International Journal of Geography and Geography Education (IGGE)

To cite this article: Çelik, M. A., Bayram, H. & Özüpekçe, S. (2018). An assessment on climatological, meteorological and hydrological disasters that occurred in Turkey in the last 30 years (1987-2017). *International Journal of Geography and Geography Education*, 38, 295-310.

Submitted: May 17, 2018 **Revised:** June 08, 2018 **Accepted:** June 26, 2018

AN ASSESSMENT ON CLIMATOLOGICAL, METEOROLOGICAL AND HYDROLOGICAL DISASTERS THAT OCCURRED IN TURKEY IN THE LAST 30 YEARS (1987-2017)

Türkiye'de Son 30 Yılda (1987-2017) Meydana Gelen Klimatolojik, Meteorolojik ve Hidrolojik Afetler Üzerine Bir Değerlendirme

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Özet

Bu çalışmada, Türkiye'de son 30 yılda ekstrem iklim koşullarına bağlı olarak meydana gelen klimatolojik, meteorolojik ve hidrolojik afet olaylarındaki sıklıklar ile bu afetlerin en fazla görüldüğü bölgeler, iller ve bunlar üzerinde etkili olan faktörlerin değerlendirilmesi amaçlanmıştır. Bu değerlendirmede klimatolojik afetlerin etkili olduğu illerdeki meteorolojik ekstrem olaylar, çeşitli afet raporları (Dünya Afet Raporları vs.) ile Türkiye Ulusal Afet Arşivi (TUAA) ve Türkiye Afet Bilgi Bankası (TABB) afet veri sistemi gibi kaynaklardan temin edilmiştir. Türkiye'de meydana gelen klimatolojik afetlerin etkili olduğu bölgelere bakıldığında son 30 yılda en fazla klimatolojik, meteorolojik ve hidrolojik afetlerden etkilenen bölge, sayısal olarak 2507 klimatolojik afetle Doğu Anadolu Bölgesi olmuştur. İkinci sırada 1359 klimatolojik afetle Karadeniz Bölgesi olurken; onu 1340 klimatolojik afet ile Ege Bölgesi takip etmektedir. Bu bölgelerden sonra sırasıyla Marmara, Akdeniz, İç Anadolu ve Güneydoğu Anadolu bölgeleri gelmektedir.

Anahtar Kelimeler: Ekstrem İklim Olayları, Afet, Sel, Yangın, Türkiye

Abstract

This study aims to assess the frequencies of meteorological, hydrological and climatological disasters that occurred due to extreme climate conditions in Turkey in the last 30 years, identify the regions and provinces with the highest frequency of such disasters, and factors affecting such disasters. In this assessment, extreme meteorological events in the provinces where such climatological disasters were effective were collected from sources such as various disaster reports (World Disasters Report, etc.), the Turkish Disaster Archives (TUAA), and the disaster data system of the Turkish Disaster Data Bank. Considering regions where climatological, meteorological and hydrological disasters were frequent in this period, the Eastern Anatolia Region which witnessed 2507 climatological disasters in the last 30 years ranks first. The second region which witnessed the highest number of climatological disasters is the Black Sea Region with 1359 events, followed by the Aegean Region in the third place with 1340 events. These are followed by the Marmara Region, the Mediterranean Region, the Central Anatolia Region and the Southeastern Anatolia Region.

Keywords: Extreme Climatological Events, Disaster, Flood, Fire, Turkey

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INTRODUCTION

In its most general and basic sense, disaster is a disruptive, destructive, and altering event arising from extreme conditions. A more comprehensive definition can be made as follows: Disaster is a natural or artificial (human-induced/technological) event which affects people living in the region where extreme conditions are experienced physically, economically, socially, culturally, and environmentally in a direct or indirect manner; causes loss of life and property; limits or temporarily halts everyday lives and activities of people; does not allow people living in the region to deal with the situation by their own capabilities and resources; requires the use of crisis solution methods and the activation of disaster management systems (Demir et al., 2011; Ergünay, 2007; Gökçe et al., 2008; Hoyois, 2006; Işık et al., 2012; Kadıoğlu, 2011; Özey, 2006; Özşahin, 2013).

While there are different "disaster" definitions made by various industries, organizations, and academics; the meaning attached to the term "disaster" has been criticized by some academics due to uses beyond the word's definition. According to Kadıoğlu (2011), who is among these critics, the term disaster should be used with the meaning and definition accepted by the United Nations. The definition accepted by the United Nations is as follows: "A serious disruption of the functioning of society, causing widespread human, material, or environmental losses which exceed the ability of affected society to cope using only its own resources (Department of Humanitarian Affairs, United Nations, 1992)".

According to the definition given above and Kadıoğlu, in order for an event to be accepted as a disaster, it must cause loss of life, loss of property, or both for people living in the place of its occurrence; it must result in situations which interrupt everyday lives of people by limiting or crippling their ability to meet their basic needs; and the local population and the local government must fall short to cope using their own resources (Kadıoğlu, 2011, s.38).

Kadıoğlu (2011) has developed the following formula for the term disaster in order to allow for the use of a more appropriate language in Turkey in line with international classifications and norms:

"Disaster = Needs > Resources or Disaster = Necessary Intervention > Actual Intervention"

According to this definition by Kadıoğlu, the term "disaster" involves an event which requires more resources than those available to people living in the place where the disaster occurs. Alternatively, the necessary intervention during or after the event must be far greater than the actual intervention.

Based on opinions of Kadıoğlu related to the term disaster, it is possible to measure the magnitude of a disaster by examining the relationship between life and property losses and cultural losses caused by the event. That being said, Kadıoğlu suggests that it is important to understand disasters with their scientific dimensions and reveal them with every aspect. However, Kadığolu underlines that scientific knowledge is insufficient on its own. In order to minimize losses and damages caused by disasters, all stakeholders related to the "disaster" must come together and share technical, scientific, and sociological knowledge and skills, as well as creating environments where solutions can be produced.

Disaster Types and Disasters with Climatological Origins/Meteorological Character

Based on their characteristics and origins, disasters can be organized in two main categories in line with international classifications. In general, disasters can be grouped in 5 groups according to their most common patterns and origins in the world (Table 1). According to their origins, it is possible to classify disasters as natural disasters, human-induced (technological) disasters, and mixed disasters (Kadıoğlu, 2011: 40).

Table 1: Types of Disasters According to the Most Common Forms of Sight and Origins in the World .

THE ROOT OF THE DİSASTER	THE MAİN TYPE OF THE DİSASTER	THE SUBSPECİES OF THE DİSASTER
GEOPHYSICAL DISASTERS (GEOLOGICAL-GEOMORPHOLOGICAL)	Earthquakes	Earthquake Tsunami
	Volcanoes	Volcanic eruption (lava flow, ash, pyroclastic material eruption, volcanic pebble/ bombardment etc.) Toxic gas discharge etc.
	Mass Movements (dry)	Rockfall Avalanche Landslide Subsidence
CLIMATOLOGICAL DISASTERS	Extreme Warms	Heat wave Cold wave Severe winter conditions
	Drought Wild Fires	Meteorological drought Hydrological drought Agricultural drought and so on. Forest fire Land fires (step, meadow, bush etc.)
METEOROLOGICAL DISASTERS	Storm	Tropical cyclone Tropical cyclone (winter storm, middle latitude cyclonic storm, etc.) Thunder / lightning local convective storm (orasj, full storm, etc.) Hose and so on.
HYDROLOGICAL DISASTERS	Flood	General flood Flood Storm surge / coastal flood etc.
	Mass Movements (Wet / moist)	Flowing Drift Rockfall Avalanche Landslide Subsidence
BIOLOGICAL DISASTERS	Epidemic (epidemic disease)	Viral infectious diseases Bacterial infectious diseases Parasitic infectious diseases Fungal (fungal) infectious diseases Prion infectious diseases
	Insect infestation Animal panic	

Source: (Türkeş and Acar Deniz, 2010).

Natural Disasters: Natural disasters are extreme events which occur naturally due to environmental phenomena without human intervention. Such disasters can be organized in two groups: Geological Disasters and Meteorological/Climatological Disasters.

According to global disaster impact assessments; climatological, meteorological, and hydrological disasters account for approximately 80% of natural disasters. Among these; storms, overflows, and floods account for 65% of natural disasters (Türkeş, 2014: 2).

Natural disasters cripple the ability of people living in the region to perform their everyday activities; considerably interrupts their socio-economic and socio-cultural activities. People in the region may find some relief for a certain period of time if the necessary support is provided; however, their activities may be interrupted completely if the magnitude of the disaster is too big for them to cope using local resources. Natural disasters also cause loss of life and property in varying degrees depending on their impact level (Kadıoğlu, 2011: 42). Events which originate from sun and indirectly from the atmosphere, may develop suddenly or gradually, and occur as a result of extreme climate conditions such as floods, storms and typhoons, whirlwinds, forest fires, heat waves, extreme winter conditions, air pollution, acid rains, avalanches, sea and lake overflows, thunderbolts, droughts, hails, and frosts are referred to as *"climatological disasters"* or *"natural disasters of meteorological character"* (Zhai and Guocai, 2004; Karabulut et.al., 2007; Akkemik at.al., 2014). Climatological disasters; or in other words, disasters of meteorological character, account for a significant portion of natural disasters. Such disasters have been occurring with increasing severity and frequency for the last 30-40 years. Human activities which are the biggest threats of our age such as industrialization, haphazard urbanization, migration, overconsumption, large-scale environmental disruption, and climate change due to increased greenhouse gas emission increase the impact level of such disasters and expand their area of effect and frequency. The most significant

characteristic which distinguish natural disasters of climatological origin from other natural disasters is the ability to minimize damages caused by these disasters using systematic monitoring and early warnings. Meteorological forecasting and early warning systems, which are part of the disaster management efforts in many developed and developing countries such as Turkey, allow for significant decreases in life losses in the place of disaster, and considerable reductions in economic damages (Kadıoğlu, 2011: 42).

Available reports indicate that climatological disasters have been affecting Turkey, which experiences four seasons both separately and simultaneously in the same period due to its geographical location and formations, and other countries in almost each continent with increasing severity and frequency, causing considerable loss of life and property. Therefore, this study addresses these disasters, which are of particular concern to Turkey, and their frequency (Bacanlı, 2011). However, in spite of the susceptible and significant location of Turkey which frequently experiences disasters, only the following disasters (Meteorological drought, Hydrological drought, Agricultural drought, Heat wave, Cold wave, fog and so on.) are specified in Article 1 of the Law No. 7269 which entered into force in 1959 (Kemaloğlu, 2015; Aksoy, 1995; Kadıoğlu, 2011: 43).

Since disasters other than those mentioned (drought, heat wave, cold wave, fog, frost, and so on) above are not listed in our laws and passed over as "**etc.**"; unfortunately, information and documents related to other types of disaster are either available through records of local governments and individuals, which are very limited in nature, or not available at all. For example, because drought is not specified as a disaster according to the Law No. 7269, drought (which is one of the most significant natural disasters in the world) is completely ignored in Turkish disaster statistics.

Due to unreliable nature of disaster statistics in Turkey "*because disaster statistics are assessed based solely on 'the number of damaged buildings' and there have been buildings reported to be damaged only to receive payment from the disaster fund*" (Kadıoğlu, 2011: 43), the disasters addressed in this study are those included in the Turkish Disaster Data Bank's (TABB) website (https://tabb-analiz.afad.gov.tr/Genel/Raporlar.aspx), which is published as a common project of the Prime Minister's Disaster Relief Agency (AFAD). TABB considers storm, fire, flood, extreme winter conditions, and avalanche as natural disasters. Due to the lack of statistical data about other disaster types or the unreliable nature of the available records, such meteorological disaster types (drought, extreme heat, fog, frost, etc.) are, unfortunately, not included in our study.

Turkey experiences disasters quite frequently due to its wide variety of geographical formations, tectonic formations, and particularly climatological conditions (Kemaloğlu, 2015: 127). Although geological disasters (especially earthquake) take the top place in Turkey, which has experienced a large number earthquake since the early times of its formation and still experiences them occasionally, the data of the last 30 years indicate an intensive period full of disasters caused by extreme climatological conditions. For this reason, the topic of disasters must be addressed urgently with its various aspects in Turkey, which is under the threat of a natural disaster at all times. So much so that, "*the number of people who lost their lives due to natural disasters in the last 70 years is about 100,000, while about 600,000 buildings were damaged in Turkey*" (Özşahin, 2013: 1). Also, according to a study by Ersoy (2009), annually 950 people lose their lives due to disasters in Turkey, which places it at the third rank in the world. Turkey ranks 4th in the world in terms of death toll relative to population, and the average number of people exposed to disasters annually is 2,745,757, which means Turkey ranks 8th in the world in terms of disaster exposure.

We believe that emergency action plans and up-to-date and healthy databases must be created in Turkey based on available statistics, making use of knowledge and experience of experts, and today's technological tools such as Geographical Information Systems (GIS), which offer popular and particular solutions in short periods of time. For this reason, a planning must be performed taking lessons from past events, and these plans for future events must be made the priority of the government's policy.

The purpose of this study was to create an up-to-date dataset by compiling data related to the frequency of climatological disasters arising from extreme climate conditions in Turkey between 1987 and 2017 using various sources, TABB archives in particular; and based on this data set, to visualize the impacts of natural and human-induced meteorological climate conditions caused by many factors from global climate change to industrialization and over-urbanization and the frequency of anomalies in the last 30 years in the form of tables and maps. This will make it easier for us to determine in which years the occurrence of climatological disasters increased or decreased in Turkey in this period (1987-2017), and the type and frequency of disasters experienced in various provinces. As a result, these statistics will provide a great advantage and predictive ability for future studies in that they will allow use evaluate disaster on a provincial and regional scale. Also, this will allows us to determine provinces which are under risk, thereby presenting the opportunity to take necessary measures for these provinces more rapidly and achieve a more efficient use of resources.

MATERIAL AND METHOD

After a literature review related to the study subject, we were in search of a database which kept a healthy record of climatological disasters and other natural or artificial (human-induced/technological) disasters in Turkey. We came across many data systems during our search; however, almost all of them had missing data or no record related to interested disasters. At the end of this process of search for a source, we found the Turkish Disaster Data Bank's (TABB) website (https://tabb-analiz.afad.gov.tr/Genel/Raporlar.aspx), which we believe is a superior database system compared to others in spite of its rough edges. The disaster data for all provinces of Turkey was obtained from the online data system of this website. Then, the data was tabulated in Microsoft Excel. These tables were imported to ArcGIS/ArcMap 10.1 in order to create relevant maps. However, in order to achieve a more healthy data assessment, certain criteria were applied to ensure the event could be accepted as a disaster. These criteria include: (1) At least 10 deaths; (2) At least 50 injuries; (3) At least 100 individuals affected by the event; (4) Impact on everyday life; (5) A historical value; and for forest fires, an affected area over 20 hectares (TUAA, 2013).

FINDINGS AND DISCUSSION

According to the statistical data obtained from the Turkish Disaster Data Bank's (TABB) website (https://tabb-analiz.afad.gov.tr/Genel/Raporlar.aspx), which is published as a common project of the Prime Minister's Disaster Relief Agency (AFAD) providing great convenience and access for users, researchers, and other interested individuals, there have been 8474 climatological disasters exceeding the optimum climatic level in Turkey in the last 30 years (between 1987 and 2017) (Figure 1). Especially the provinces in the Eastern Anatolia Region stand out in the ranking of climatological disasters between 1987-2017. So much so that, Erzurum is in the first place in Turkey in terms of both flood (211 events) and extreme winter conditions (55 events); while it ranks third in terms of total disasters with 386 events (Table 2-3). Similarly, Bitlis is in the second place after Muğla in terms of the total number of climatological disasters with 414 events, and in the first place in terms of avalanche (Figure 2 and Table 2).

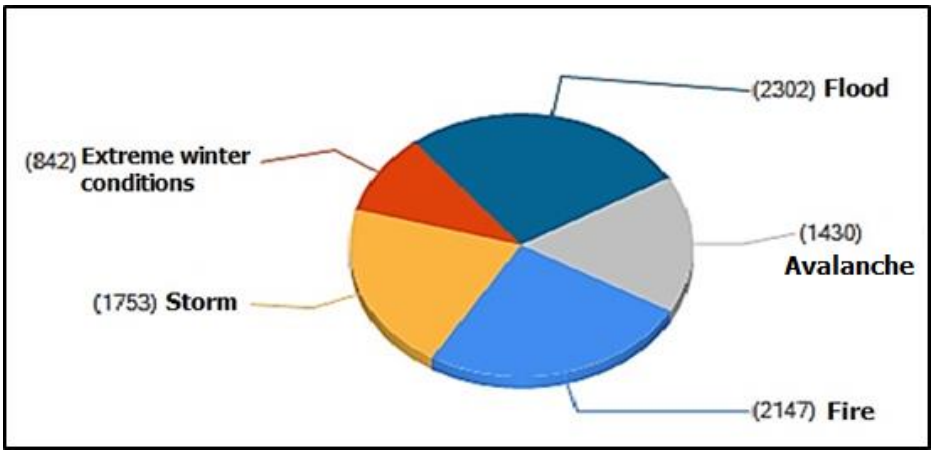
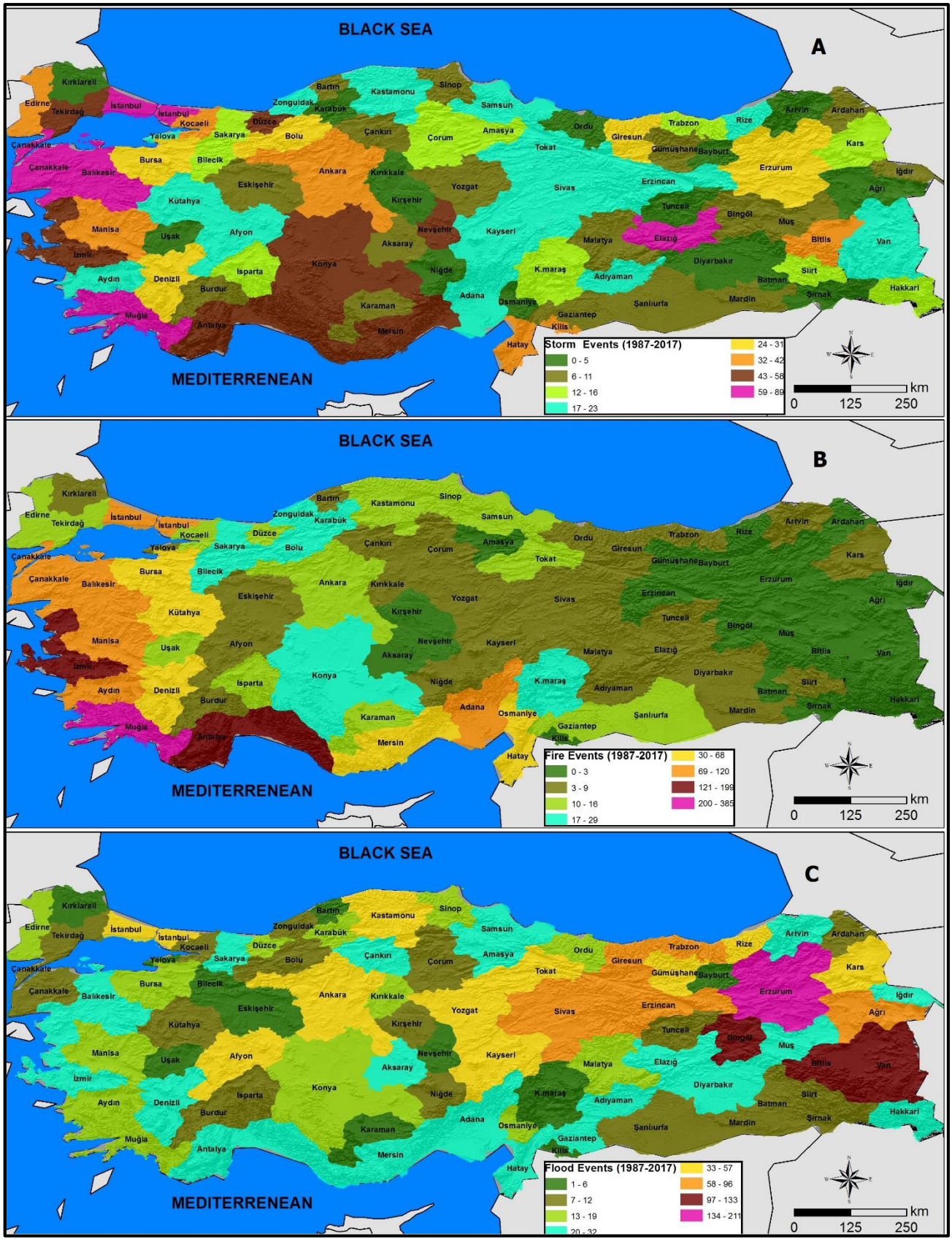


Figure 1: The Total Number of Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years (1987-2017) by Disaster Type.


A
BLACK SEA
MEDITERRENEAN
Storm Events (1987-2017)
0 - 5
6 - 11
12 - 16
17 - 23
24 - 31
32 - 42
43 - 58
59 - 89
km
0 125 250
B
BLACK SEA
MEDITERRENEAN
Fire Events (1987-2017)
0 - 3
3 - 9
10 - 16
17 - 29
30 - 68
69 - 120
121 - 199
200 - 385
km
0 125 250
C
BLACK SEA
MEDITERRENEAN
Flood Events (1987-2017)
1 - 6
7 - 12
13 - 19
20 - 32
33 - 57
58 - 96
97 - 133
134 - 211
km
0 125 250

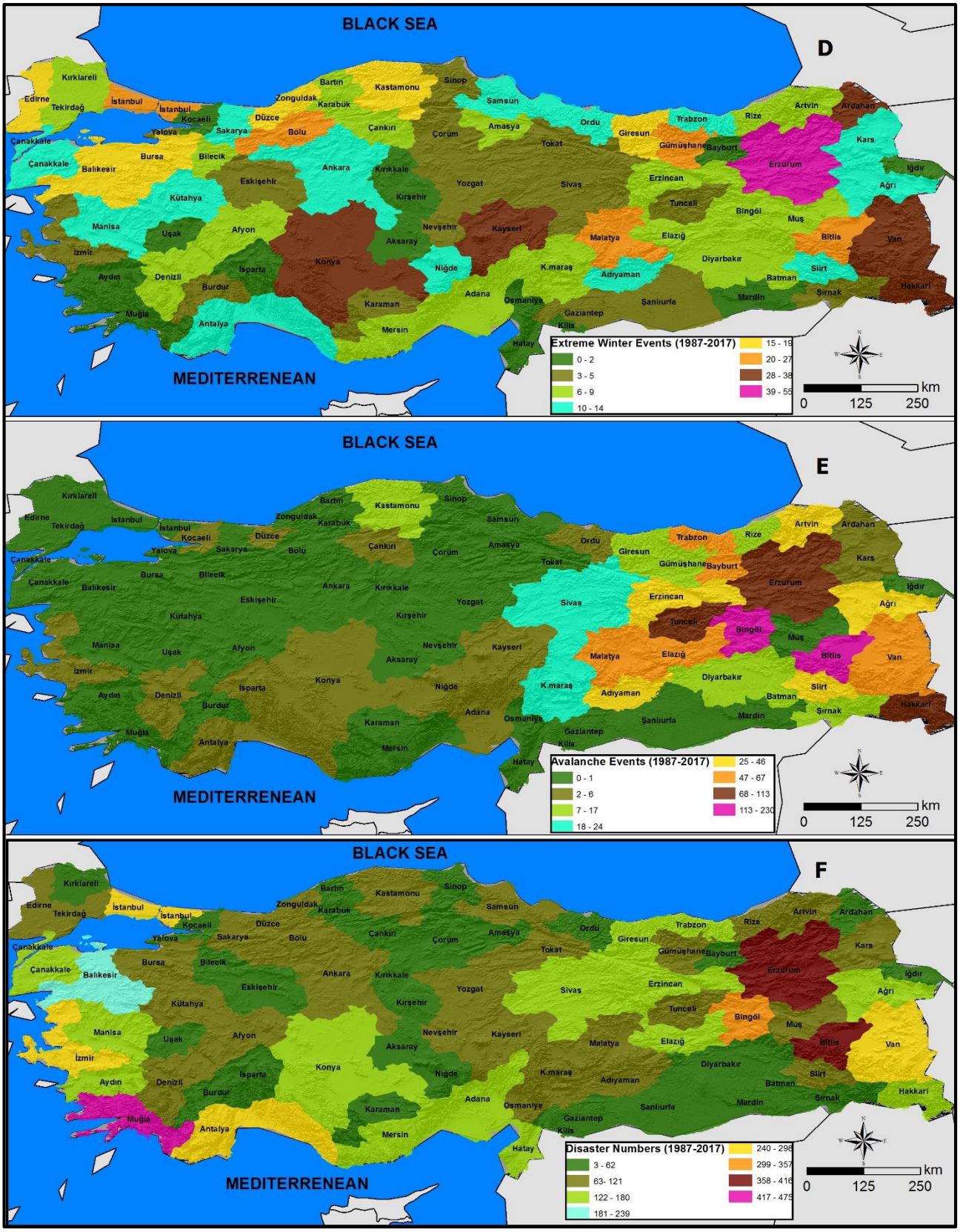


Figure 2: The Distribution of Climatological, Meteorological and Hydrological Disasters in Turkey (1987-2017). (A: Storm, B: Fire, C: Flood, D: Extreme Winter Conditions, E: Avalanche, F: Disaster Numbers*)*

Table 2: The Total Number of Climatological, Meteorological and Hydrological Disasters in Turkey in The Last 30 Years (1987-2017) by Disaster Type and Province.

PROVİNCE	Storm	Fire	Flood	Extreme Winter Conditions	Avalanche	TOTAL
ADANA	18	79	20	9	5	131
ADIYAMAN	18	7	24	12	33	94
AFYONKARAHİSAR	22	6	36	7	0	71
AĞRI	5	0	83	10	38	136
AKSARAY	8	3	23	1	0	35
AMASYA	14	3	22	9	0	48
ANKARA	39	15	38	14	0	106
ANTALYA	58	199	24	13	4	298
ARDAHAN	7	1	9	32	2	51
ARTVİN	0	7	25	7	46	85
AYDIN	23	120	16	1	0	160
BALIKESİR	89	76	22	16	0	203
BARTIN	9	5	5	7	1	27
BATMAN	2	2	9	6	13	32
BAYBURT	0	0	4	2	51	57
BİLECİK	13	23	1	7	1	45
BİNGÖL	7	1	110	7	191	316
BİTLİS	33	0	124	27	230	414
BOLU	28	22	9	21	0	80
BURDUR	7	6	11	3	0	27
BURSA	28	56	16	17	1	118
ÇANAKKALE	82	77	9	10	0	178
ÇANKIRI	11	6	20	9	2	48
ÇORUM	12	5	12	4	0	33
DENİZLİ	28	48	32	8	2	118
DİYARBAKIR	4	4	22	7	10	47
DÜZCE	46	16	17	19	3	101
EDİRNE	42	16	13	17	0	88
ELAZIĞ	67	4	26	7	67	171
ERZİNCAN	20	1	72	8	43	144
ERZURUM	31	3	211	55	86	386
ESKİŞEHİR	9	5	3	5	0	22
GAZİANTEP	8	13	21	4	0	46
GİRESUN	25	5	84	15	14	143
GÜMÜŞHANE	9	1	57	22	12	101
HAKKÂRİ	12	3	23	29	113	180
HATAY	34	68	25	1	0	128
IĞDIR	6	0	22	2	0	30
ISPARTA	16	15	10	0	3	44
İSTANBUL	67	100	54	22	0	243
İZMİR	58	177	20	5	3	263
KAHRAMANMARAŞ	16	24	6	7	24	77
KARABÜK	1	28	14	7	0	50
KARAMAN	8	12	4	5	0	29
KARS	16	5	35	12	5	73
KASTAMONU	19	11	34	18	11	93
KAYSERİ	19	5	44	38	6	112
KIRIKKALE	33	6	14	1	0	54
KIRKLARELİ	4	6	5	7	0	22
KIRŞEHİR	2	0	10	1	0	13
KİLİS	2	0	1	0	0	3
KOCAELİ	36	10	9	1	2	58
KONYA	52	29	18	30	3	132
KÜTAHYA	20	54	7	11	1	93
MALATYA	11	6	15	26	62	120

MANİSA	37	75	18	11	0	141
MARDİN	9	4	12	2	0	27
MERSİN	50	63	22	6	0	141
MUĞLA	70	385	19	1	0	475
MUŞ	7	0	24	8	41	80
NEVŞEHİR	53	0	6	4	0	63
NİĞDE	4	6	10	11	5	36
ORDU	5	6	19	12	2	44
OSMANİYE	0	49	14	0	1	64
RİZE	18	3	42	6	15	84
SAKARYA	16	26	22	11	0	75
SAMSUN	17	10	28	12	1	68
SİİRT	13	5	8	12	34	72
SİNOP	9	15	15	3	1	43
SİVAS	23	6	96	5	21	151
ŞANLIURFA	7	11	12	3	0	33
ŞIRNAK	4	2	10	5	17	38
TEKİRDAĞ	47	16	8	6	0	77
TOKAT	17	10	39	4	0	70
TRABZON	16	9	75	12	50	162
TUNCELİ	5	4	8	4	92	113
UŞAK	5	12	2	0	0	19
VAN	21	1	133	38	62	255
YALOVA	17	6	4	3	0	30
YOZGAT	10	6	47	3	0	66
ZONGULDAK	19	23	9	19	0	70
TOTAL	1753	2147	2302	842	1430	8474

Source: https://tabb-analiz.afad.gov.tr/ date: 01.01.1987-30.11.2017.

Muğla experiences trouble with forest fires almost every summer, which cause great damage to settlements, lead to mass evacuations, and destroy hectares of forests, lungs of our country. Although Muğla does not frequently witness climatological disasters other fires, it yielded an interesting result by raking first among all provinces in Turkey in terms of the total number of disasters (383 fires with 475 disaster events in total) (Table 3).

Table 3: Top Ten Provinces In Terms of the Total Number of Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years (1987-2017) by Disaster Type.

PROVINCE	Storm	Fire	Flood	Extreme Winter Conditions	Avalanche	TOTAL
1. MUĞLA	70	**385**	19	1	0	475
2. BİTLİS	33	0	124	27	**230**	414
3. ERZURUM	31	3	**211**	**55**	86	386
4. BİNGÖL	7	1	110	7	191	316
5. ANTALYA	58	199	24	13	4	298
6. İZMİR	58	177	20	5	3	263
7. VAN	21	1	133	38	62	255
8. İSTANBUL	67	100	54	22	0	243
9. BALIKESİR	**89**	76	22	16	0	203
10. HAKKÂRİ	12	3	23	29	113	180

Source: https://tabb-analiz.afad.gov.tr/ date: 01.01.1987-30.11.2017

Considering percentiles of climatological disasters that have occurred in Turkey in the last 30 years, flood is in the first place with 27%, followed by fires with 25%, and storm with 21%. These are followed by avalanche in the fourth place with 17% and extreme winter conditions with 10% (Figure 3).

The period that witnessed the highest number of climatological disasters is 2007-2008 with 531 events, while the period with the lowest number of climatological disasters is 2001-2002 with 81 events (Figure 4). From 1987 to 2004, in no period more than 400 people lost their lives due to climatological disasters in Turkey; however, a trend of over 400 deaths (Figure 7 and Figure 9) has begun after 2004, yet remained limited to only a few periods (2005-2006, 2007-2008, and 2010-2011) to the present day. Beginning from 2011 up until 2017, there has been an increasing trend in terms of the number of climatological disasters (Figure 4).

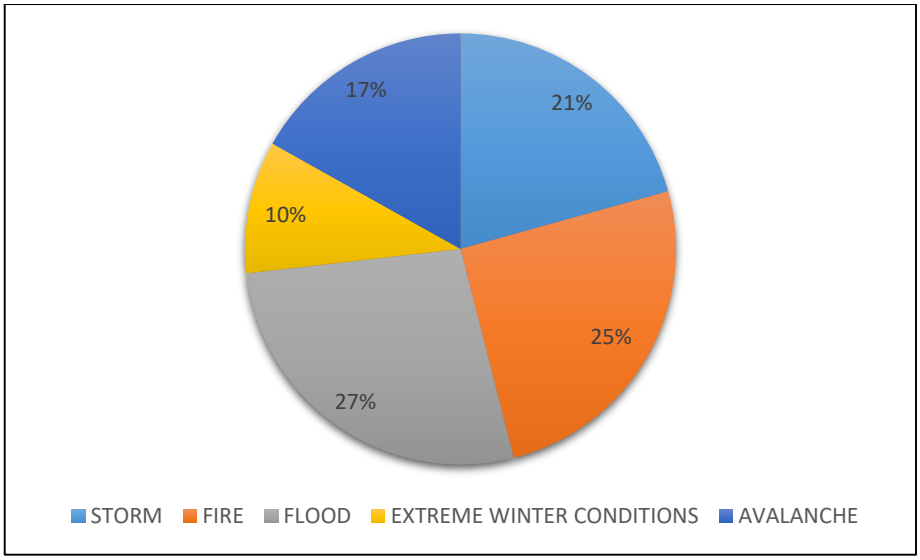


Figure 3: The Percentile Distribution of Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years (1987-2017) by Disaster Type

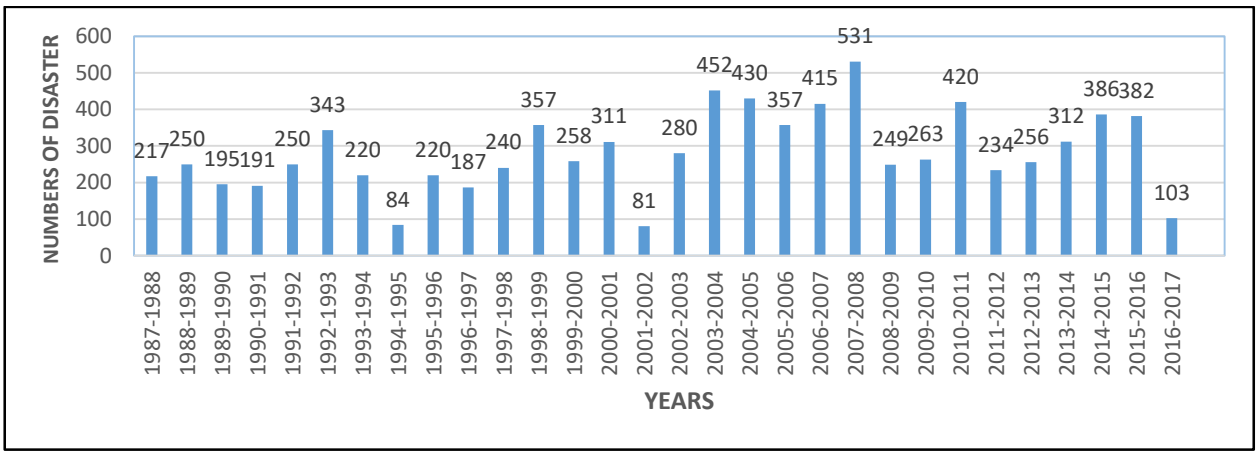


Figure 4: The Distribution by Years of Occurring Climatological Disasters Between the Years 1987-2017 in Turkey

In terms of frequency, the most frequent climatological disaster in Turkey is flood with 2302 events. The most frequent climatological disaster in Turkey from 1987 to 2017 is fire with 2147, followed by storm in the third place with 1753 events. These are followed by avalanche with 1430 events and extreme winter conditions with 842 events (Table 4).

Table 4: The Ranking of Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years by Disaster Type.

Name of climatological, meteorological and hydrological disasters /event					
FLOOD	**FIRE**	**STORM**	**AVALANCHE**	**EXTREME WINTER CONDITIONS**	**TOTAL**
2302	2147	1753	1430	842	8474

Source: https://tabb-analiz.afad.gov.tr/ date: 01.01.1987-30.11.2017.

1501 people were injured in climatological, meteorological and hydrological disasters that occurred in Turkey between 1987-2017 (Figure 5). The disaster type which caused the highest number of injuries is extreme winter conditions with 944 people. This high number of injuries caused by extreme winter conditions is, of course, because of the fact that Turkey has a wide variety of geographical formations, including hills and mountains, and a large number of settlements in Turkey have a quite high altitude (for example, the Başkale district of Van is built at an altitude over 2000 m). In terms of the number of injuries, storm ranks second, followed by flood with 116 injuries, avalanche with 89 injuries, and fire with 42 injuries.

The distribution of the number of injuries caused by climatological, meteorological and hydrological disasters that occurred in Turkey between 1987-2017 by province draws a quite interesting picture (Figure 5). This is because Konya, a

province in the Central Anatolia Region, ranks first with 141 injuries, while the region that witnesses the highest number of disasters is the Eastern Anatolia Region. Konya leads the number of injuries by far, and it is followed by provinces of the Eastern Anatolia Region. Bingöl, Bitlis, Erzincan, and Erzurum follow Konya and stand out as the provinces with the highest number of injuries caused by climatological disasters that occurred in Turkey in this period (between 1987-2017).

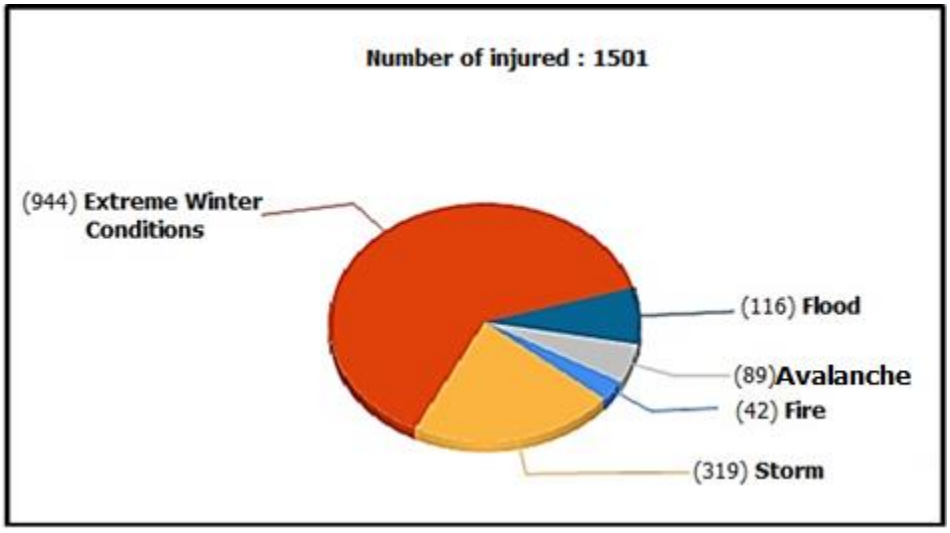


Figure 5: The Distribution of Those Who Were Injured in Climatological, Meteorological and Hydrological Disasters That Occurred in Turkey Between 1987-2017 by Disaster Type

Considering buildings that were damaged or destroyed due to climatological, meteorological and hydrological disasters in Turkey in the last 30 years, the disaster that caused the most damage or destruction is flood. This finding is consistent with the data from around the world (Kay et.al. 2009; Hirabayashi et.al. 2013). According to available reports, a total of 61197 buildings were damaged and 501 buildings were destroyed due to flood in Turkey from 1987 to 2017 (Figure 6). Other disasters are not as effective as flood in terms of damage or destruction caused. According to the results of TABB's disaster report, the second disaster type with the most damage caused to buildings is storm with 3638 buildings. Avalanche ranks third with 846 damaged buildings, followed by fire with 120 damaged buildings, and extreme winter conditions with 13 damaged buildings. Considering the number of buildings destroyed, flood ranks in the first place among all climatological disasters with 501 destroyed buildings. Flood is followed by avalanche which destroyed 122 buildings, storm which destroyed 14 buildings, and fire which destroyed 9 buildings (Figure 6).

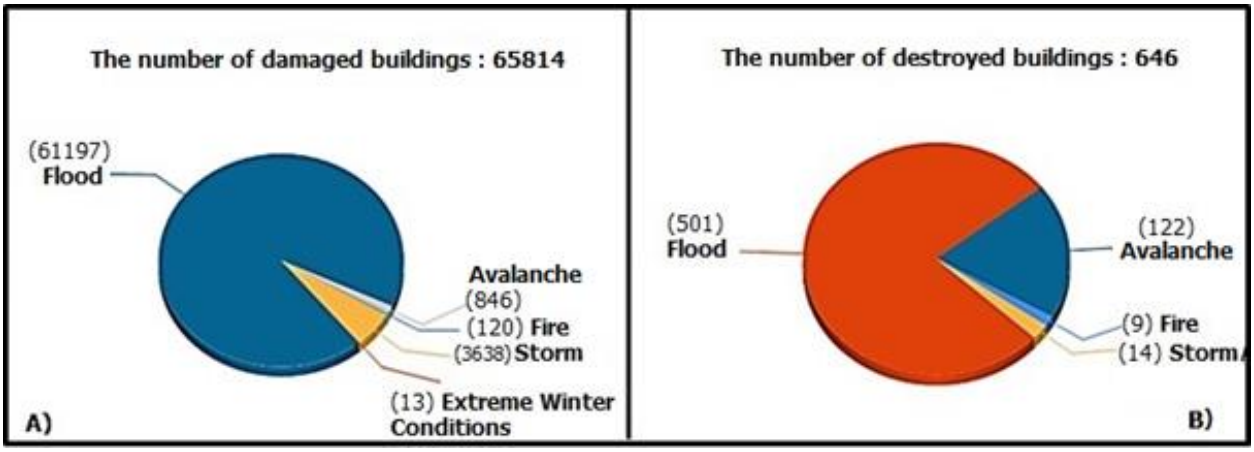


Figure 6: The Number of Buildings Damaged (A) and Destroyed (B) Due to Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years

Two provinces stand out in terms of the number of buildings that were damaged or destroyed due to climatological, meteorological and hydrological disasters in the last 30 years. These are Ağrı in the first place with 18295 damaged buildings due to climatological disasters in Turkey in this period disasters (particularly due to flood and avalanche), and İstanbul with 1039 damaged buildings (particularly due to fire, storm, and flood) (Table 5). The distribution of the number

of buildings destroyed due to climatological disasters in this period by province shows that the Eastern Black Sea Region ranks first. It should be noted that this is because the high precipitation in this region. Events of flood followed by landslides have destroyed a great deal of buildings, or caused them to slide down slope and become unusable in provinces such as Rize (57 buildings), Artvin (128 buildings), and Bayburt (62 buildings) in particular (Figure 7).

Table 5: The Top 5 Provinces with the Most affected Due to Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years by the Number of Damaged and Destroyed Buildings.

PROVINCES	1. AĞRI	2. İSTANBUL	3. ARTVİN	4. BAYBURT	5. RİZE
THE NUMBERS OF DAMAGED AND DESTROYED BUILDINGS	18295	1039	128	62	57

Source: https://tabb-analiz.afad.gov.tr/ date: 01.01.1987-30.11.2017.

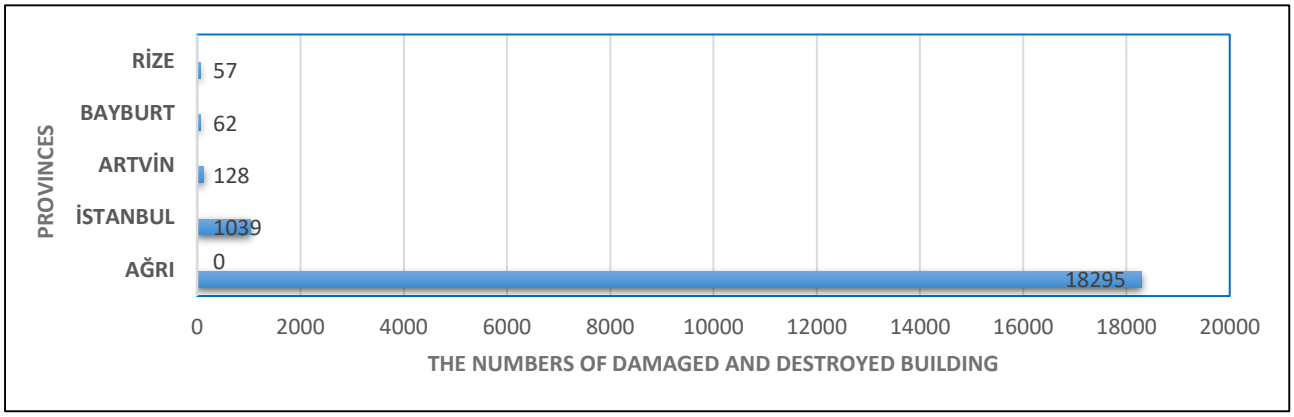


Figure 7: The Status by The Top 5 Provinces the Most Affected Due to Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years by the Number of Damaged and Destroyed Buildings

The disaster type which caused the highest number of deaths in Turkey is flood with 222 people. In terms of the highest number of deaths in this period, flood is followed by storm with 205, extreme winter conditions with 143, avalanche with 117, and fire with 25 (Figure 8). A total of 712 people lost their lives due to climatological disasters in Turkey in the 30 year period from 1987 to 2017 (Figure 9). The distribution of the number of deaths caused by climatological disasters by province shows that Isparta is in the first place with 78 cases of death. The Senirkent flood event that occurred in Isparta on 13 July 1995 is effective on this result. This event involved a flood followed by a landslide, which caused a record number of deaths (74 people), and placed Isparta in the first place in Turkey as the province with the highest number of deaths caused by climatological, meteorological and hydrological disasters (Table 6).

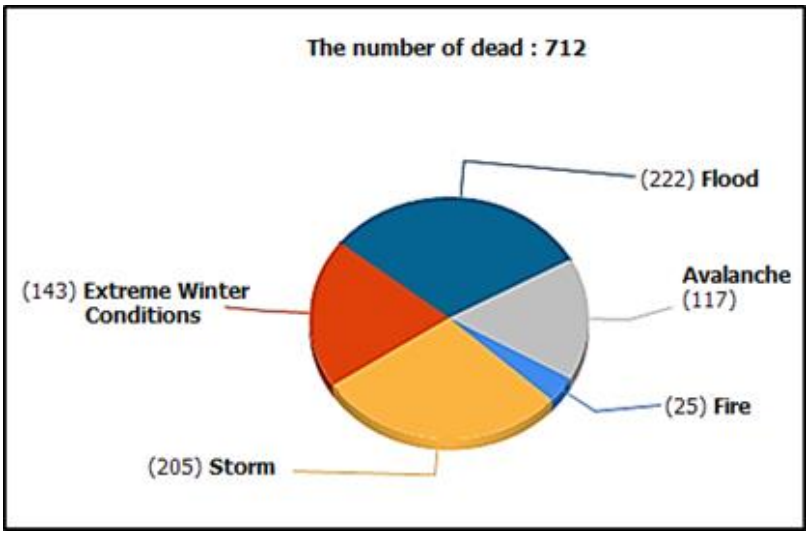


Figure 8: The Distribution of Death Toll Due to Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years by Disaster Type

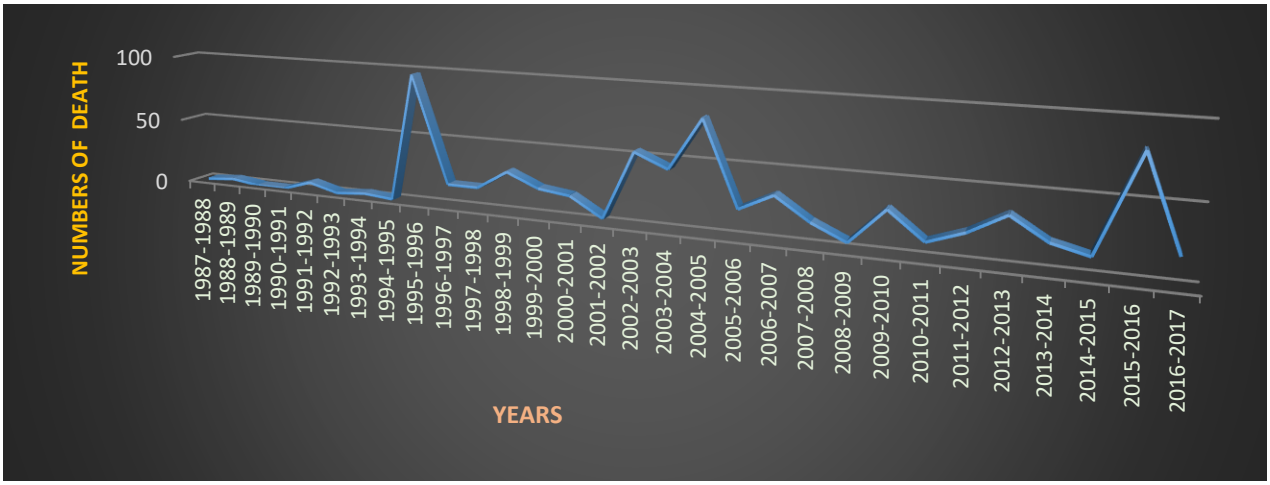


Figure 9: Numbers of Death by Years Due to Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years

Table 6: The Top 5 Provinces with the Highest Death Toll Due to Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years by Disaster Type and Total Number of Events.

PROVINCE	Storm	Fire	Flood	Extreme Winter Conditions	Avalanche	TOTAL
1. ISPARTA	3	1	74	0	0	78
2. ERZURUM	6	0	0	40	9	55
3. İSTANBUL	1	1	34	10	0	46
4. ARTVİN	0	0	19	1	6	26
5. ANTALYA	12	8	2	2	0	24

Source: https://tabb-analiz.afad.gov.tr/ date: 01.01.1987-30.11.2017.

Considering regions where climatological, meteorological and hydrological disasters were frequent in this period, the Eastern Anatolia Region which witnessed 2507 climatological disasters in the last 30 years ranks first. The second region which witnessed the highest number of climatological disasters is the Black Sea Region with 1359 events, followed by the Aegean Region in the third place with 1340 events. These are followed by the Marmara Region (4th place with 1137 events), the Mediterranean Region (5th place with 913 events), the Central Anatolia Region (6th place with 867 events), and the Southeastern Anatolia Region (7th place with 351 events) (Table 7).

The ranking of the regions in Turkey by disaster type presents a great deal of variety. While the Marmara Region takes the first place in terms of storm with 441 events, the Southeastern Anatolia Region is in the last place with 61 events. The Aegean Region ranks first in terms of fire with 877 events, the Eastern Anatolia Region is in the last place with 31 events. The picture is somewhat different for flood; the Eastern Anatolia Region ranks first with 905 events, whilst the Southeastern Anatolia Region, which experiences a high number of droughts, is in the last place with 108 events. There is not a considerable difference between the regions of Turkey in terms of extreme winter conditions and avalanche. In not too much variability when compared to other types of disasters of this disaster, it the elevation with the topographic features of the regions played an important role. This is evidenced by the avalanche events that follow in the spring together with high snowfall and extreme snowfall in the Eastern Anatolia Region and the Black Sea Region where the landforms vary. While the Eastern Anatolia Region ranks first in extreme winter conditions with 270 events, as well as in avalanche with 1049 events. It is followed by the Black Sea Region with 199 events of extreme winter conditions and 207 events of avalanche. The region which was affected by extreme winter conditions and avalanches the least is the Aegean Region with 44 events of extreme winter conditions and 6 events of avalanche. According to these results, the region which witnessed the highest number of climatological disasters is the Eastern Anatolia Region, which has the highest average altitude as well. The least affected region, on the other hand, is the Southeastern Anatolia Region with 351 events (Table 7).

Table 7: The Total Number of Climatological, Meteorological and Hydrological Disasters in Turkey in the Last 30 Years (1987-2017) by Region and Disaster Type, and the Regional Ranking.

REGION	Storm		Fire		Flood		Extreme Winter Conditions		Avalanche		TOTAL	
EAST ANATOLIA	252	**5.**	31	**7.**	905	**1.**	270	**1.**	1049	**1.**	2507	**1.**
BLACK SEA	264	**3.**	179	**4.**	510	**2.**	199	**2.**	207	**2.**	1359	**2.**
EAGEAN	263	**4.**	877	**1.**	150	**5.**	44	**6.**	6	**6.**	1340	**3.**
MARMARA	441	**1.**	412	**3.**	163	**4.**	117	**4.**	4	**7.**	1137	**4.**
MEDITERRENEAN	201	**6.**	503	**2.**	133	**6.**	39	**7.**	37	**4.**	913	**5.**
CENTRAL ANATOLIA	271	**2.**	99	**5.**	333	**3.**	127	**3.**	37	**5.**	867	**6.**
SOUTHEASTERN ANATOLİA	61	**7.**	46	**6.**	108	**7.**	46	**5.**	90	**3.**	351	**7.**
TOTAL	**1753**		**2147**		**2302**		**842**		**1430**		**8474**	

Source: https://tabb-analiz.afad.gov.tr/ Reports covering the period between 01.01.1987-30.11.2017.

RESULTS

The results obtained in this study demonstrate some significant details which have been not been paid much attention to this day. One of the most striking parts of our study is that although various definitions of disaster made by individuals or institutions do not differ much, they have missing aspects or far from an international unity of language. Also, complexities arising from different definitions made by institutions or individuals according to their own field of expertise or perspective, or various interpretations of the term by researchers according to their own field of study stir up problems related to the definition of the term. The lack of common action to reach an international standard related to the definition of disaster and the failure to give a national identity to the definition of disaster cripple the ability to keep a healthy record of disasters in data systems. It goes to show that information shared by disaster data systems in Turkey contains errors, and has problems related to accuracy and reliability.

Turkey is one of the countries with the highest frequency of disasters due to its geological and geomorphological structure and climate characteristics. The late formation of geographical units and the high and hilly land structure in Turkey play a considerable role in this. Also, it has been observed that the disasters that have affected the Turkey the most in recent years were disasters with climatological origins, hydrological and meteorological character. A considerable number of people lost their lives due to floods (222) and fires (205) in the last 30 years. Also, it is concerning that a considerably high number of people injured in climatological disasters that occurred in this period (between 1987-2017), which is almost twice the number of people who lost their lives with approximately 1500. According to the data obtained from TABB's disaster reports data system, there have been 8474 climatological disasters exceeding the optimum climatic level in Turkey in the last 30 years (between 1987 and 2017). Especially the provinces in the Eastern Anatolia Region such as Erzurum and Bitlis stand out in the ranking of climatological disasters by province between 1987-2017. The most common type of climatological disaster in Turkey appears to be flood. Indeed, increasing seasonal precipitation in recent years has led to an abnormal frequency of flood events especially in the Black Sea Region and the Eastern Anatolia Region, and some provinces in western and southern parts of Turkey. These events of flood have gained pace in parallel with industrialization and increased production and consumption of technological products.

The most frequent climatological, meteorological and hydrological disasters in Turkey from 1987 to 2017 is fire with 2147, followed by storm in the third place with 1753 events. These are followed by avalanche with 1420 events and extreme winter conditions with 842 events. Considering percentiles of climatological, meteorological and hydrological disasters that have occurred in Turkey in the last 30 years, flood is in the first place with 27%, followed by fires with 25%, and storm with 21%. These are followed by avalanche in the fourth place with 17% and extreme winter conditions with 10%. 2007-2008 is the period which witnessed the highest number of disasters with climatological, meteorological and hydrological character with 531 events. The period with the lowest number of climatological disasters in Turkey is 2001-2002 with 81 events.

While 1501 people were injured due to climatological, meteorological and hydrological disasters in Turkey between 1987-2017, the disaster type which caused the highest number of injuries is extreme winter conditions. In terms of the number of injuries, storm ranks second, followed by flood with 116 injuries, avalanche with 80 injuries, and fire with 42 injuries. The distribution of the number of injuries caused by climatological disasters that occurred in Turkey between 1987-2017 by province draws a quite interesting picture. Konya ranks first in terms of the number of injuries due to climatological disasters with 141 people. Bingöl, Bitlis, Erzincan, and Erzurum follow Konya and stand out as the provinces with the highest number of injuries caused by climatological disasters that occurred in Turkey in this period (between 1987-2017).

A total of 61197 buildings were damaged and 501 buildings were destroyed due to flood in Turkey from 1987 to 2017. Other disasters are not as effective as flood in terms of damage or destruction caused. According to the results of TABB's

disaster report, the second disaster type with the most damage caused to buildings is storm with 3638 buildings. Avalanche ranks third with 846 damaged buildings. Two provinces stand out in terms of the number of buildings that were damaged or destroyed due to climatological disasters in the last 30 years. These are Ağrı in the first place with 18295 damaged buildings due to climatological disasters in Turkey in this period disasters (particularly due to flood and avalanche), and İstanbul with 1039 damaged buildings (particularly due to fire, storm, and flood). Events of flood followed by landslides have destroyed a great deal of buildings, or caused them to slide down slope and become unusable in provinces such as Rize (57 buildings), Artvin (128 buildings), and Bayburt (62 buildings) in particular. Moreover, common events of floods have caused damages and casualties in all regions from the Eastern Anatolia to the Marmara, the Aegean, and the Mediterranean.

The disaster type which caused the highest number of deaths in Turkey is flood with 222 people, which is also the most frequent climatologicsal disaster type. In terms of the highest number of deaths in this period, flood is followed by storm with 205, extreme winter conditions with 143, avalanche with 117, and fire with 25.

The Eastern Anatolia Region which witnessed 2507 climatological, meteorological and hydrological disasters in the last 30 years ranks first. The second region which witnessed the highest number of climatological disasters is the Black Sea Region with 1359 events, followed by the Aegean Region in the third place with 1340 events. These are followed by the Marmara Region (4th place with 1137 events), the Mediterranean Region (5th place with 913 events), the Central Anatolia Region (6th place with 867 events), and the Southeastern Anatolia Region (7th place with 351 events).

It can be said that we are leading ourselves to our own trap. The winner of this war caused by natural and artificial (human-induced/technological) disasters is the nature, and the loser is man.

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