GWT18 air circulation types linked to heavy precipitation in Romania between 1980 and 2009

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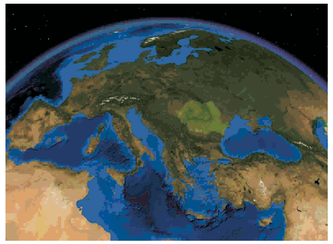
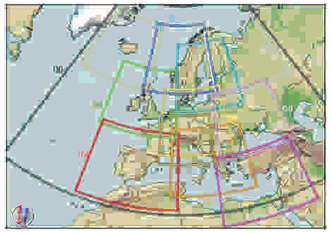
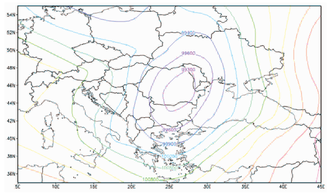






HYBRID SPATIAL DOMAIN FOR ASSESSING THE RELEVANCE FOR ROMANIA OF CERTAIN CIRCULATION TYPES

A hybrid spatial domain has been used, to represent the SLP and HGT500 centroids for a 30-year interval and associate circulation types with hazardous weather in Romania - specifically, heavy precipitation that can lead to flash floods there.

Having Romania close to its center, this domain was formed by intersecting the Domains 8 and 10, as they are defined within the COST Action 733 - *Harmonisation and Applications of Weather Type Classifications for European Regions.*

The circulation types for each day were extracted with the *cost733cat* software.

A SQL Server database has been populated afterwards with these data, for easier separation of various datasets.

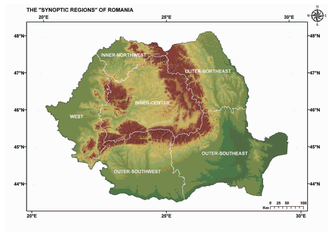
VARIOUS PRECIPITATION PATTERNS IN ROMANIA

The Carpathian Mountains act as an orographic barrier, in relation to the movement of air masses in the lower troposphere over Romania.

The North-Western and central areas are influenced by frontal activity associated with the Icelandic Low and with low pressure systems moving at higher latitudes. Humid air masses of oceanic origin can enter the Carpathians' arch. Foehnal processes somewhat defend the central areas from large amounts of precipitation.

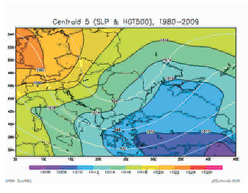
The South-West is exposed to cyclonic activity in the Mediterranean area. Therefore, most of the year this region is exposed to milder weather than the rest of the country.

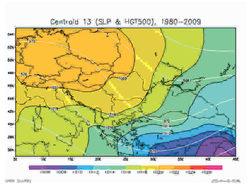
The Eastern parts of the country are exposed to the infuence of low pressure systems of Mediterranean origin, that can also advance over the Black Sea and bring precipitation in the North-East.

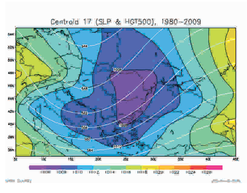


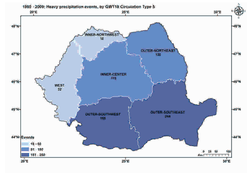
SYNOPTIC REGIONS OF ROMANIA

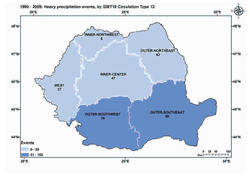
The varied orography, where each altitude range occupies about a third of the entire territory (lowlands: <300 m, hills: 301-800 m, and mountains), and the local layout of the Carpathain Mountains, lead to peculiarities of climate in each region.

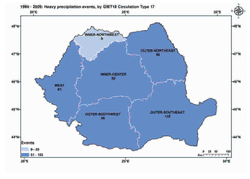


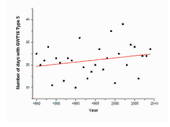


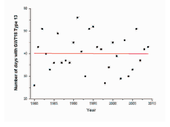


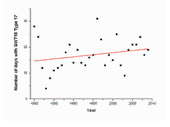






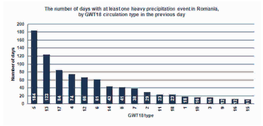


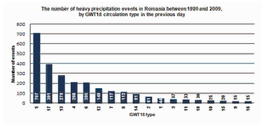


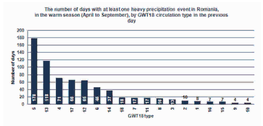


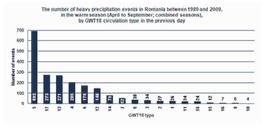
MOST HAZARDOUS CIRCULATION TYPES FOR ROMANIA, HEAVY PRECIPITATION-WISE, BETWEEN 1980 AND 2009

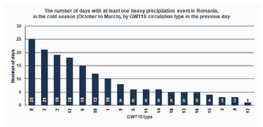
Taking the value of 50 mm/24 hours as the threshold for *heavy precipitation*, the circulation types 5, 13 and 17 of the GWT18 Catalogue were associated with the largest number of heavy precipitation events and the largest number of days with at least one such event. These types were manifest the day before the one with heavy precipitation events.

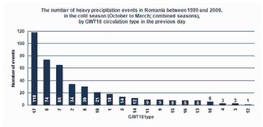






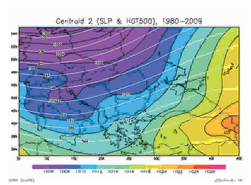


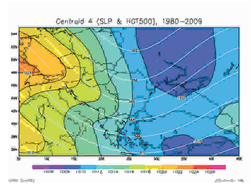


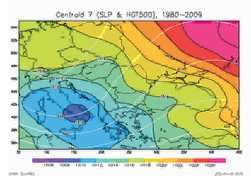


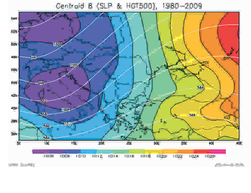
HAZARDOUS GWT18 TYPES IN THE COLD SEASON

Types 2, 7 and 8 were most influential during the cold season. The SLP centroids show prolonged frontal activity over Romania, due to low pressure systems in the Western half of Europe.
Type 4 was more frequent during the warm season.









SOUTH-EASTERN EXPOSURE

The South-Eastern and central areas were most exposed to heavy precipitation, the day after each of these three types was manifest.

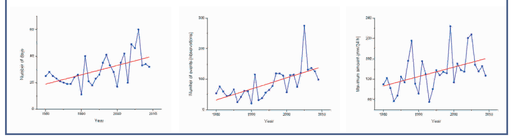
Most of the events, and most days with at least one event were in the areas outside the Carpathians' arch.

The maximum annual amounts recorded in this general area were on the increase, from decade to decade.

The East is also most prone to suffer flash floods, especially along small tributaries of river Siret, in Moldavia.

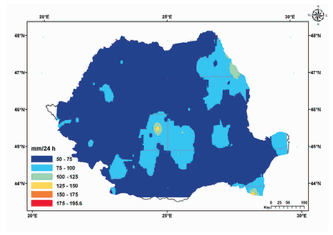
TRENDS IN HEAVY PRECIPITATION BETWEEN 1980 AND 2009

After analysing data from 230 stations and rain gauges, increasing trends were found in the time series of:
- the number of days with at least one event
- the number of events each year
- the maximum annual amounts, recorded in 24 hours. Especially evident in the areas outside the Carpathian arch, from one decade to the next.

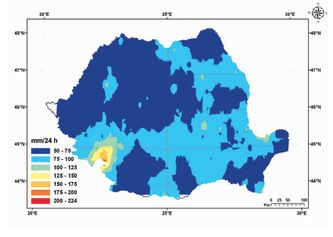


MAXIMUM ANNUAL AMOUNTS, RECORDED IN 24 HOURS

1980.01.01 - 1989.12.31



1990.01.01 - 1999.12.31



2000.01.01 - 2009.12.31