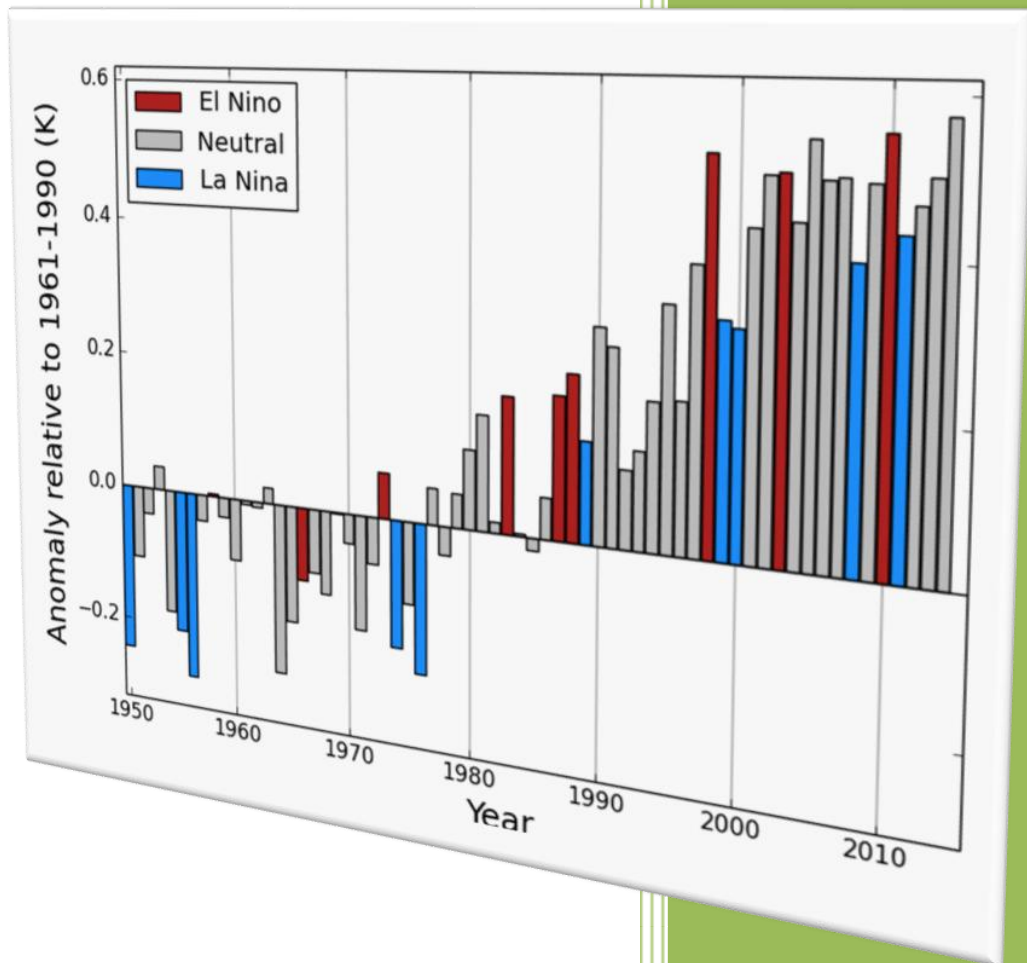




State of the Climate in Turkey in 2014



Research Department

FEBRUARY 2015

REPUBLIC of TURKEY
MINISTRY of FORESTRY and WATER AFFAIRS
TURKISH STATE METEOROLOGICAL SERVICE

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Ankara

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1. State of the Climate in Turkey in 2014

Turkey annual mean temperature in 2014 has been 14.9°C. This value is 1.4°C above from 1981-2010 normal (13.5°C). This makes 2014 the second warmest year since 1971. Generally most of the country had above normal temperature except for Bitlis.

Monthly mean temperatures of 2014 were above the normal in January, February, March, April, July, August and December. Other month's temperatures were near normal.

105 stations had heatwaves in 2014 (some of them more than once) mainly in first four months of 2014. Twelve stations had both heat and cold wave in 2014.

Lowest temperature in 2014 was in February with -32.8°C in Ardahan while highest temperature was in July with 46.1°C in Cizre. 34 stations have broken their monthly extreme maximum temperature records in 2014.

Turkey mean total precipitation in 2014 was 697.3 mm which is 8% above the 1981-2010 normal (646mm).

Although there were significant monthly precipitation anomalies, Turkey's 697.3 mm annual total precipitation in 2014 was slightly (51.3mm) above the 1981-2010 normal (646mm). In general, western part of the country had above normal precipitation while eastern parts had below it.

Monthly precipitation in 2014 was above the 1981-2010's average in March, May, June, July, August, September, October and December but below average in January, February, April and November.

The number of extreme events in 2014 reached 500. There is an increasing trend in extreme event as 34 events/decade.

During 2014 most hazardous extreme events were wind storm-tornado (36%, 6 people died), heavy rain/flood (35%, 8 people died), hail (16%), heavy snow (4%), lightning (4%, 11 people died, 28 injured) and frost (3%). Although rare, 2 avalanches and 4 landslides also occurred in 2014.

On August 19, 2014 South Eastern Anatolia experienced dust transport coming from the Middle East.

The Monthly Brewer Total Ozone Values of Ankara in 2014 were similar to the general trend in Northern Mid-Latitudes. They were highest March and April: 345 and 353 DU, and lowest in October and November, 289 and 286 DU.

2. Temperature

Turkey annual mean temperature in 2014 has been 14.9°C. This value is 1.4°C above from 1981-2010 normal (13.5°C)¹ (Fig.2.1). This makes 2014 the second warmest year since 1971.

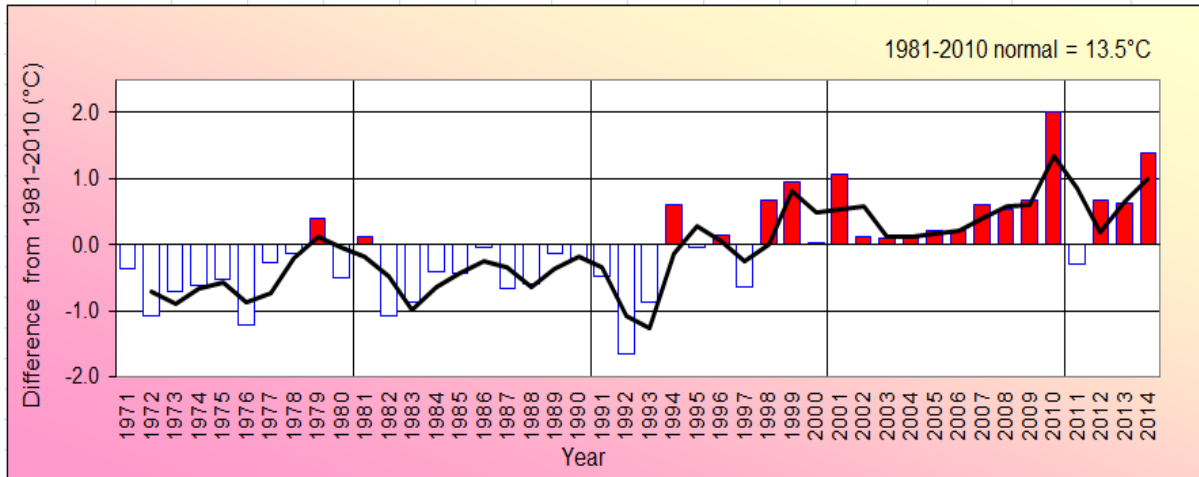


Figure 2. 1. Temporal mean temperature anomalies in Turkey (Url 1)

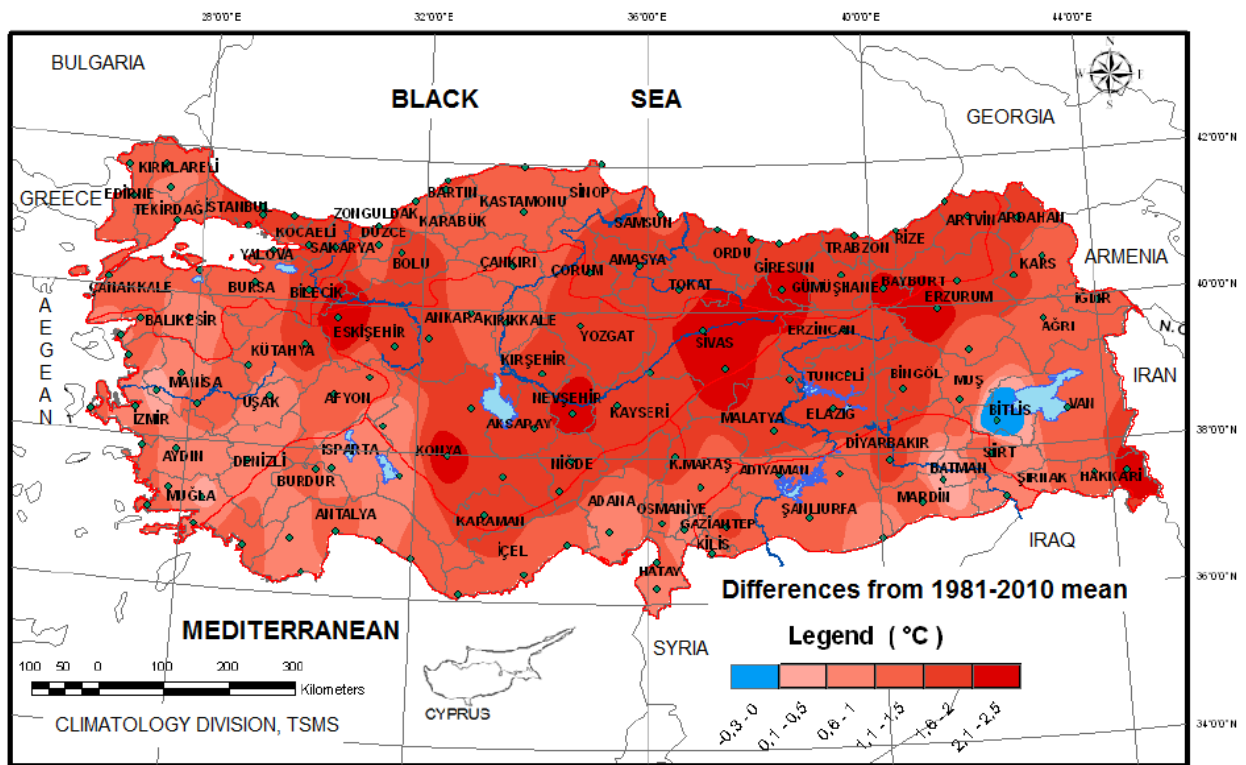


Figure 2.2. Spatial mean temperature differences in Turkey in 2014 (Url 1).

Generally most of the country had above normal temperature except for Bitlis (Fig. 2.2).

¹ 130 stations data have been used in this analysis.

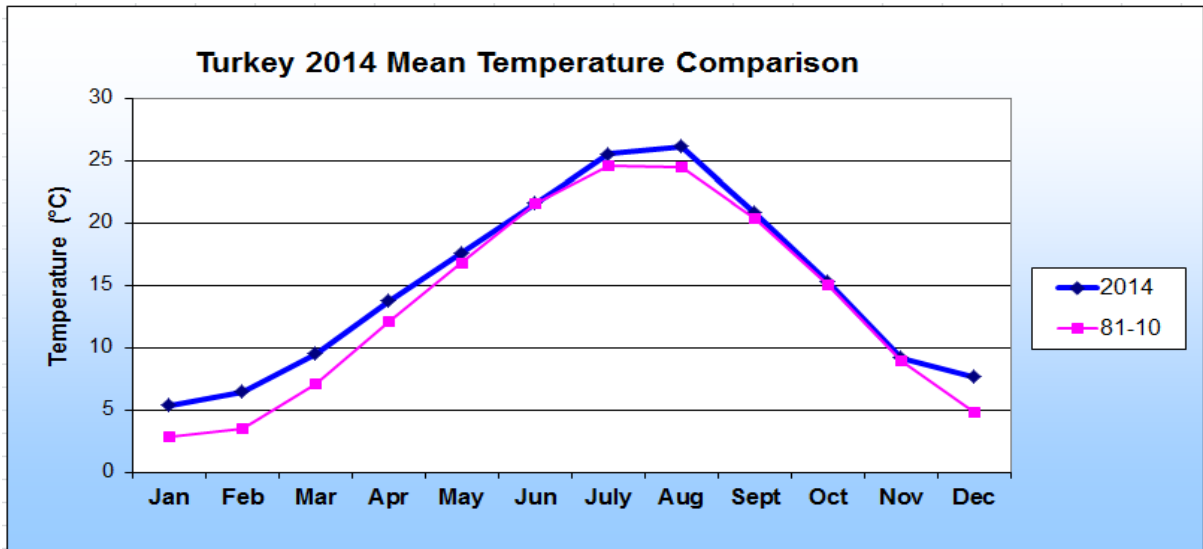


Figure 2.3. Monthly mean temperature differences in Turkey in 2014

Monthly mean temperatures of 2014 were above the normal in January, February, March, April, July, August and December. Other month's temperatures were near normal (Fig. 2.3).

2.1. Heat and cold waves in 2014

Heat wave is daily maximum temperature on more than five consecutive days exceeding the average maximum temperature by 5°C (Frich et al., 2002). Cold wave is daily minimum temperature on more than five consecutive days below the average minimum temperature by 5°C.

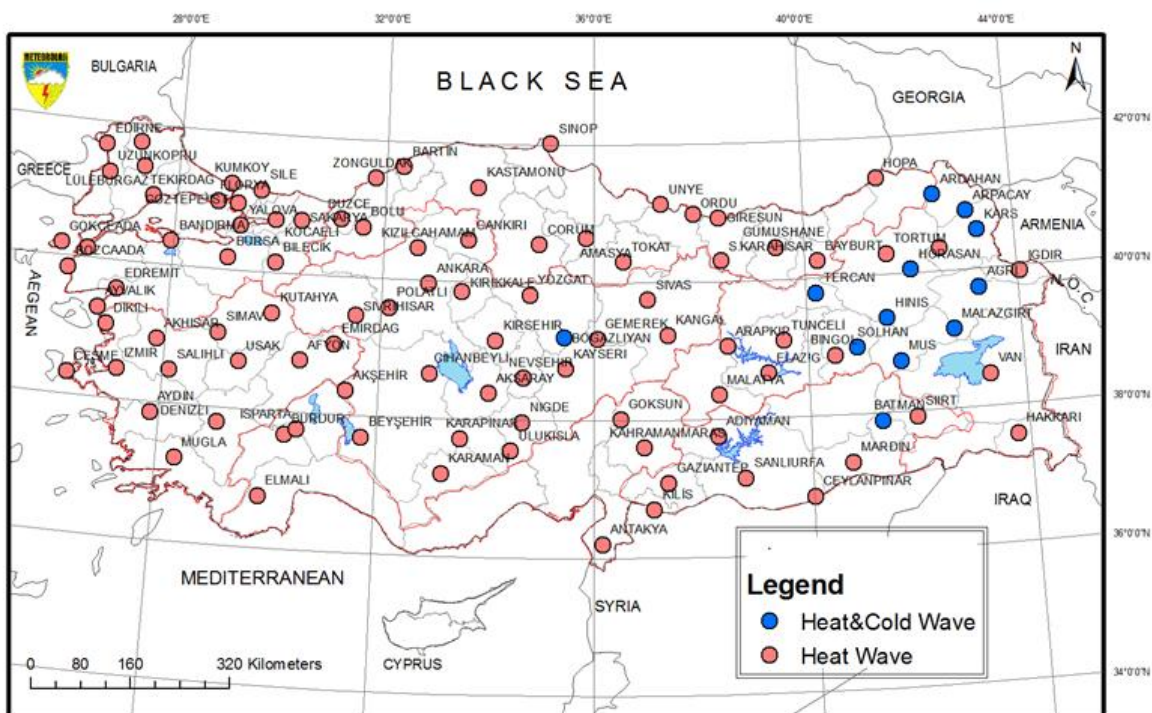


Figure 2.4. Heat and cold wave spatial distribution in 2014

105 stations had heatwaves in 2014 (some of them more than once) mainly in first four months of 2014. 12 stations had both heat and cold wave in 2014

2.2. Extreme temperatures in 2014

Lowest temperature in 2014 was in February with -32.8°C in Ardahan while highest temperature was in July with 46.1°C in Cizre. 34 stations have broken their monthly extreme maximum temperature records in 2014 (Table 1).

Table 1. Stations broken their extreme maximum temperature in 2014

Date	Station	Long Term Maximum (°C)	2014 Maximum (°C)	Diff.
21.01.2014	Kocaeli	22,6	23,7	1,1
20.01.2014	Uzunköprü	19	19,1	0,1
20.01.2014	Göksun	12,5	13,9	1,4
10.02.2014	Uzunköprü	20,4	20,8	0,4
19.02.2014	Kütahya	20,6	21	0,4
19.02.2014	Simav	20,7	21,3	0,6
22.02.2014	Adana	26,2	26,7	0,5
20.02.2014	Göksun	16,5	18,1	1,6
20.02.2014	K.Maraş	21,8	22,4	0,6
20.02.2014	Eskişehir	20,8	22,3	1,5
21.02.2014	Kangal	13,8	15,6	1,8
21.02.2014	Karaman	21,1	22,1	1
21.02.2014	Karapınar	21,4	22,3	0,9
20.02.2014	Kırkkale	20,8	21,4	0,6
21.02.2014	Niğde	20,3	20,4	0,1
20.02.2014	Polatlı	19,9	20	0,1
20.02.2014	Sivas	17,5	18,1	0,6
20.02.2014	Sivrihisar	18,2	19,9	1,7
20.02.2014	Bolu	21,2	21,8	0,6
20.02.2014	Kastamonu	20,6	21,1	0,5
21.02.2014	Ş.Karahisar	16,1	16,4	0,3
21.02.2014	Arapgir	16,2	16,7	0,5
21.02.2014	Elazığ	17,3	17,4	0,1
18.02.2014	Malatya	18,6	18,9	0,3
23.02.2014	Tunceli	18,1	18,6	0,5
19.02.2014	Gaziantep	21	22,7	1,7
21.02.2014	Islahiye	21,7	22,2	0,5
19.02.2014	Kilis	22,5	22,7	0,2
24.04.2014	Sivrihisar	29	29,1	0,1
15.08.2014	Elazığ	41,2	41,4	0,2
06.09.2014	Sivas	34,8	35,7	0,9
03.09.2014	Bayburt	33,3	33,7	0,4
03.12.2014	Florya	20,0	20,2	0,2
03.12.2014	Edremit	22,8	23,5	0,7

3. Precipitation

Turkey mean total precipitation in 2014 was 697.3 mm which is 8% above the 1981-2010 normal (646mm), (Fig. 3.1).

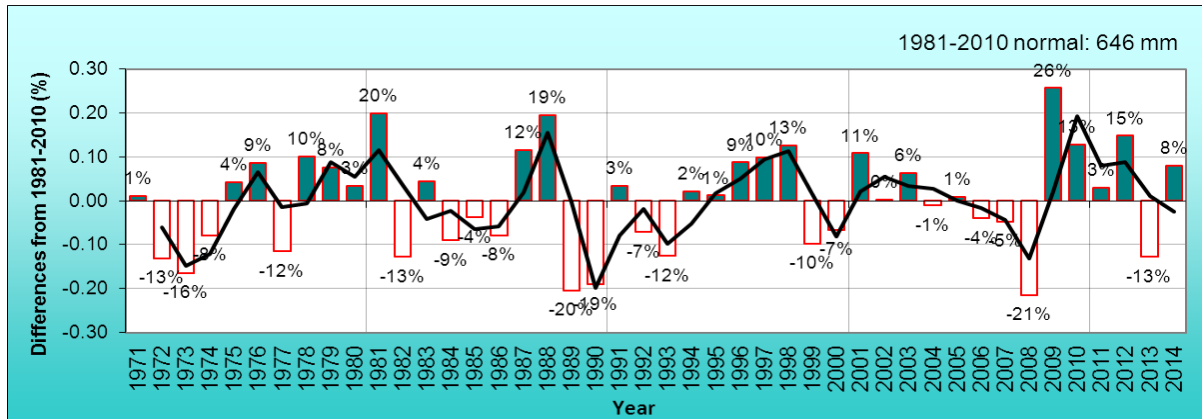


Figure 3.1. Temporal precipitation anomalies in Turkey (Url 2).

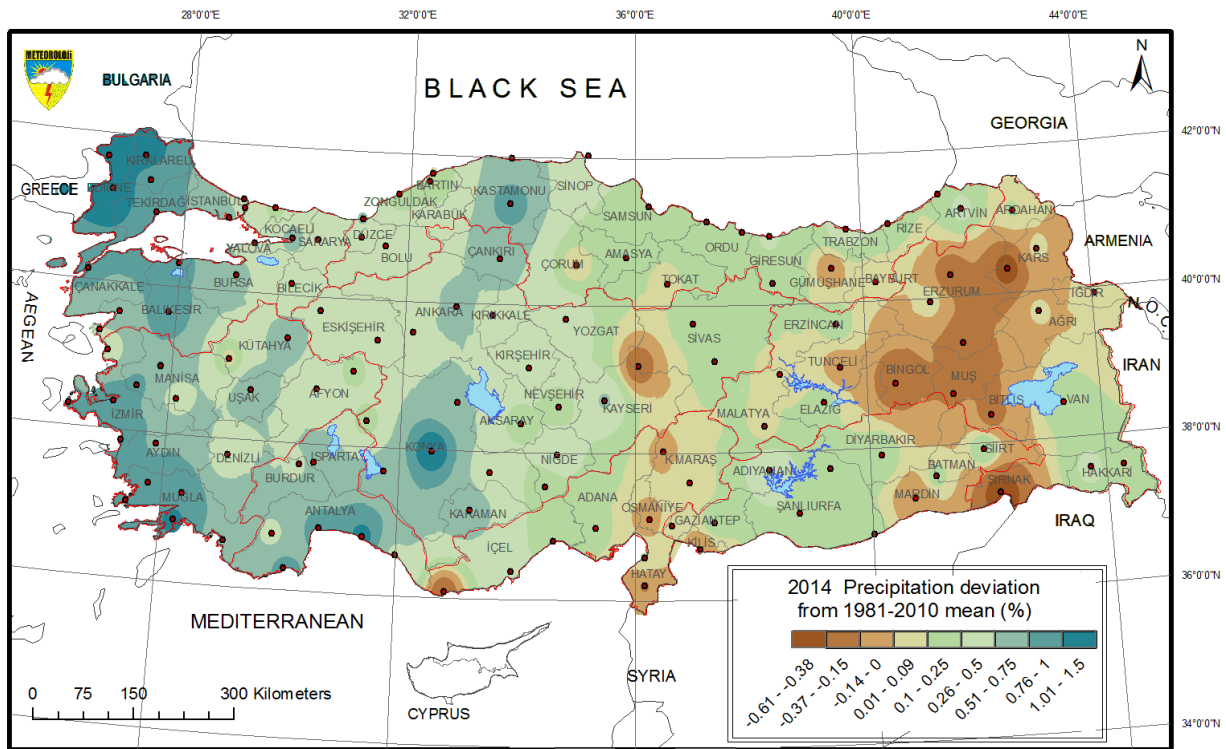


Figure 3.2. Spatial mean precipitation anomalies in Turkey in 2014

Although there were significant monthly precipitation anomalies (Fig. 3.3), Turkey's 697.3mm annual total precipitation in 2014 was slightly (51.3mm) above the 1981-2010 normal (646mm). In general, western part of the country had above normal precipitation while eastern parts had below it. (Fig. 3.2).

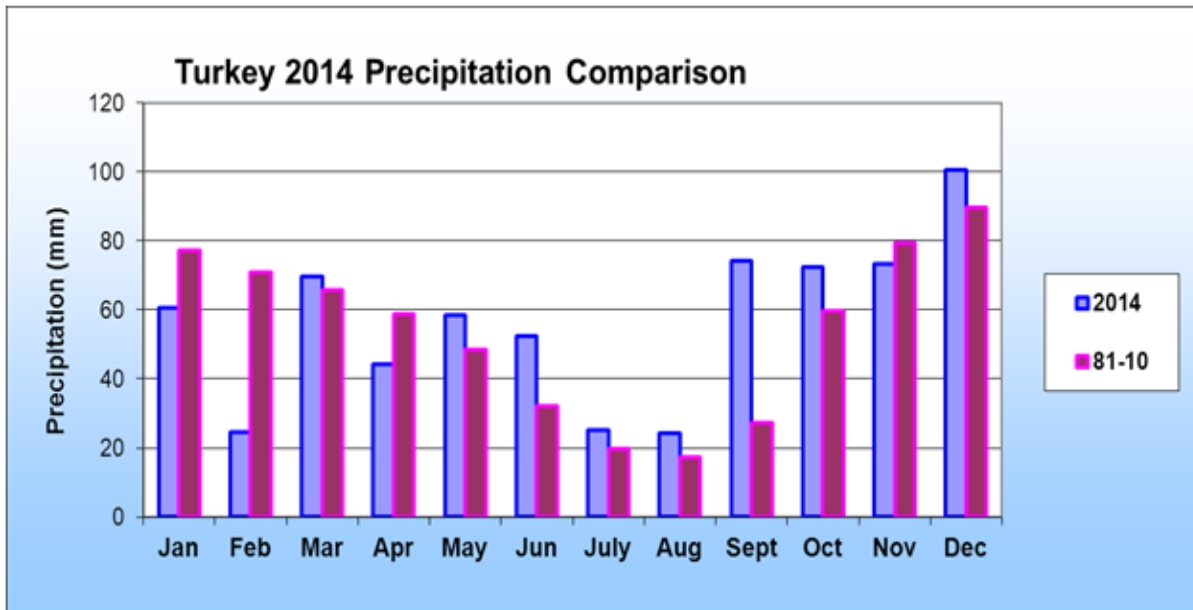


Figure 3.3. Monthly precipitation differences from 1981-2010 mean in Turkey in 2014

Monthly precipitation in 2014 was above the 1981-2010's average in March, May, June, July, August, September, October and December but below average in January, February, April and November (Fig. 3.3).

3.1. Extreme rainfall

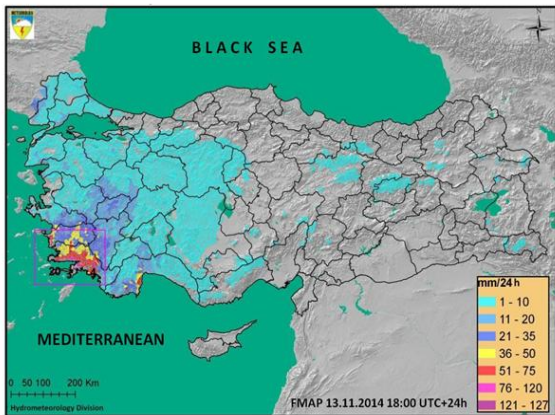


Table 2. Rainfall intensity analysis of Marmaris

Start Date	Start Time	End Date	End Time	Duration (min)	Amount (mm)	Intensty (mm/ha)
13.11.2014	20:10	13.11.2014	20:14	5	19.6	235.20
13.11.2014	20:10	13.11.2014	20:19	10	36.8	220.80
13.11.2014	20:05	13.11.2014	20:19	15	50.2	200.80
13.11.2014	19:50	13.11.2014	20:19	30	80.8	161.60
13.11.2014	19:20	13.11.2014	20:19	60	135.8	135.80
13.11.2014	18:23	13.11.2014	20:22	120	158.4	79.20
13.11.2014	18:09	13.11.2014	21:08	180	168.6	56.20
13.11.2014	17:29	13.11.2014	21:28	240	170.2	42.55
13.11.2014	16:48	13.11.2014	21:47	300	172.0	34.40
13.11.2014	16:15	13.11.2014	22:14	360	172.8	28.80
13.11.2014	19:03	14.11.2014	03:02	480	191.6	23.95
13.11.2014	17:16	14.11.2014	05:15	720	240.8	20.07
13.11.2014	11:55	14.11.2014	05:54	1080	244.0	13.56
13.11.2014	06:00	14.11.2014	05:59	1440	244.0	10.17

Figure 3.4. 24-hour areal precipitation forecast (left), rainfall intensity analysis of Marmaris (right Table2)

According to TSMS's Flash Flood Guidance System (FFGS), heavy precipitation was expected in Marmaris on 13 November 2014 at 18:00 UTC. This forecast was published as warning by TSMS. Marmaris's normal rainfall for November is 171mm. But on 13 November 244mm rain fell in one day. Due to this heavy rainfall, Beldibi River overflowed; landslides occurred on some village roads, muddy water covered some of the shops and basements, urban traffic was disrupted temporarily. There were no casualties but some property damage.

4. Notable events

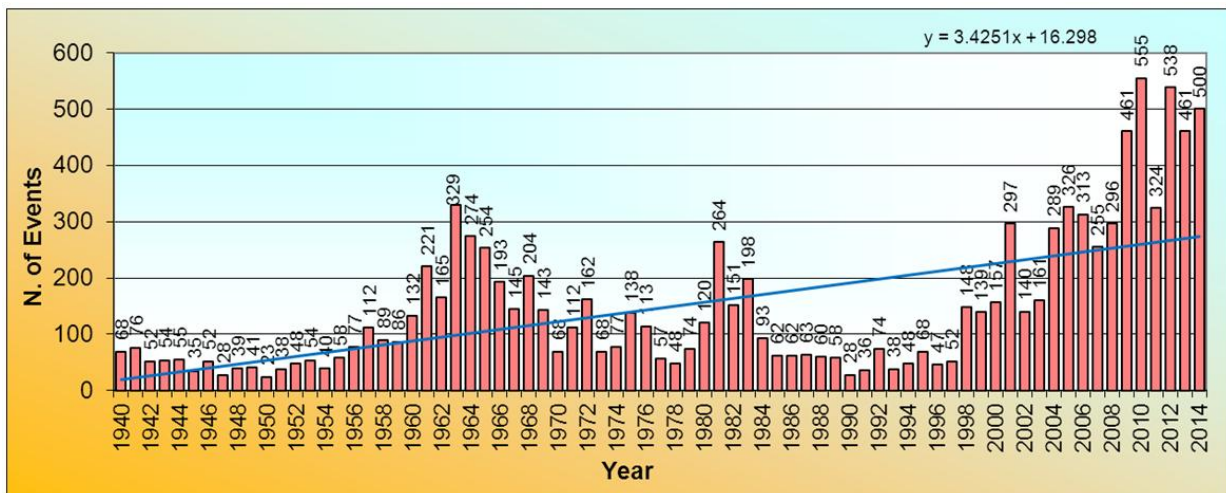


Figure 4.1. Annual count of extreme events in Turkey in 2014 (Url 2.)

The number of extreme events in 2014 reached 500. (Fig. 4.1). There is an increasing trend in extreme event (34 events/decade).

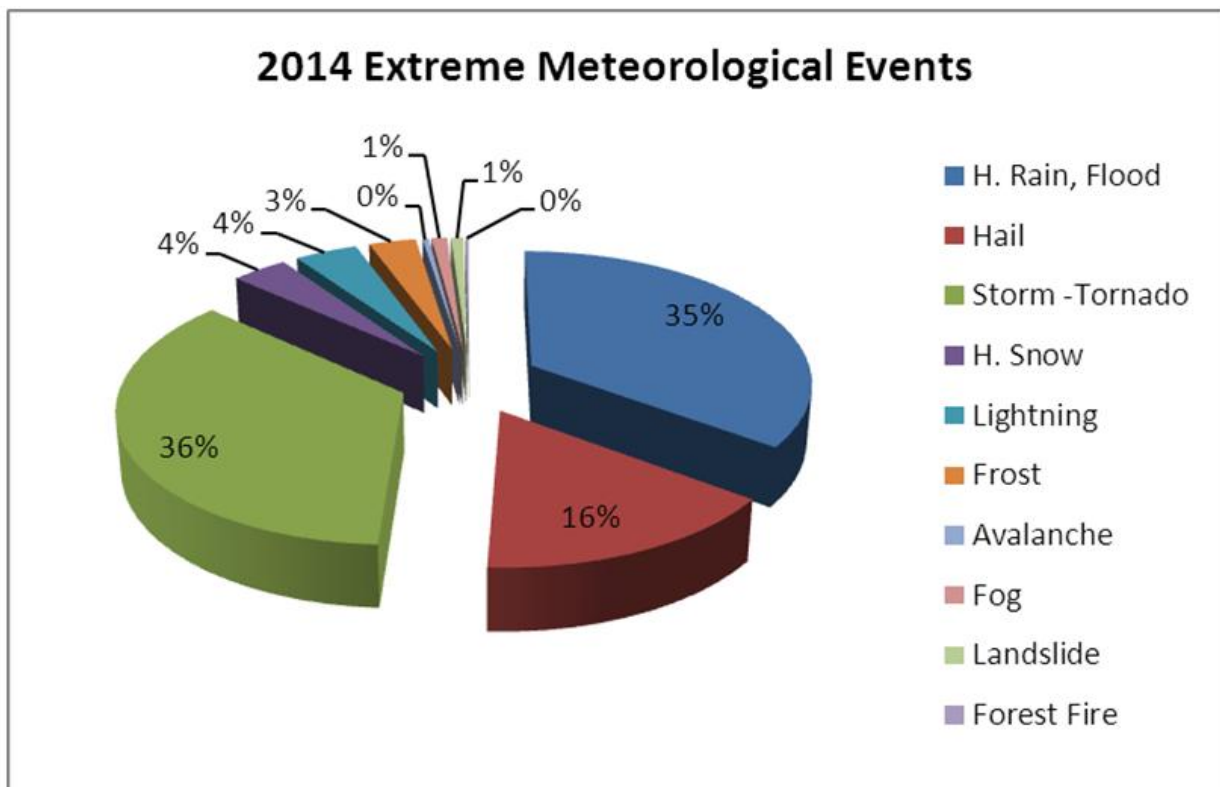


Figure 4.2. Distribution of extreme events in Turkey in 2014, (Url 2.)

During 2014 most hazardous extreme events were wind storm-tornado (36%, 6 people died), heavy rain/flood (35%, 8 people died), hail (16%), heavy snow (4%), lightning (4%, 11 people died, 28 injured from lightning) and frost (3%) respectively (Fig. 3.2). Although rare, 2 avalanches and 4 landslides also occurred in 2014.

4.1. Avalanche



Figure 4.3. Avalanche on 29 January 2014 in Hamzalar village, Tekman, Erzurum,, Turkey (Url 3.)

One woman, who has 4 children, lost her life by staying under the avalanche when returning from family visit.

4.2. Wind Storm



Figure 4.4. Storm damage on trees and cars on 02 March 2014, in Tokat (Url 3).

23,8 m/sec (85.7km/h) storm occurred in Tokat on 02 March 2014, at 15:00 local time, breaking the branches of trees and damaging vehicles and roofs.

Totally 6 people died from wind storms.

4.3. Sand and Dust Storm

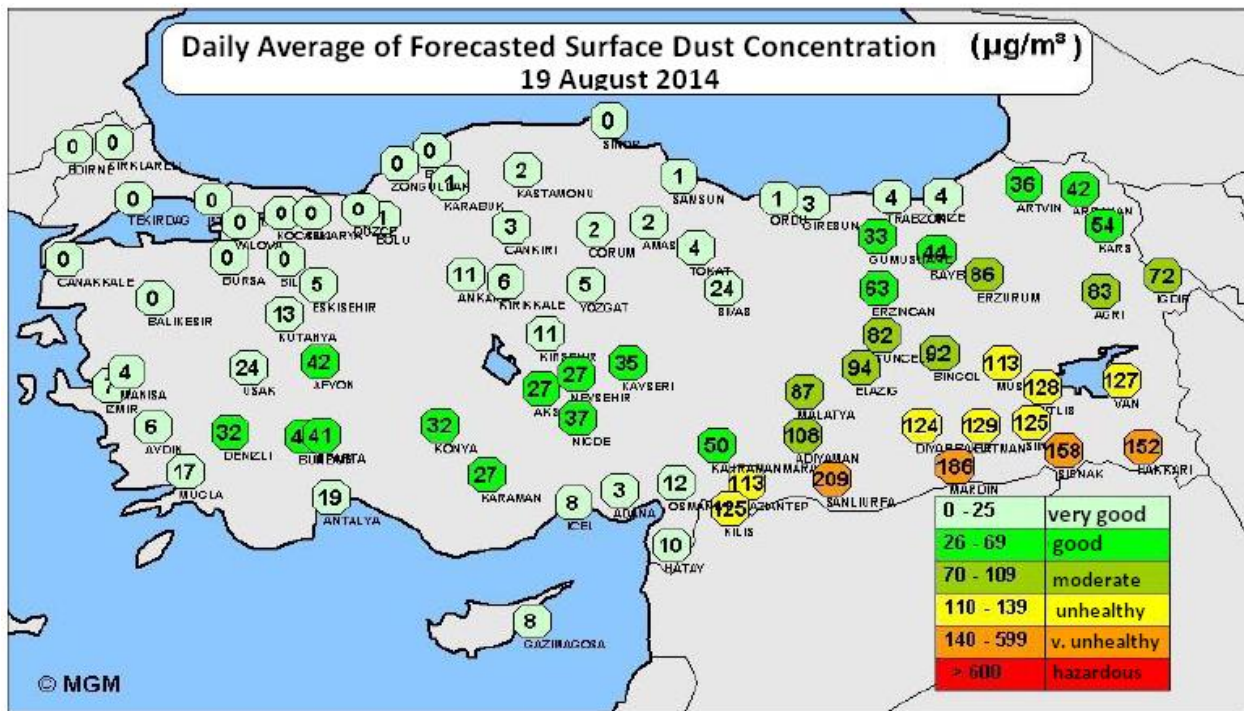


Figure 4.5. Daily dust concentration forecast for 19 August 2014 (Url 4).

Turkish State Meteorological Service published dust storm warning for 19 August 2014 on 18 August based on the model output MGM/BSC-DREAM8b v1.0. This forecast was supported by MSG Satellite observation and Particulate matter (PM₁₀) measurement.

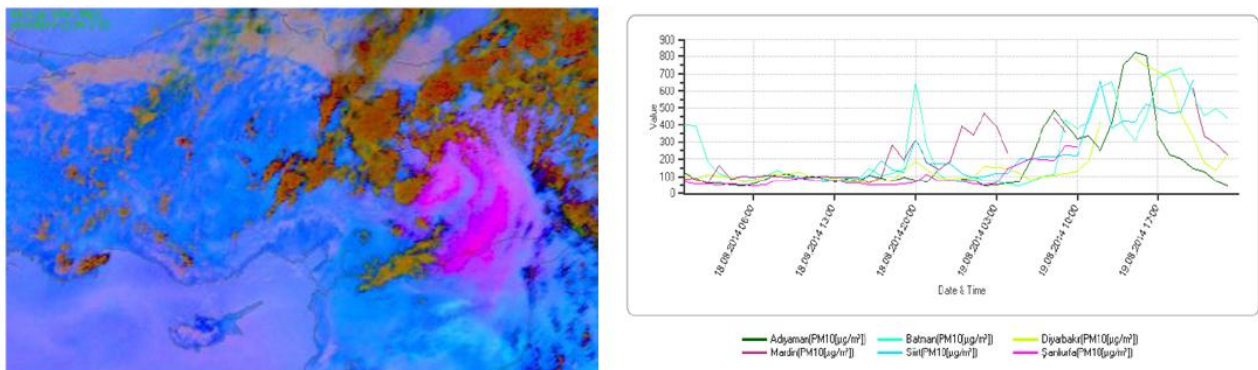


Figure 4.6. MSG Satellite image on 19.08.2014,15GMT (left), Particulate Matter (PM₁₀) observation (right)

On August 19, 2014 South Eastern Anatolia experienced dust transport coming from the Middle East.

5. Ozone measurements and analysis for Ankara, Turkey

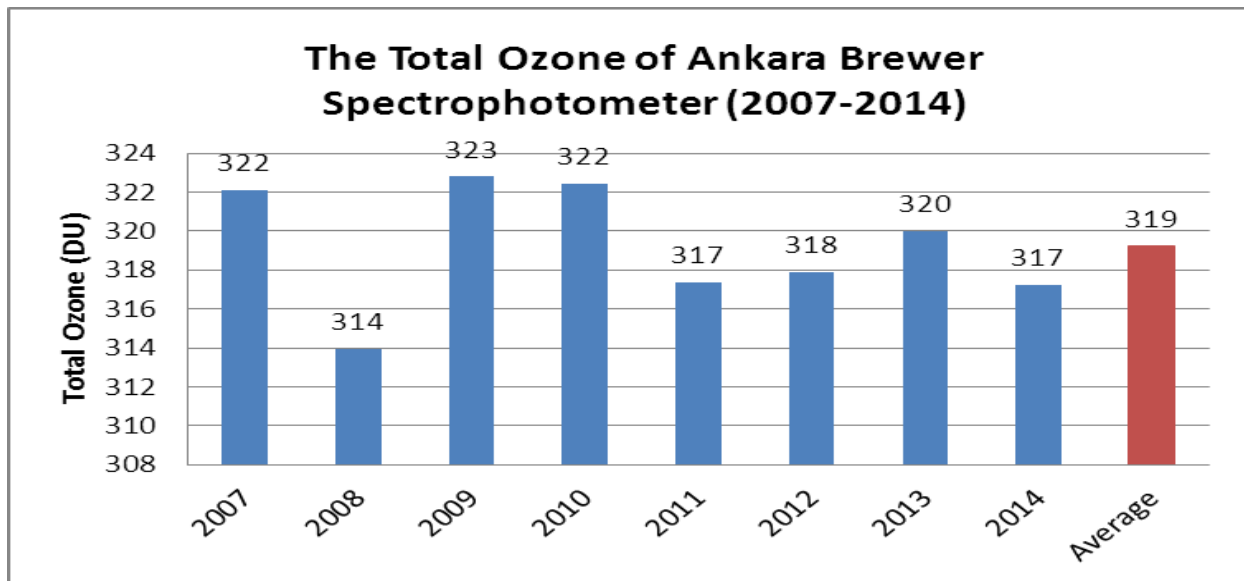


Figure 5.1. Total Ozone of Ankara Brewer Spectrophotometer (2007-2014)

Total Column Ozone has 319 Du average for the period of 2007-2014 over Ankara. The minimum total ozone value is seen in 2008 as 314 DU and the maximum value of total ozone amount is 323 DU in 2009.

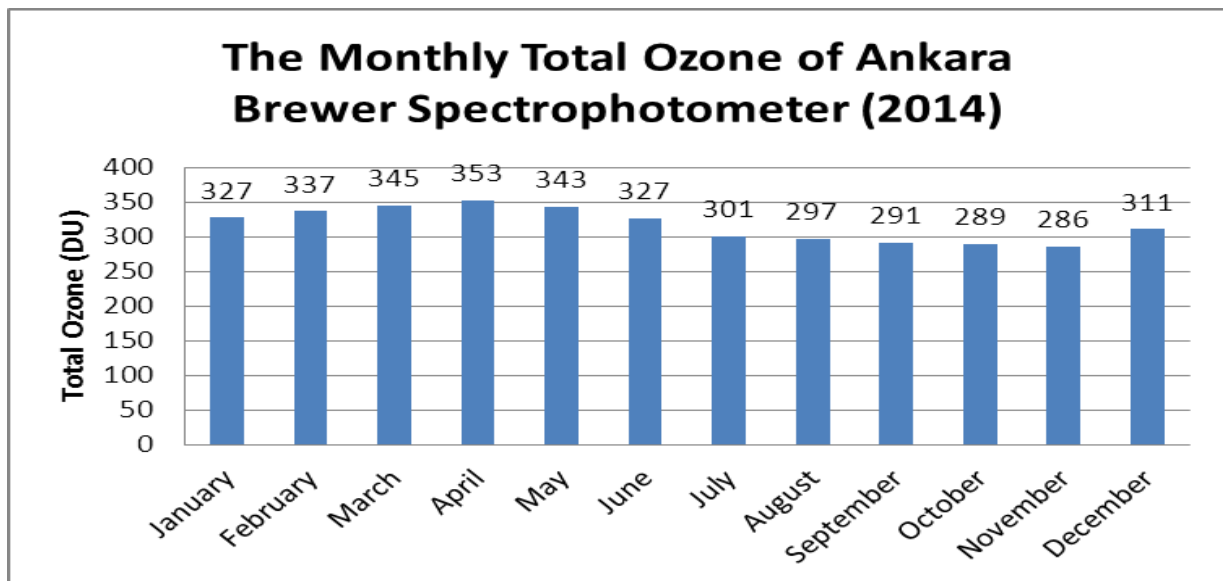


Figure 5.2. The monthly Total Ozone of Ankara Brewer Spectrophotometer in 2014

The Monthly Brewer Total Ozone Values of Ankara in 2014 were similar to the general trend in Northern Mid-Latitudes. They were highest March and April: 345 and 353 DU, and lowest in October and November, 289 and 286 DU (Url 5).

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