



27 November 2020

CONSIDERATIONS REGARDING THE FORECASTING OF AGRICULTURE RELATED SEVERE WEATHER EVENTS IN THE WESTERN PART OF ROMANIA

Vlad MARAZAN^{1,3}, Karina HAUER², Vlad MIRCOV¹, Adalbert OKROS¹, Antoanela COZMA¹

¹Banat's University of Agricultural Sciences and Veterinary Medicine

²Doctoral School, West University of Timisoara

³Department of Ground Communications, Foundations and Cadastre (CCTFC), Politehnica University of Timisoara

Abstract: The aim of this paper is to analyze and highlight the most important meteorological parameters which are in strong bound with severe weather events and their impact on agriculture in the Western part of Romania. Forecasting severe weather events is one of the most challenging tasks in operational meteorology. The complexity of the forecasting process comes from the large amount of data which is to be analyzed in order to issue a severe weather alert. Nowcasting is used as a short-term three hour forecast in which severe weather events might appear. It is usually issued with the help of the Weather Surveillance Radar either by a forecaster or by a computer software. Severe weather events such as squalls, supercells and flashfloods tend to become normal under the current climate change situation. One of the most important areas in which climate change and its associated severe weather events produce important damage is agriculture. The climate of a region is determined by factors such as physical, dynamic and radiative geography. They directly affect spatial and temporal variations of climatic elements in a given territory. The Western part of Romania is characterized as having a warm temperate continental climate with moderate humidity originating from the South and South Western part of Europe. By analyzing the synoptic situation, the convection indices (KI, CAPE, CTI, TTI) together with RADAR and satellite images, weather related hazards are identified and hazard maps are compelled. Due to the humid air, which originates from the South Western part of Europe, convection is initiated and severe thunderstorms may develop. Risks associated with Cumulonimbus clouds (hail, squalls, flashfloods) account for the majority of the agriculture-related severe weather events. This study points out the importance of agriculture related severe weather forecasts as well as mitigation strategies and adaptation measures for climate change.

• Introduction

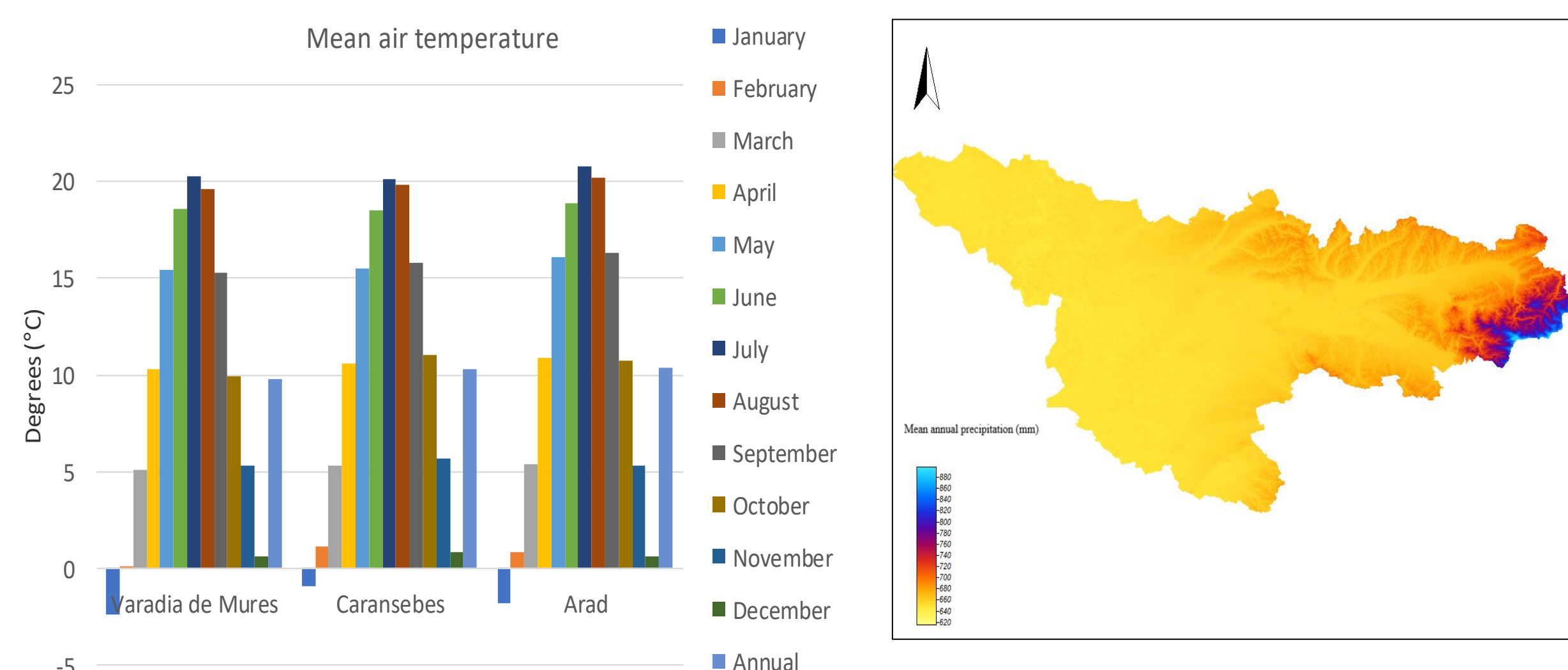
Severe weather has affected human society since the beginning of recorded history and certainly long before then. Humans, along with every other living being on Earth have adapted to a certain range of variabilities in the weather. But not only humans have been affected by severe weather events. One of the most by severe weather events affected areas is agriculture. Though agriculture in Romania continues to achieve enhanced productivity due to scientific research and development, hazards such as severe weather events affect the crops and as such reduce the quality and quantity of the harvest. Every year, droughts, floods, heat waves, storms cause destruction and significant agricultural losses in various regions across Romania. During the last several decades there has been an increase in both frequency and severity of severe weather events.

Due to the local but also regional air circulation, the Western part of Romania experiences a warm temperate continental climate with moderate humidity throughout the entire year, without excessive dry season and relatively moderate summers. There is a well-defined thermal difference between the warm and the cold season. The Western part of Romania has a large opening in all directions of the wind, so that advections of different air masses occur. Rain is usually determined by cyclonic formations. Due to the Carpathian dam, weather fronts tend to have a higher frequency in the Western and South – Western part of Romania and frontal rainfall occurs.

• Material and method

For this study, the Western part of Romania has been selected because of the atmospheric circulation, which allows the mixing of both hot and humid air masses as well as cold and dry air masses. Weather data from three weather stations has been analyzed and processed. The analyzed meteorological parameters include monthly average temperature, monthly maximum temperature, monthly minimum temperature, precipitation quantity, number of days with squalls, number of days with hail and solar radiation. Data regarding the following stations has been used: Caransebeș, Vărădia de Mureș and Arad. These stations all represent a different landform. Data from 1979 to 2009 has been processed.

Weather station	Altitude (m)	Elevation level	Geographical coordinates		River basin	Year of establishment
			Latitude	Longitude		
Caransebeș	241	Hallow	45°25'	22°15'	Timiș	1896
Vărădia de Mureș	156	River valley	46°10'	22°09'	Mureș	1953
Arad	117	Plain	46°08'	21°21'	Mureș	1935



• Results and discussions

Overall agriculture-related severe weather events tend to focus more on the hydro-atmospheric risks, but also on drought. The biggest problem which arises, is that of nowcasting phenomena. Drought can be forecasted and adaptation measures and mitigation strategies may be implemented. With regard to flashfloods, heavy rain and hail there are modern forecasting methods besides climatological charts.

Hail and heavy rainfall producing thunderstorm follow the classic thunderstorm pattern. As such, a thunderstorm is made up of two basic processes: an updraft and a downdraft. The updraft is fed by an inflow current and it usually manifests by the appearance of a Cumulonimbus cloud. The main constituents are cloud droplets, which are not detected by Weather Surveillance Radars (WSR). The downdraft, by the other hand, is produced by condensation and droplet growth originating from the updraft. This region is visible on the WSR.

WSR Reflectivity (dBZ)	Description
10	Very light rain or light snow
20	Light rain or heavy snow
30	Moderate rain
40	Heavy rain with some thunder
50	Heavy rain with likely thunderstorm
60	Heavy thunderstorm, heavy rain and small to medium hail
70	Heavy thunderstorm, heavy rain and huge hail (> 2 cm)

• Conclusions

The aim of this study was to analyze and point out some of the severe weather events which can occur in the Western part of Romania. Since hail and squalls can affect the discussed area, a further analysis is required in order to better understand the need for nowcasting. By identifying some of the weather-related hazards, adaptation measures and mitigation strategies might be implemented in order to come with current severe weather events. As such, a review of current weather observation techniques is to be done in order to ensure that the latest technologies are implemented in order to achieve maximum forecasting efficiency.