FUTURE PROJECTION OF WARM SPELLS AND COLD SPELLS IN TRANSITION SEASONS IN LOW-LANDS OF WESTERN ROMANIA

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OBJECTIVE

The aim of this study is to analyse future changes in warm spells (**WSs**) and cold spells (**CSs**) characteristics in spring and autumn, in Western Romania over the periods 2041-2070 and 2071-2100.

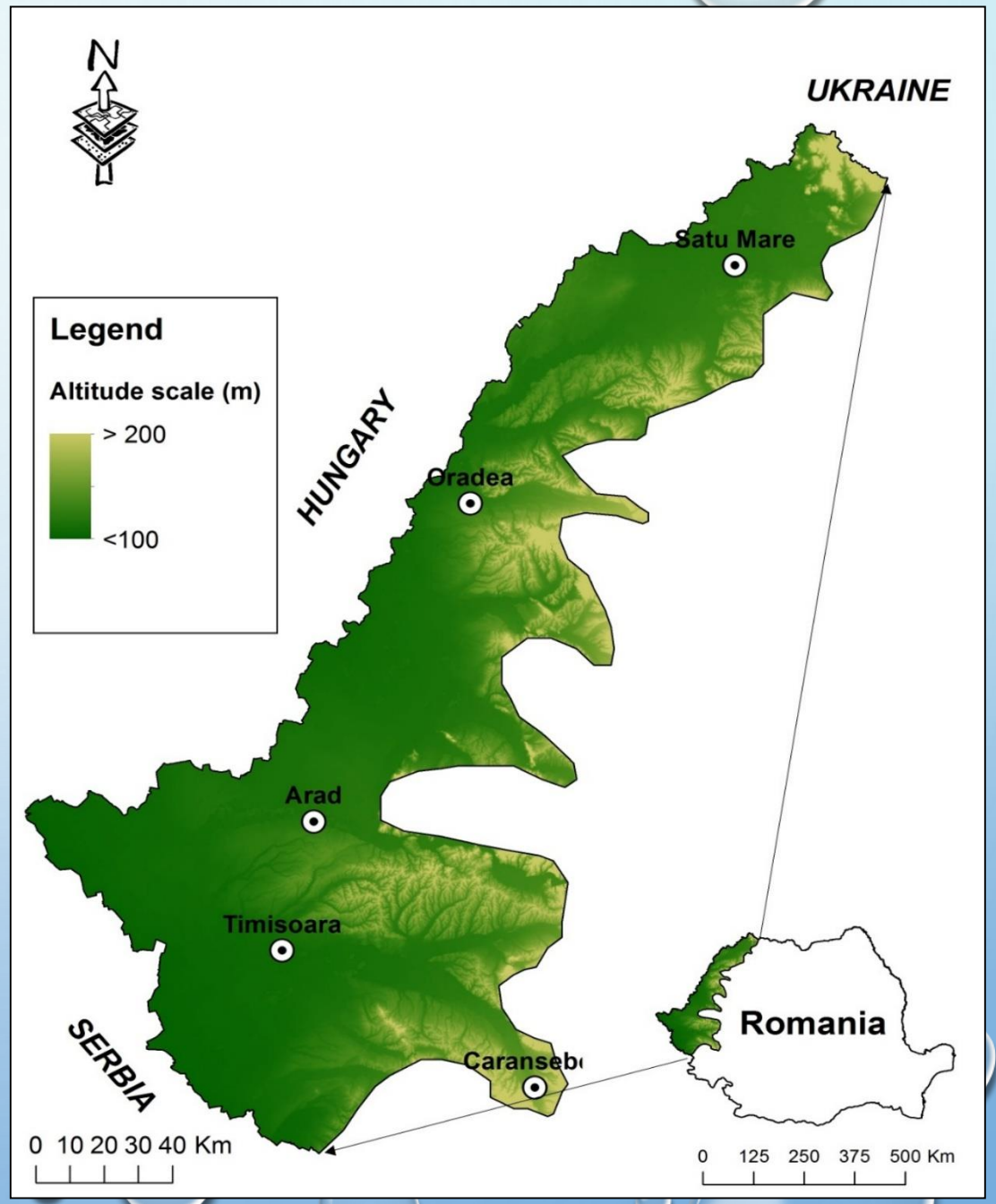
DATA AND METHODS

Study area:

- lowland region in Western Romania (Western Plain)
- 5 weather stations): Arad, Caransebeș, Oradea, Satu Mare, and Timișoara.

Geographical coordinates of weather stations considered from North to South

No.	Station Name*	Latitude (N)	Longitude (E)	Altitude (m)
1	Satu Mare	47°43′18″	22°53′20″	128
2	Oradea	47°02′10″	21°53′51″	136
3	Arad	46°08′15″	21°21′13″	117
4	Timișoara	45°46′17″	21°15′35″	86
5	Caransebeș	45°25′01″	22°13′30″	241



Study Area

DATA

For historical datasets:

- ECA&D (The European Climate Assessment and Database project) (non-blend data)
- www.meteomanz.com
- NMA (National Meteorological Administration)
- the observed datasets were checked for quality control (QC) by the FMETPRO project team *(http://fmetpro.granturi.ubbcluj.ro)*

For modeled data series:

- Outputs of Regional Climate Models (RCMs) downloaded from EURO-CORDEX project database (available at *https://esgf-data.dkrz.de*)
- Spatial resolution 0.1 degree (~12.5 km)
- Six RCMs: ALADIN53, CCLM4-8-17, RACMO22E, RCA4, REMO2009 and WRF331F
- RCP 4.5 scenario

METHODS

WSs and CSs identification:

- Intensity thresholds:
  - The 90th percentile, for WSs
  - The 10th percentile for CSs
- Duration threshold: at least three consecutive days
- The baseline period for percentile calculation was 1961-1990
- Eight indices was analysed:
  - WSN/CSN - seasonal number of warm/cold spells events;
  - WSF/CSF - the seasonal number of days participating in warm/cold spells;
  - WSD/CSD - maximum length of warm/cold spells;
  - WSI/WSI - mean intensity of warm/cold spells.

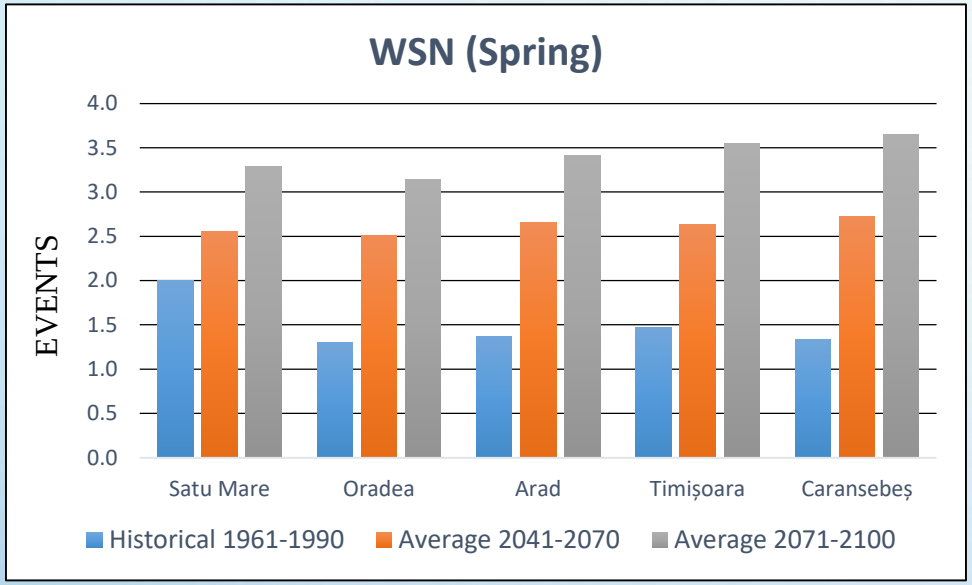
METHODS

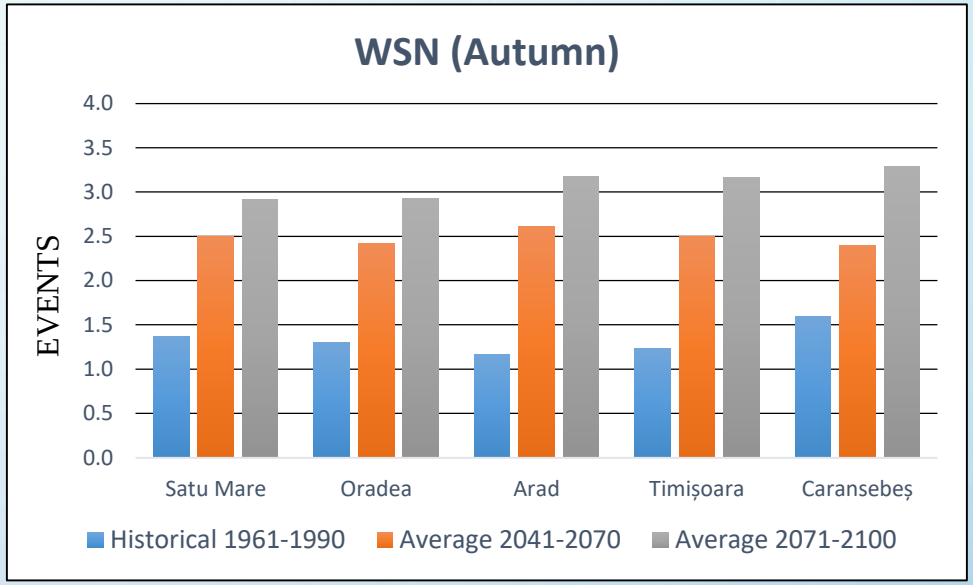
BIAS CORRECTION

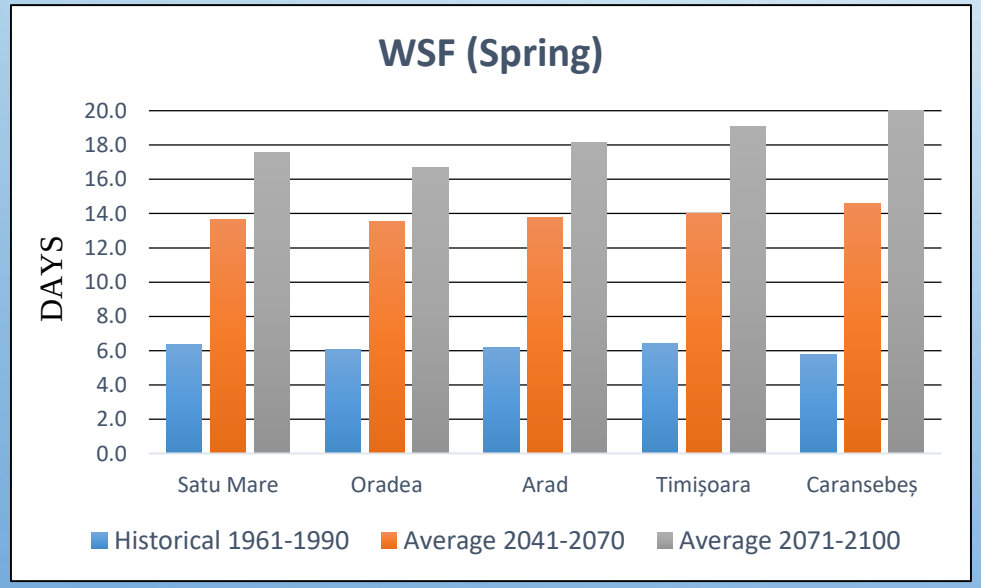
- RCM outputs correction is needed;
- To reduce systematic model errors in the climate variables we used quartile mapping method, which is the most used method for bias correction of regional climate model simulations compared to observational data.

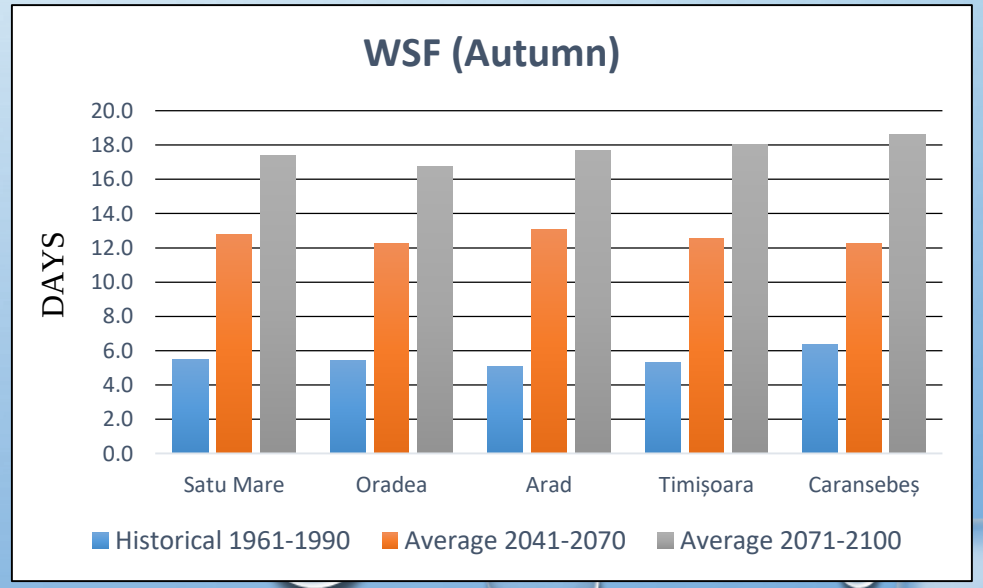
Finally, we compared the average values of historical period (1961-1990) with both future sub-periods (2041-2070 and 2071-2100) .

RESULTS

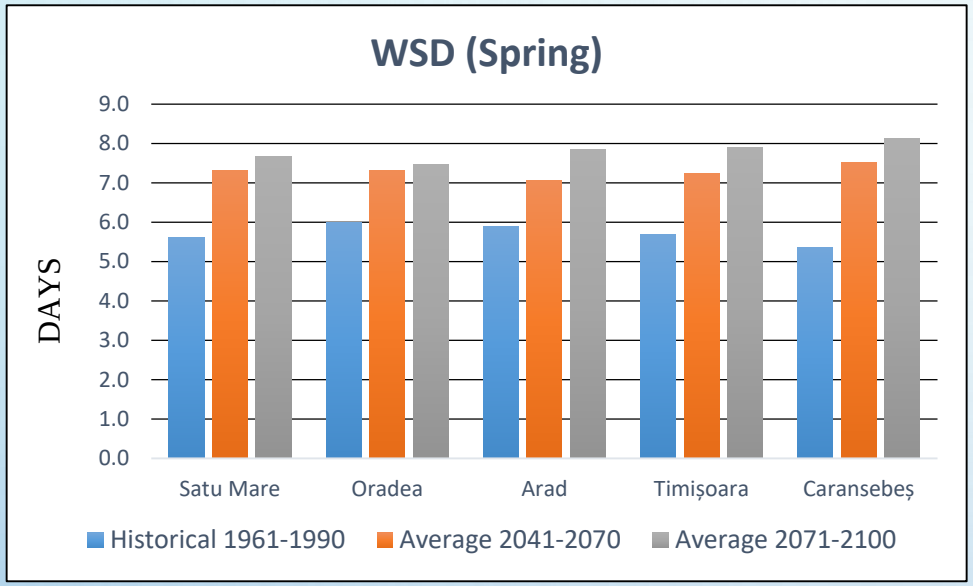

WSN (Spring)
EVENTS
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
Average 2041-2070
Average 2071-2100

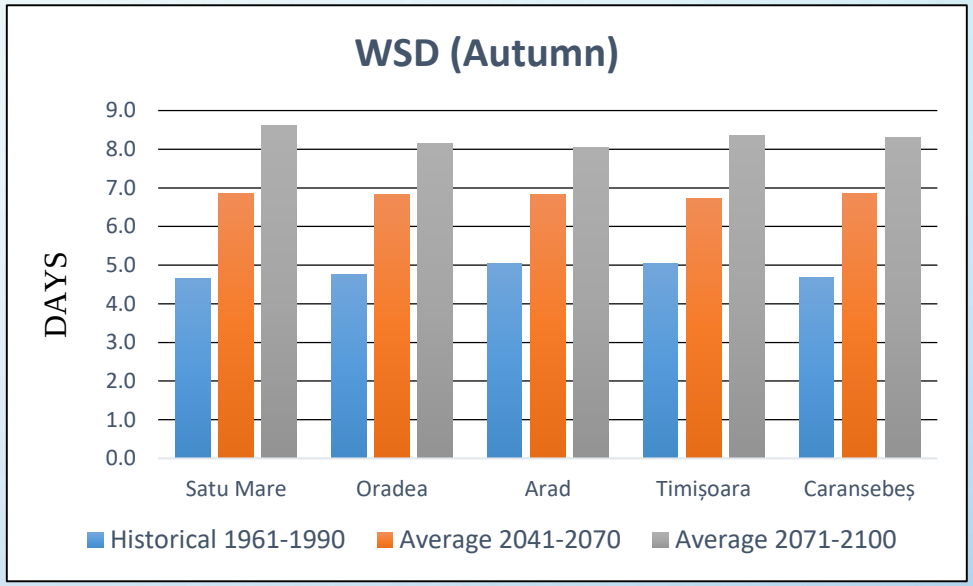

WSN (Autumn)
EVENTS
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
Average 2041-2070
Average 2071-2100


WSF (Spring)
DAYS
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
Average 2041-2070
Average 2071-2100


WSF (Autumn)
DAYS
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
Average 2041-2070
Average 2071-2100

RESULTS


WSD (Spring)
DAYS
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
Average 2041-2070
Average 2071-2100


WSD (Autumn)
DAYS
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Satu Mare
Oradea
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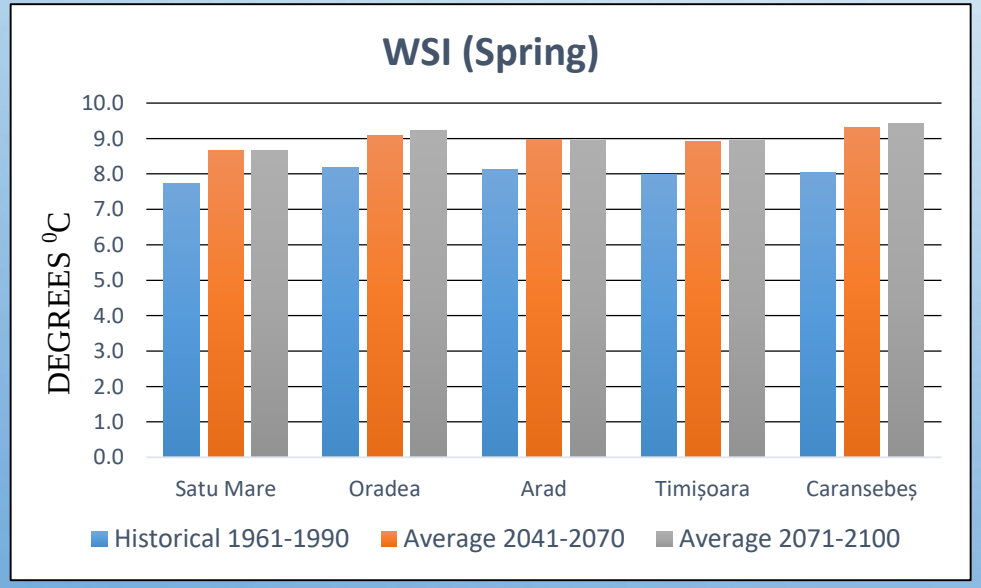
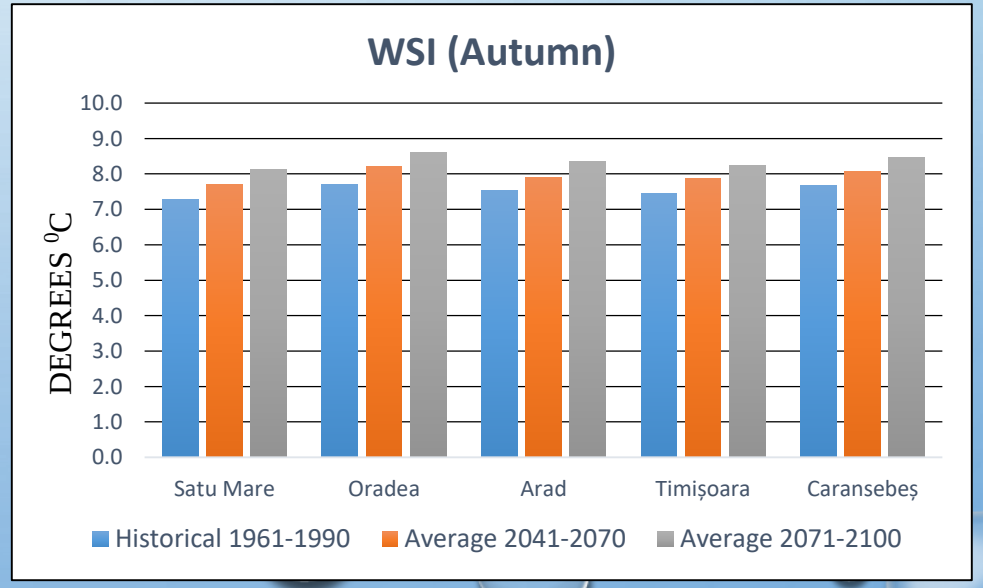
Average 2041-2070
Average 2071-2100


WSI (Spring)
DEGREES 0C
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
Average 2041-2070
Average 2071-2100


WSI (Autumn)
DEGREES 0C
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Satu Mare
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Historical 1961-1990
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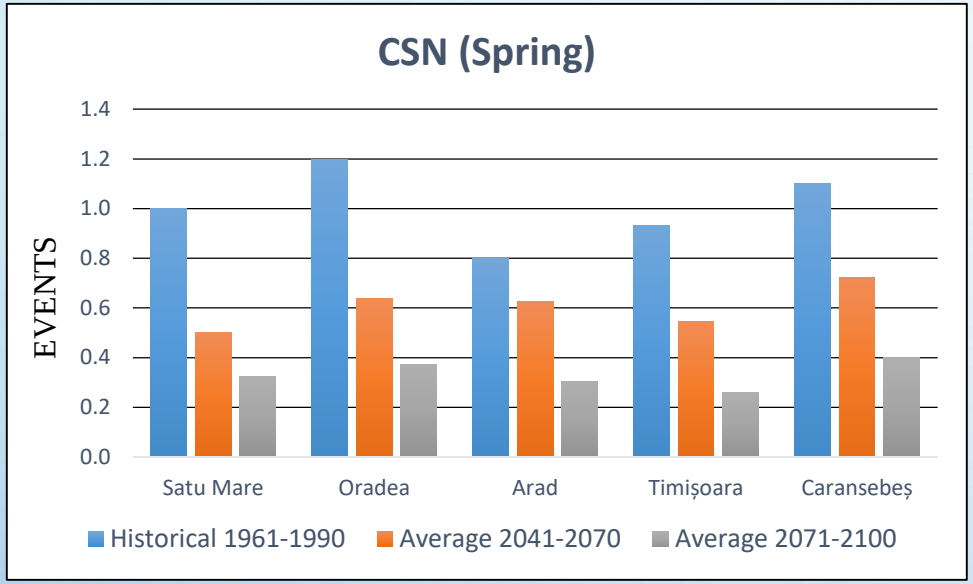
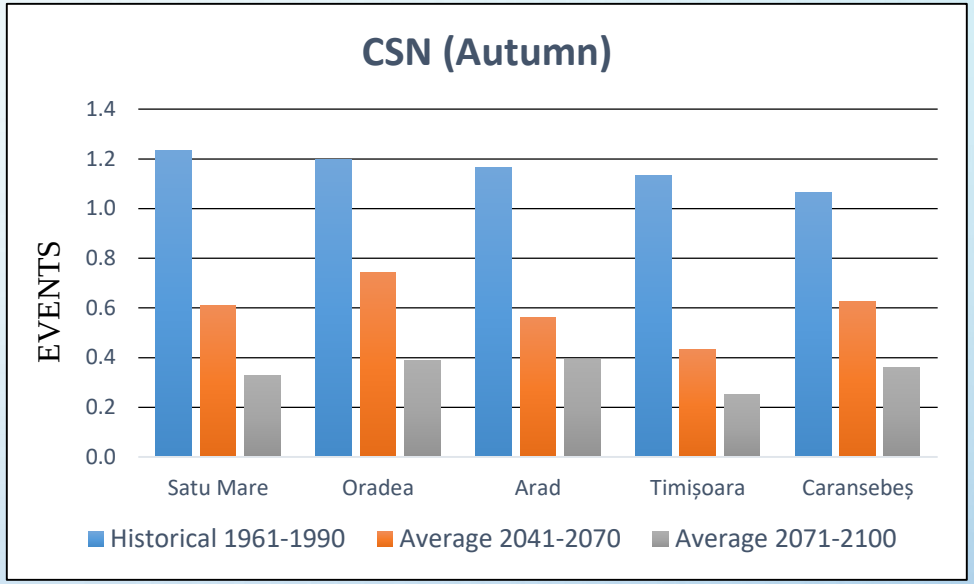
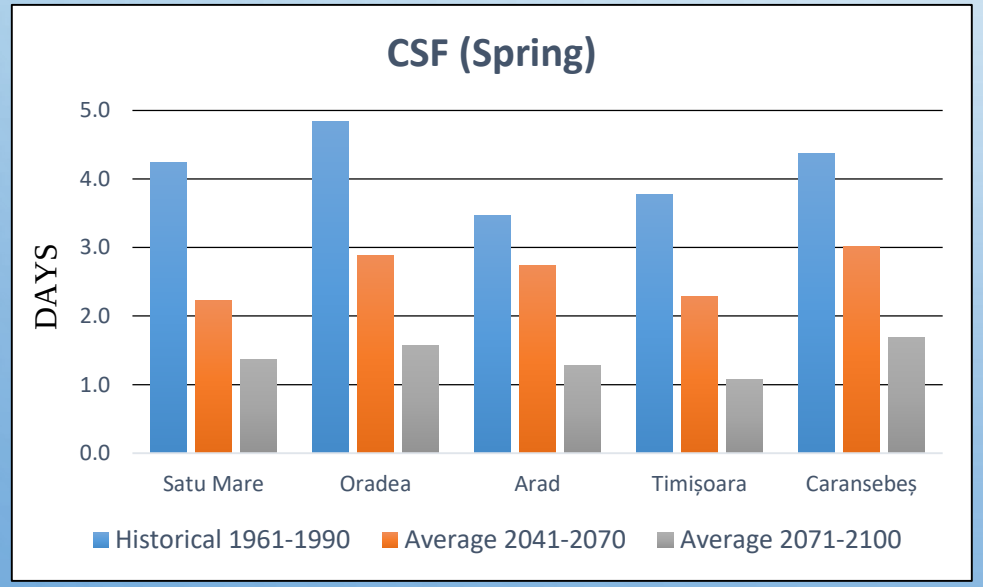
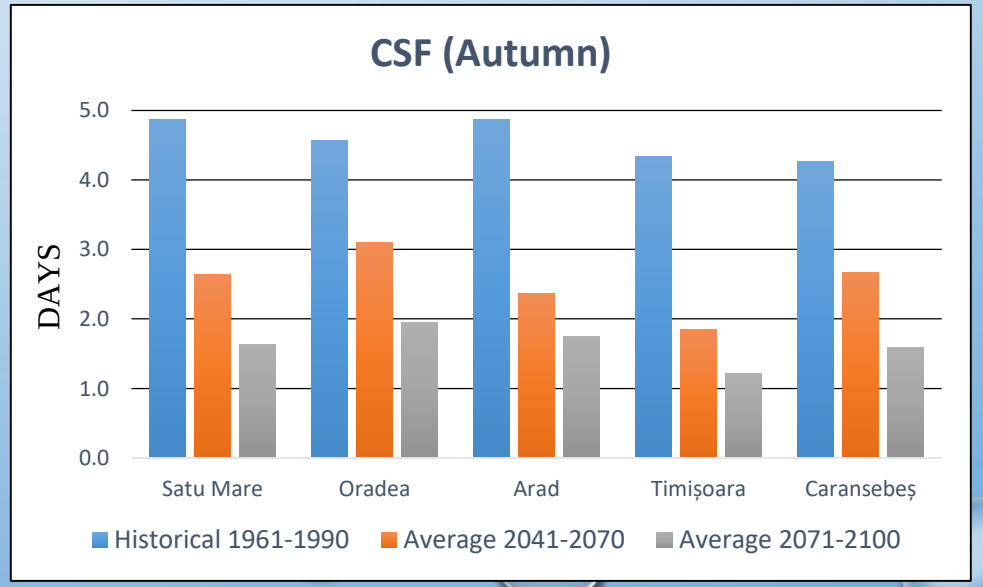
RESULTS


CSN (Spring)
EVENTS
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
Average 2041-2070
Average 2071-2100


CSN (Autumn)
EVENTS
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
Average 2041-2070
Average 2071-2100


CSF (Spring)
DAYS
5.0
4.0
3.0
2.0
1.0
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
Average 2041-2070
Average 2071-2100


CSF (Autumn)
DAYS
5.0
4.0
3.0
2.0
1.0
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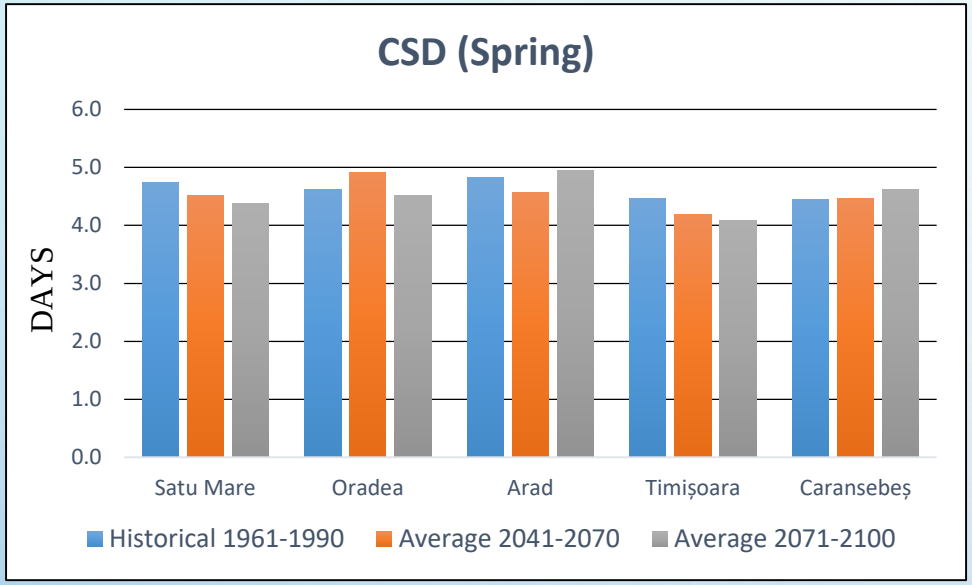
RESULTS


CSD (Spring)
DAYS
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
Historical 1961-1990
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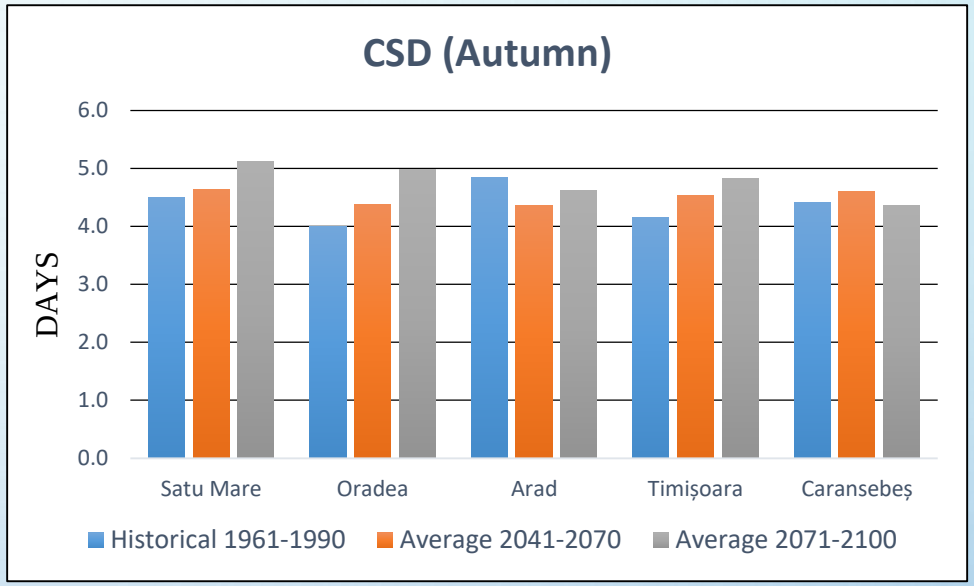
CSD (Autumn)
DAYS
6.0
5.0
4.0
3.0
2.0
1.0
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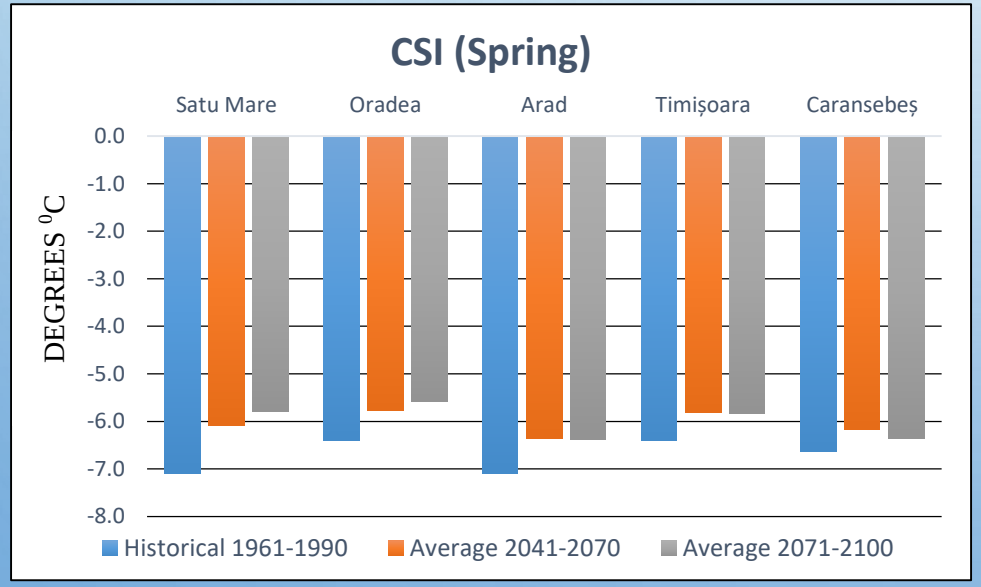
CSI (Spring)
DEGREES 0C
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
0.0
-1.0
-2.0
-3.0
-4.0
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-6.0
-7.0
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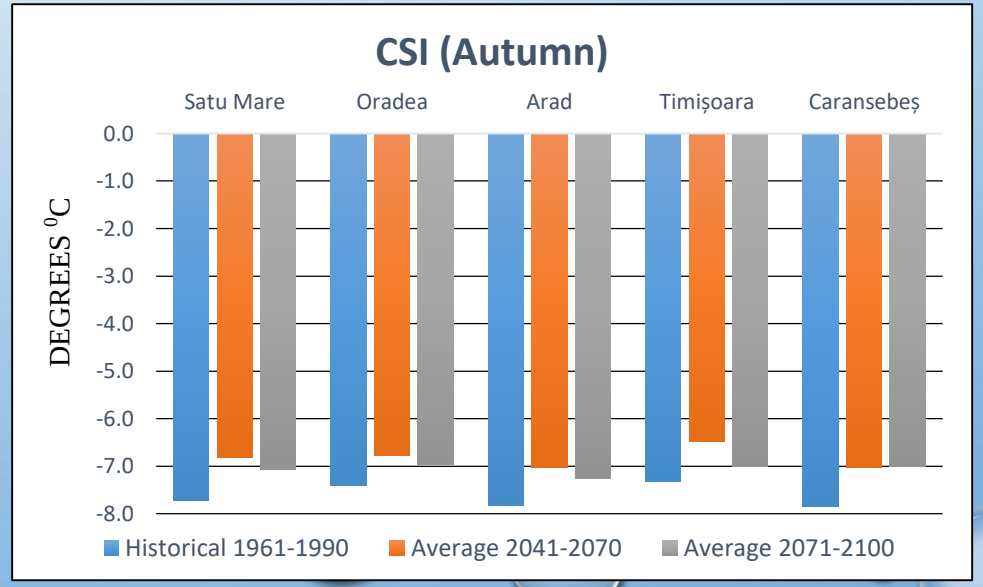
Historical 1961-1990
Average 2041-2070
Average 2071-2100


CSI (Autumn)
DEGREES 0C
Satu Mare
Oradea
Arad
Timișoara
Caransebeș
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
Historical 1961-1990
Average 2041-2070
Average 2071-2100

CONCLUSIONS

- ✓ The impacts of warm and cold spells on the onset of phenological seasons will differ strongly depending on species, phase, and timing;
- ✓ The results show important changes for both future sub-periods compared to the historical one;
- ✓ The period 2071-2100 indicate the highest changes in the average values, but the estimation should be periodically updated;
- ✓ For both transition seasons, analyzed indices show that warm spells will be more frequent, longer and more intense, while the cold spells will be less frequent and less intense.

CONCLUSIONS

- ✓ Average values of cold spells indices will be lower for future sub-periods compared with historical period for both spring and autumn. However, maximum length of cold spells reveals an increase for both seasons in some weather stations;
- ✓ Since present changes in warm and cold spells indices seems to continue in the future at higher rates, this study could be useful as a tool for developing adaptation strategies especially for agriculture sector.

ACKNOWLEDGEMENTS

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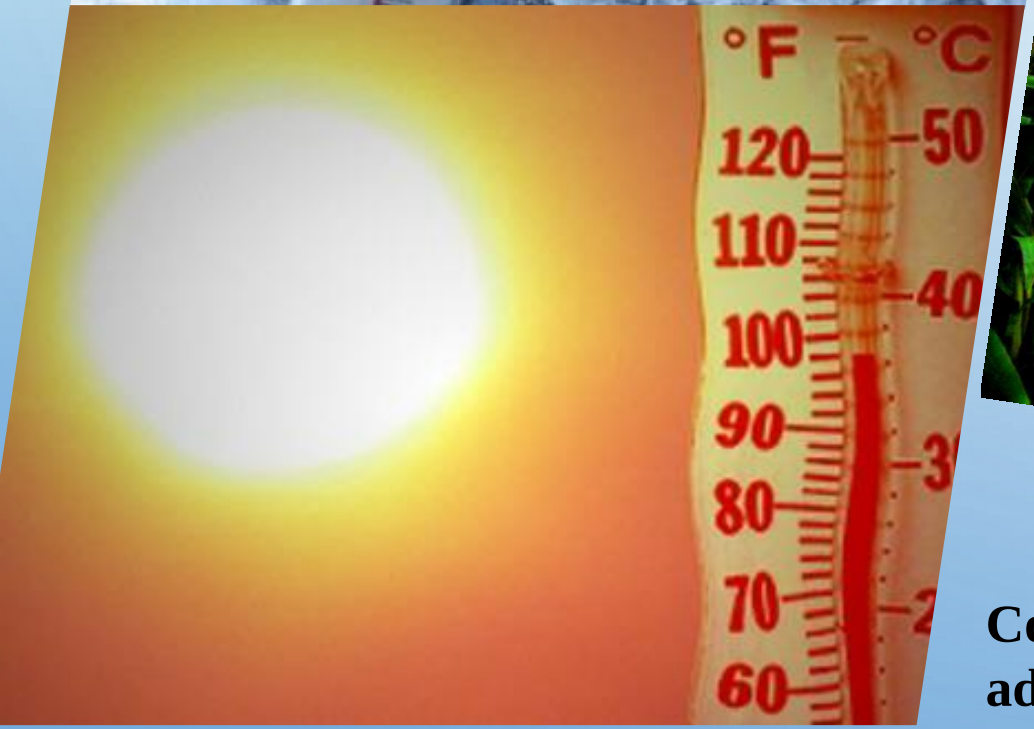

THANK YOU FOR YOUR ATTENTION!

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