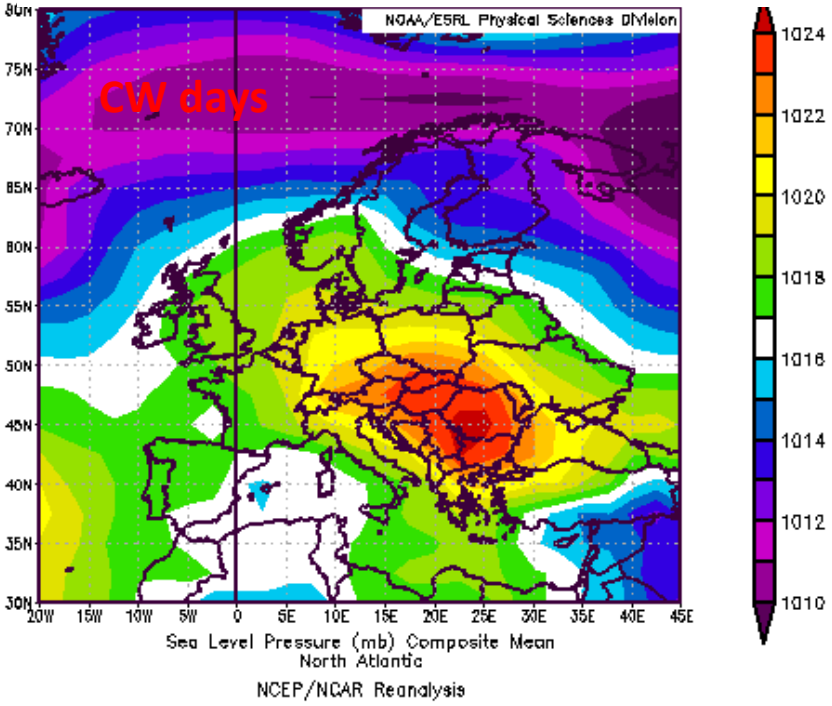

20° E
25° E
30° E
48° N
47° N
46° N
45° N
44° N
1A Summer
Anomaly (°C)
-4.9 - -4
-5.9 - -5
-6.7 - -6


48° N
47° N
46° N
45° N
44° N
1A Summer
Min Mean (°C)
13 - 16
11 - 12
8.1 - 10
6.1 - 8
4.1 - 6
2.1 - 4
1 - 2
20° E
25° E
30° E

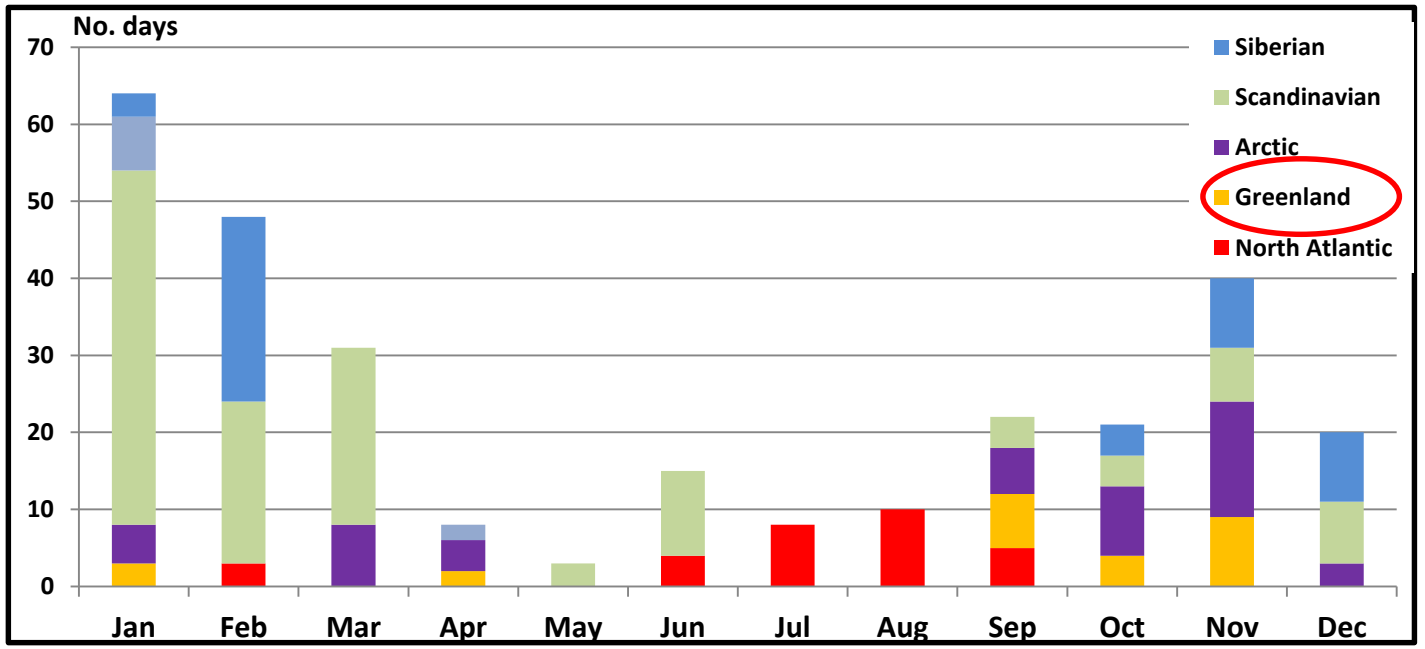
1b. Greenland CWs (7 events; 25 days)



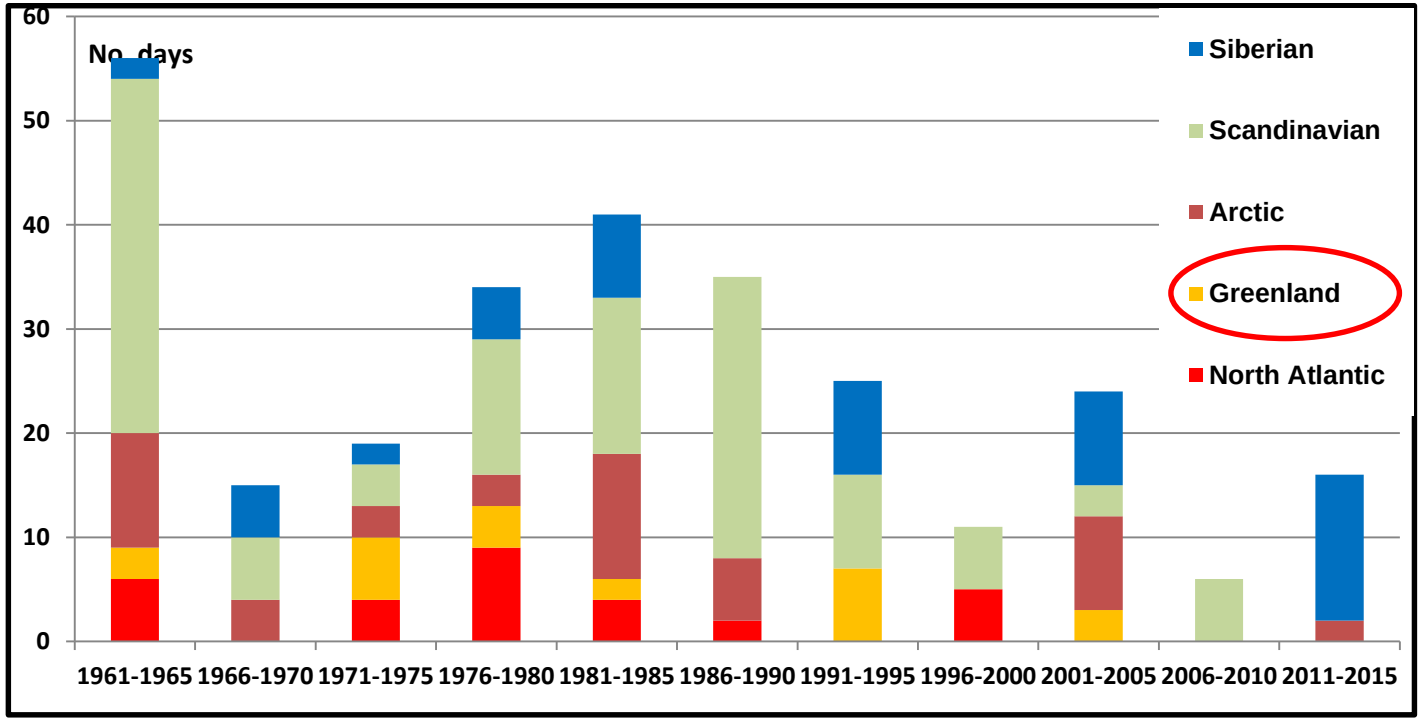


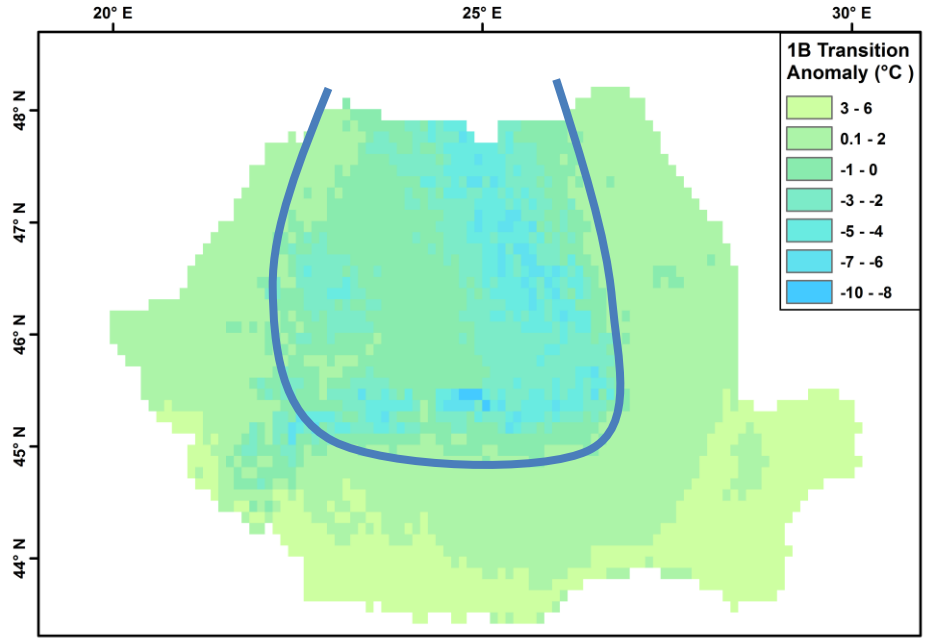


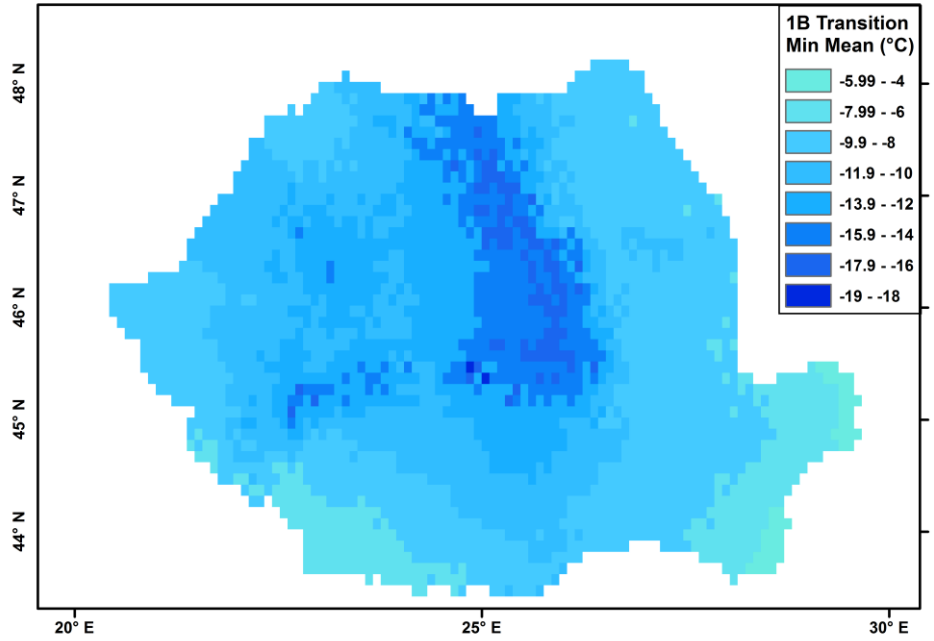
Monthly regime:



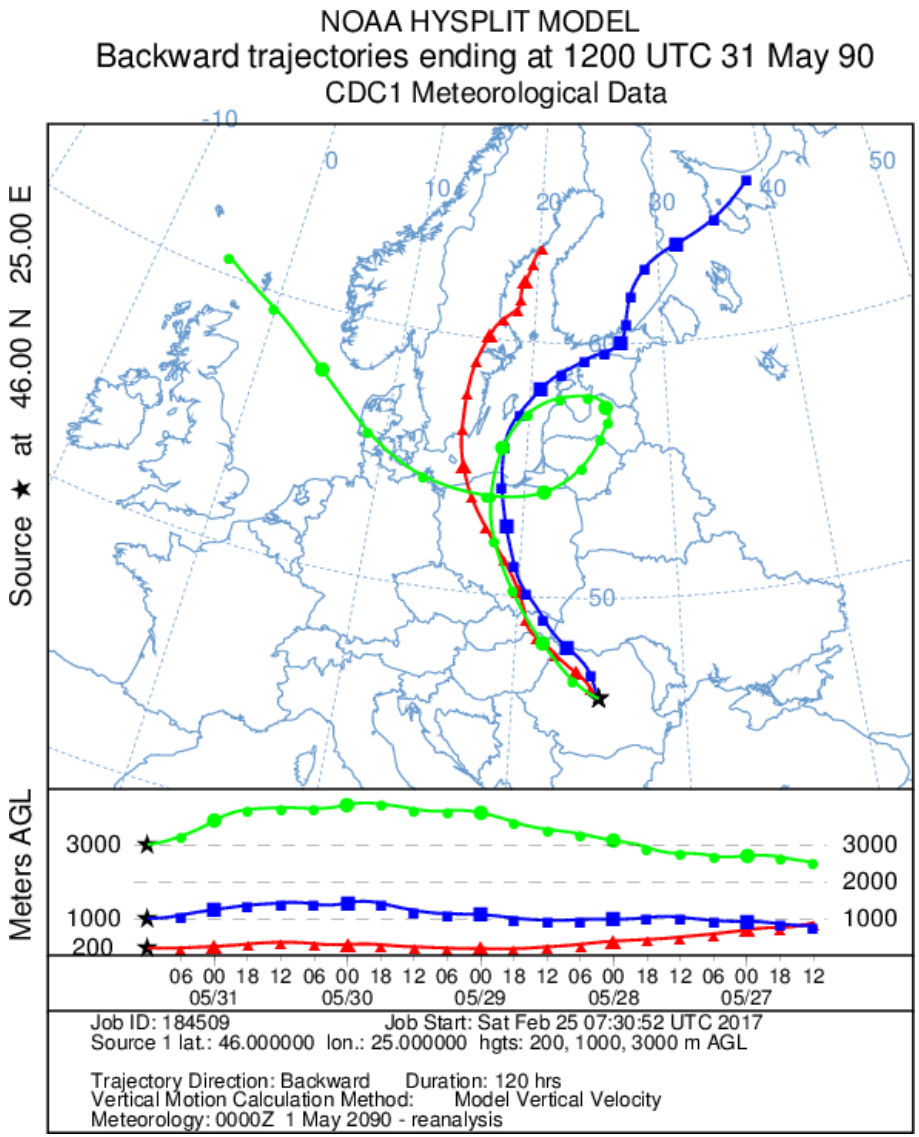
Multi-annual variations:

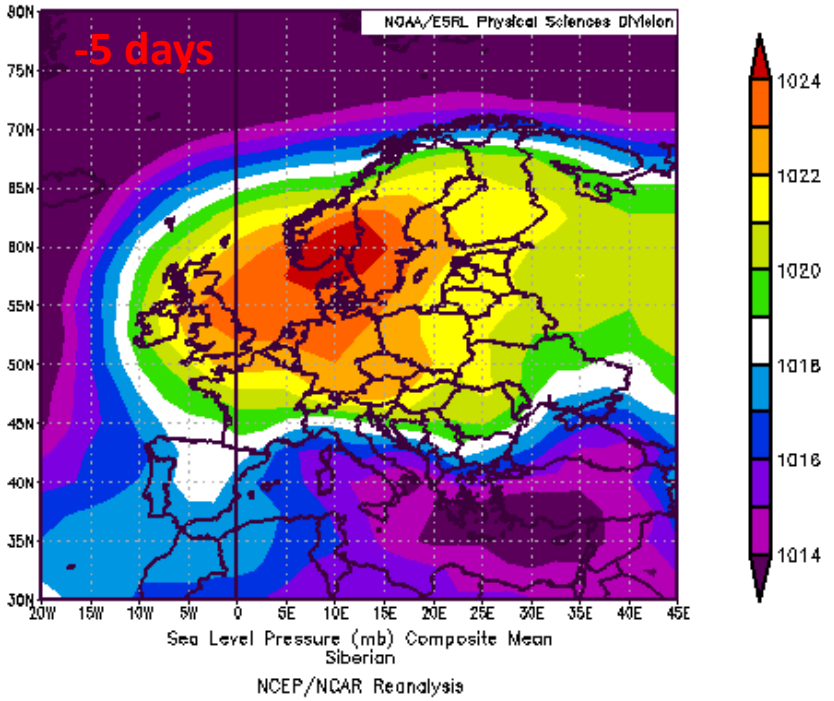


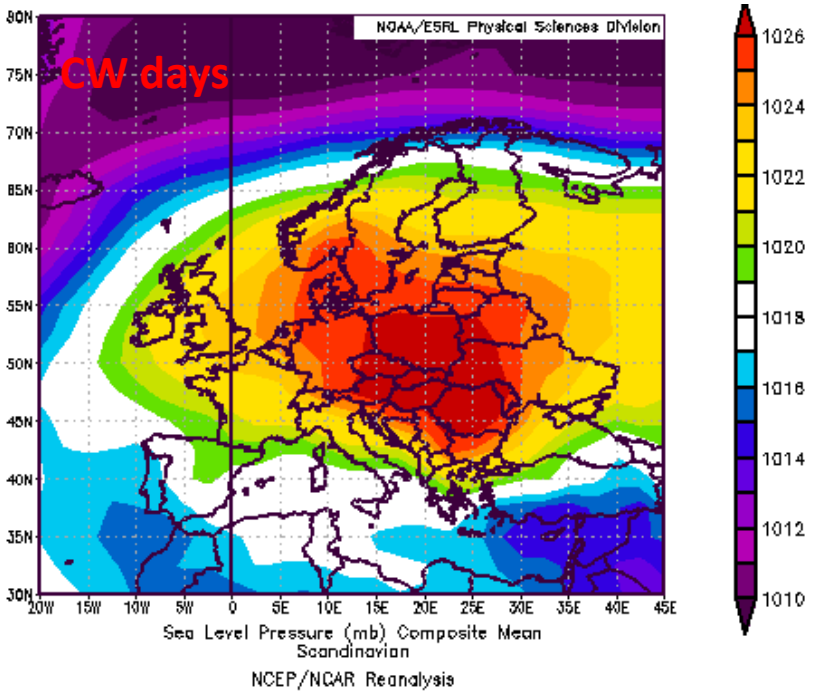

20° E
25° E
30° E
48° N
47° N
46° N
45° N
44° N
1B Transition Anomaly (°C)
3 - 6
0.1 - 2
-1 - 0
-3 - -2
-5 - -4
-7 - -6
-10 - -8

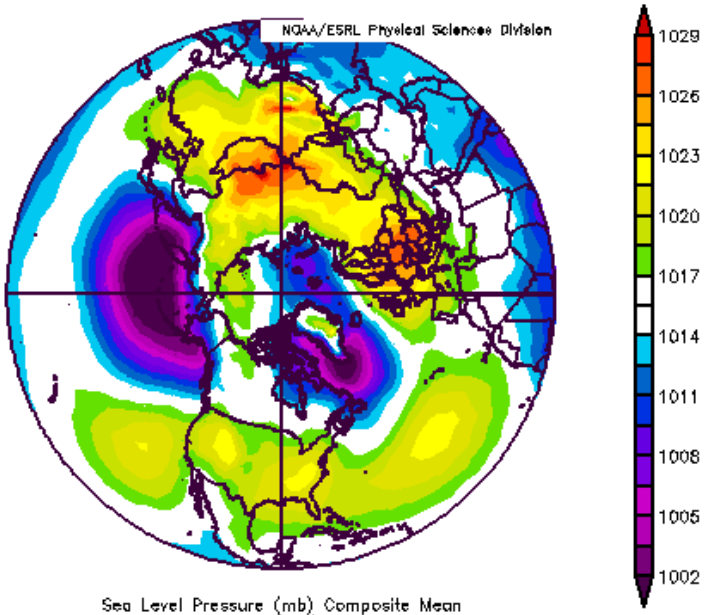

48° N
47° N
46° N
45° N
44° N
20° E
25° E
30° E
1B Transition Min Mean (°C)
-5.99 - -4
-7.99 - -6
-9.9 - -8
-11.9 - -10
-13.9 - -12
-15.9 - -14
-17.9 - -16
-19 - -18

2. Scandinavian CWs (26 events; 128 days)

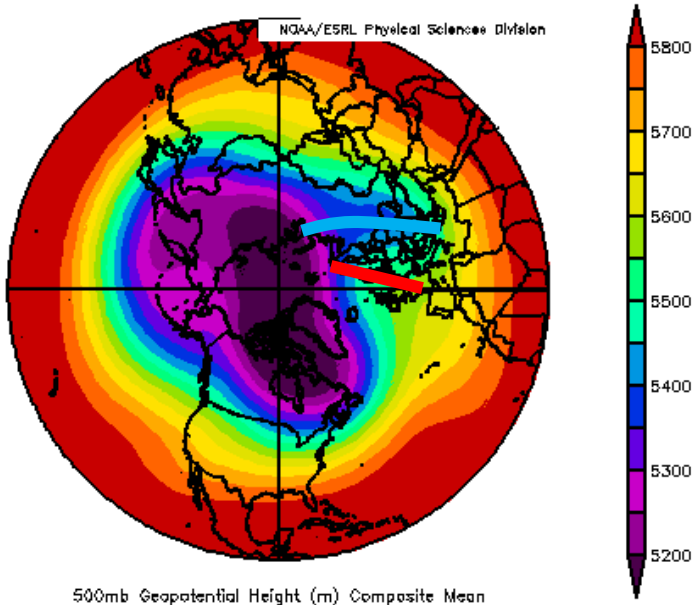




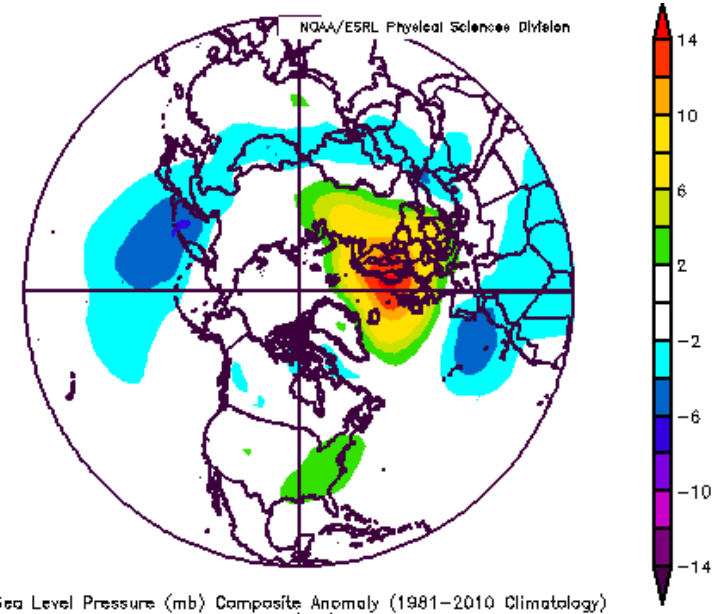




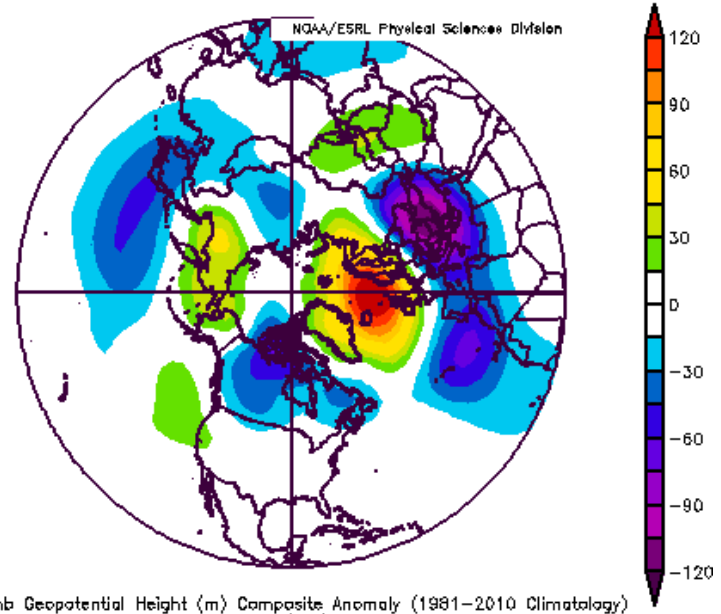
Sea Level Pressure (mb) Composite Mean
Scandinavian
NCEP/NCAR Reanalysis



500mb Geopotential Height (m) Composite Mean
Scandinavian
NCEP/NCAR Reanalysis

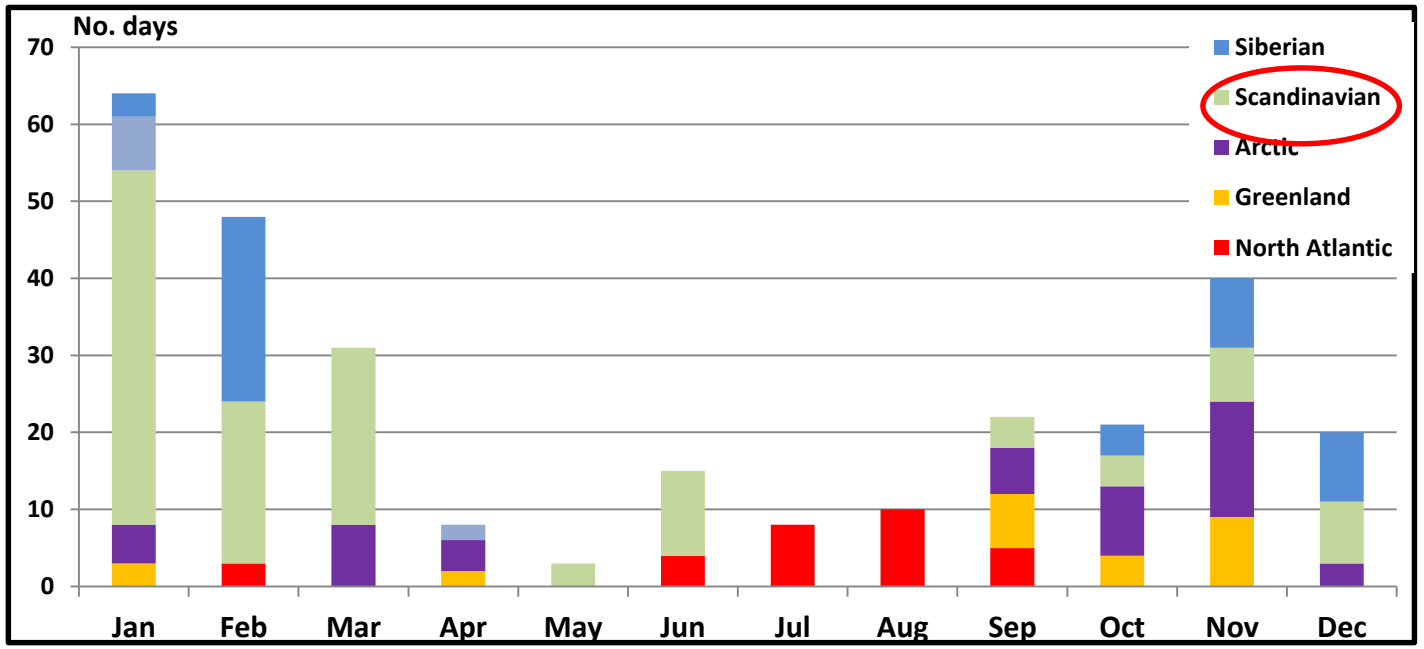


Sea Level Pressure (mb) Composite Anomaly (1981–2010 Climatology)
Scandinavian
NCEP/NCAR Reanalysis

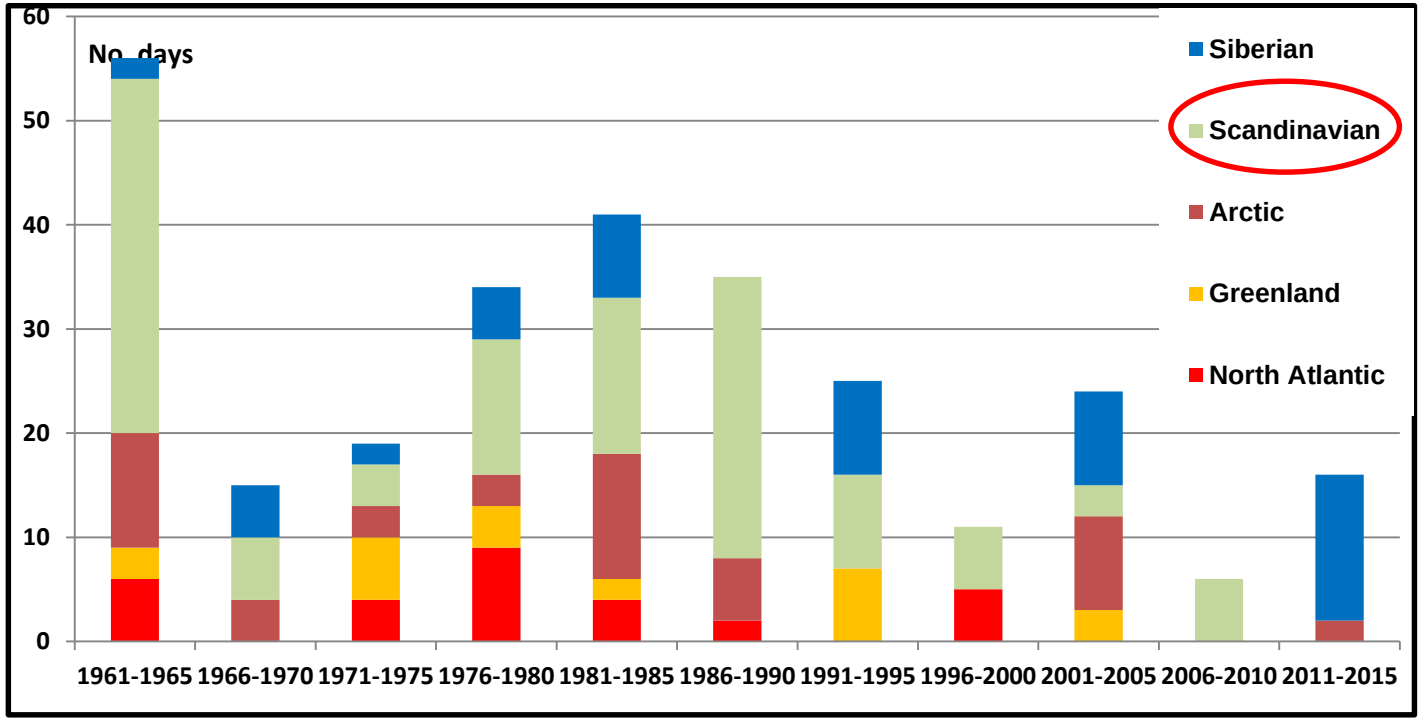


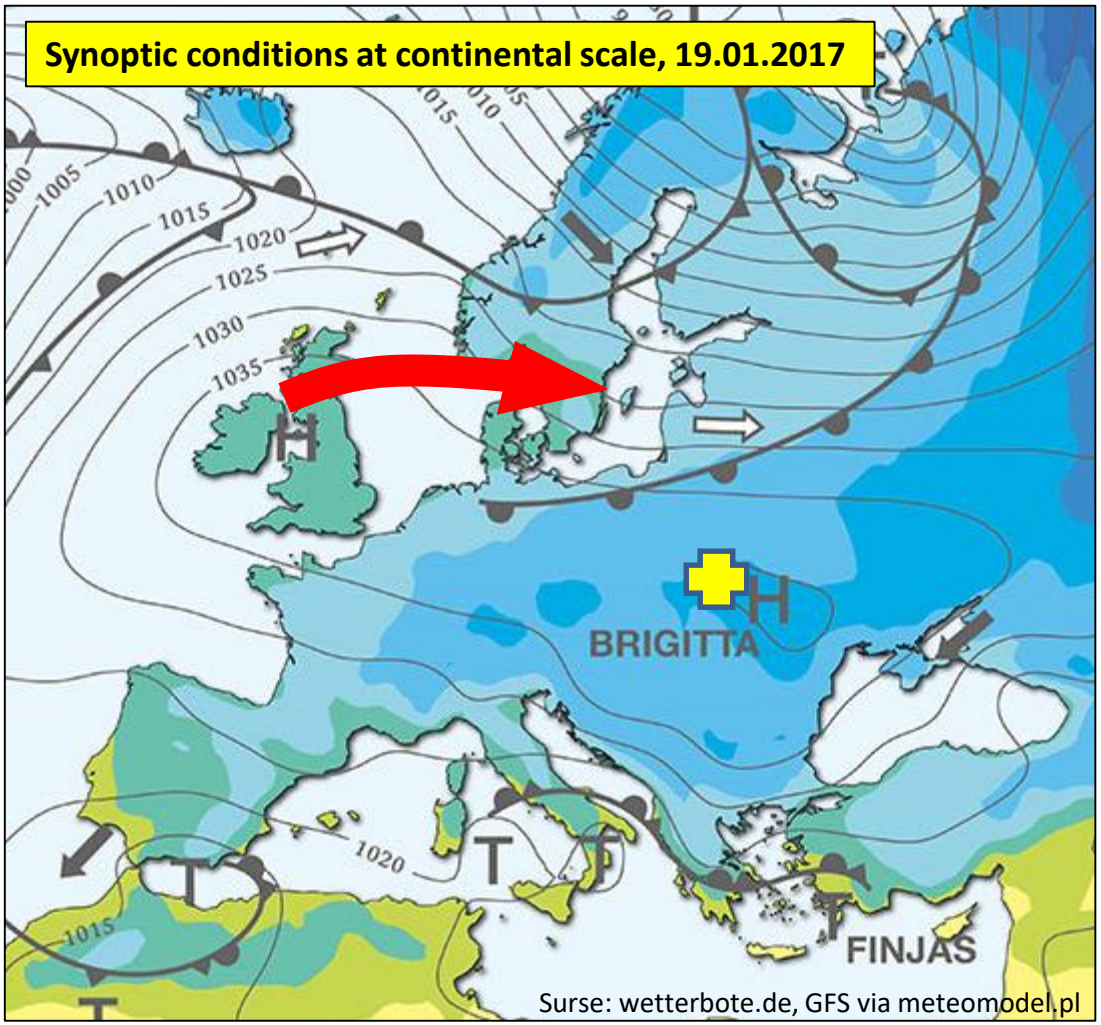
500mb Geopotential Height (m) Composite Anomaly (1981–2010 Climatology)
Scandinavian
NCEP/NCAR Reanalysis

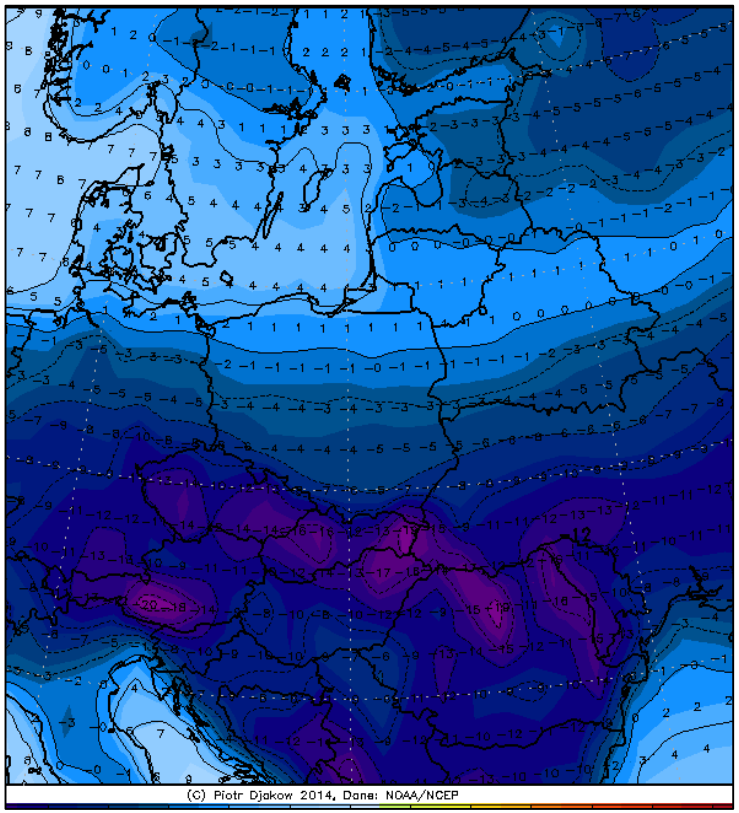
Monthly regime:

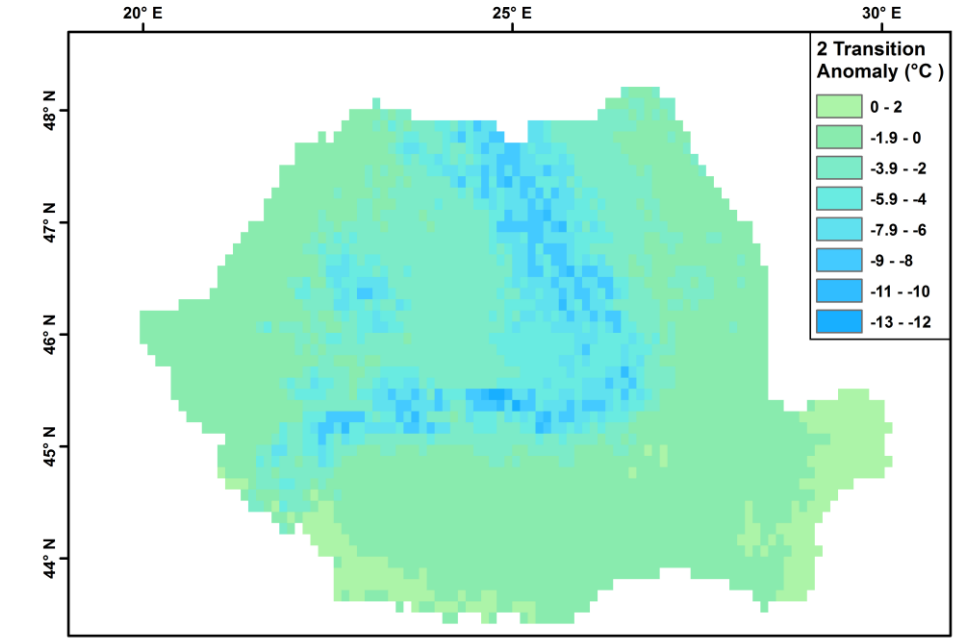


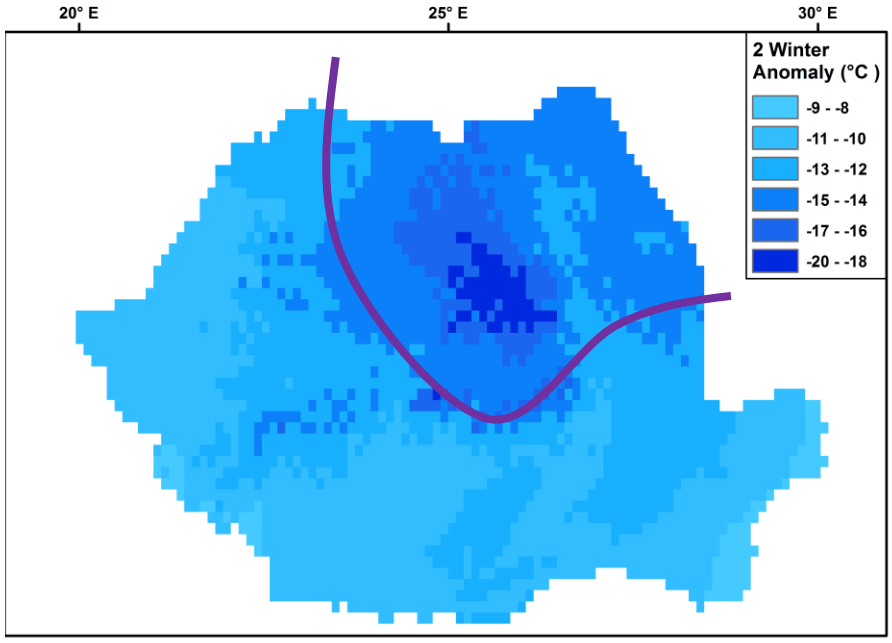
Multi-annual variations:

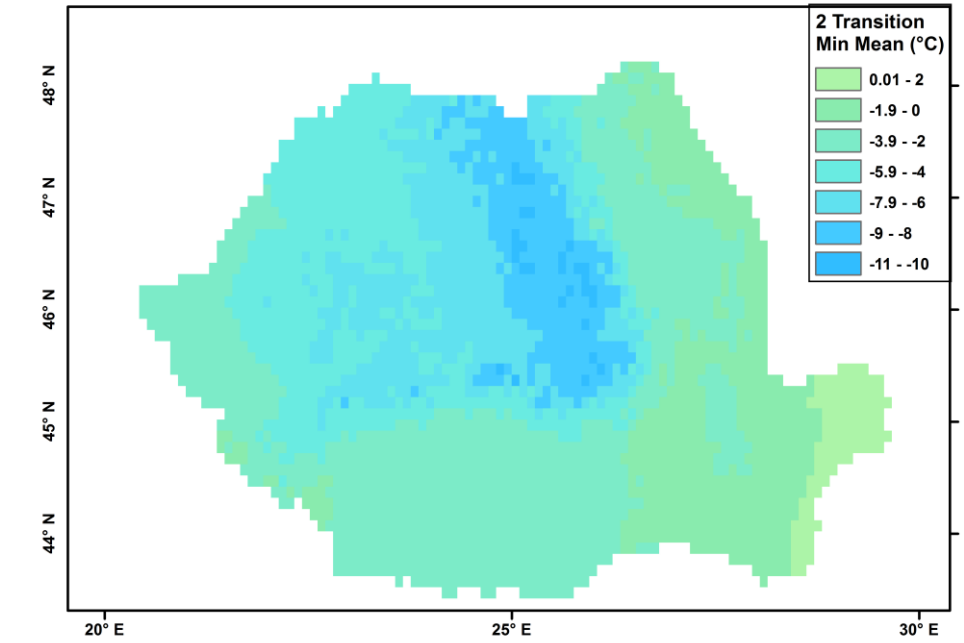


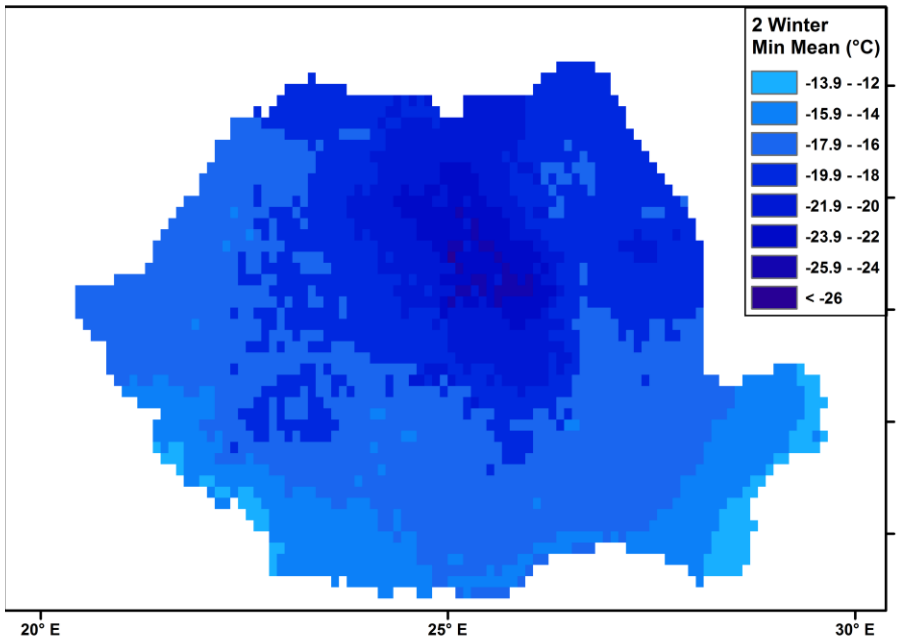

Synoptic conditions at continental scale, 19.01.2017
1000
1005
1010
1015
1020
1025
1030
1035
H
H
BRIGITTA
T
T
1020
1015
FINJAS
Surse: wetterbote.de, GFS via meteomodel.pl


(C) Piotr Djakow 2014, Dane: NOAA/NCEP

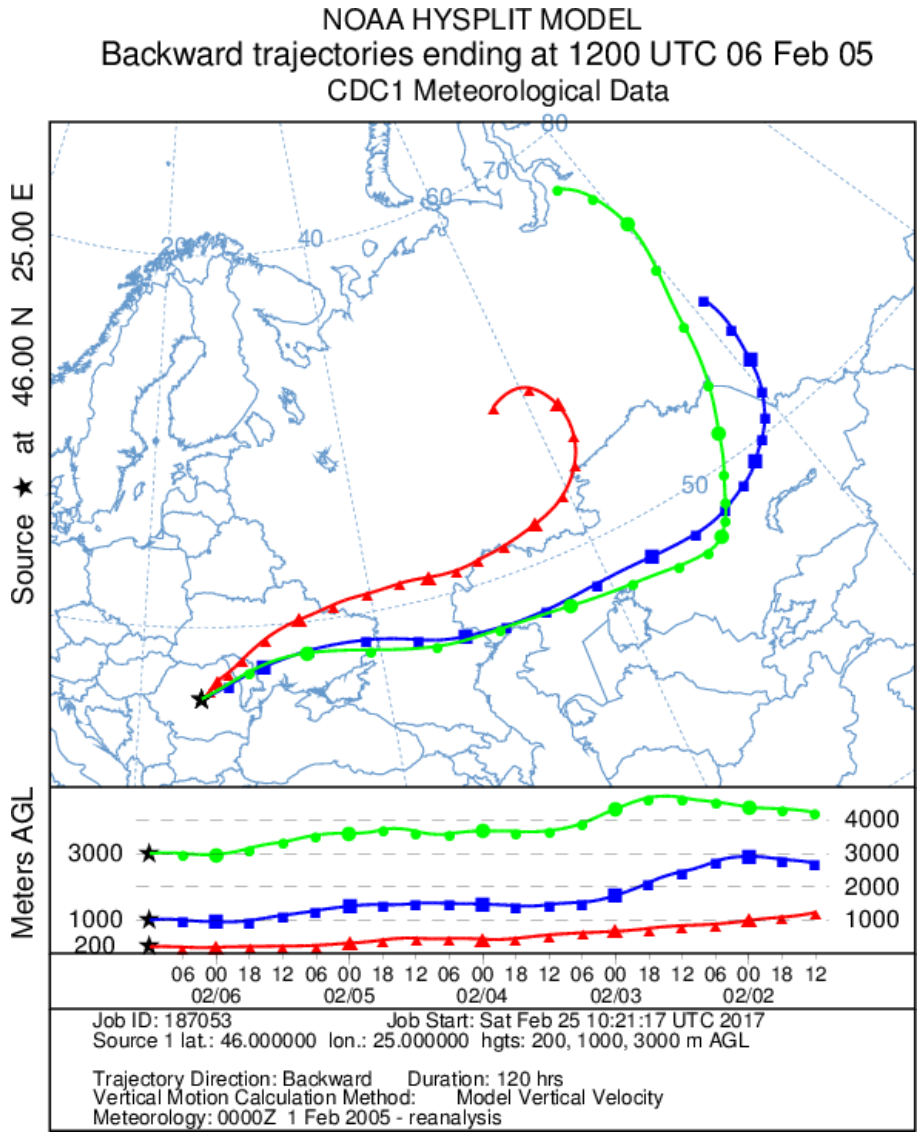

20° E
25° E
30° E
48° N
47° N
46° N
45° N
44° N
2 Transition Anomaly (°C)
0 - 2
-1.9 - 0
-3.9 - -2
-5.9 - -4
-7.9 - -6
-9 - -8
-11 - -10
-13 - -12

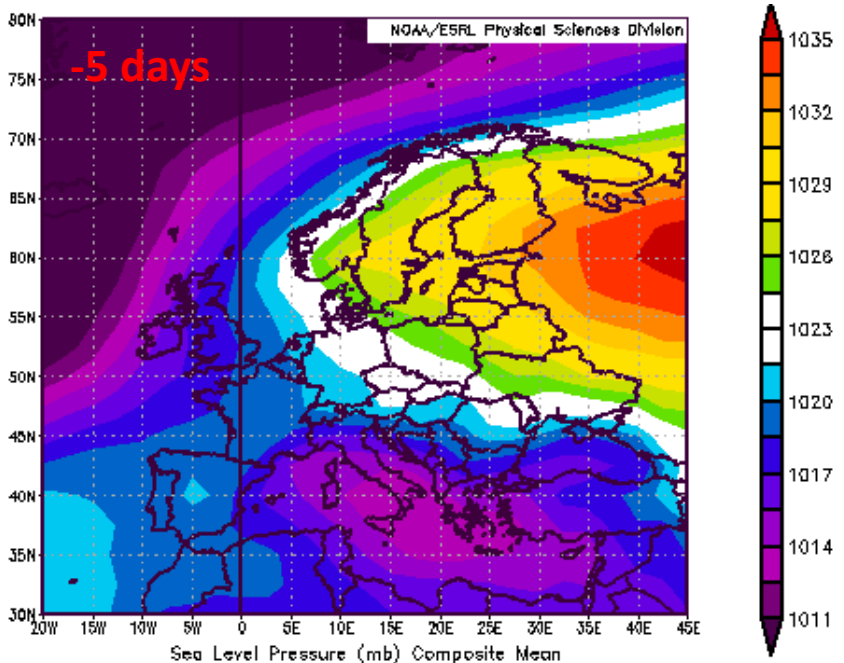

20° E
25° E
30° E
2 Winter Anomaly (°C)
-9 - -8
-11 - -10
-13 - -12
-15 - -14
-17 - -16
-20 - -18

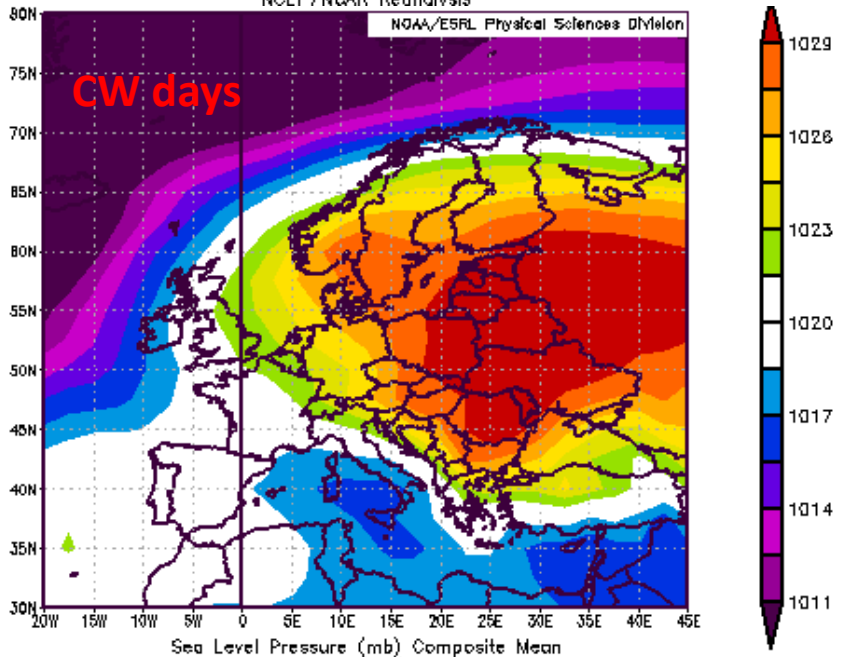

48° N
47° N
46° N
45° N
44° N
2 Transition Min Mean (°C)
0.01 - 2
-1.9 - 0
-3.9 - -2
-5.9 - -4
-7.9 - -6
-9 - -8
-11 - -10
20° E
25° E
30° E

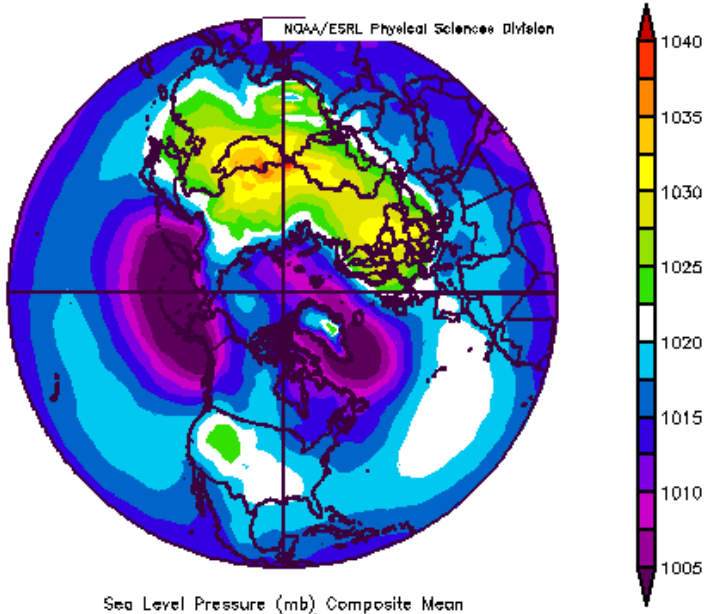

2 Winter Min Mean (°C)
-13.9 - -12
-15.9 - -14
-17.9 - -16
-19.9 - -18
-21.9 - -20
-23.9 - -22
-25.9 - -24
< -26
20° E
25° E
30° E

3. Siberian CWs (16 events; 58 days)

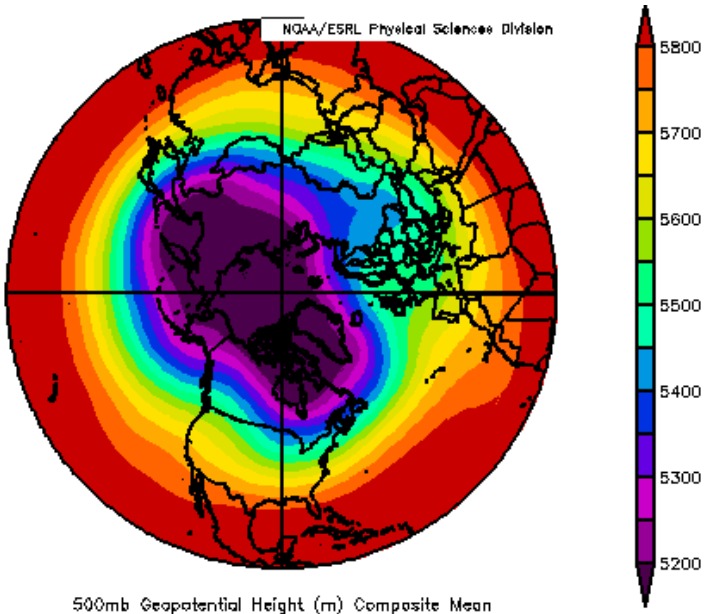




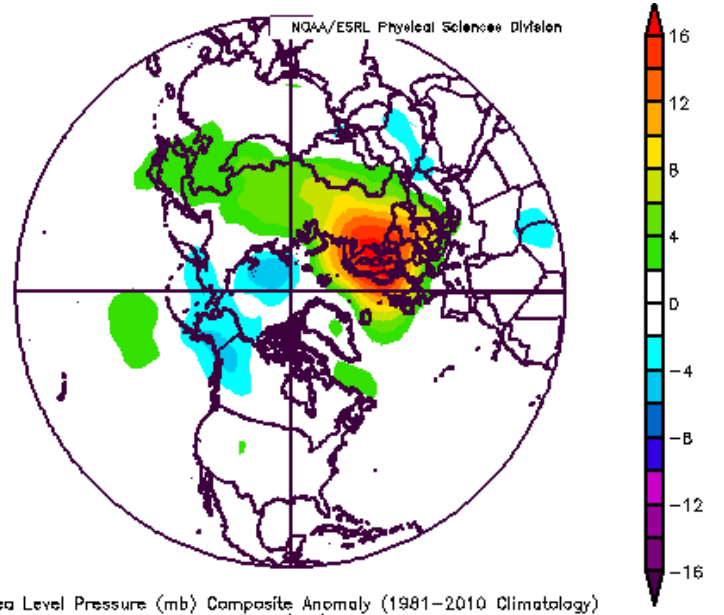




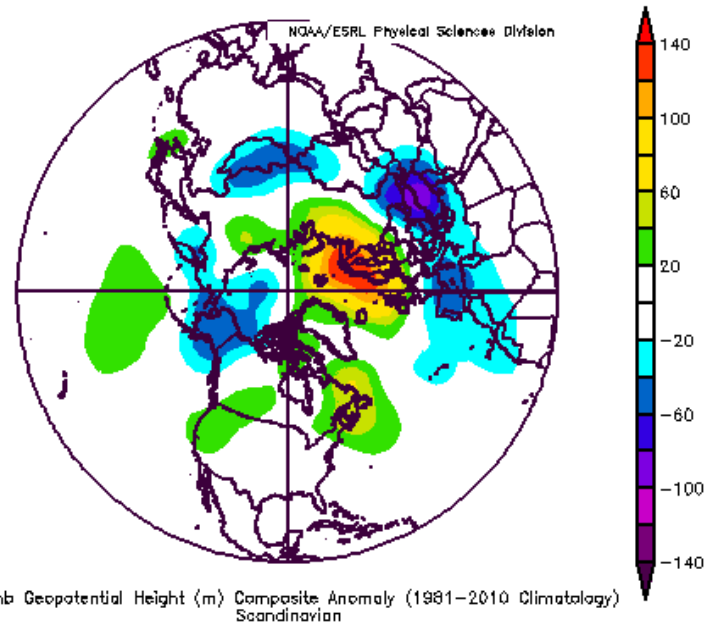
Sea Level Pressure (mb) Composite Mean
Scandinavian
NCEP/NCAR Reanalysis



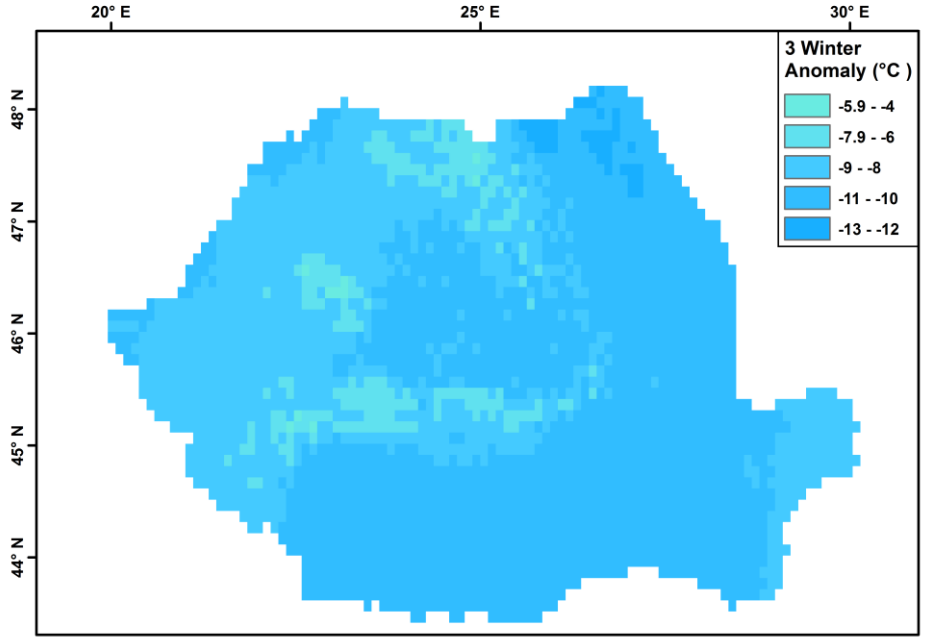
500mb Geopotential Height (m) Composite Mean
Scandinavian
NCEP/NCAR Reanalysis

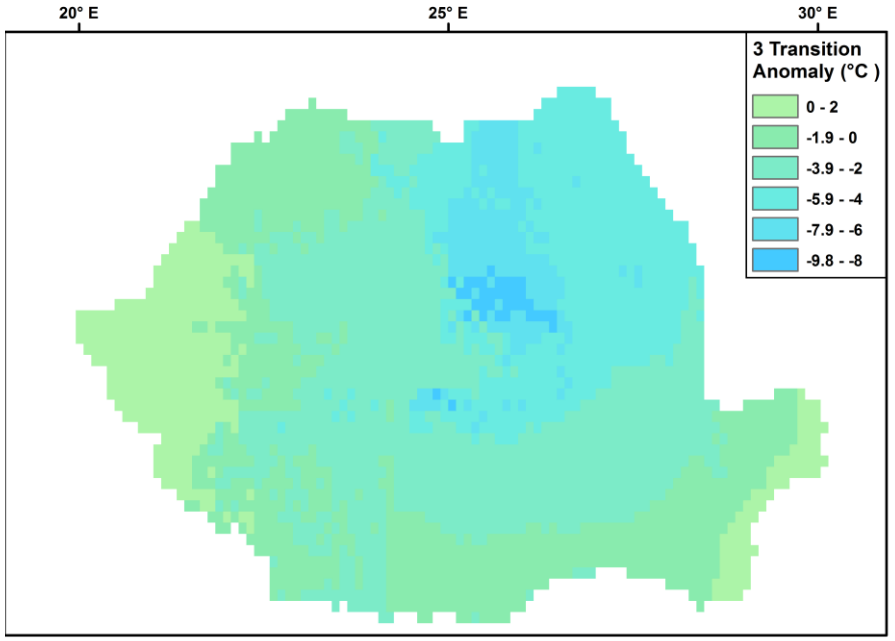


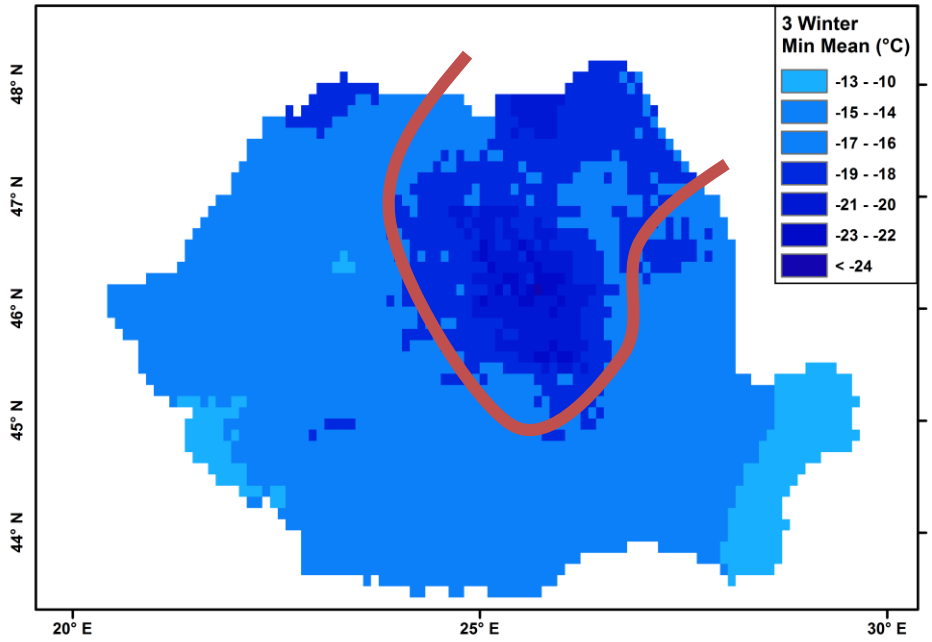
Sea Level Pressure (mb) Composite Anomaly (1981-2010 Climatology)
Scandinavian
NCEP/NCAR Reanalysis

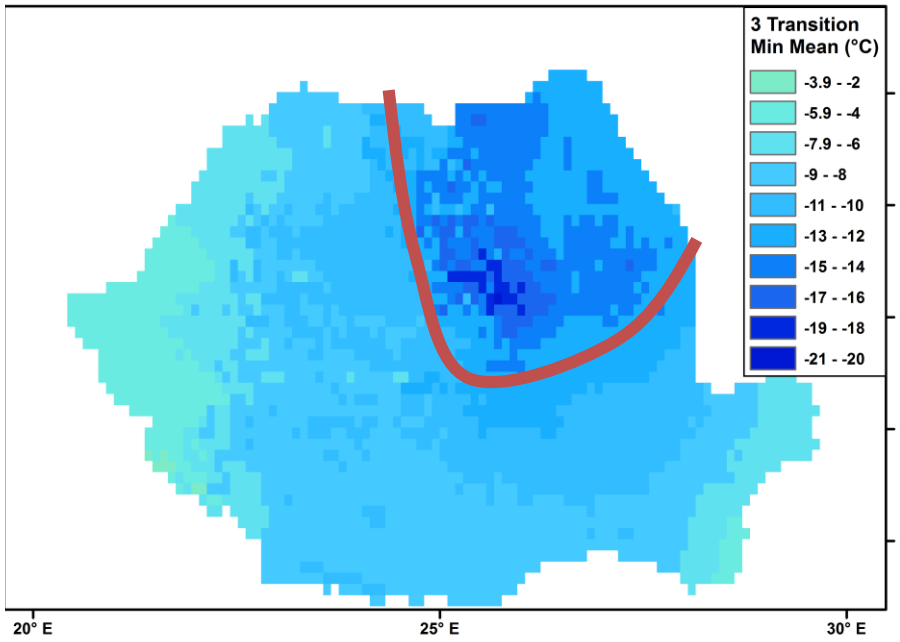


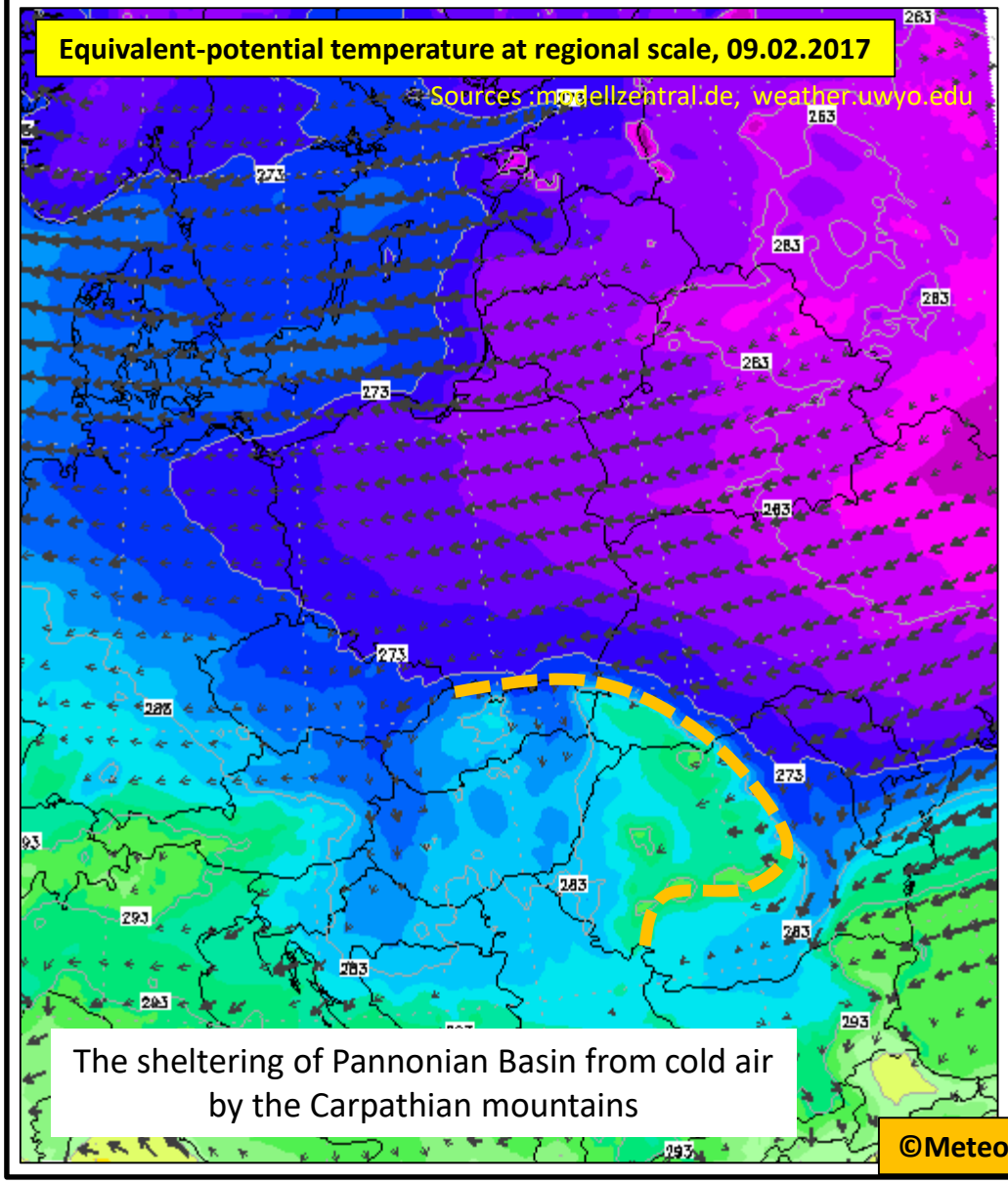
500mb Geopotential Height (m) Composite Anomaly (1981-2010 Climatology)
Scandinavian
NCEP/NCAR Reanalysis

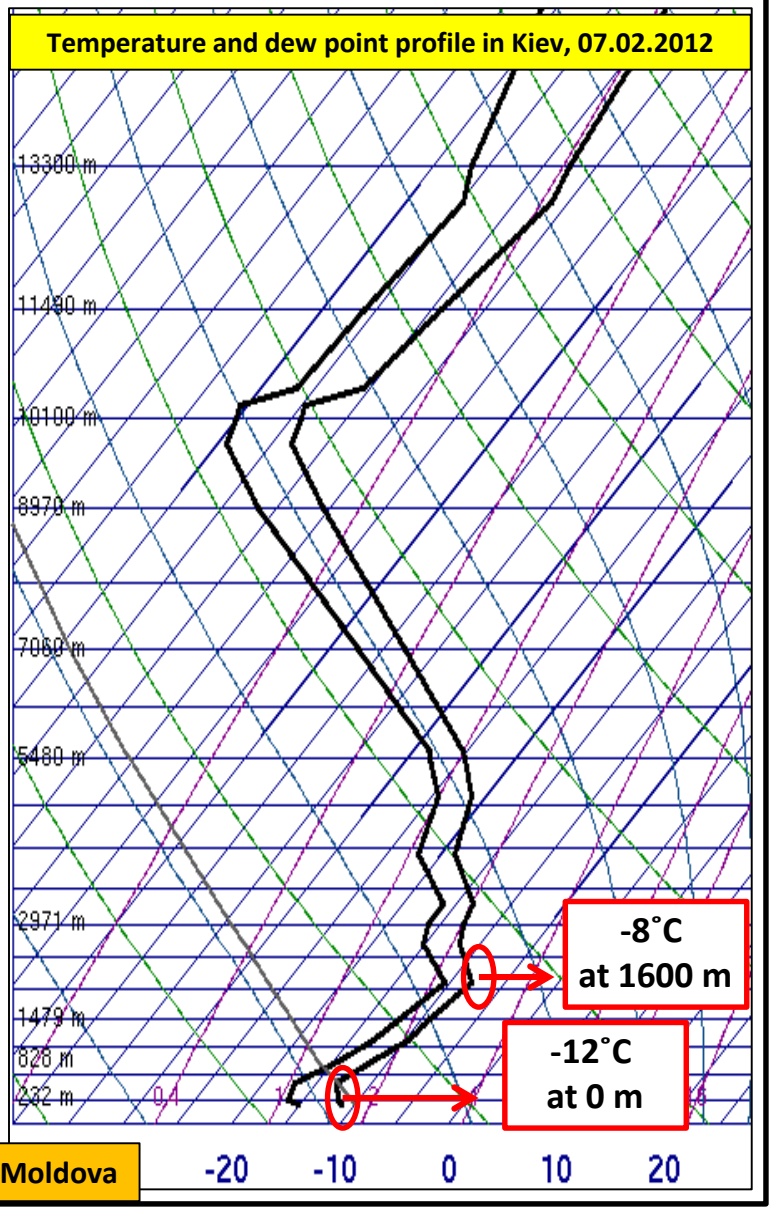

20° E
25° E
30° E
48° N
47° N
46° N
45° N
44° N
3 Winter Anomaly (°C)
-5.9 - -4
-7.9 - -6
-9 - -8
-11 - -10
-13 - -12


20° E
25° E
30° E
3 Transition Anomaly (°C)
0 - 2
-1.9 - 0
-3.9 - -2
-5.9 - -4
-7.9 - -6
-9.8 - -8

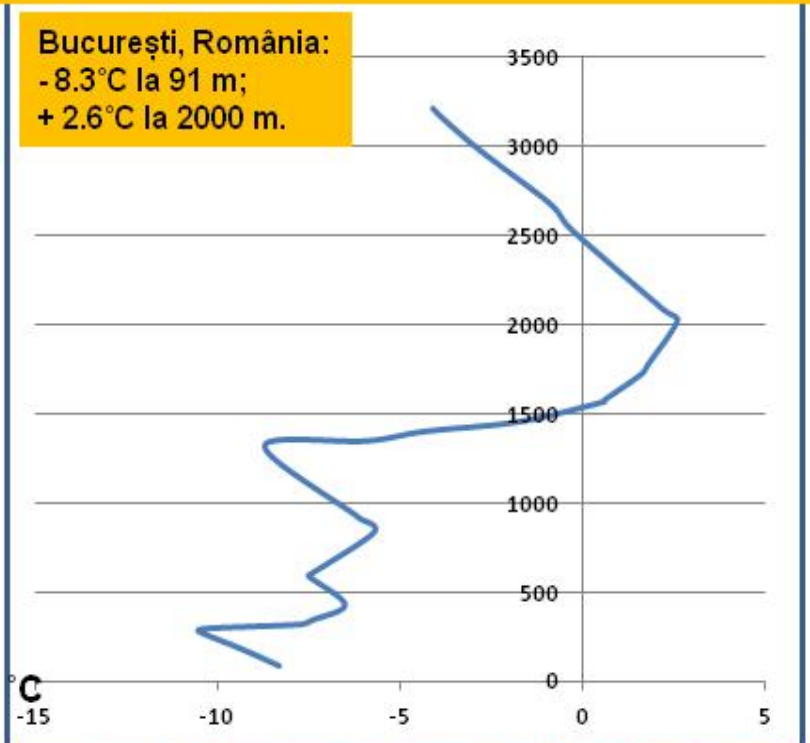

20° E
25° E
30° E
48° N
47° N
46° N
45° N
44° N
3 Winter Min Mean (°C)
-13 - -10
-15 - -14
-17 - -16
-19 - -18
-21 - -20
-23 - -22
< -24

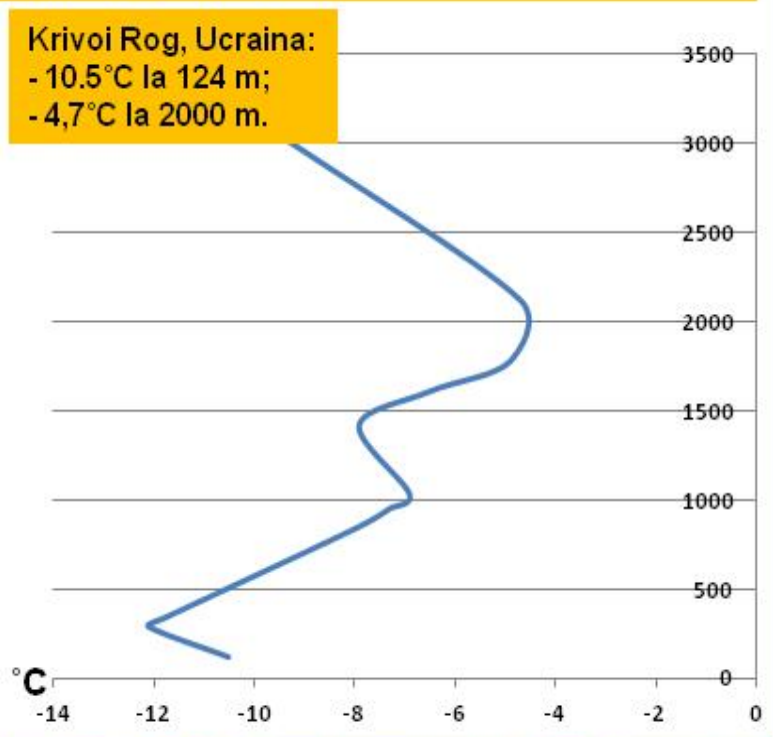

20° E
25° E
30° E
3 Transition Min Mean (°C)
-3.9 - -2
-5.9 - -4
-7.9 - -6
-9 - -8
-11 - -10
-13 - -12
-15 - -14
-17 - -16
-19 - -18
-21 - -20

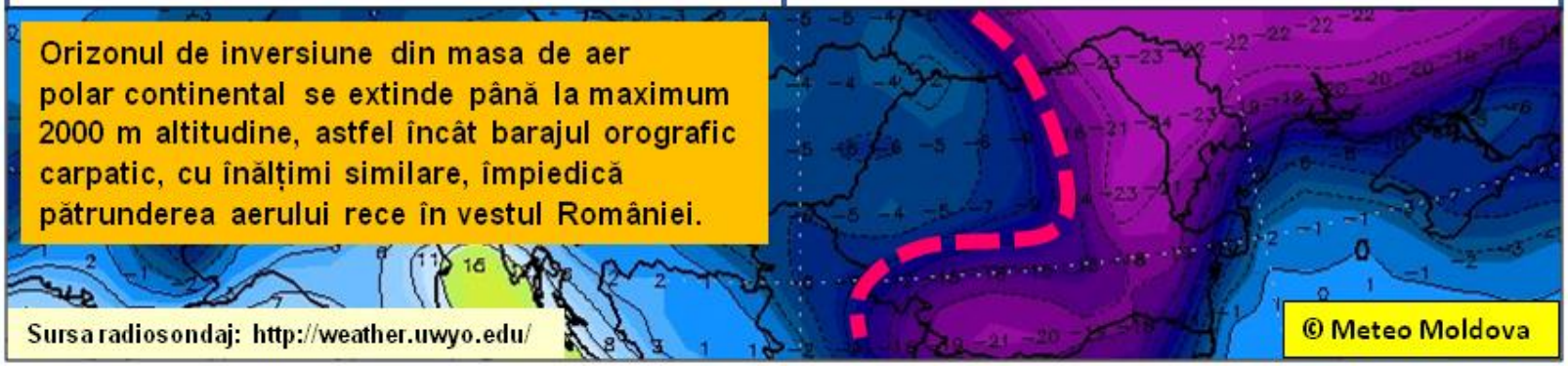

Equivalent-potential temperature at regional scale, 09.02.2017
Sources :modellzentral.de, weather.uwyo.edu
The sheltering of Pannonian Basin from cold air by the Carpathian mountains
©Meteo Moldova


Temperature and dew point profile in Kiev, 07.02.2012
13300 m
11490 m
10100 m
8970 m
7080 m
5480 m
2971 m
1479 m
828 m
232 m
-8˚C
at 1600 m
-12˚C
at 0 m
-20
-10
0
10
20

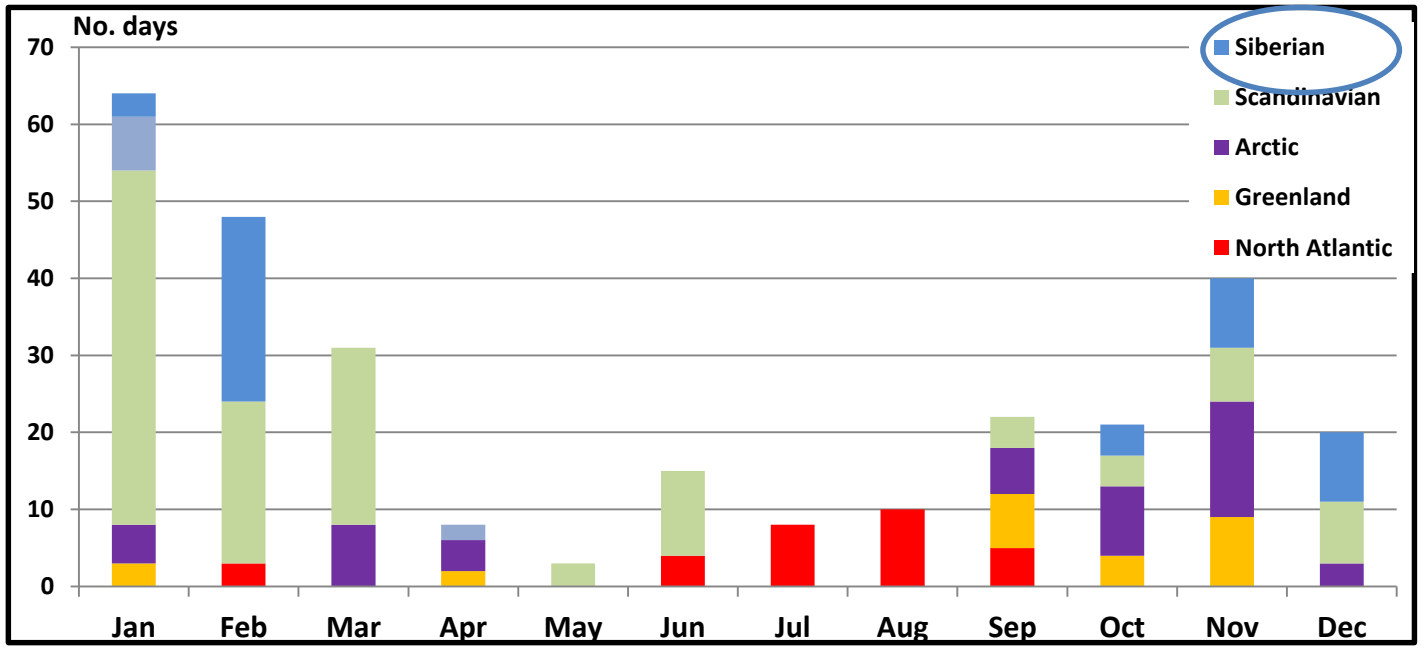
Evoluția temperaturii aerului în troposfera inferioară pe baza observațiilor de radiosondaj, 01.II.2014, ora 12.



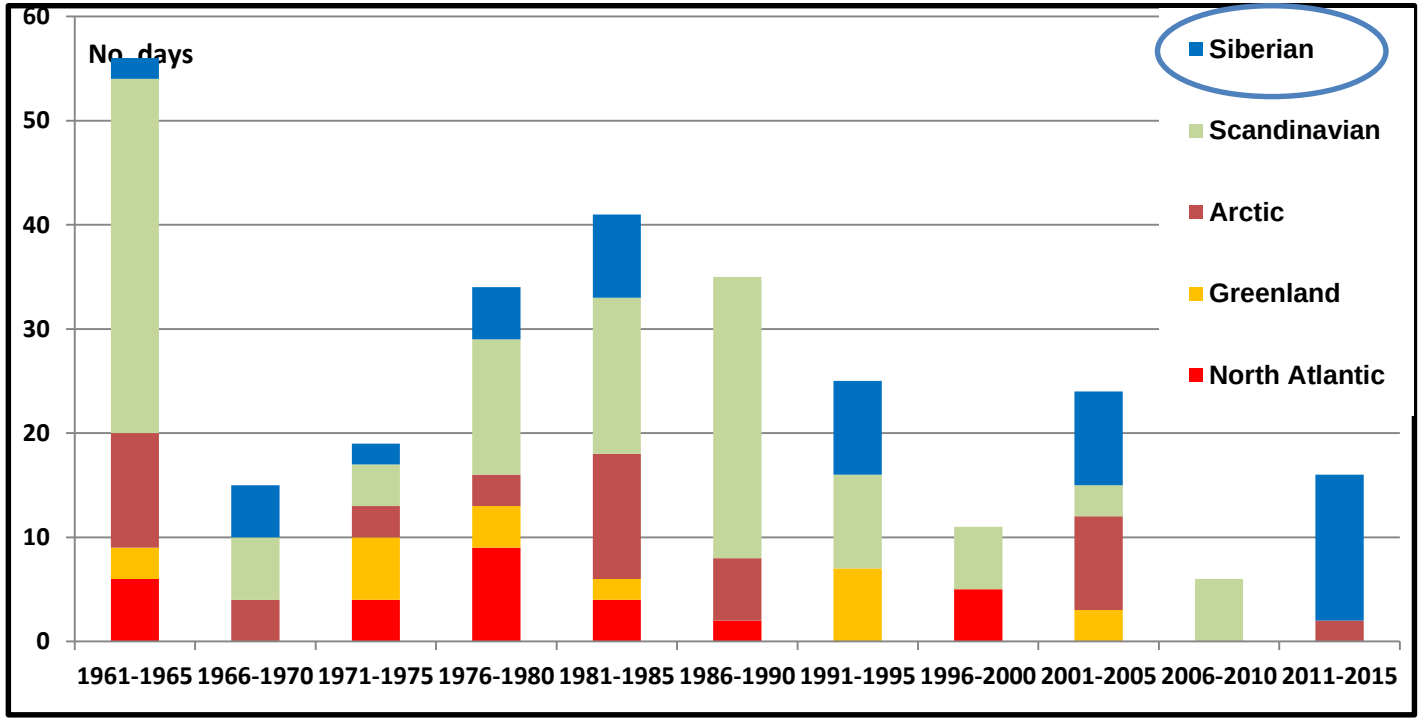




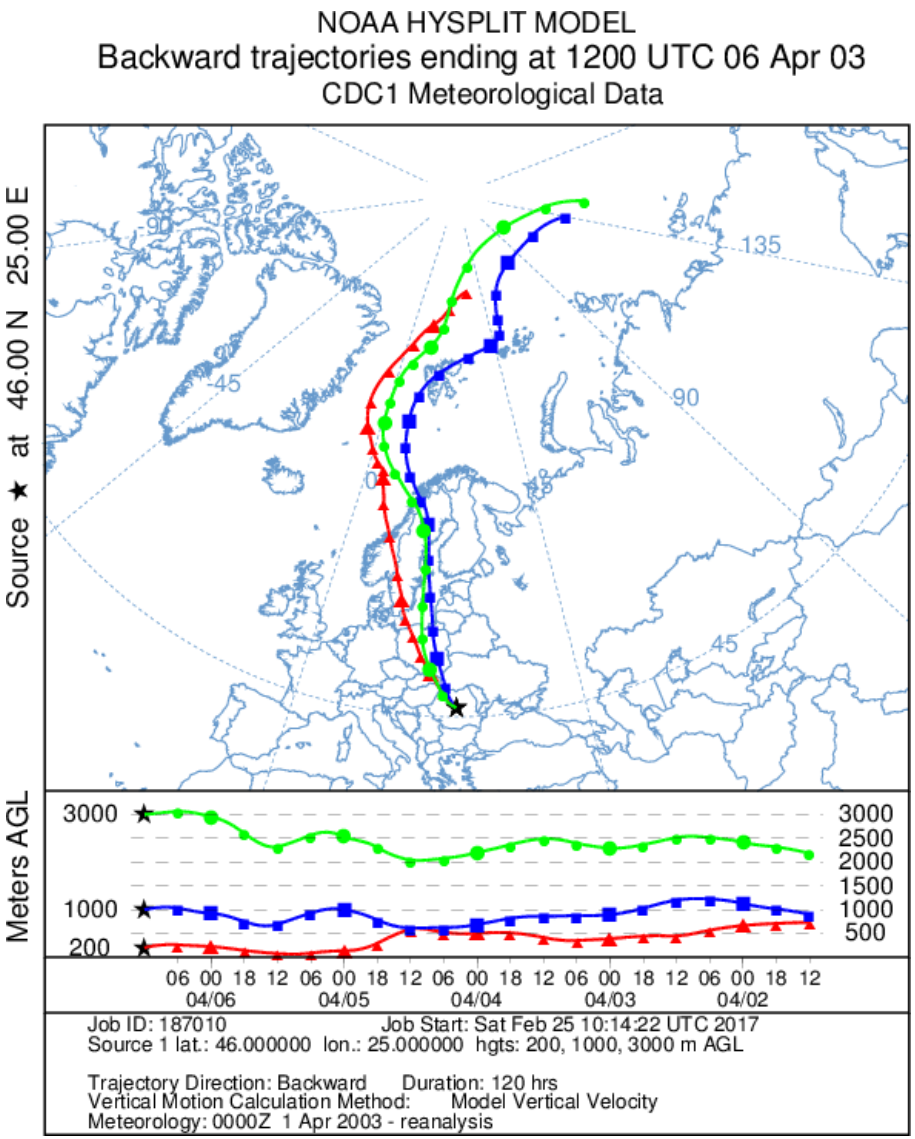
Monthly regime:

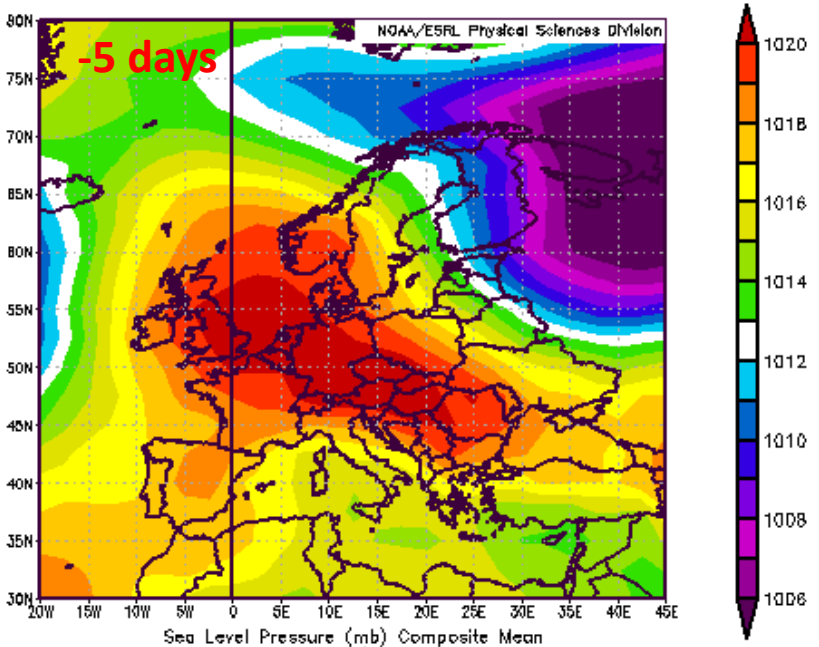


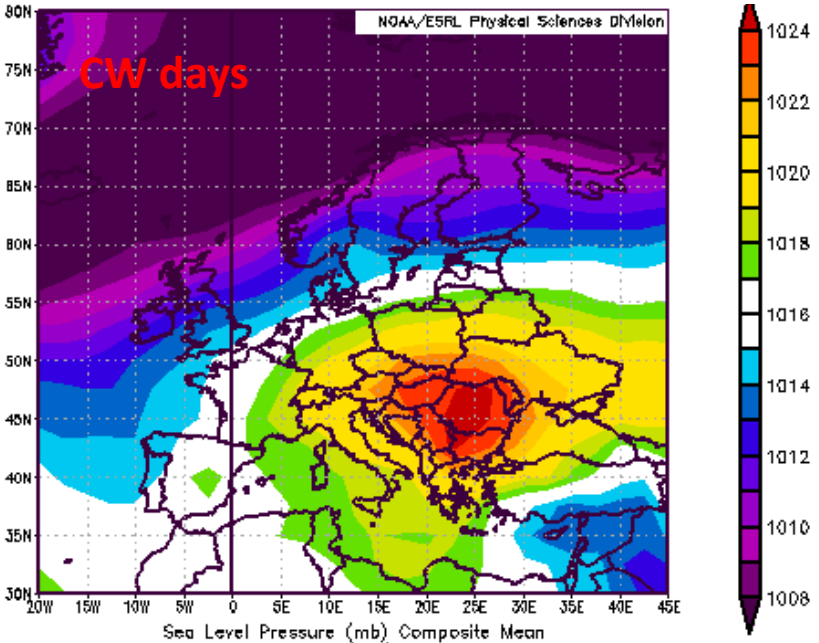
Multi-annual variations:



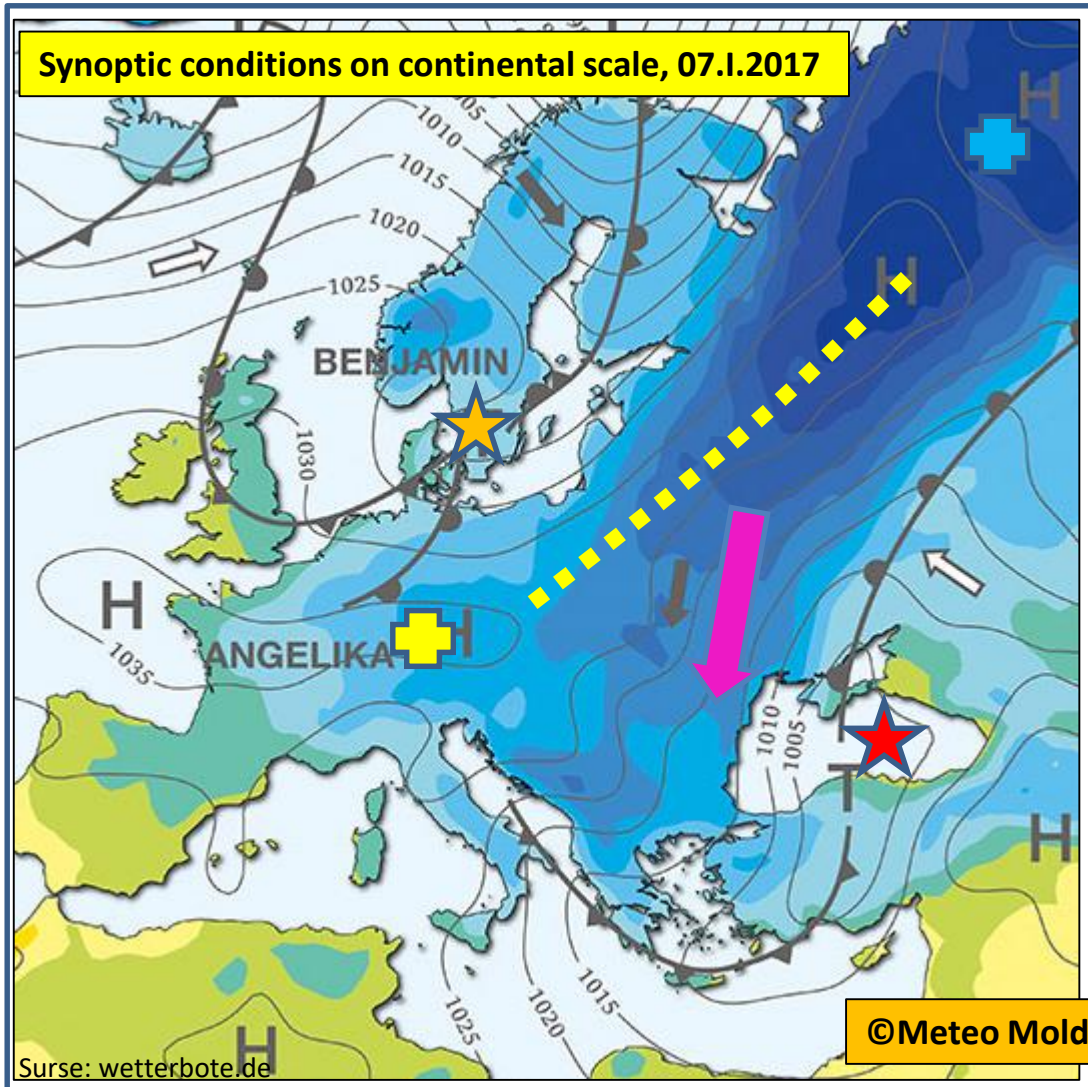
4. Arctic CWs(14 events; 50 days)





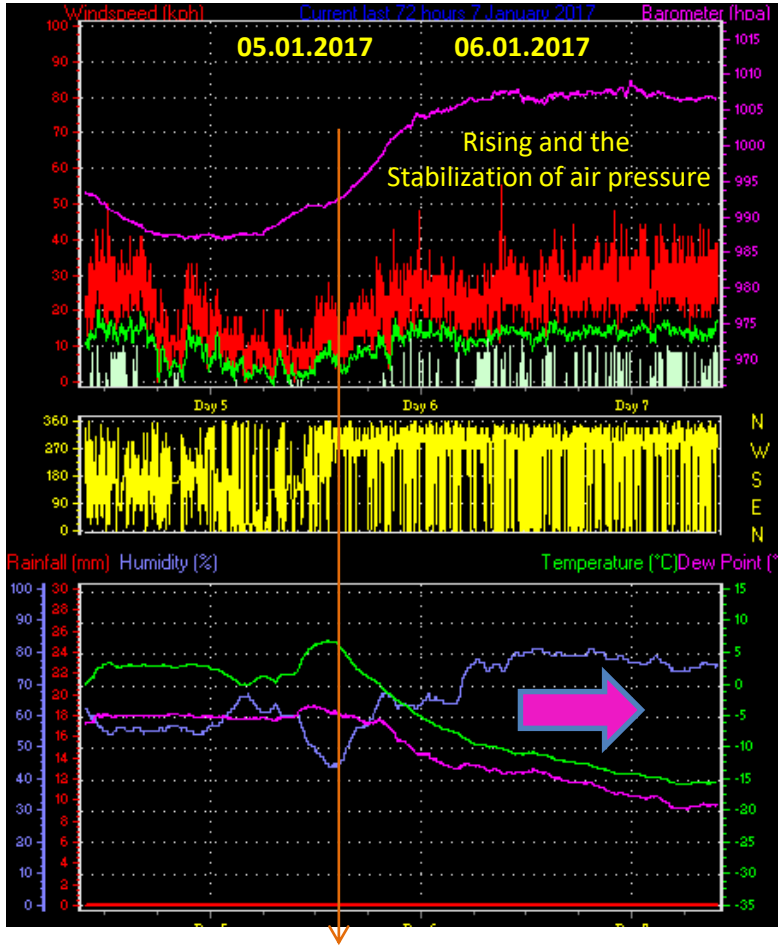


Synoptic conditions on continental scale, 07.I.2017



Surse: wetterbote.de

©Meteo Moldova



Thermal evolution during an arctic advection

Ridge of Acores High

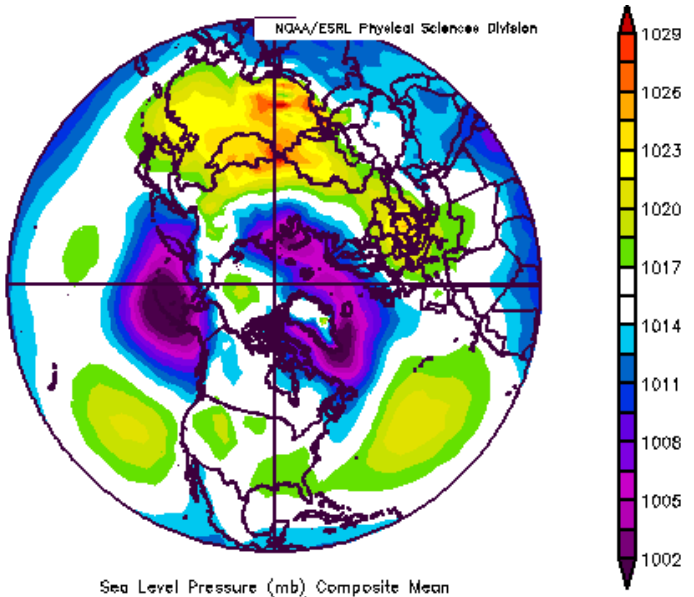
Voeikov ridge over the continent

East-European High

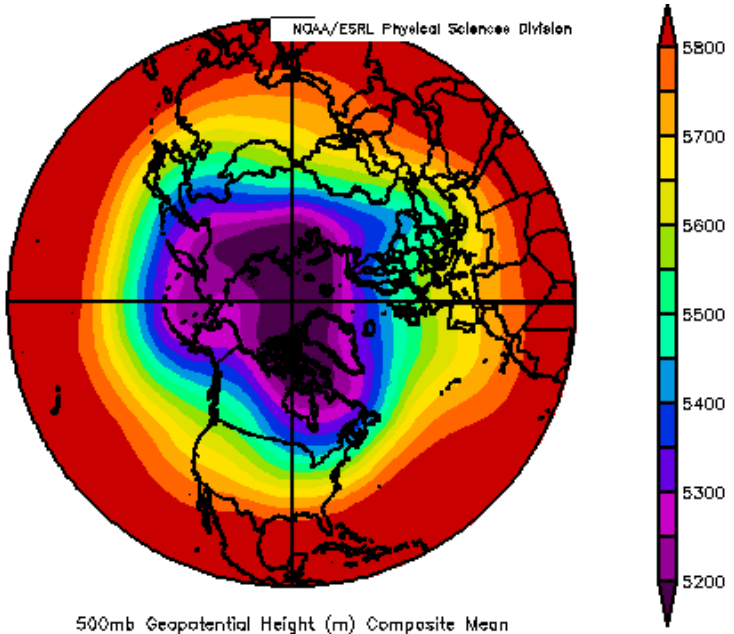
Mediteranean cyclone

Atlantic cyclone

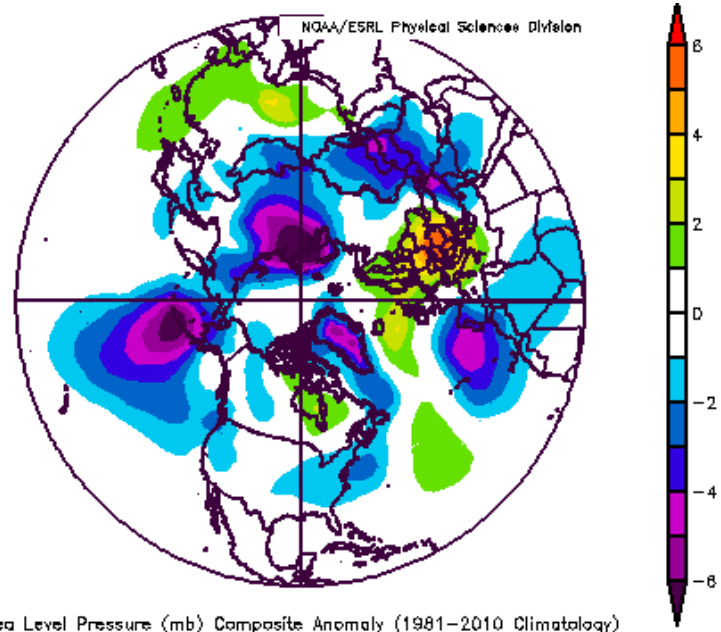
Advecție masivă și constantă de aer arctic pe circulație ultrapolară între câmpul de mare presiune din centrul europei și ciclonul din Marea Neagră ce a condus la o scădere accentuată temperaturii de la +5C la -16C în mai puțin de 48 de ore la Iași



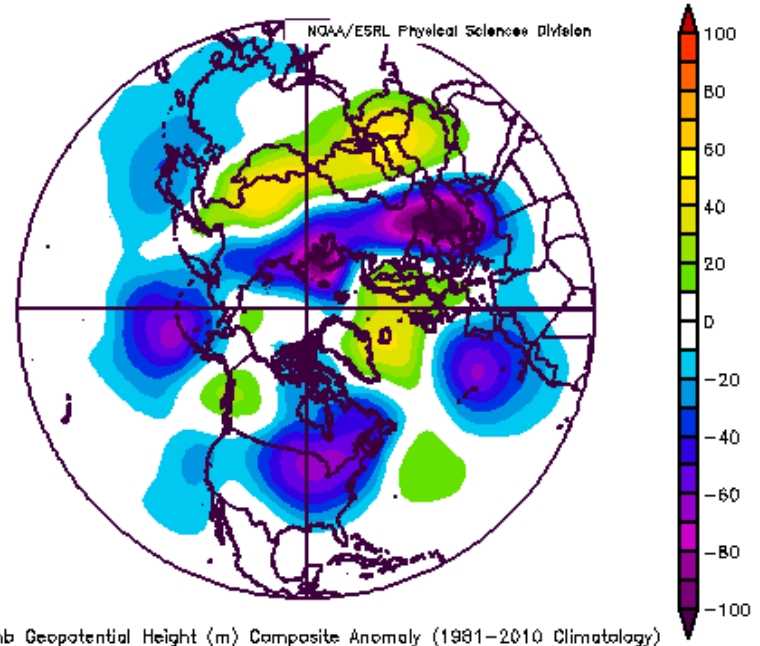
Sea Level Pressure (mb) Composite Mean
Scandinavian
NCEP/NCAR Reanalysis



500mb Geopotential Height (m) Composite Mean
Scandinavian
NCEP/NCAR Reanalysis

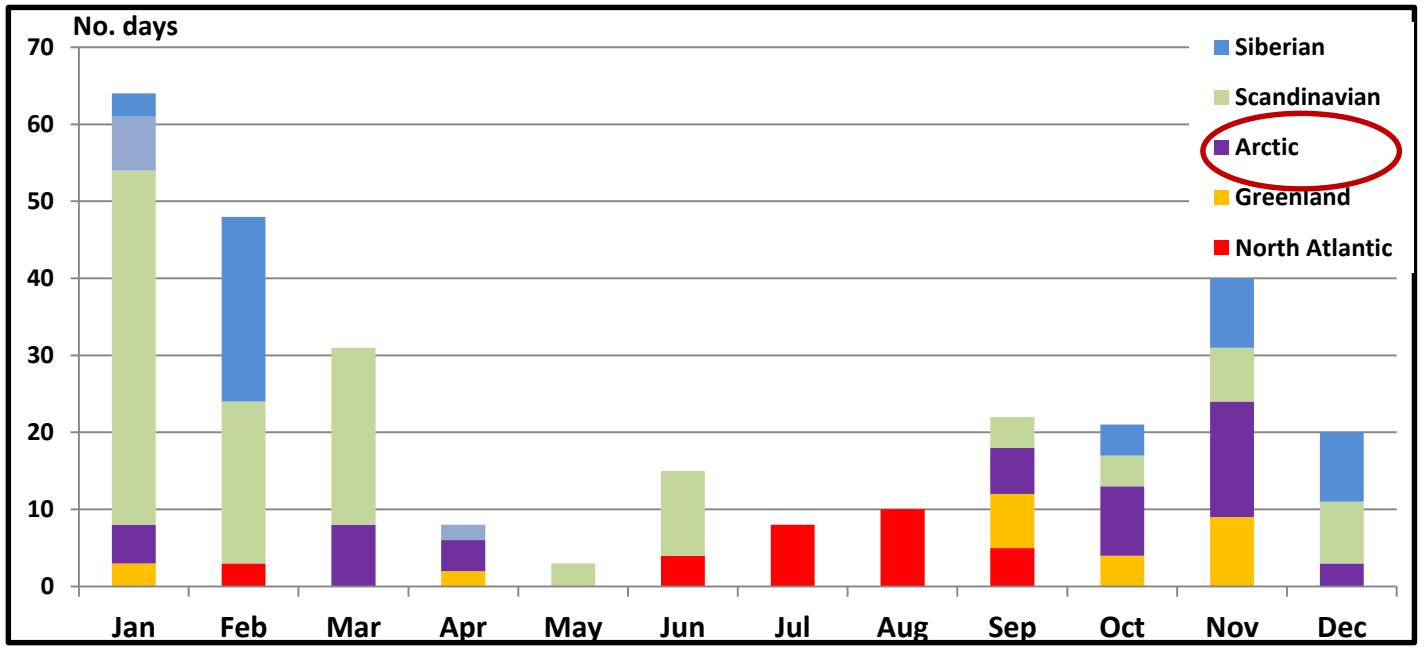


Sea Level Pressure (mb) Composite Anomaly (1981−2010 Climatology)
Scandinavian
NCEP/NCAR Reanalysis

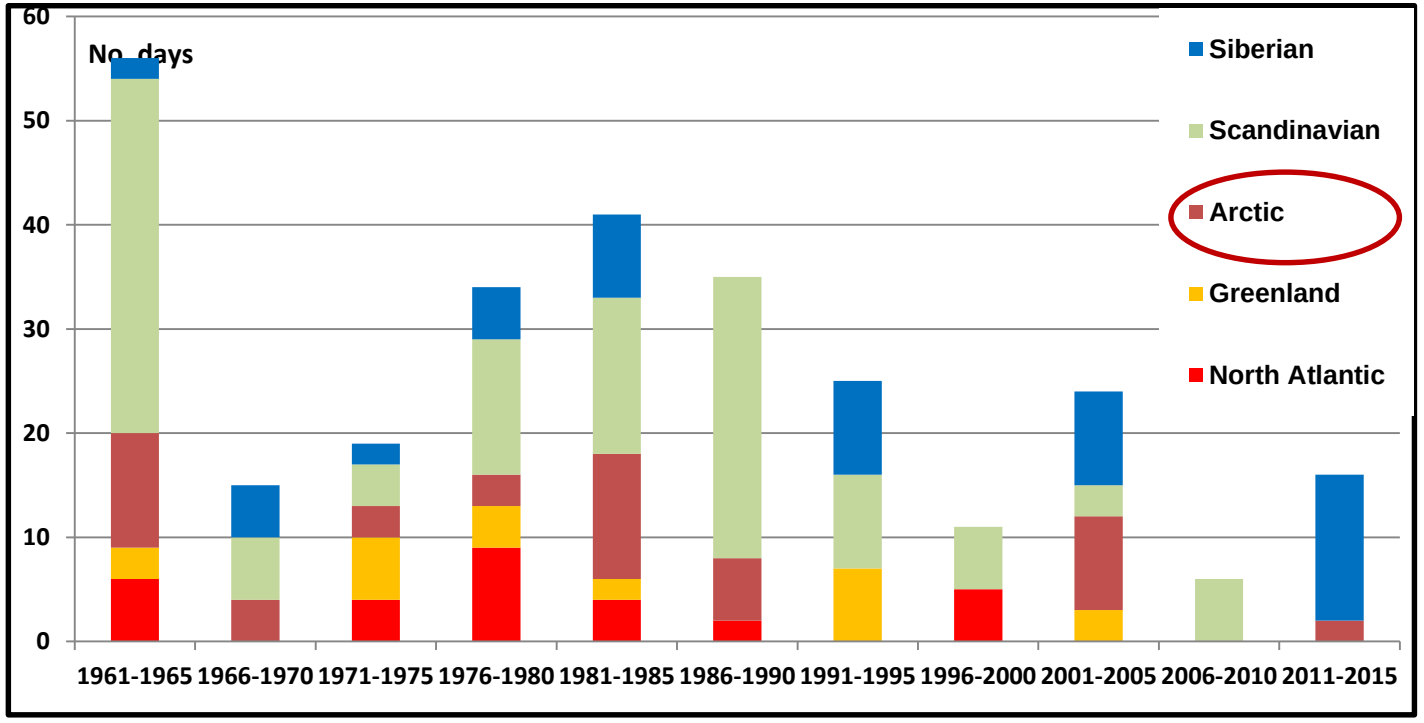


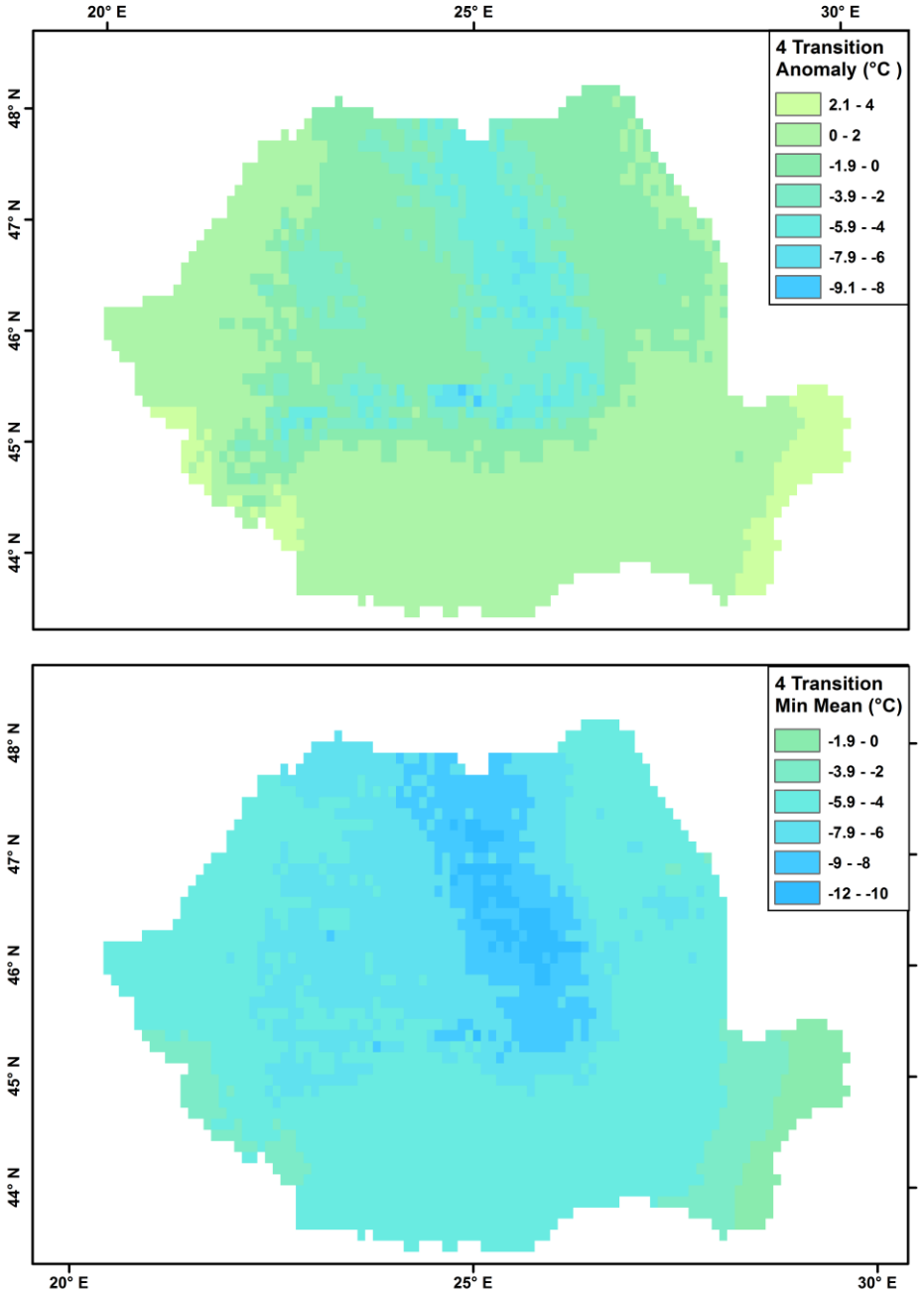
500mb Geopotential Height (m) Composite Anomaly (1981−2010 Climatology)
Scandinavian
NCEP/NCAR Reanalysis

Monthly regime:



Multi-annual variations:




20° E
25° E
30° E
48° N
47° N
46° N
45° N
44° N
4 Transition Anomaly (°C)
2.1 - 4
0 - 2
-1.9 - 0
-3.9 - -2
-5.9 - -4
-7.9 - -6
-9.1 - -8
4 Transition Min Mean (°C)
-1.9 - 0
-3.9 - -2
-5.9 - -4
-7.9 - -6
-9 - -8
-12 - -10

Aknowledgement. This research was developed under the framework of the research grant Extreme weather events related to air temperature and precipitation in Romania (project code: PN-II-RU-TE-2014-4-0736), funded by the Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI) in Romania. Coordinator: **Professor PhD. Adina-Eliza Croitoru**.

Ďakujem!

Дякую!

Köszönöm!

Vielen Dank!

Dziękuję!

Nais tuke!

Hvala!

Хвала!

Vă mulțumim!