

**Evaluation of Hail in Kastamonu Province in Western Black Sea Region on the Basis of Climate Change Projections**

Merve KALAYCI KADAK<sup>1\*</sup>, Sevgi ÖZTÜRK<sup>1</sup>

<sup>1</sup> Kastamonu University, Faculty of Engineering and Architecture, Department of Landscape Architecture, 37100, Kastamonu, TURKEY

\*Sorumlu Yazar: [mkalayci@kastamonu.edu.tr](mailto:mkalayci@kastamonu.edu.tr)

<sup>1</sup> This paper was presented at ICLAR 2019 Congress, İstanbul, Turkey, 23-24 August 2019.

**ÖZET**

Sanayi devrimi ile başlayan fosil yakıt kullanımı, atmosferde tutulan sera gazı yoğunluğunu devamlı olarak arttırmaktadır. Bu gazların miktarındaki artış, iklim değişimine neden olmakta ve tüm canlıların yaşamını tehlikeye atmaktadır. İklim değişikliği günümüzde, canlıların karşı karşıya kaldığı en büyük problemlerden biridir. İklim değişikliğinin olumsuz etkileri ile mücadele küresel, bölgesel ve yerel ölçekte çeşitli çalışmalar yapılmasını ve bir yol haritası çizilmesini zorunlu hale getirmektedir. Karadeniz bölgesi için yapılan iklim değişikliği tahminlerinin ve çalışmalarının tamamı; yağışların artacağını, alışılmadık hava olaylarının gerçekleşeceğini işaret etmektedir. Batı Karadeniz havzasında yer alan 9 ilden en çok yer kaplayan %25,6 oranı ile Kastamonu ildir. Kastamonu ili bazı ilçelerinde 2018 yılında büyük hasarlara sebep olan dolu yağışları meydana gelmiştir. Bu yağışlar, mevsimsel olarak değişiklik göstermekle birlikte beklenmedik ölçüde maddi kayba, arazi bozulmalarına ve canlılarda yaralanmalara neden olmuştur. Çalışmada, Kastamonu İli Meteoroloji Müdürlüğü'nden alınan veriler ve AFAD verileri değerlendirilerek, geçmişten bugüne dolu yağışlarının durumu ve bölgesel projeksiyonlardaki tahminleri ile uyum durumları değerlendirilmiştir.

**Anahtar Sözcükler:** İklim Değişikliği, Karadeniz Bölgesi, Dolu

**ABSTRACT**

Utilization of fossil fuels ever since the industrial revolution consistently increases the greenhouse gas concentration in the atmosphere. The increased level of these gases in the air leads to climate change and endangers the lives of all living creatures. Climate change is one of the biggest problems that the living creatures encounter at the present time. In an attempt to fight against the adverse effects of climate change, it has become compulsory to conduct studies on global, regional and local scales. The projections and studies on climate change in Black Sea Region reveal that the amount of rainfall will increase, and unusual weather events will be experienced. Among the 9 provinces in Western Black Sea Basin, Kastamonu is the biggest one and it covers 25.6% of the area of the whole region. The hail in some districts of Kastamonu in 2018 has caused a great damage. Even though the amount of rainfall in the said period varied seasonally, it resulted in material damage to an unexpected extent, land degradation and injury of living creatures. In this study, the data obtained from the Provincial Directorate of Meteorology in Kastamonu Province and the Disaster and Emergency Management Presidency (DEMP) under the Ministry of the Interior of the Republic of Turkey are evaluated. The levels of hail from past to present and their accordance with regional projections are evaluated.

**Keywords:** Climate Change, Black Sea Region, Hail

---

**INTRODUCTION**

Increased utilization of fossil fuels ever since the industrial revolution has been the first step towards climate change. The gradual technological advancements, rapid population growth and the pressure to get urbanized have resulted in concentration of greenhouse gasses in the atmosphere and the world faced the reality of climate change. Global climate change has become a common agenda of the world in recent years. The first and biggest initiative on a global scale in this respect was the establishment of

Intergovernmental Panel on Climate Change (IPCC) in 1988 to assess the hazards of the climate change caused by human intervention [4]. Different groups composed of scientists are developing various scenarios. All of these scenarios are based on the fact that the global climate change will result in global warming [6].

Due to the geographical location of Turkey, the effects of climate change throughout the country are considerably visible. According to IPCC reports, the Mediterranean basin where Turkey is located is the most fragile zone where the climate change will take effect [3].

In order to demote the studies conducted on a global scale to a local scale and further elaborate them, subscale studies should be conducted. In this sense, the General Directorate of Meteorological Service carries out significant studies and prepares joint action plans with Turkish Ministry of Environment and Urban Planning.

In this study, the hail disaster in Kastamonu province is assessed in line with the projections regarding the Black Sea Region.

## **MATERIAL AND METHODS**

Significant climatic differences have been observed all over the world in recent years. One of the zones where these changes have taken effect is the Mediterranean basin where Turkey is located [5]. While it is projected that the amount of rainfall in Mediterranean Region will decrease, it is also estimated that the storms originating from North Atlantic will move further north [7]. The main elements of climate, temperature and rainfall are of great importance in determination of the tendency to climate change. Both of these climatic elements vary to a great extent on both spatial and temporal scale [1].

One of the sub-zones where the effects of global climate change are significantly visible is the Western Black Sea Region [2].

This study was conducted for the central district of Kastamonu province. Kastamonu province is located in Western Black Sea Region in northern Turkey (Figure 1). Karaçomak Stream, which is a reach of Gökırmak River passes through the city. The altitude of the city center is 774 meters [8]. Kastamonu is the largest province in Western Black Sea Region with a surface area covering 25.6% of the region.



**Figure 1.** Location of the study area

Kastamonu province encountered a climatic disaster in 2018 which led to serious consequences. Although there has always been hail in the region due to its climate characteristics and geographical location, the hail in September 2018 caused catastrophic damages [9].

There are both local and global projections and scenarios with respect to climate change. These projections include the estimates regarding the consequences of climate change in Black Sea Region where Kastamonu province is located and necessary measures to be taken [10].

In an attempt to evaluate the levels of hail from past to present and their accordance with regional projections, the data obtained from the Provincial Directorate of Meteorology in Kastamonu Province and DEMP are evaluated in this study.

It was revealed that the climate change projections were confirmation of the hail disaster in 2018.

*Evaluation of Hail in Kastamonu Province in Western Black Sea Region on the Basis of Climate Change Projections*

*Merve KALAYCI KADAK, Sevgi ÖZTÜRK*

## CONCLUSIONS

In this study, the data regarding the extreme weather conditions in 2018 and 2019 obtained from the sudden change report prepared by Kastamonu Provincial Directorate of Meteorology are compiled (Table 1).

**Table 1.** Data Obtained from the Sudden Change Report of Kastamonu Provincial Directorate of Meteorology for 2018-2019 (Meteorological Station: Kastamonu)

DATE	WEATHER EVENT	INTENSITY OF RAINFALL
19.01.2018	17- Storm _ whirlwind	03- powerful
23.03.2018	17- Storm _ whirlwind	03- powerful
20.05.2018	22- Hail	02- middle level
25.05.2018	22- Hail	03- powerful
06.06.2018	43- heavy rainfall _ flood	03- powerful
18.07.2018	43- heavy rainfall _ flood	03- powerful
24.07.2018	22- Hail	03- powerful
26.07.2018	43- heavy rainfall _ flood	03- powerful
05.09.2018	17- Storm _ whirlwind	03- powerful
05.09.2018	22- Hail	02- middle level
13.09.2018	22- Hail	04- very strong
13.09.2018	22- Hail	04- very strong
14.09.2018	22- Hail	02- middle level
18.05.2019	22- Hail	02- middle level
24.05.2019	22- Hail	02- middle level
04.06.2019	22- Hail	03- powerful
10.06.2019	22- Hail	03- powerful
11.06.2019	22- Hail	02- middle level
11.06.2019	17- Storm _ whirlwind	04- very strong
16.06.2019	43- heavy rainfall _ flood	02- middle level
17.06.2019	43- heavy rainfall _ flood	02- middle level
18.06.2019	43- heavy rainfall _ flood	02- middle level
18.06.2019	72- stroke of lightning	03- powerful
30.06.2019	43- heavy rainfall _ flood	03- powerful
05.07.2019	43- heavy rainfall _ flood	02- middle level

As is seen in the table, 12 hails have been occurred in the years of 2018 and 2019 (the data until 7th month) and only the one on 13.09.2018 was a severe hail squall. The main reason why the said hail was regarded as a disaster is that it had caused a severe damage to both living creatures and non-living things. In order to determine the financial burden laid on the state because of this hail which was possibly caused by climate change according to the data obtained from the General Directorate of Meteorology, the data of DEMP are reached.

The aids granted by Kastamonu Branch of the Provincial Disaster and Emergency Management Presidency and the payment items not included within the scope of these aids are determined in the interviews made with the Branch Manager (Table 2).

**Table 2.** Damages, applications and payments made by the state according to DEMP data

	<b>NUMBER OF STATED DAMAGES</b>	<b>PAYMENT AMOUNT</b>
<b>Roofs</b>	5350	TL 4.439.000
<b>Vehicles</b>	10240	unknown*
<b>Infrastructure</b>	unknown*	TL 7.250.000
<b>Agricultural land</b>	unknown*	unknown*
<b>Solar energy systems</b>		
<b>Sheathing</b>		
<b>Windows</b>		
<b>Combi</b>	out of scope**	
<b>Housepaint</b>		
<b>Plaster</b>		
<b>Satellite dishes</b>		

\* paid by insurance companies  
\*\* out of state guarantee

As it is seen in the table damages to roofs, vehicles, infrastructure, agricultural land damages are covered by aids and insurance. However, damages to solar energy systems, sheathing, windows, combi boilers, housepaint, plaster, satellite dishes are not covered. 5350 and 10240 persons have applied for compensation of the damages to roofs and vehicles respectively. The state has paid TL 4.439.000 to compensate the damages to roofs. Although the total amount paid to compensate the damages to vehicles is not known, insurance companies have paid TL 7.250.00 to compensate the damages to infrastructure. The Branch Manager states that the amount of total payment made is at least one-seventh of the total damages according to unwritten information. In addition to the payments made by the state, the payments made by the insurance companies cover the agricultural lands, but the total amount of the payment is not known.

The majority of natural disasters caused by climatic conditions results in loss of life and property and irrevocable damages. The amount of these losses can be somewhat prevented or reduced by taking measures within the context of global scenarios and lower scale climate projection studies. The most important thing to do in this context will be minimizing the damage to nature caused by humans in every respect and preventing emission of greenhouse gases as far as possible.

As it is seen in this data compilation study conducted in central district of Kastamonu province, the price of tens of natural disasters that have occurred in Black Sea Region in the years of 2018 and 2019 were very heavy and they have resulted in irrevocable losses of life and property. Forward-thinking developed countries should consider keeping their end of the bargain as an obligation. The most catastrophic hail disaster in the history of Kastamonu province that occurred on 13.09.2018 confirms the climate projections and makes taking immediate action necessary.

## **ACKNOWLEDGEMENTS**

We would like to thank Dr. Suat Tüfekci (AFAD) and Salih Yıldırım (MGM) for their assistance in providing official data.

## **REFERENCES**

- [1] Bahadır, M. North-South Directional Temperature and Precipitation Alteration Predictions in Reflection of Climate Change in Turkey on Climatic Zones Journal of Academic Perspective Issue: 26, September - October 2011. pp: 1-18. 2011.
- [2] Çeribaşı, G. Analysis of Precipitation Data in Western Black Sea Basin by Using Innovative Trend Method of Şen. Academic Platform Journal of Engineering and Science 6-3, 168-173. 2018.

- [3] IPCC. The physical science basis. Contribution of working group I to fifth assessment report on the intergovernmental panel on climate change. USA. 2013.
- [4] MGM. Climate Projections and Climate Change in Turkey based on New Scenarios, Directorate of Research Department, Climatology Branch Office, General Directorate of Meteorology Printing House, Ankara. 2015a.
- [5] Özkan, K. Global Climate Change Scenarios, Forest Engineering, Year: 47, Issue 1-2-3, Jan-February-March 2010, ISSN 1301-3572, Chamber of Forest Engineers' Publication Organ, Ankara. 2010.
- [6] Öztürk, K. Global Climate Change and Its Potential Effects on Turkey, Gazi University, Journal of Gazi Faculty of Education 22, Issue 1, 47-65. 2002.
- [7] Şen, Ö. L., Bozkurt, D., Gokturk, O. M., Dundar, B., Alturk, B. 2013. Climate Change in Turkey and Its Potential Effects Access Address: [https://ipc.sabanciuniv.edu/wp-content/uploads/2012/11/Bildiri\\_Omer\\_L\\_Sen\\_vd\\_2013.pdf](https://ipc.sabanciuniv.edu/wp-content/uploads/2012/11/Bildiri_Omer_L_Sen_vd_2013.pdf) Date Accessed: 11.08.2019.
- [8] URL1. Access address: <http://www.wikizero.biz/index.php?q=aHR0cHM6Ly90ci53aWtpcGVkaWEub3JnL3dpa2kvS2FzdGFtb251> Date Accessed: 13.08.2019.
- [9] URL2. Access address: <http://www.kastamonu.gov.tr/dolu-yagisi-hasar> Date Accessed: 13.08.2019.
- [10]. URL3. Access address: <https://www.iklimhaber.org/cevre-ve-sehircilik-bakanligi-karadeniz-iklim-degisikligi-eylem-planini-yayimladi/> Date Accessed: 13.08.2019.