

**SIGNIFICANT  
WEATHER and  
CLIMATIC EVENTS  
in GREECE during  
2017**

*CLIMATOLOGY  
APPLICATIONS DIVISION*

# SIGNIFICANT WEATHER and CLIMATIC EVENTS in GREECE during 2017

The significant weather and climatic events in Greece during 2017 are described in the present report - bulletin. Information on anomalies of temperature and precipitation with respect to the monthly normal values (1971-2000) represented graphically, as well as brief summaries on the significant weather events are included. First, a brief description of the outstanding weather and climatic events in Greece during 2017 is given below. Then, an analytical description of the monthly weather and climatic events follows.

## BRIEF DESCRIPTION

### FLOOD

#### • 11-15 November, 2017

1. On 15 November, a sudden flash flooding over west Attica (Mandra) caused **23 fatalities**.
2. On 13 November, heavy rainfall hit Symi island causing flash flooding.
3. On 11 November, **one human fatality** and dozens of trees fallen in Kerkyra island.

#### • On September 25<sup>th</sup>, 2017

1. A heavy rainstorm hit the island of Samothraki causing flash flooding.

#### • 24-25 October, 2017

1. Heavy rainfall and hailstorm caused damages in the town of Marathon (north-east Attica), in central Greece and particularly in Fthiotis region and Skyros island.

### FROST and SNOW

#### • During 7-12 January 2017

1. The Aegean islands of Skopelos, Alonnisos as well as Evia and municipalities of Thessaly declared a state of emergency due to heavy snowfall.
2. Many areas in northern Greece experienced 5 – 6 consecutive days of total frost ( $T_{max}$  and  $T_{min} \leq 0^{\circ}C$ ).
3. The lowest negative monthly temperature anomalies of 3 - 5  $^{\circ}C$  referred to 1971-2000 were observed in the central and northern Greece.

### HIGH TEMPERATURES

#### • On March, 2017

Unusually high temperatures were recorded in the northern continental Greece. The positive monthly maximum temperature anomalies exceeded the 5.0  $^{\circ}C$  in some regions.

#### • 12-13 May, 2017

Very high, abnormal temperatures were recorded in the central and southern parts of Greece. Daily maximum temperatures exceeded 40.0  $^{\circ}C$  in some areas in mainland.

#### • Heat wave during June 29 and July 3, 2017

Most regions of Greece experienced very high temperatures. Daily maximum temperatures exceeded 40  $^{\circ}C$ , however, there were no temperature records.

- **On December, 2017**

During the first days of December unusually high temperatures were recorded in the northeast Greece. Monthly maximum temperature anomalies exceeded 2.0 °C over northeastern areas

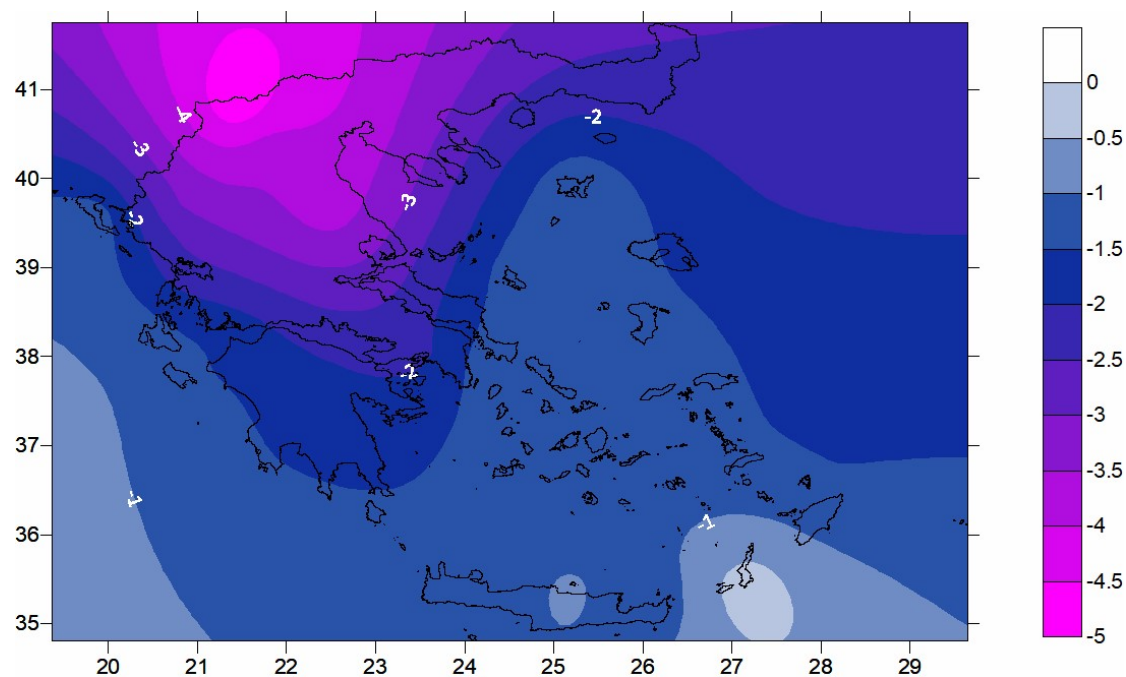
## ANALYTICAL DESCRIPTION (ON MONTHLY BASIS)

In this part of the report, for each very month, first a description is presented. Then, the sections named **Records** and **High Impacts Events** follow.

### January

#### Description

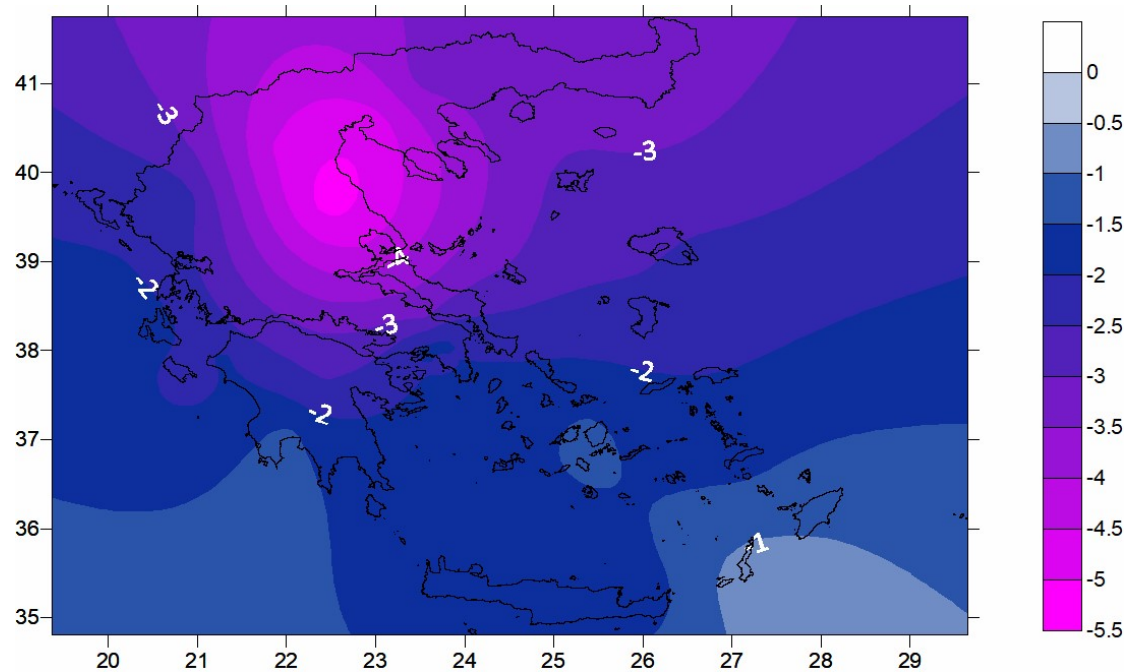
January was characterized by an extreme cold episode over southeastern Europe during the period 5 to 12 January 2017. A developing high pressure system over western Europe caused a significant outbreak of arctic air masses into the eastern and central Europe. Later a cut-off low formed at the level of 500 hPa over southeastern Europe and a pool of cold air from Siberia established over the Balkan Peninsula for many days. Cold air masses moved across warmer Aegean Sea creating a strong convergence zone affecting mainly the eastern continental Greece and Aegean islands (mainly Sporades) that received high amount of snowfall. Monthly minimum and maximum temperatures were 3 to 5 °C below climatological normals (1971-2000)<sup>1</sup> over central and northern Greece (Figures 1 and 2).



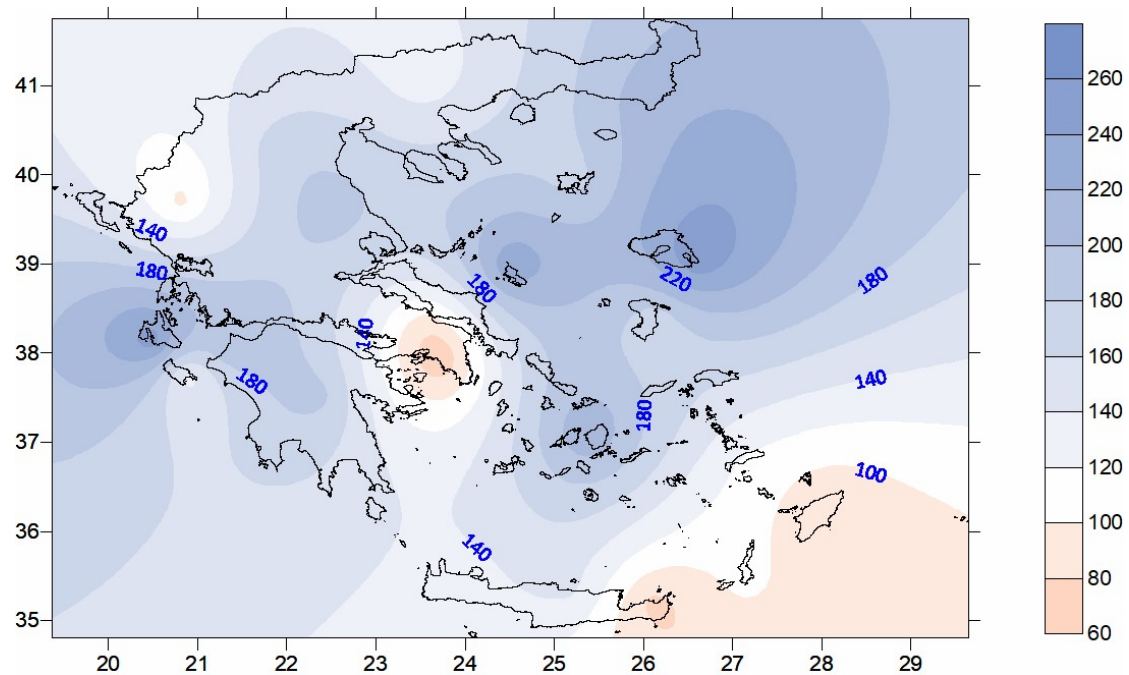
**Figure 1.** Min temperature anomalies (°C) for January 2017 in Greece according to the 1971-2000 climatology.

<sup>1</sup>All temperature and precipitation normal values were computed for the period 1971-2000 and are based on homogenized data series

Wet conditions dominated in most parts of Greece during the second half of January. The monthly precipitation ratios to the normal values (1971-2000) are given in percentages in Figure 3. The precipitation amounts for January were 140 -260 % above climatological normals (1971-2000) for the greatest part of Greece.



**Figure 2.** Max temperature anomalies (°C) for January 2017 in Greece according to the 1971-2000 climatology.



**Figure 3.** January precipitation anomalies given in percentages according to the 1971-2000 climatology.

## Records

### **Temperature**

The HNMS station of Florina (WMO-ID:16613) recorded on 11 January 2017  $T_{min}=-22.7^{\circ}\text{C}$  which is the 5<sup>th</sup> lowest record since 1961, while its monthly normal (1971-2000) minimum temperature is  $-3.2^{\circ}\text{C}$  (*Previous station's historical records  $T_{min}=-25.1^{\circ}\text{C}$  on 17 and 18 January 2012;  $T_{min}=-24.5^{\circ}\text{C}$  on 16 January 2012;  $T_{min}=-24.2^{\circ}\text{C}$  on 19 January 2012*).

Other low daily minimum temperatures recorded at:

- The HNMS Station of Kastoria (WMO-ID:16614) on January 12<sup>th</sup>, 2017  $T_{min}=-17.5^{\circ}\text{C}$  (*not historical record*).
- The HNMS Station of Kozani (WMO-ID:16632) on January 8<sup>th</sup>, 2017  $T_{min}=-15.0^{\circ}\text{C}$  (*not historical record*), while its monthly normal value (1971-2000) is  $T_{min}=-1.0^{\circ}\text{C}$ .
- The HNMS Station of Larisa (WMO-ID:16648) on January 11<sup>th</sup>, 2017  $T_{min}=-14.8^{\circ}\text{C}$  (*not historical record*), while its monthly normal value (1971-2000) is  $T_{min}=0.6^{\circ}\text{C}$ .

### **Frost Days**

There were a great number of frost days in many areas:

- The HNMS Station of Kozani (WMO-ID:16632) had at least 28 frost days ( $T_{min} \leq 0^{\circ}\text{C}$ ), 5 of which are characterized as total frost days ( $T_{max}$  and  $T_{min} \leq 0^{\circ}\text{C}$ ) whereas the average mean of frost days in January (relative to 1971-2000) is about 19 days.
- The HNMS Station of Larisa (WMO-ID:16648) had at least 17 frost days ( $T_{min} \leq 0^{\circ}\text{C}$ ), 6 of which are characterized as total frost days ( $T_{max}$  and  $T_{min} \leq 0^{\circ}\text{C}$ ) whereas the average mean of frost days in January (relative to 1971-2000) is about 14 days.
- The HNMS Station of Macedonia (WMO-ID:16622) had at least 16 frost days ( $T_{min} < 0^{\circ}\text{C}$ ), 5 of which are characterized as total frost days ( $T_{max}$  and  $T_{min} \leq 0^{\circ}\text{C}$ ) whereas the average mean of frost days in January (relative to 1971-2000) is about 11 days.
- The HNMS Station of Alexandroupoli (WMO-ID:16627) had at least 17 frost days ( $T_{min} < 0^{\circ}\text{C}$ ), 3 of which are characterized as total frost days ( $T_{max}$  and  $T_{min} \leq 0^{\circ}\text{C}$ ) whereas the average mean of frost days in January (relative to 1971-2000) is about 13 days.

### High Impacts Events

- Snowy weather caused huge problems in transportation; hundreds of vehicles were trapped in highways; public transportation in Thessaloniki collapsed and flights were suspended.
- Aegean islands of Skopelos, Alonnisos, and Evia declared a state of emergency following serious power failures due to heavy snowfall.
- Many municipalities of Thessaly declared a state of emergency due to long-lasting, heavy snowfall causing damages.
- More than forty villages in the prefecture of Kozani were isolated due to heavy snowfall with electricity and water supply problems.

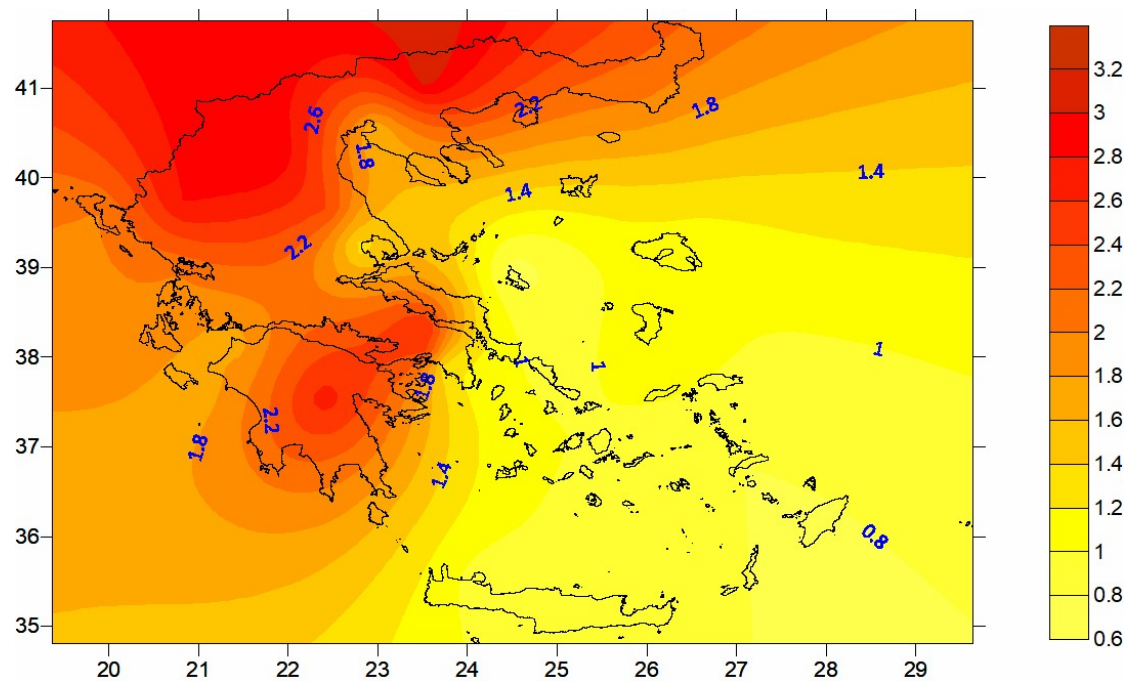
- Migrants in Greece suffered from very low temperatures and were housed in commercial buildings and ships; **one migrant died** due to harsh weather conditions.



# February

## Description

February of 2017 was a warmer than average month compared to normal values of 1971-2000 since the prevalence of southerly winds kept higher temperatures than normal. The monthly maximum temperature anomalies were positive, varying from 1.2 °C to 3.2 °C for the continental Greece and the Ionian islands and from 0.6 °C to 1.2 °C for the central and southern Aegean islands. The greatest positive anomalies were found over the northern continental Greece (Figure 4).



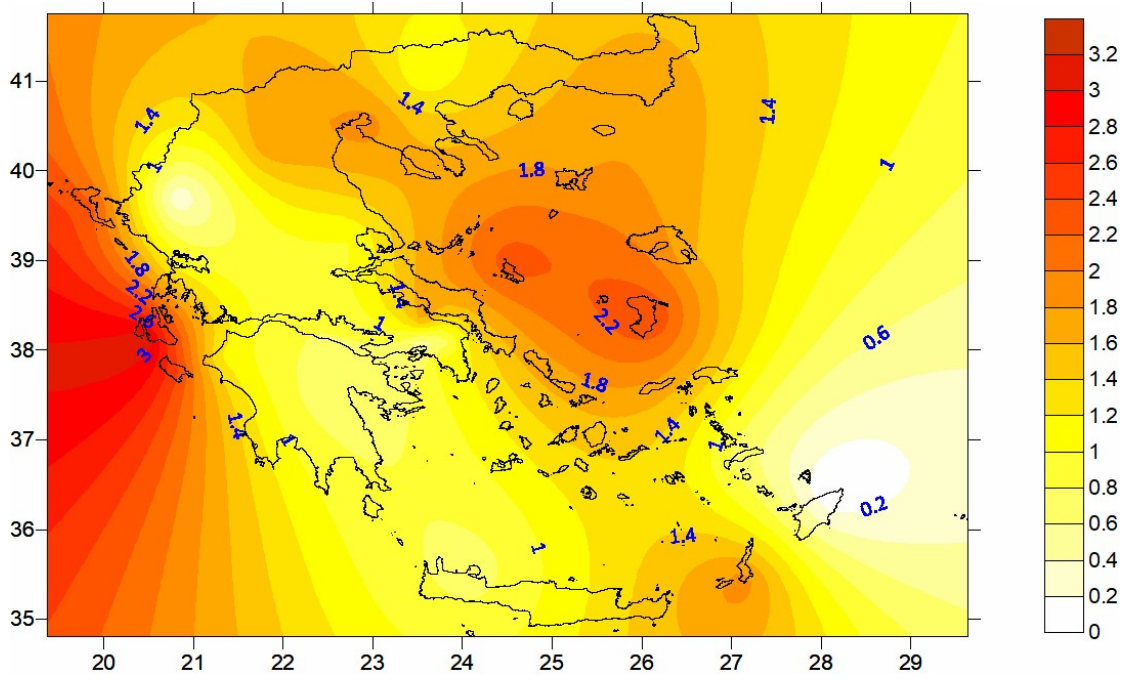
**Figure 4.** Max temperature anomalies (°C) for February 2017 in Greece according to the 1971-2000 climatology.

Similarly to maximum temperatures, minimum temperatures in February throughout Greece were above normal values of 1971 – 2000. Minimum monthly temperature anomalies ranged between 0.2°C and 3.2 °C. However the greatest positive anomalies were found in the Ionian and the northern Aegean islands (Figure 5).

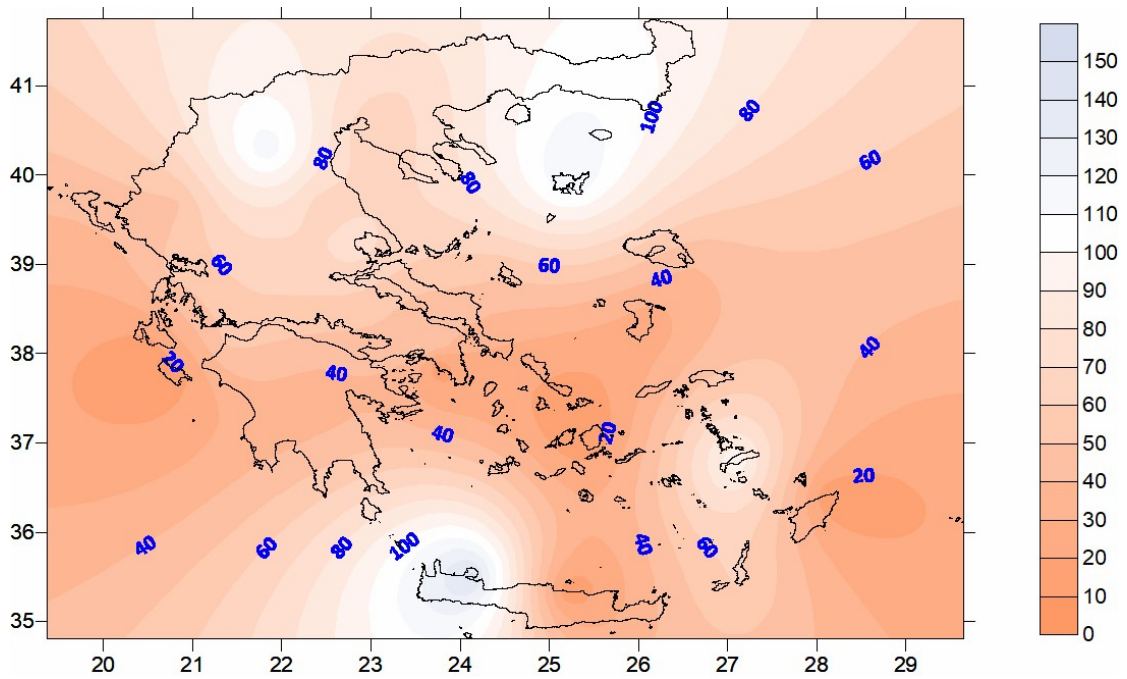
With respect to precipitation, February was a rather dry month. However, there were a few strong rainfalls over west Crete in early February (10 -11 February). Also, isolated rainfall dropped on February 19, 2017 over northwest Greece. Monthly precipitation anomalies, given in percentages, are shown in Figure 6.

A large amount of Saharan dust was swept up into a low pressure system over north Africa on February 21, 2017. Dust cloud reached Greece on February 24, and lasted for 2 days.





**Figure 5.** Min temperature anomalies ( $^{\circ}\text{C}$ ) for February 2017 in Greece according to the 1971-2000 climatology.



**Figure 6.** February precipitation anomalies given in percentages according to the 1971-2000 climatology.

## **Records**

### **Temperature**

The highest daily maximum temperatures (Tmax) were recorded:

- on February 24, in Larisa station (WMO-ID:16648) Tmax=21.6 °C while the station's monthly normal value 1971-2000 is Tmax=11.7 °C.
- on February 27, in Kerkyra station (WMO-ID:16641) Tmax=22.0 °C while the station's monthly normal value 1971-2000 is Tmax=14.3°C.
- on February 25, in Heraklio station (WMO-ID:16754) Tmax=22.0 °C while the station's monthly normal value 1971-2000 is Tmax=15.1 °C.

### **Precipitation**

The highest 12-hour rainfall was on February 10 and 11, in Souda station(WMO-ID:16746),where a total of 40.0 mm and 66.4 mm were recorded respectively.

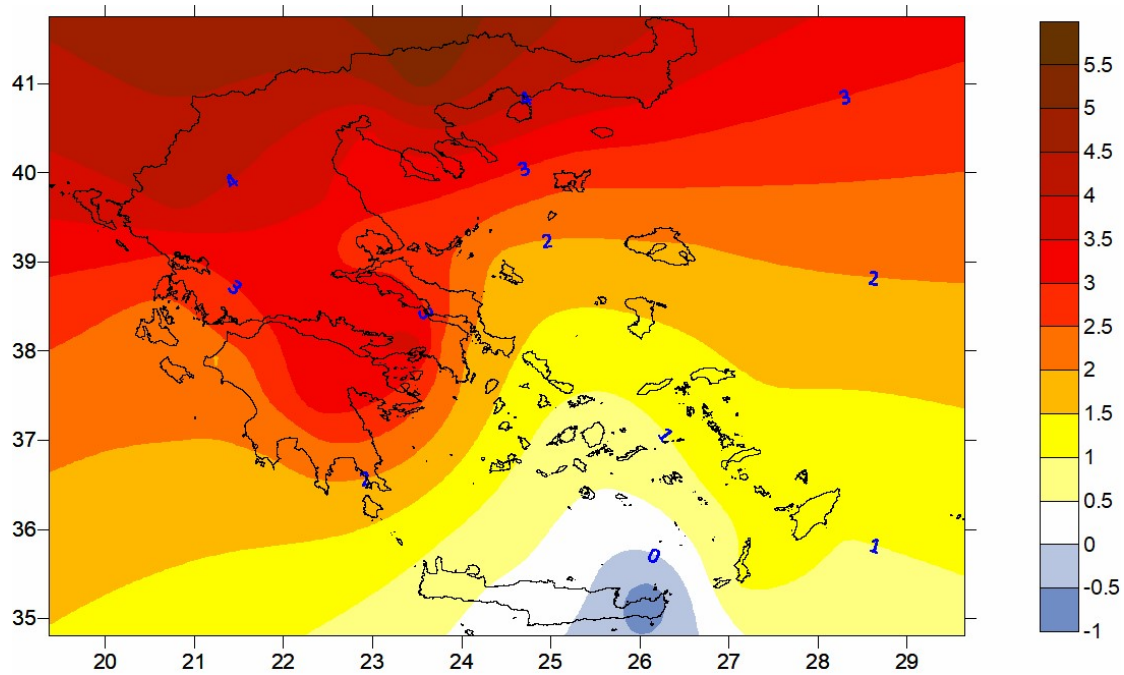
### **High Impacts Events**

No high impact events

# March

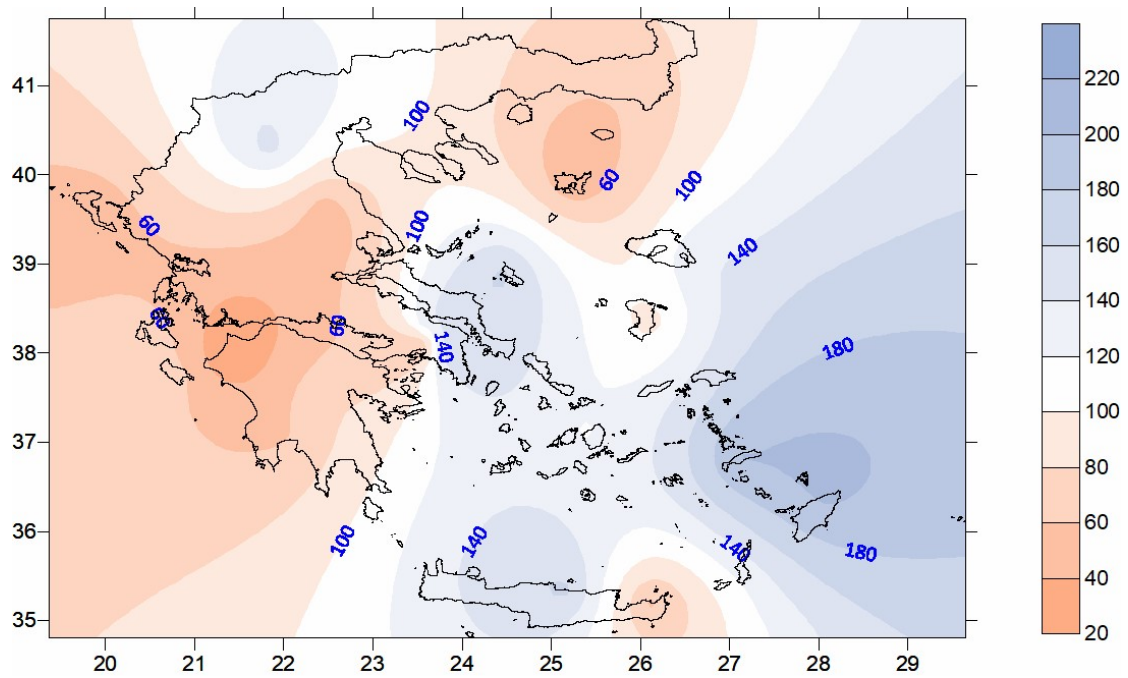
## Description

The main characteristics of March 2017 were the higher than normal values (1971-2000) temperatures and several rainfalls, mainly in the eastern part of the country. The positive anomalies of monthly maximum temperature varied from 1.5 °C up to 5.0 °C for the greatest part of the country, while, locally, the deviations from normal values (1971-2000) exceeded the 5 °C over northern continental Greece (Figure 7).



**Figure 7.** Max temperature anomalies (°C) for March 2017 in Greece according to the 1971-2000 climatology.

Moderate to strong rainfall and thunderstorms were recorded between 7 and 12 March mainly in eastern Greece. On March 11<sup>th</sup>, isolated thunderstorms lashed the city of Athens, where the northern parts received large amount of precipitation. For instance, OAKA automatic weather station received 44.6 mm precipitation within about 3 hours. The precipitation amounts for March 2017 were 1.2 to 2.0 times above normal values (1971-2000) for the Aegean islands, Attica, Evia, and western Macedonia while they were below or near normal values for western Greece and eastern Macedonia and Thrace(Figure 8).



**Figure 8.** March precipitation anomalies given in percentages according to the 1971-2000 climatology.

## Records

### **Temperature**

The highest daily maximum temperatures (Tmax) were recorded:

- on March 25, in Serres station (WMO-ID:16606) Tmax=27.7°C while the station's monthly normal value 1971-2000 is Tmax=14.7 °C. Moreover 14 days of March daily maximum temperature exceeded 20.0 °C.
- on March 25, in Florina station (WMO-ID:16613) Tmax=24.5 °C while the station's monthly normal value 1971-2000 is Tmax=11.8 °C. It is also worth mentioning that daily maximum temperature in Florina was above 20.0 °C for 7 consecutive days from 19 to 25 March.

### **Precipitation**

The highest daily rainfall values were recorded:

- on March 8, in Mitilini station (WMO-ID: 16667), where a total of 84.20 mm were recorded.
- on March 11, in OAKA automatic weather station (WMO-ID: 16792), located in Athens, where a total of 50.2 mm were recorded.

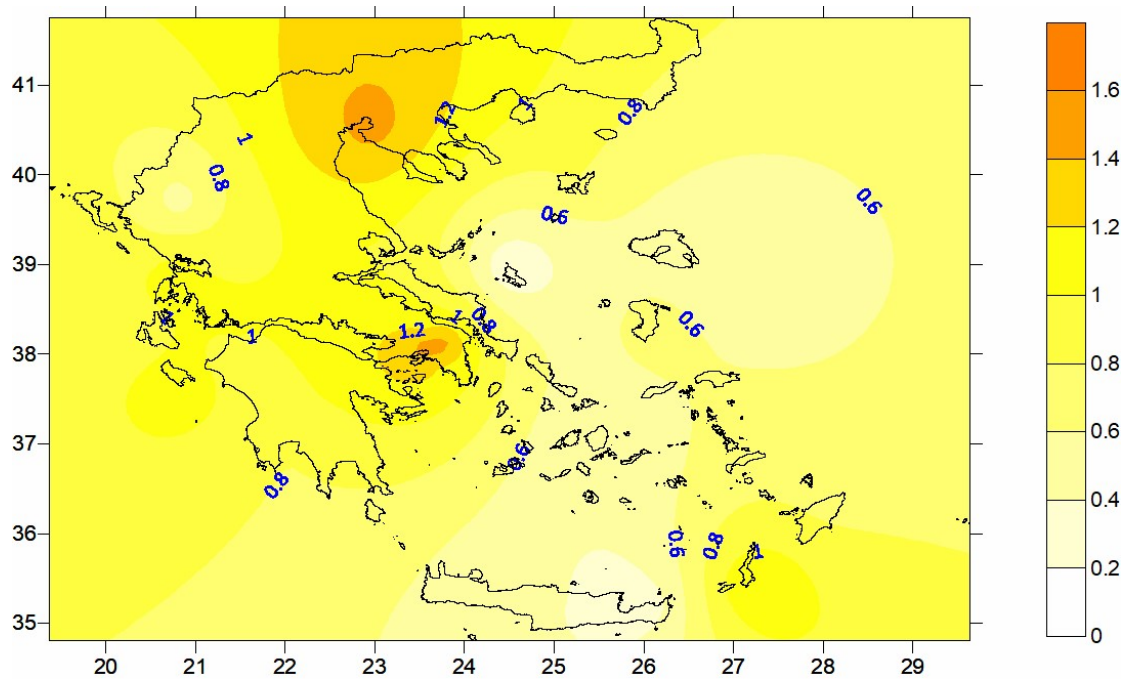
### High Impacts Events

No high impact events

# April

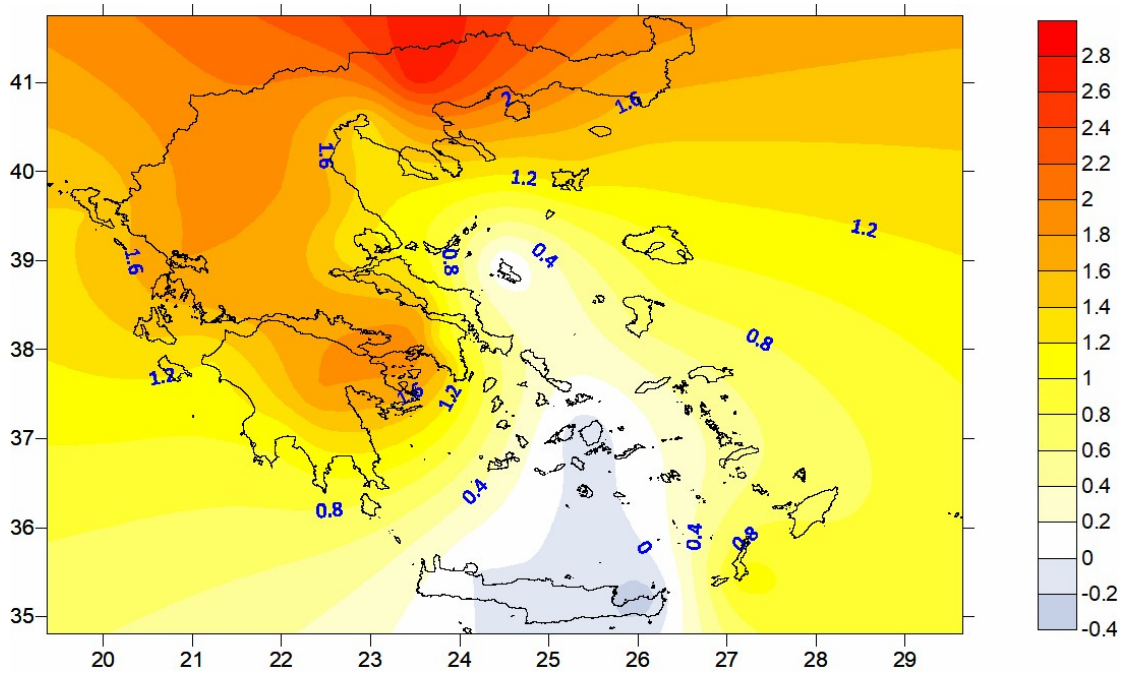
## Description

April of 2017 was a slightly warmer than average month and the departures of mean monthly temperatures from the normal values for 1971-2000 ranged from 0.2 to 1.5°C. Figure 10 shows that maximum monthly temperatures were higher than mean values, especially in mainland, in the areas of central and northern Greece, with positive anomalies varying from 0.4 to 2.8°C. Regarding the minimum monthly temperatures negative anomalies were observed in most parts of Greece and mainly in central and north areas (-0.1 to -1.7°C from normal values 1971-2000) whereas positive anomalies were found in the southeast Aegean areas (Figure 11).

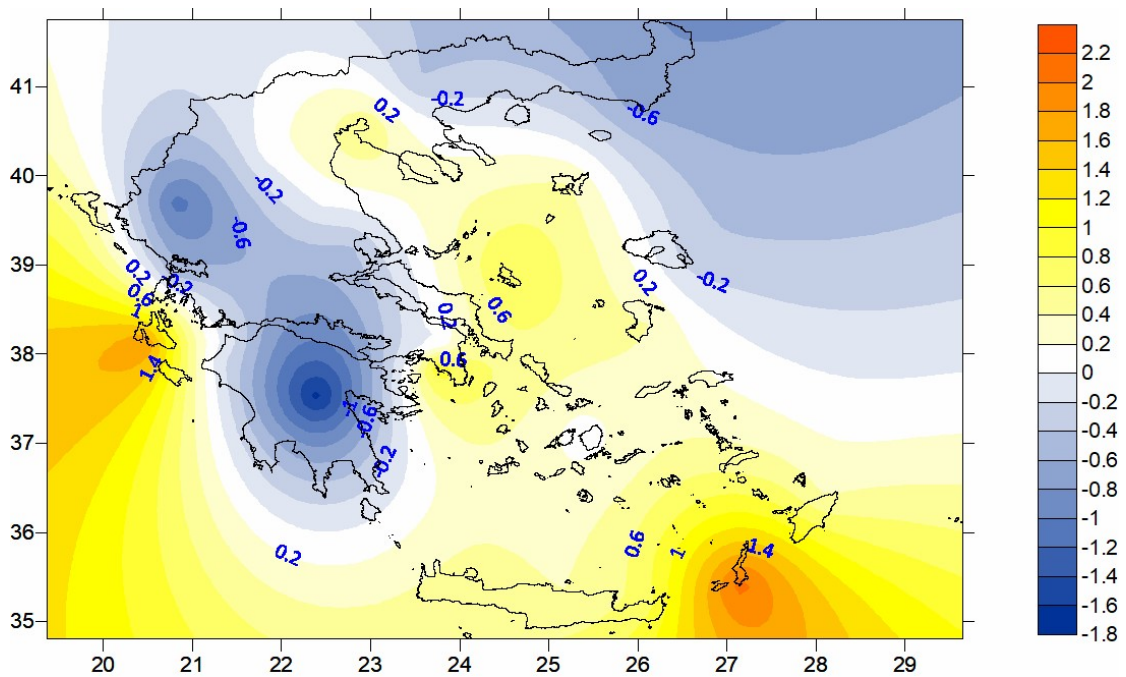


**Figure 9.** Mean temperature anomalies (°C) for April 2017 in Greece according to the 1971-2000 climatology.



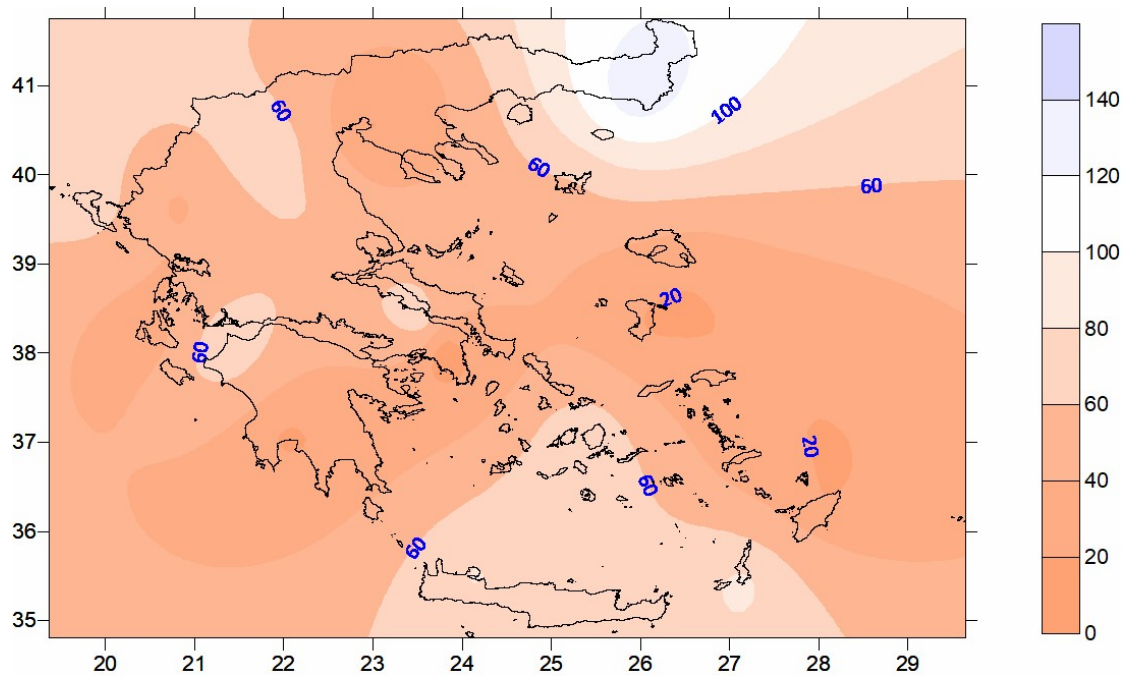


**Figure 10.** Max temperature anomalies (°C) for April 2017 in Greece according to the 1971-2000 climatology.



**Figure 11.** Min temperature anomalies (°C) for April 2017 in Greece according to the 1971-2000 climatology.

The accumulated monthly precipitation for April 2017 was, in general, below the normal values 1971-2000. The accumulated monthly precipitation accounted for 20 % to 80 % of normal values 1971-2000 for most parts in the entire country, with greater values in the northeast parts of Greece.



**Figure 12.** April precipitation anomalies given in percentages according to the 1971-2000 climatology.

### **High impact events**

- Hailstorm on the 17<sup>th</sup> of April 2017 destroyed areas of agricultural crops in the regions of Macedonia (Kozani), and Central Greece (Trikala).

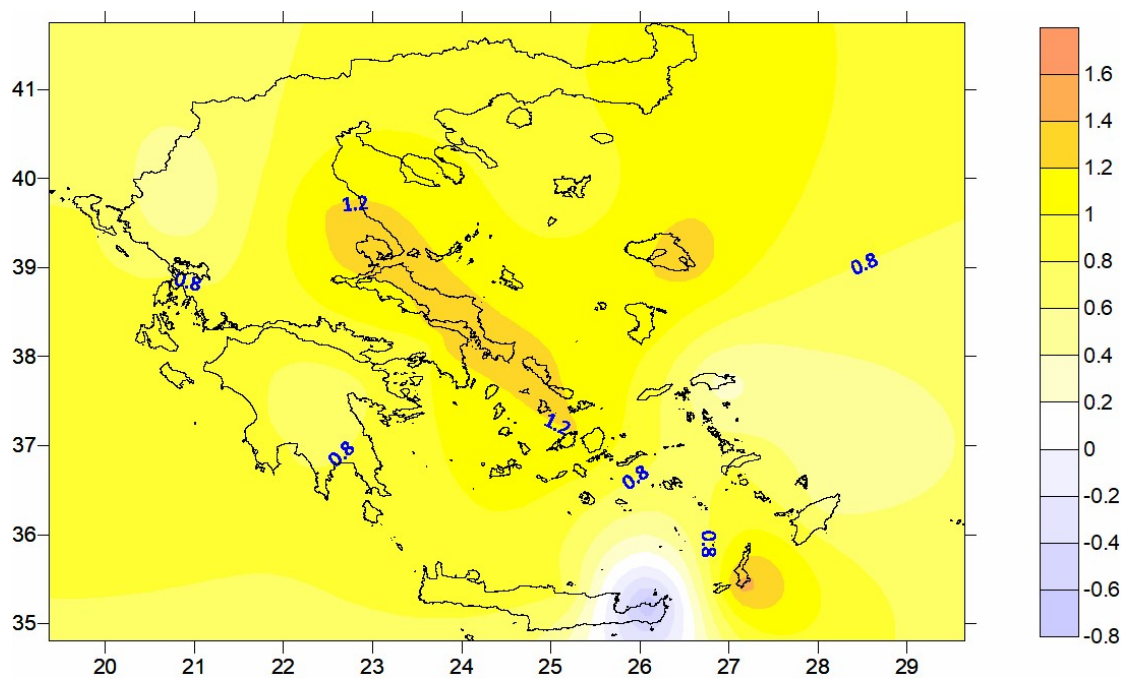


# May

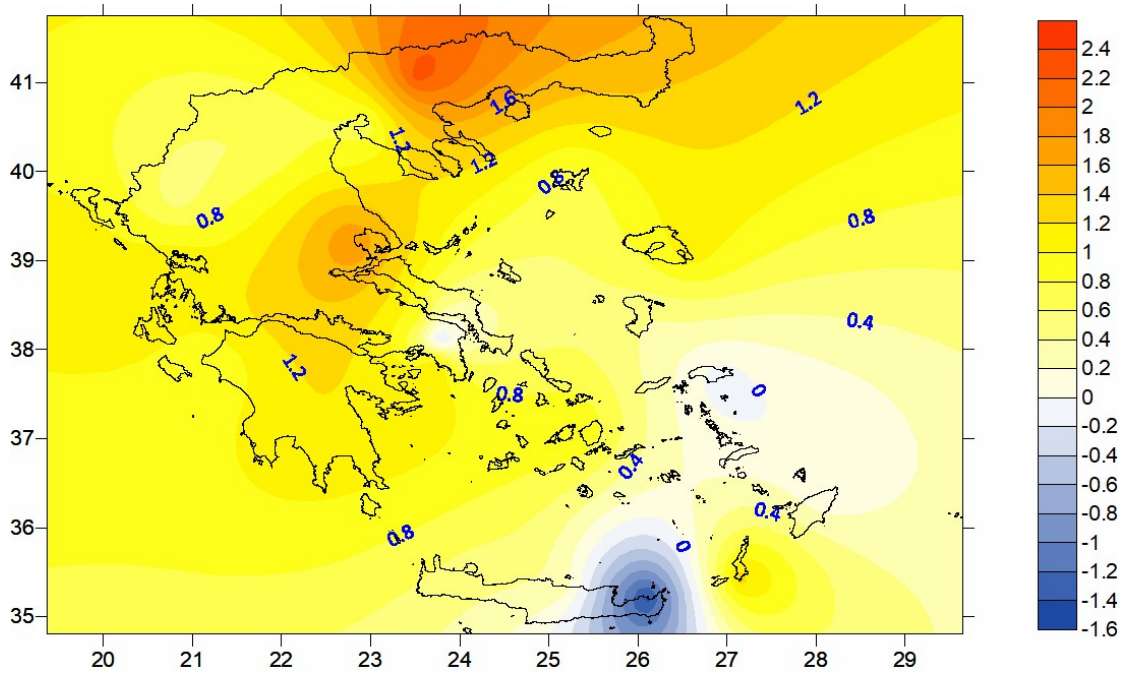
## Description

May of 2017 in Greece was characterized by higher temperatures than normal values in the first 15 days and lower ones in the last 15 days of the month.

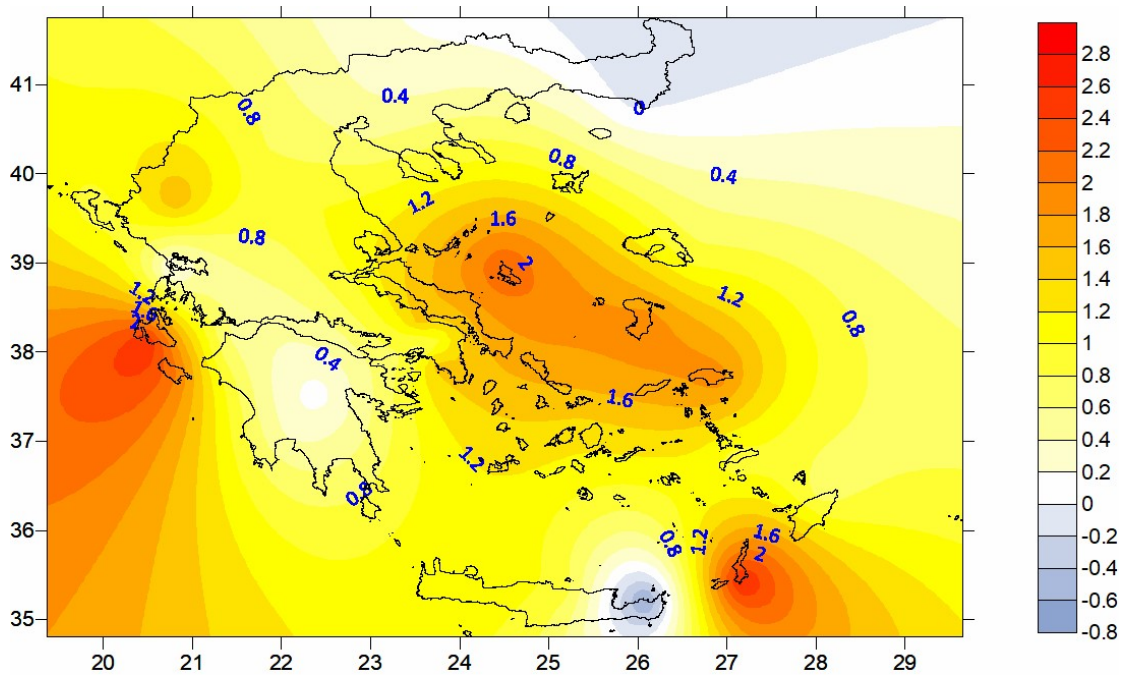
In general, monthly mean temperatures were slightly higher than the normal values for 1971-2000 with positive anomalies from 0.5 °C to 1.2 °C. The monthly maximum temperatures presented positive anomalies for most parts of the country (0.4 to 2.3 °C from normal 1971-2000 values). The monthly minimum temperatures were also higher than the normal values for 1971-2000 with positive anomalies 0.1 °C to 2.7 °C mostly in the areas of Ionian and Aegean Sea.



**Figure 13.** Mean temperature anomalies (°C) for May 2017 in Greece according to the 1971-2000 climatology.

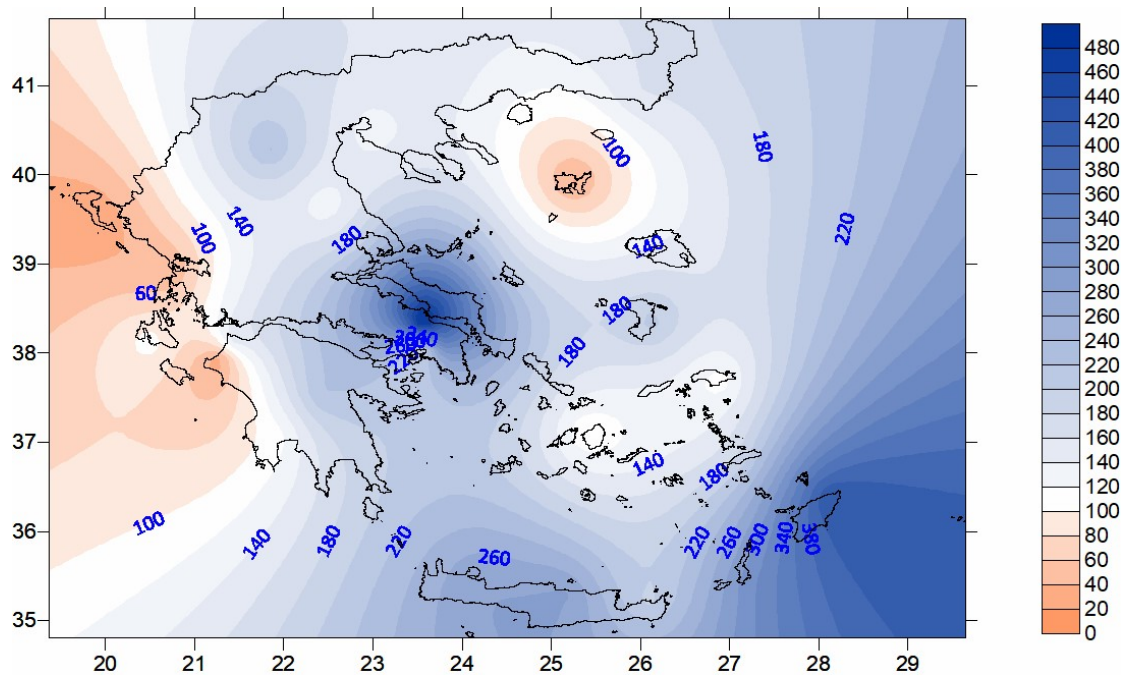


**Figure 14.** Max temperature anomalies (°C) for May 2017 in Greece according to the 1971-2000 climatology.



**Figure 15.** Min temperature anomalies (°C) for May 2017 in Greece according to the 1971-2000 climatology.

May of 2017 was a wetter than average month. The accumulated monthly precipitation for May 2017 was above the normal values. The accumulated monthly precipitation was up to 510 % of normal values 1971-2000, and the greater values appeared in the areas of Central and South, Southeast Greece.



**Figure 16.** May precipitation anomalies given in percentages according to the 1971-2000 climatology.

## Records

### Temperature

Heat wave during 12-13 May 2017 in the central and southern parts of Greece. Many stations over southeastern mainland recorded temperature records e.g.

- The HNMS Station of Argos (WMO-ID:16724) recorded on May 13<sup>th</sup>,2017 Tmax = 40.6 °C while its monthly average (1981-2017) is 27.0 °C.

### Precipitation

- The greater values of accumulated monthly precipitation appeared in the stations of Tanagra 122 mm (510 % of normal monthly values 1971-2000), Tripoli 65mm (218 % of normal monthly values 1971-2000), Tatoi 60 mm (340% of normal monthly values 1971-2000), Kozani 82 mm (224% of normal monthly values 1971-2000), Rodos 58 mm (417 % of normal monthly values 1971-2000), Elliniko 35 mm (256 % of normal monthly values 1971-2000).

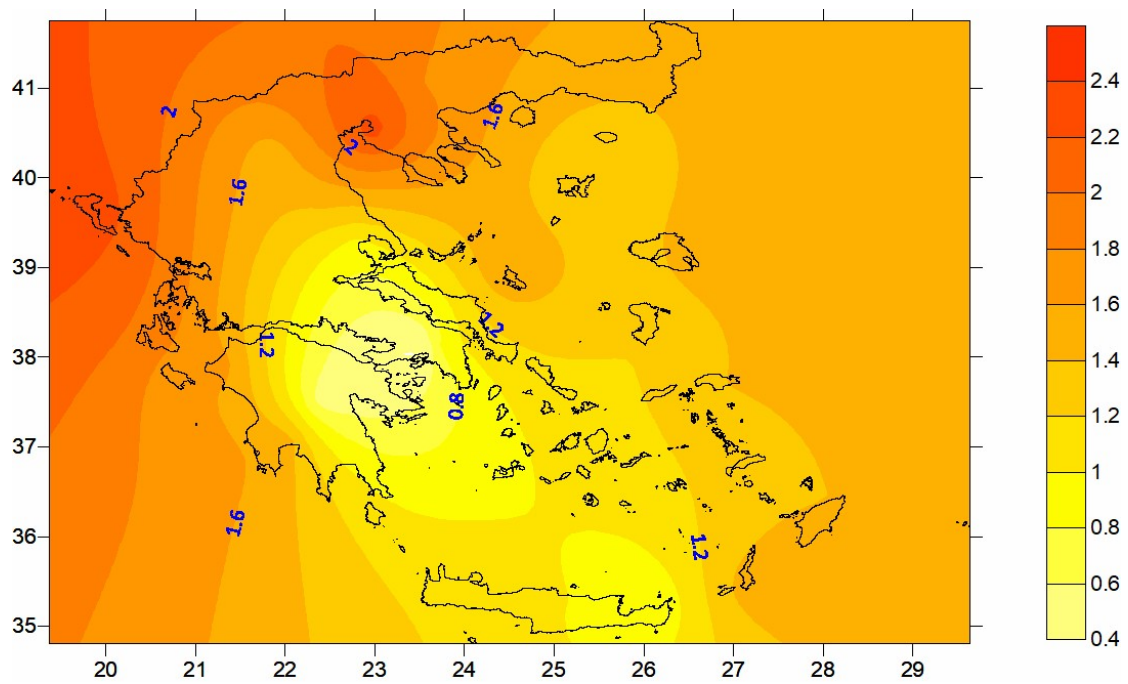
## Highimpactevents

- Hailstorm on the 7<sup>th</sup> - 9<sup>th</sup> of May 2017 caused destructions in agricultural areas in the northern part of Greece (regions of Serres, Poligiros, Kavala, N. Evros, Orestiada). On the 9<sup>th</sup> of May 2017 **a woman lost her life** due to thunder in the area of Pieria.
- During 25-29 May 2017, hailstorm destroyed agricultural crops in the area of Farsala (central mainland).

# June

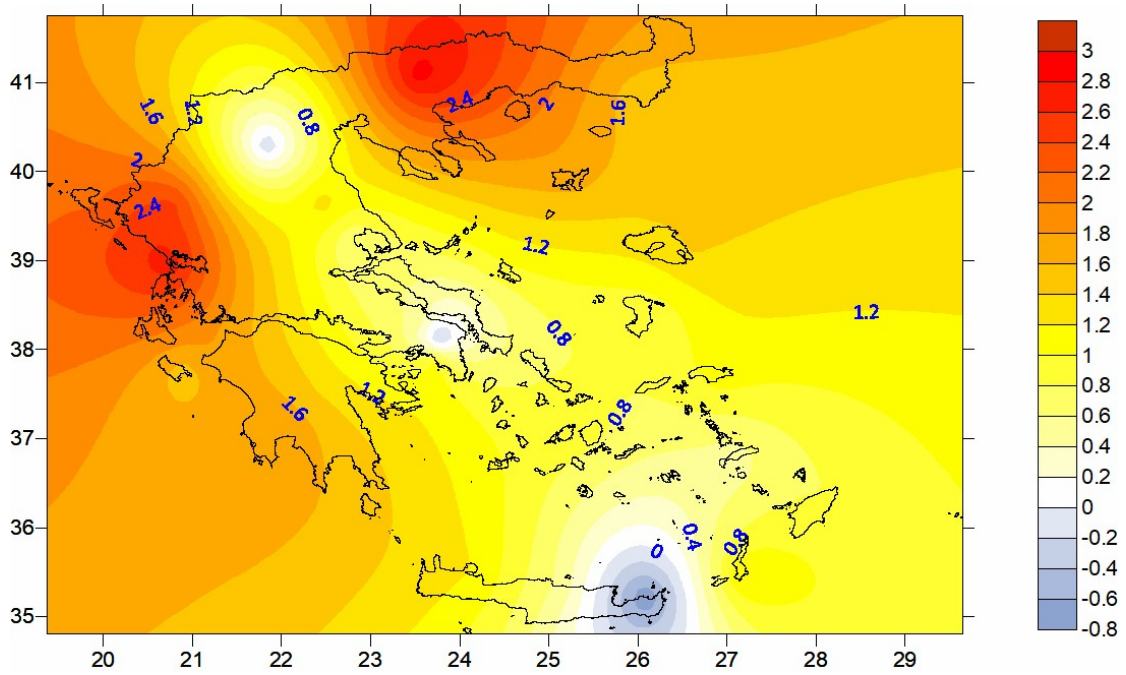
## Description

June of 2017 in Greece was, in general, a warmer than average month and the departures of mean monthly temperatures from the normal values for 1971-2000 ranged from nearly 0.5 °C to 2.3 °C. Fig 18 and Fig 19 show that both monthly maximum and minimum temperatures were above the normal values for 1971-2000. The main characteristic of June was the gradual increase of temperature during the last ten days with the maximum air temperature finally exceeding 40.0 °C on the 29<sup>th</sup> and 30<sup>th</sup> of June in several regions.

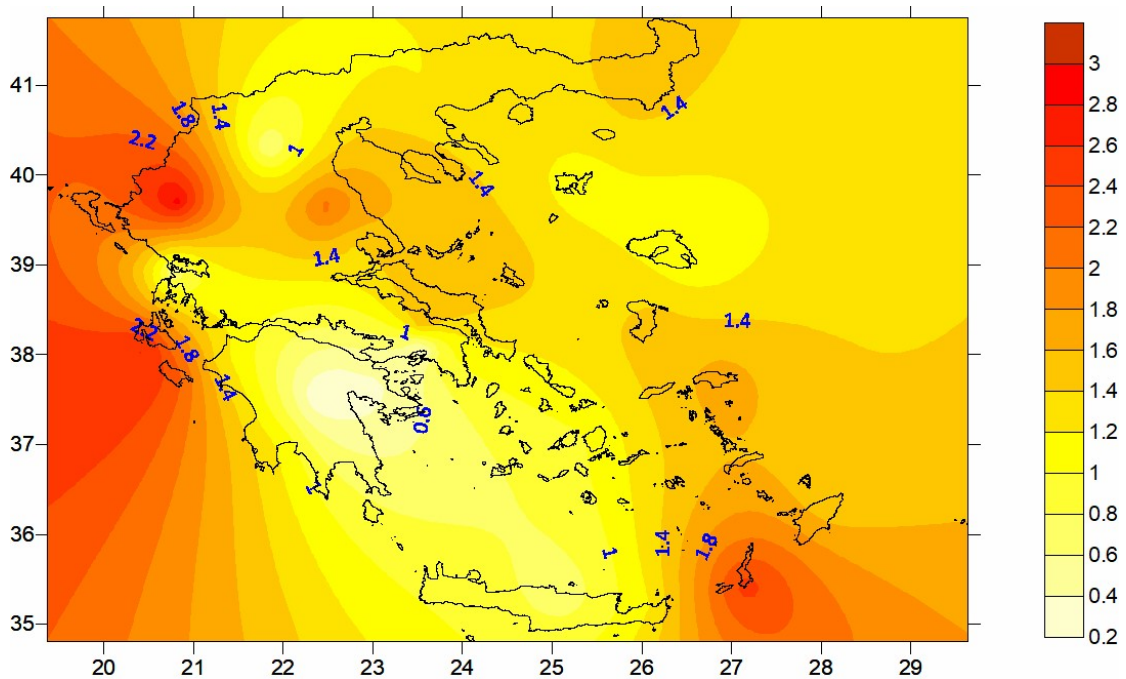


**Figure 17.** Mean temperature anomalies (°C) for June 2017 in Greece according to the 1971-2000 climatology.





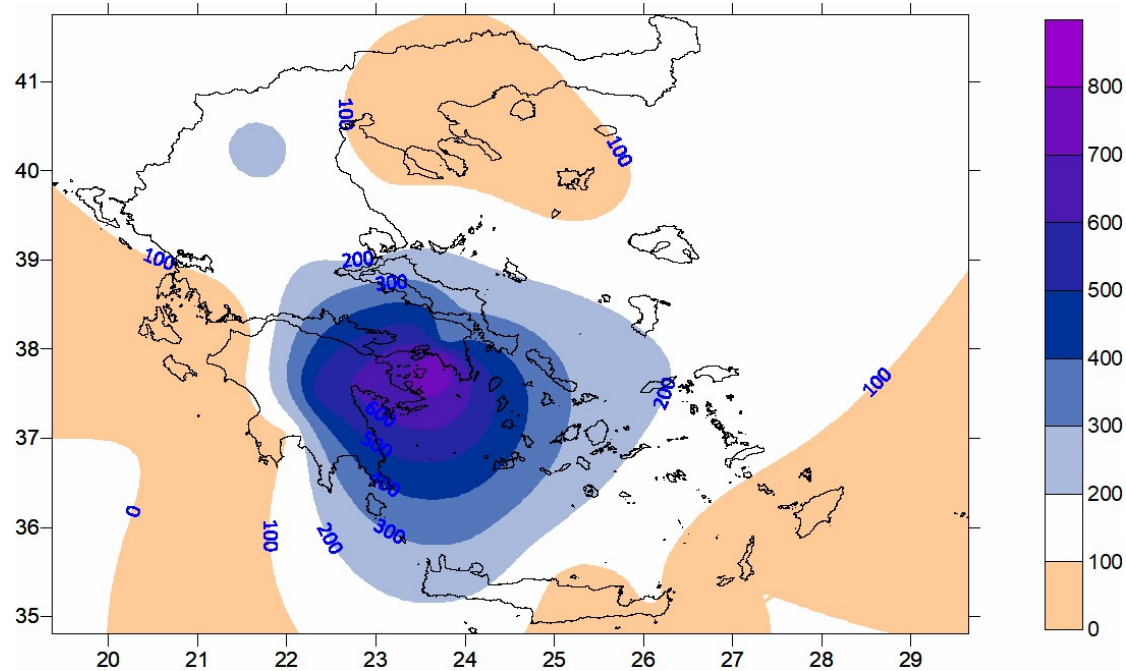
**Figure 18.** Max temperature anomalies (°C) for June 2017 in Greece according to the 1971-2000 climatology.



**Figure 19.** Min temperature anomalies (°C) for June 2017 in Greece according to the 1971-2000 climatology.

June of 2017 was, in general, a wet month for central Greece but dry for the western and northeastern parts and for the eastern Aegean islands. Moderate to heavy rainfall occurred during the first 15-17 days of the month, mainly over the eastern regions of central Greece (including Attica). The precipitation amounts for June 2017 varied from 120 - 788 % of normal values (1971-2000) for the largest part of the central Greece and for some islands of

Cyclades while, in the western Greece (including Ionian islands), in the eastern Crete, in the



**Figure 20.** June precipitation anomalies given in percentages according to the 1971-2000 climatology.

eastern Aegean islands and in some areas in the northeastern Greece, the total monthly precipitation was below normal values.

### Records

#### **Temperature**

- Heat wave between 29 June and 3 July 2017. Most regions of Greece experienced high temperatures. Daily maximum temperatures on June 30, 2017 exceeded 40 °C in many parts of Greece (e.g the stations Elefsis (airport) and Larissa (airport) recorded a maximum daily temperature of 44.8 °C and 42.6 °C respectively).

#### **Precipitation**

- The greater values of accumulated monthly precipitation appeared in the stations of Elliniko 45mm (788% of normal monthly values 1971-2000), Elefsis 39mm (588% of normal monthly values 1971-2000), Tatoi 29mm (330% of normal monthly values 1971-2000), Tanagra 38mm (460% of normal monthly values 1971-2000), Tripoli 80mm (580% of normal monthly values 1971-2000).

### High impact events

- Heavy rainfall and hailstorm on the 4<sup>th</sup> of June in Athens. As a result some roads in the center of Athens closed due to flooding.
- Severe hailstorm on the 17<sup>th</sup> of June destroyed areas of agricultural crops in the regions of Central Greece (Trikala, Livadia) and Peroponnese (Argolida). The

hailstorm uprooted trees, brought down electricity poles, flooded roads and demolished photovoltaic installations.

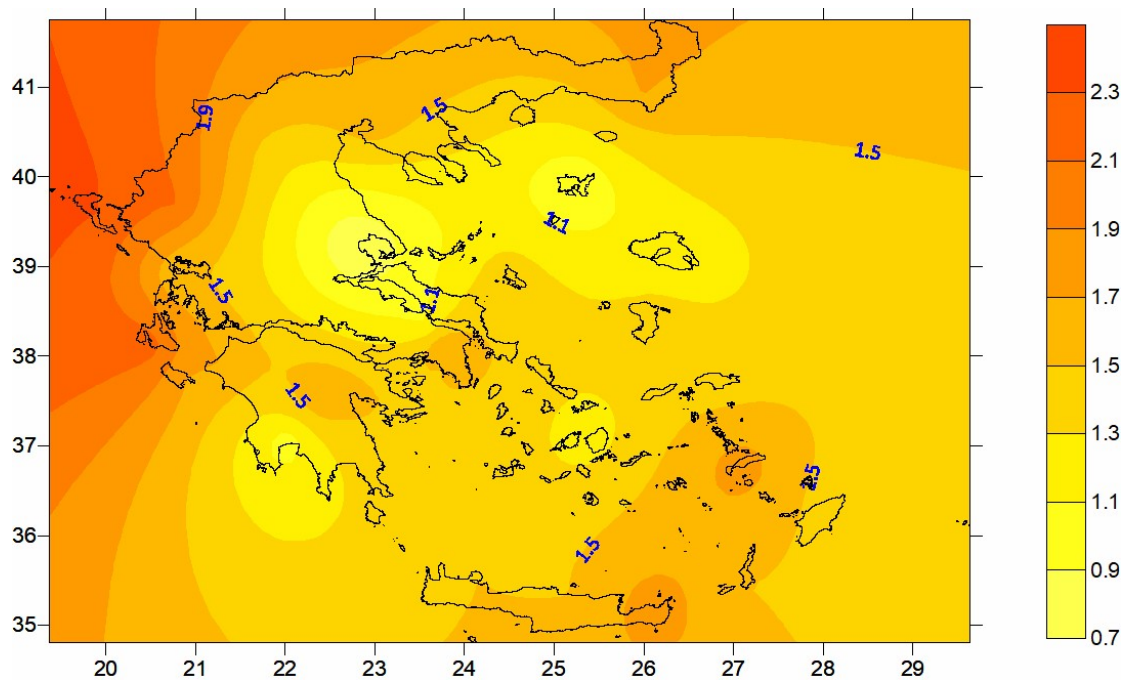
- **Two elderly people lost their lives** because of heat stroke in the island of Crete (Rethimno, Messara basin- Heraklio) due to that heat wave.



# July

## Description

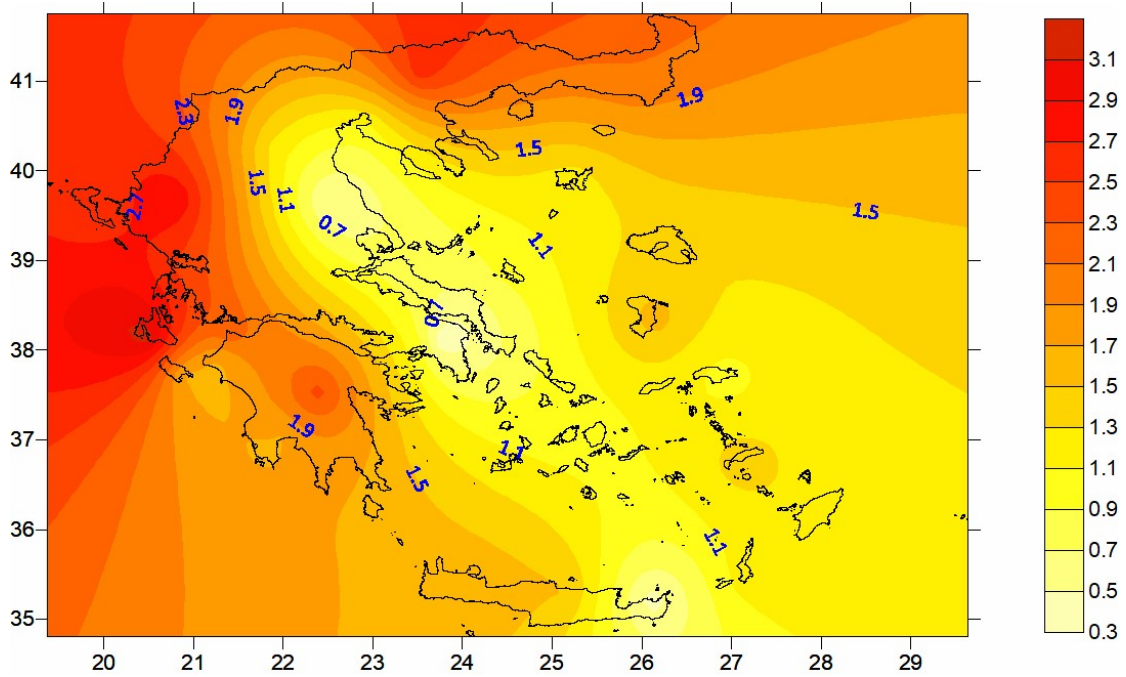
July of 2017 was also a warmer than average month compared to the normal values of 1971-2000. The highest air temperatures recorded during the first ten days of July since the heat wave that started at the end of June, continued into the beginning of July (between 29 June and 3 July). Moreover, following the heat wave in the first week of July, Greece experienced a second heat wave with similar weather conditions between 11 and 13 July, but with lower intensity. The departures of mean monthly temperature from the normal values 1971-2000 ranged from nearly 0.7 to 2.3°C (Figure 21).



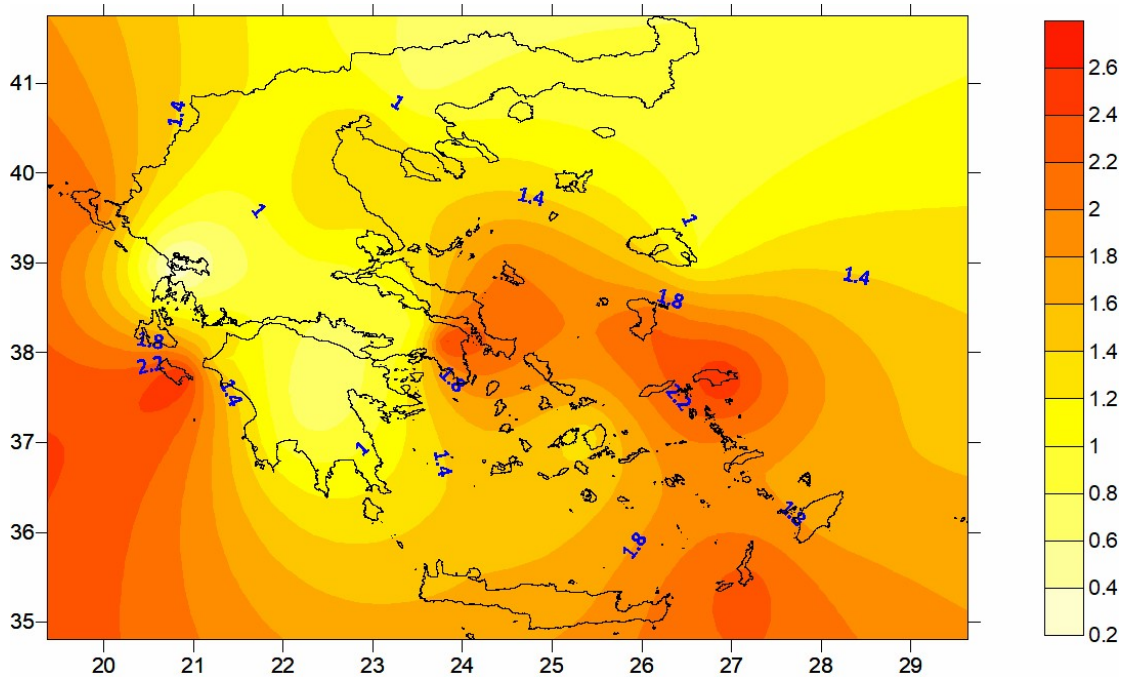
**Figure 21.** Mean temperature anomalies (°C) for July 2017 in Greece according to the 1971-2000 climatology.

Also, maximum monthly temperatures in July were above normal values (1971-2000) ranging from 0.3 to 3.1 °C (Figure 22). The greatest positive differences were detected in northwestern Greece (Epirus and Ionian islands) while the smallest ones were recorded in the east-central mainland and in the Aegean Sea islands.

The minimum monthly temperature anomalies in July were positive varying from 0.2 to 2.6 °C (Figure 23). The greatest positive anomalies were detected in Attica and in the south Aegean and Ionian islands.



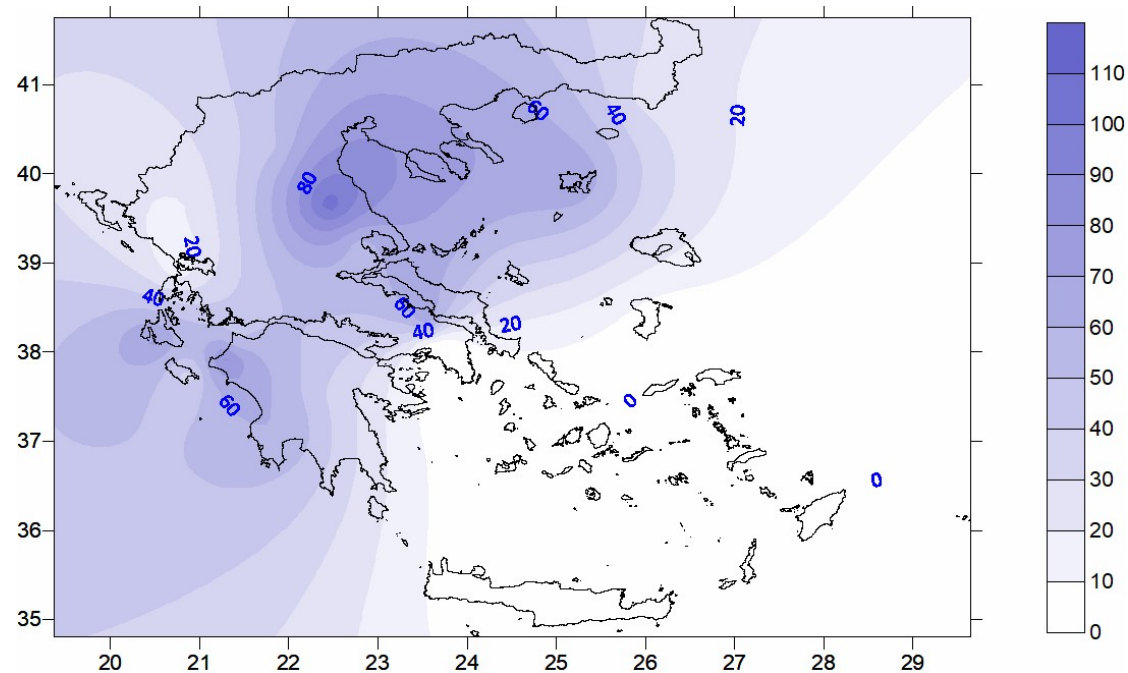
**Figure 22.** Max temperature anomalies ( $^{\circ}\text{C}$ ) for July 2017 in Greece according to the 1971-2000 climatology.



**Figure 23.** Min temperature anomalies ( $^{\circ}\text{C}$ ) for July 2017 in Greece according to the 1971-2000 climatology.

Besides high temperatures, the second ten days of July were characterized by moderate to heavy rainfall for the greatest part of the country. More specifically, the southwestern, the central and northern parts of Greece experienced severe weather phenomena (intense

rainfall and flooding) ) during the 16<sup>th</sup> and 17<sup>th</sup> of July as a result of the cold air masses movement in the upper troposphere from the North Europe to our region.



**Figure 24.** Accumulated monthly precipitation (mm) in July 2017.

Figure 24 shows the accumulated monthly precipitation (mm) in July and not anomalies since the normal value of precipitation height in summer months is near or equal to zero in many areas, thus a small recorded rainfall amount results to very extreme anomalies. However, the analysis of anomalies showed that locally the southwest areas, where the normal value of precipitation in July is below 10 mm, received a total precipitation of 10 to 20 times above normal values. Also, the northern and central areas received a total precipitation of 2 to 8 times above normal values.

## Records

### Temperature

- Heat wave between 29 June and 3 July: Very high temperatures were recorded during the first 2 days of July (e.g on 1 July Larissa (airport) (WMO-ID:16648) reported a maximum daily temperature of 43.2 °C)
- Heat wave between 11 and 13 July: Maximum daily temperatures were about 40 - 41 °C in mainland.

### Precipitation

- Heavy precipitation between 16 and 17 July. Tanagra (airport) station (WMO-Id:16699), located in the central Greece, reported its wettest July since 1957 with 68.0 mm (65.2 mm was the accumulated precipitation measured on the 17<sup>th</sup> of July

at 06 UTC for the past 12 hours), while its mean monthly precipitation in July for the normal period 1971-2000 is about 8.26 mm (about 8 times above normal).

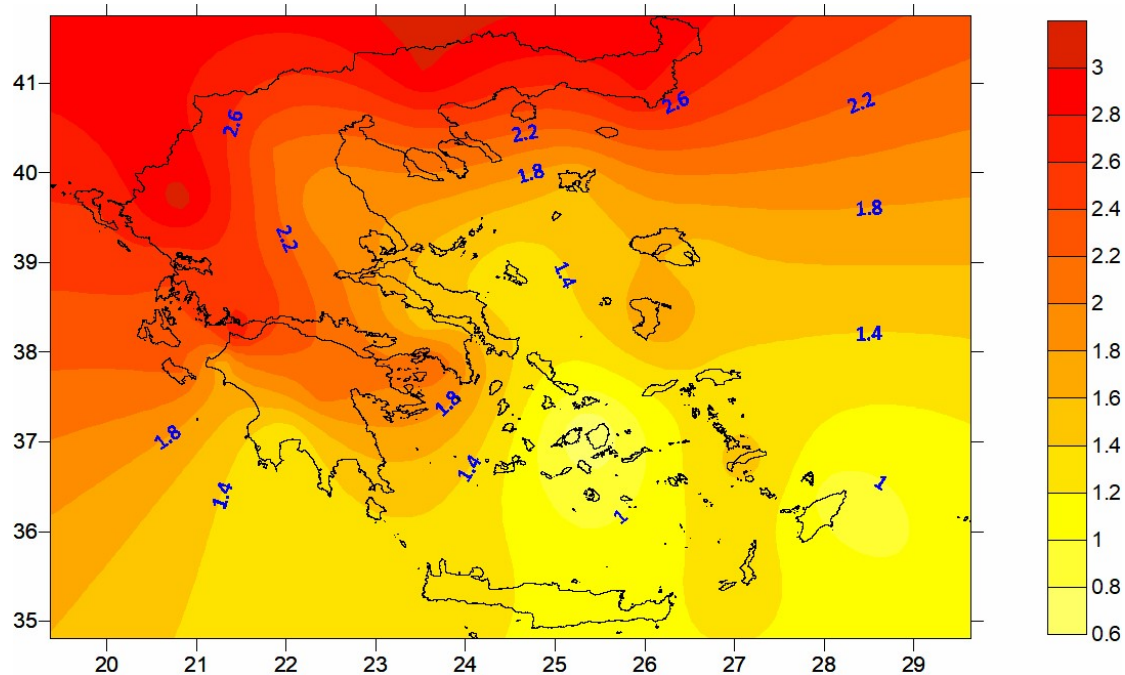
#### **High Impacts Events**

- Continuous heavy rainfall affected several areas, one of the affected regions was Chalkidiki area, in central Macedonia, which attracts millions of tourists every summer. The area of Chalkidiki was declared in 'a state of emergency', streams flooded, people were trapped in tents, trailers and cars and some roads were not accessible due to stones that rain brought down from the nearby hills and mountains.

# August

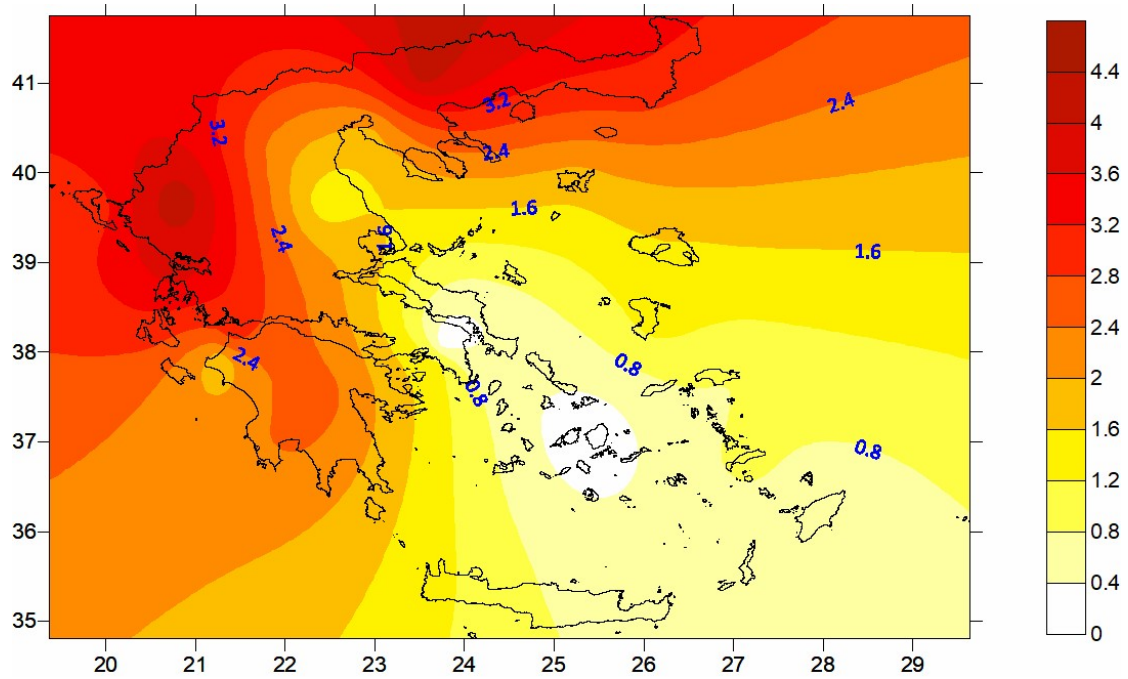
## Description

August of 2017 was characterized both by high temperatures compared to normal values 1971-2000 and strong northerly winds. As a consequence, destructive forest fires occurred in the northeast Attica during 13 and 16 of August.



**Figure 25.** Mean temperature anomalies (°C) for August 2017 in Greece according to the 1971-2000 climatology.

The whole country experienced positive temperature anomalies compared to the 1971-2000 normal values. Mean temperature anomalies varied from 0.6 to 3.0 °C and the greatest deviations from normal values ( $> 2$  °C) are detected in the northern and central areas and in the Ionian islands (Figure 25). Also, maximum temperature anomalies were positive with the greatest values (from 2 to  $> 4$  °C) occurring in west and north Greece and the lowest ones in the southern Aegean islands (Figure 26).



**Figure 26.** Max temperature anomalies (°C) for August 2017 in Greece according to the 1971-2000 climatology.

In contrast to July, August of 2017 was a drier month for the entire country, since the accumulated monthly precipitation was below the normal values. The accumulated monthly precipitation accounted for less than 10 % to 86 % of normal values 1971-2000 for almost the entire country.

### **High Impacts Events**

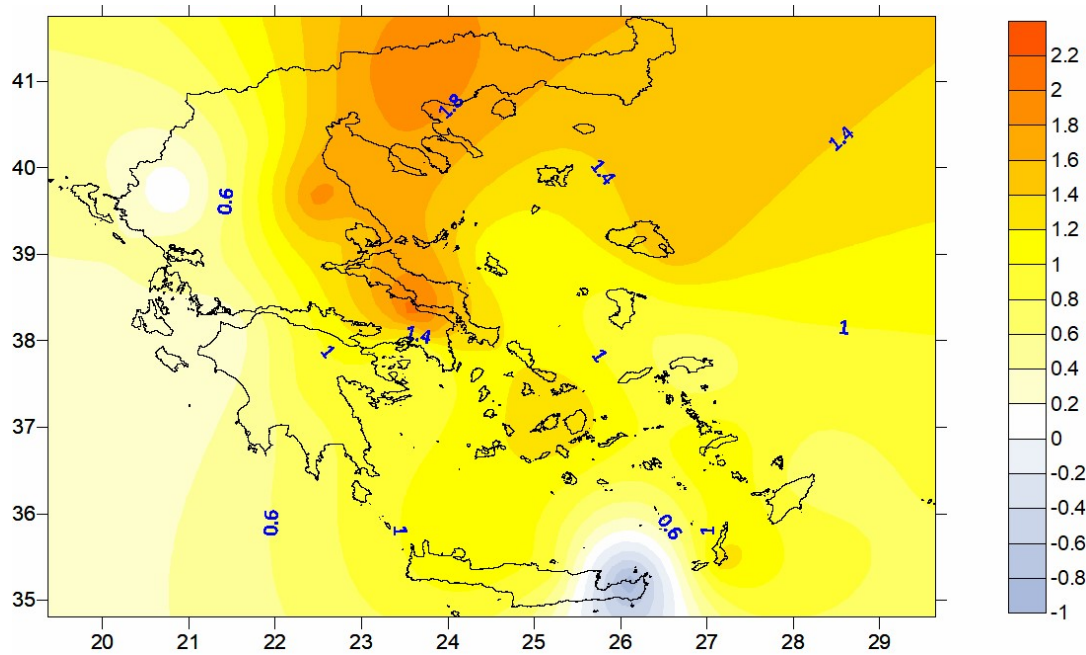
- Destructive forest fires occurred in northeast Attica during 13 to 16 of August. Prolonged high temperatures (compared to normal values 1971-2000) and strong northerly winds known as 'meltemia' quickly spread the fire.



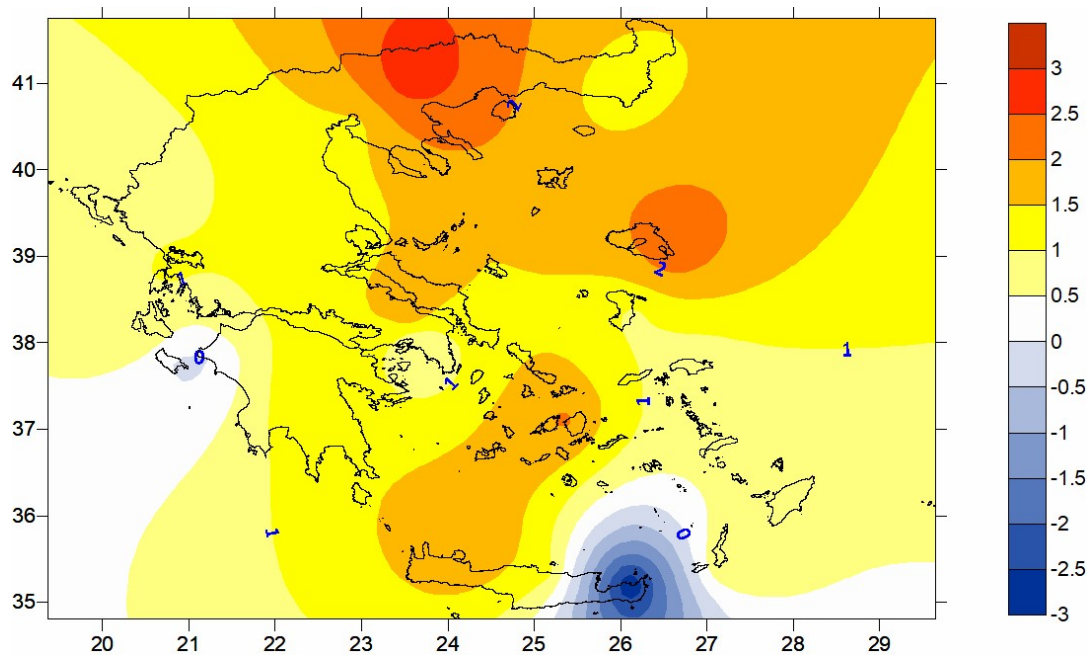
# September

## Description

September 2017 was characterized by temperature fluctuations (i.e relatively high temperatures recorded during the second ten days but low temperatures recorded during the last ten days of the month) as well as by prolonged drought. Few strong storms recorded during the last 10 days of the month.

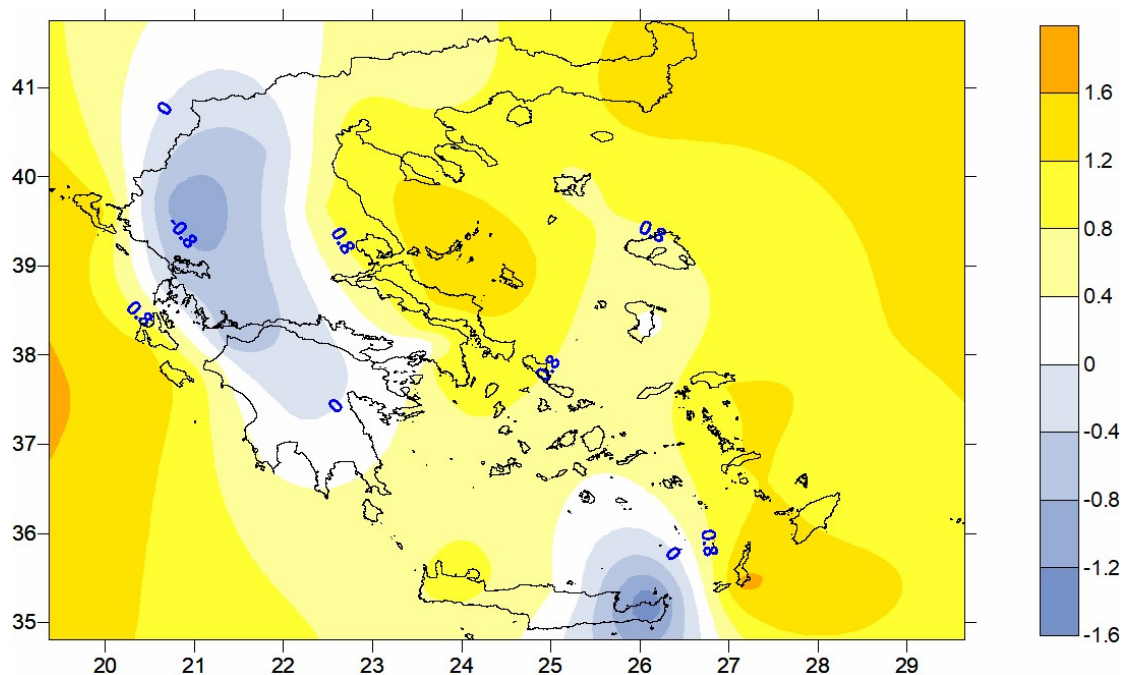


**Figure 27.** Mean temperature anomalies (°C) for September 2017 in Greece according to the 1971-2000 climatology.



**Figure 28.** Max temperature anomalies (°C) for September 2017 in Greece according to the 1971-2000 climatology.





**Figure 29.** Min temperature anomalies ( $^{\circ}\text{C}$ ) for September 2017 in Greece according to the 1971-2000 climatology.

The greatest mean monthly temperature anomalies in September were found in the east, central and northeast Greece with values 1.4 to 2.0  $^{\circ}\text{C}$  above monthly normals (1971-2000) while the lowest positive anomalies of mean monthly temperature ( $< 0.5^{\circ}\text{C}$ ) were found in West Greece (Figure 27). In agreement with mean temperature anomalies, the greatest positive maximum temperature anomalies (1.5 to 3.0  $^{\circ}\text{C}$ ) and the lowest positive anomalies ( $< 1.0^{\circ}\text{C}$ ) were found in the same areas while negative maximum temperature anomaly was detected only in east Crete (Figure 28). Minimum monthly temperatures were near or below normal values (1971-2000) in the western mainland and eastern Crete and above normal values for the remaining area (Figure 29).

According to monthly precipitation anomalies, Greece experienced a month of drought (anomalies were below normal values for the majority of the areas) and, only in the west Crete and in few other areas, precipitation anomalies above normal values were detected (Figure 30).

## **Records**

### **Temperature**

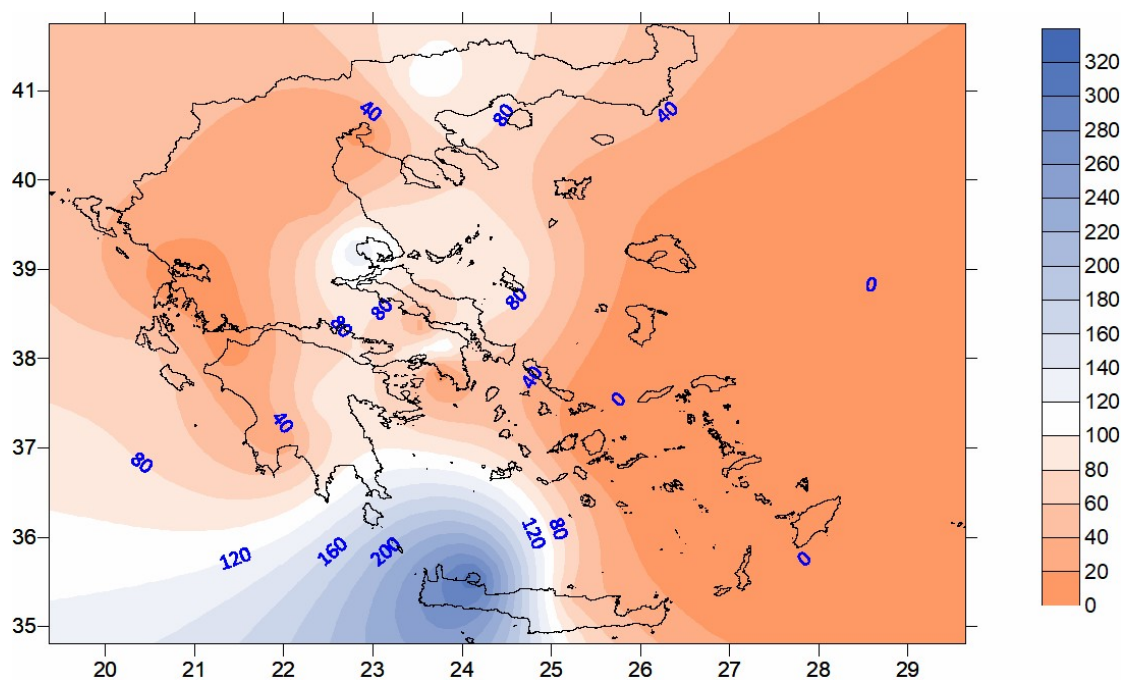
- On September 18, Serres station (WMO-Id: 16606) reported daily maximum temperature 39.9  $^{\circ}\text{C}$  while its normal monthly value is about 28.0  $^{\circ}\text{C}$ . Furthermore during 10 consecutive days (11-20 September), the maximum temperatures were above 34.0  $^{\circ}\text{C}$ . Also, station's mean monthly maximum temperature was 31.2  $^{\circ}\text{C}$ ,

which is the second highest mean monthly value in September since 1961 (previous mean monthly record of maximum temperature was 1994 with a value of 33.3 °C).

- On September 18, Tithorea station (WMO-Id: 16649) located in central mainland reported daily maximum temperature 41.0°C.

### Precipitation

- Souda (airport) station (WMO-Id:16746), located in west Crete, recorded on September 29, a daily (24-hour) precipitation 40.0 mm while its monthly normal value (1971-2000) is about 15.0 mm that is about 3 times above normal value.
- Chrysoupoli (airport) station (WMO-Id:16624), located in north Greece, reported on September 26, daily 24-hour precipitation 46.8 mm. (This station was not included in Figure 30 because the station operates since 1985).



**Figure 30.** September precipitation anomalies given in percentages according to the 1971-2000 climatology.

### High Impacts Events

- On 25 September, a heavy rainstorm hit the island of Samothraki (there is no meteorological station in the island) and many parts of the island were buried in mud. Greek authorities declared Samothraki in a state of emergency.

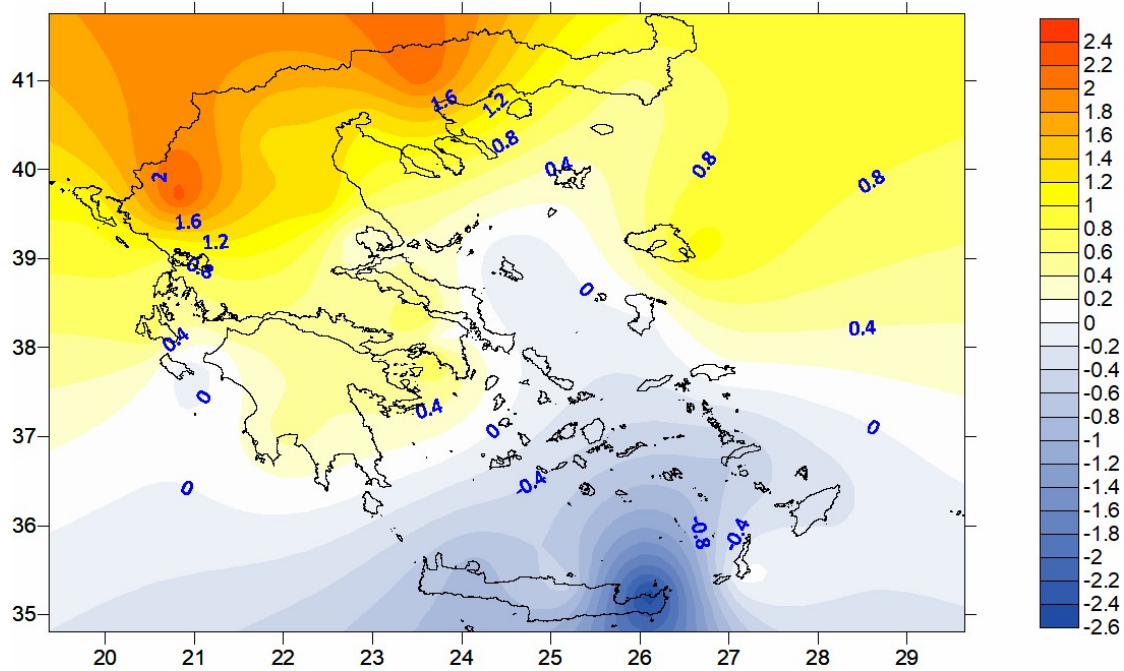


**Figure 31.** Samothraki island (source: <https://watchers.news/2017/09/28/samothraki-flood-greece/>).

# October

## Description

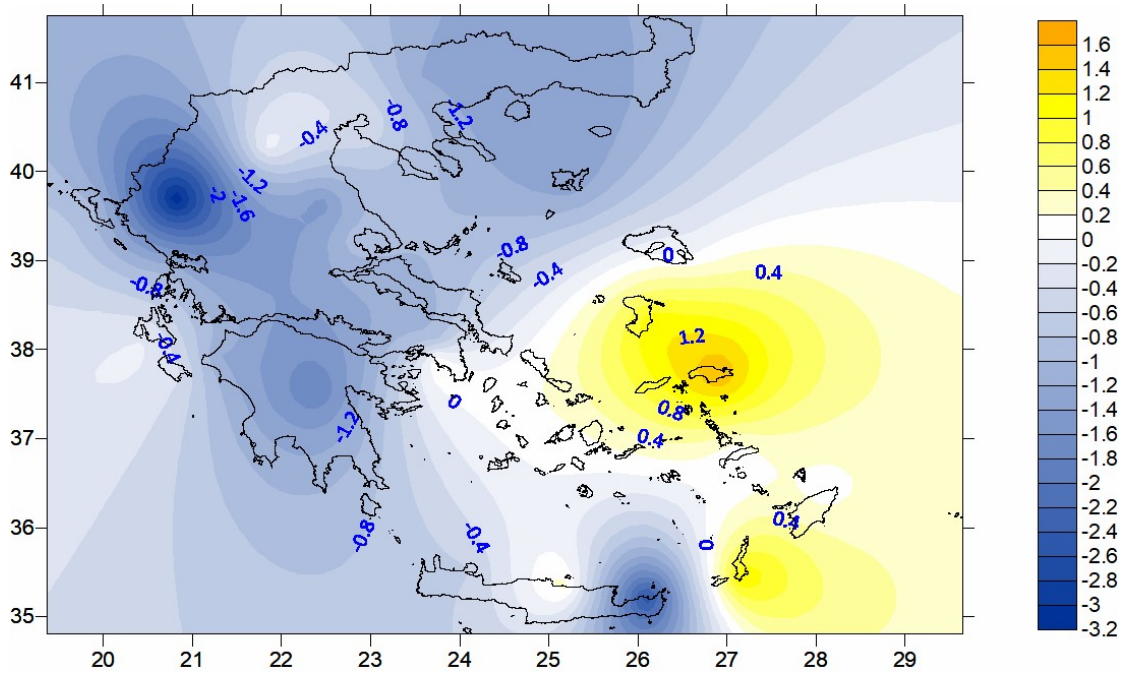
October 2017 was also characterized by temperature fluctuations (i.e high temperatures during the first days and low ones during the last days of the month). Moderate to strong rainfall, hailstorms and thunderstorms were recorded between 23 and 26 October.



**Figure 32.** Max temperature anomalies (°C) for October 2017 in Greece according to the 1971-2000 climatology.

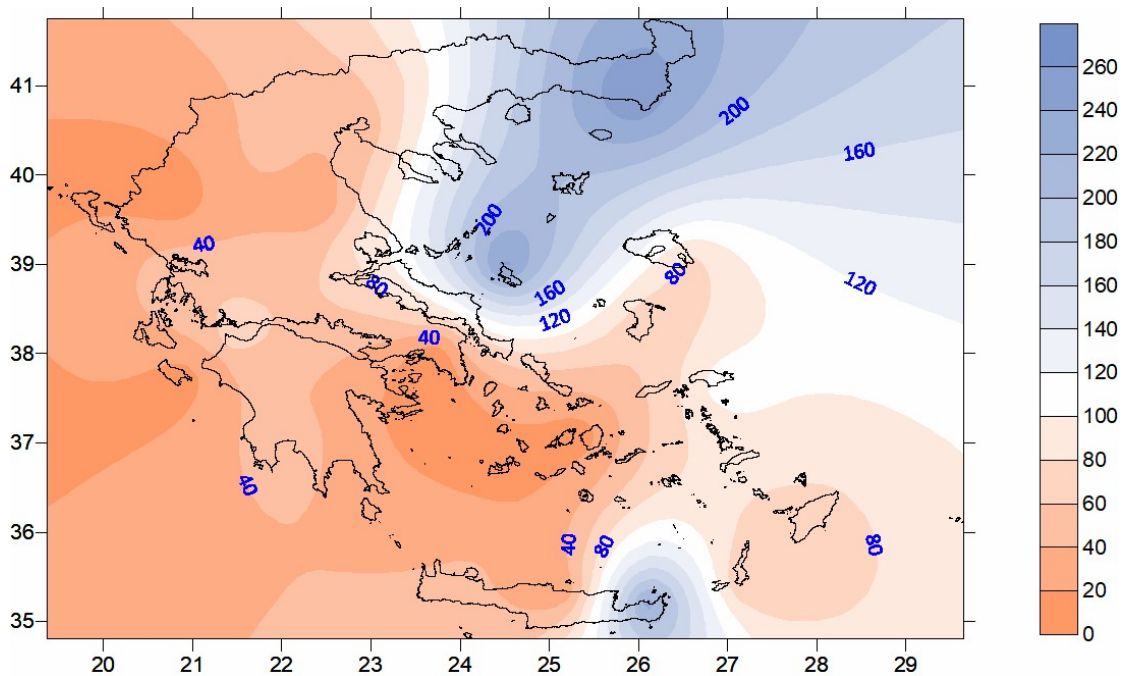
Monthly maximum temperatures in mainland were higher than normal values (1971-2000), with positive anomalies varying from 0.4 to 2.4 °C while negative maximum anomalies were observed in the south Aegean islands (Figure 32). On the contrary, the monthly minimum temperatures were lower than normal values (1971-2000) in the largest part of Greece with negative anomalies varying from -0.4 to -3.2 °C while positive minimum temperature anomalies were found only in the eastern Aegean islands (Figure 33).





**Figure 33.** Min temperature anomalies (°C) for October 2017 in Greece according to the 1971-2000 climatology.

Precipitation anomalies indicate that northeast Greece and locally Crete received a total precipitation amount of about 2.0-2.5 times above normal values (1971-2000) (Figure 34).



**Figure 34.** October precipitation anomalies given in percentages according to the 1971-2000 climatology.

## **Records**

### **Precipitation**

- Skyros (airport) station (WMO-Id:16684), located in North Aegean, recorded on October 25, 12-hour precipitation of 44.30 mm, while its monthly normal value (1971-2000) is about 29.8 mm.

### **High Impacts Events**

- Between 24 and 25 October, heavy rainfall and hailstorm caused damages in the town of Marathon (north-east Attica), in central Greece and particularly in Fthiotis region and Skyros island.

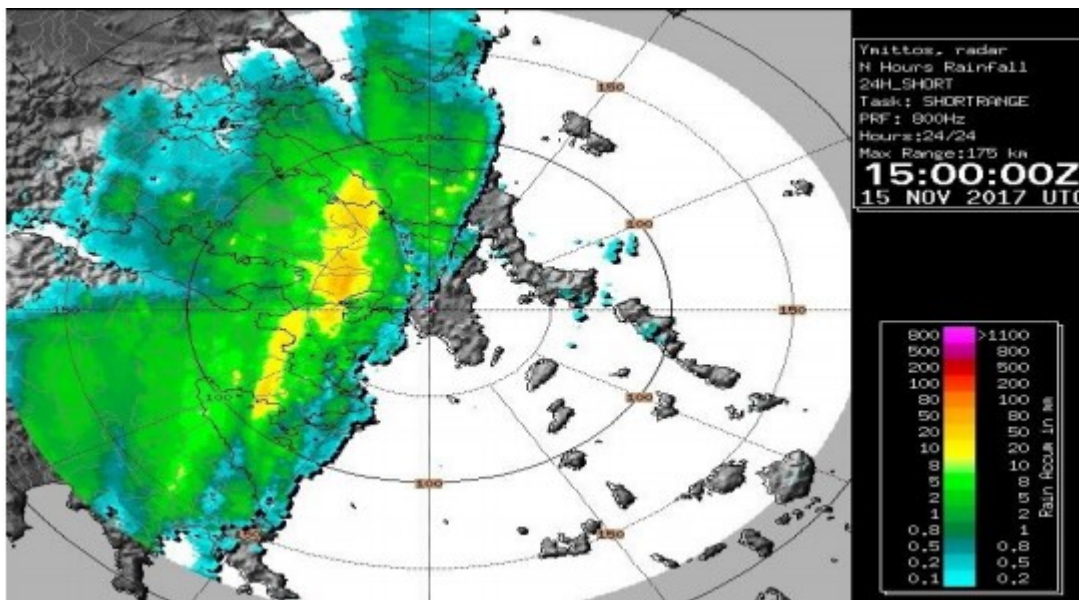
# November

## Description

In contrast to October 2017, November was a wet month for the wider area of Greece. Low pressure systems, accompanied by frontal activity, affected mainly the Ionian Sea islands and mainland, causing locally severe weather phenomena.

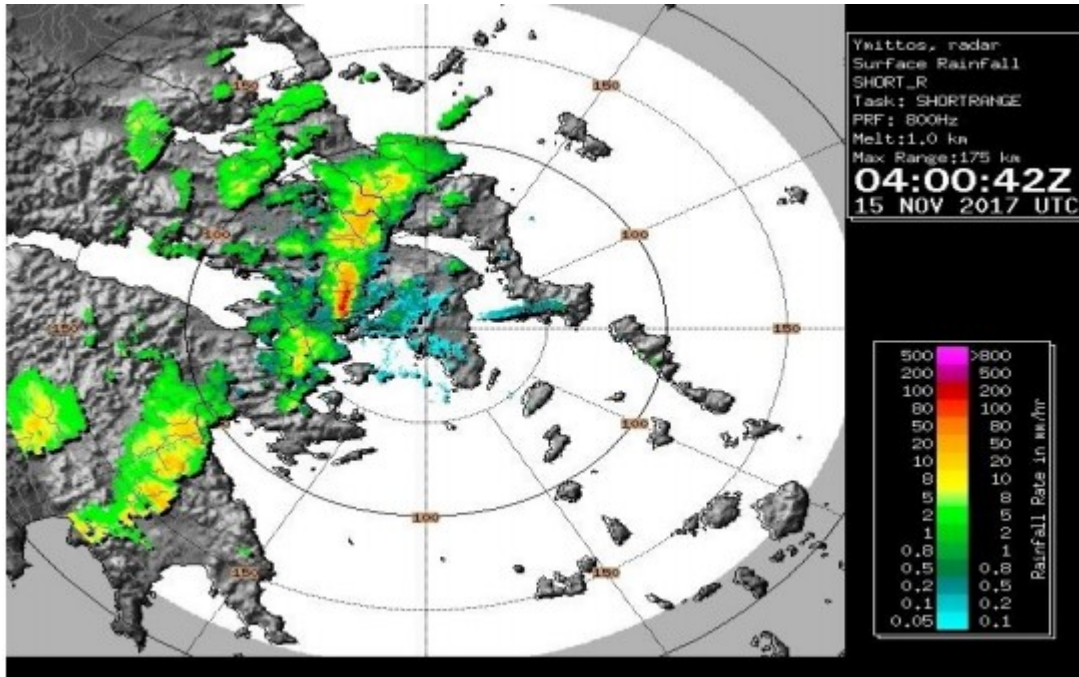
On 11 November a cut-off upper low over Tunisia accompanied by a corresponding low pressure center in the sea level pressure field over the Gulf of Syrtis produced widespread thunderstorms across the central Mediterranean region, mainly over Sicily, Malta and north Ionian Sea. On 12 November, the cut-off low moved east northeast and on 13 November affected at first the west Greece and gradually the eastern areas including Attica, Cyclades, Crete, and Dodecanese islands causing locally strong flash flooding (e.g Symi island). Also on 13 November a second deep low over the gulf of Genoa (995hPA surface pressure for 00UTC) pushed polar air towards the southern Italy. From 15 November onwards the low widened and moved to the Central Mediterranean. Over the warm Ionian Sea the cold and humid air mass destabilized, under weak vertical wind shear, causing the formation of a Medcane (Mediterranean tropical –like hurricane).

On 15 November major flash floods hit western Attica, after a night of intense rainfall. In particular, flooding hit the towns of Mandra and Nea Peramos. According to the HNMS's radar recordings the 24 hour accumulated precipitation over the wider area of the Mount Pateras (west Attica) during 14 - 15 November was 80mm approximately (there is not meteorological station in that region) (Figure 35). Also the HNMS's radar recorded the intensity of rainfall over west Attica (Figure 36).



**Figure 35.** Radar-estimated precipitation accumulation during 14 – 15 November 2017.



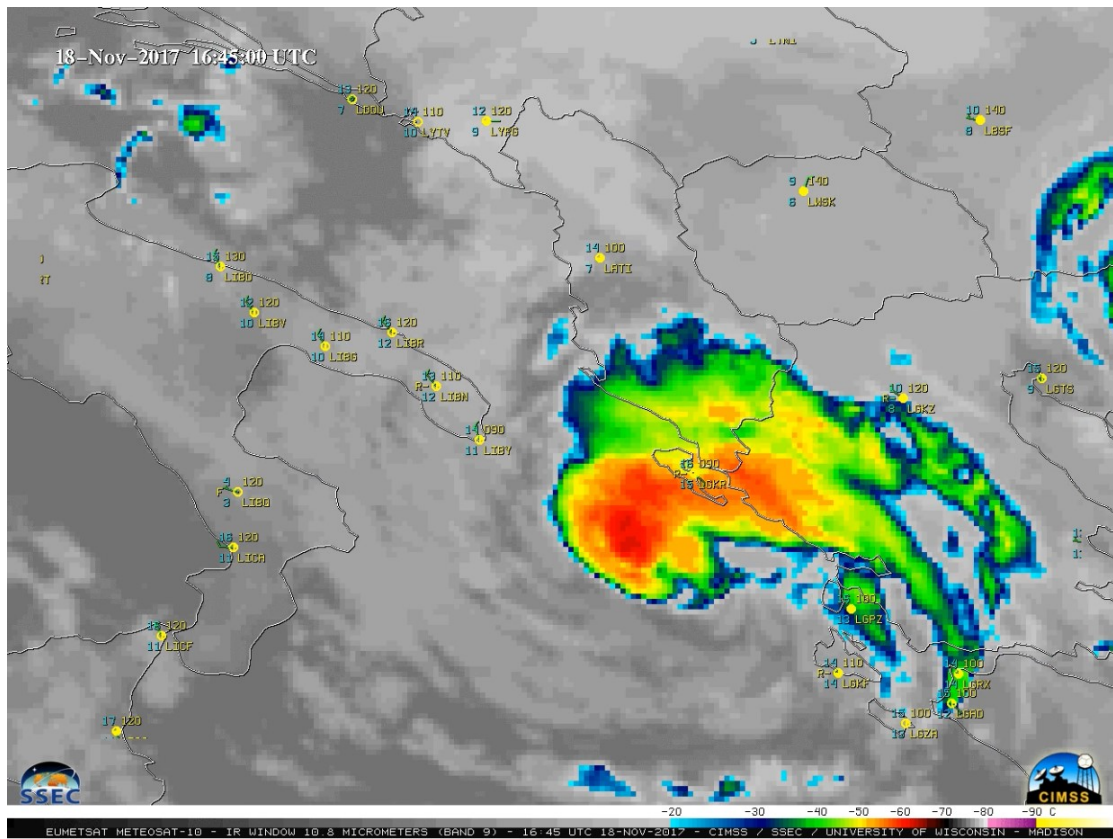


**Figure 36.** HNMS's radar image on November 15, 04:00 UTC, rainfall rate exceeded 100 mm/h (darker red).

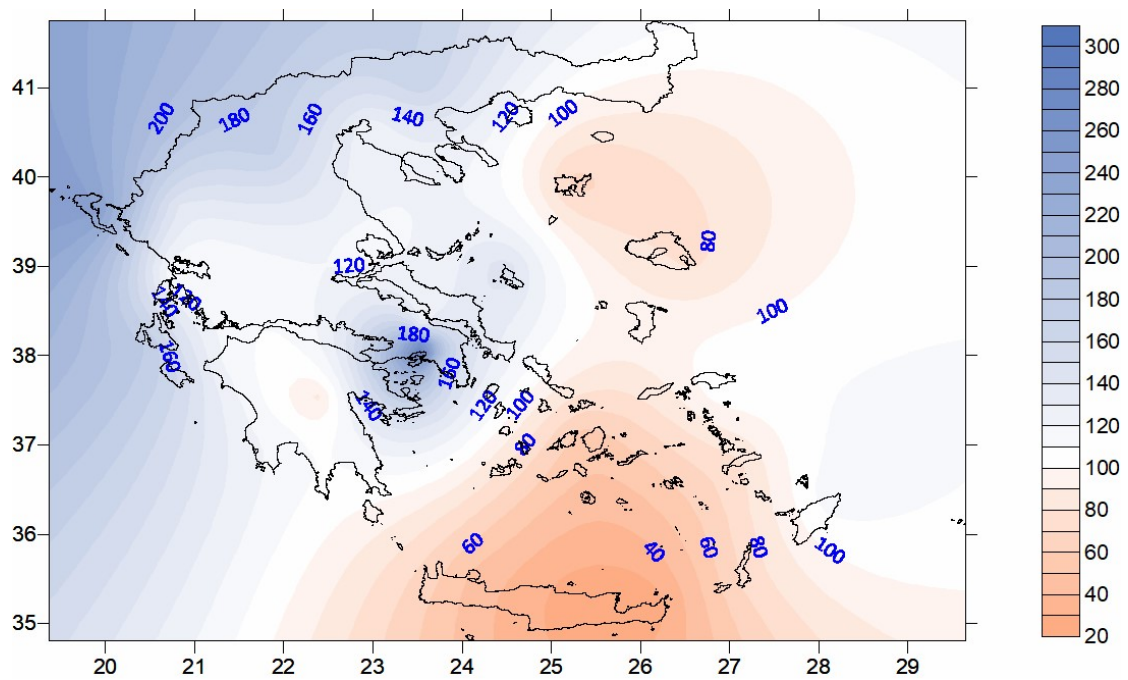
The two figures below indicate the appearance of Medicane on 18 November. A whirl of convective cloud and a distinct quasi cloud-free eye is obvious (Figure 37). However by the evening of 18 November the Medicane had dissipated.



**Figure 37.** A well defined eye structure of Medicane over the north Ionian Sea on November 18, 12:00 UTC (Terra MODIS and Suomi NPP VIIRS true-color RGB, source: <http://cimss.ssec.wisc.edu/goes/blog/archives/26136>).



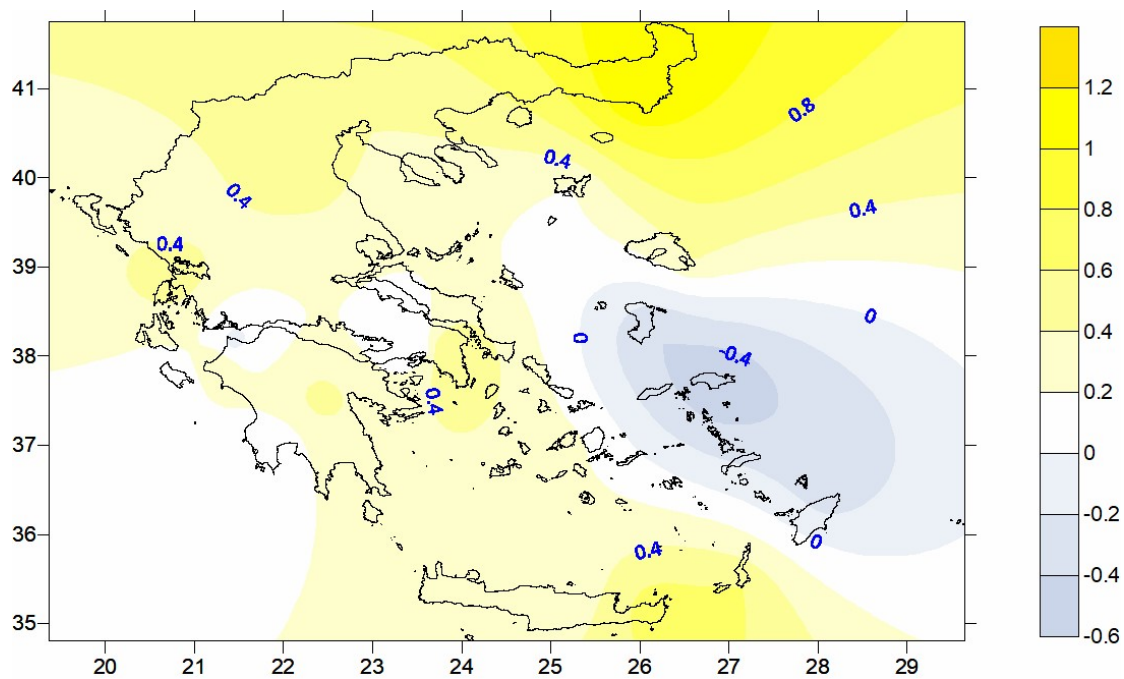
**Figure 38.** On November 18, 16:45 UTC Meteosat-10 Infrared Window (10.8  $\mu\text{m}$ ) image showed cloud-top infrared brightness temperatures around  $-60^{\circ}\text{C}$  (darker red)(source: <http://cimss.ssec.wisc.edu/goes/blog/archives/26136>).



**Figure 39.** November precipitation anomalies given in percentages according to the 1971-2000 climatology.

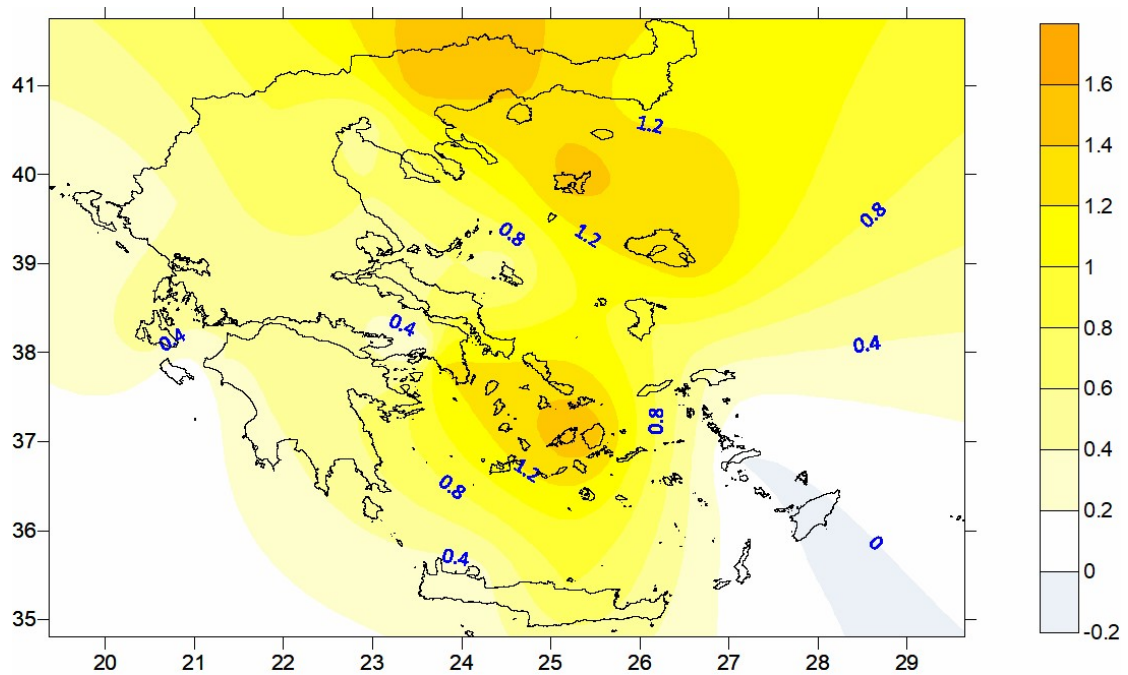
An analysis of precipitation anomalies (Figure 39) reveals that monthly precipitation for the west, north and central Greece (including Attica) was 110-300 % above normal values (1971-2000). On the other hand, precipitation anomalies for the most Aegean islands were 20-80 % below normal values (1971-2000).

Analyzing temperature anomalies in November, the mean temperatures varied from 0.2 to 1.2 °C above normal values (1971-2000) for the greatest part of the country but, for the east Aegean islands and Dodecanese, they were 0.2-0.6 °C below normal values (1971-2000) (Figure 40). Monthly maximum temperatures were 0.2 - 1.6 °C above normal values (1971-2000) for almost the entire country (Figure 41) and monthly minimum temperatures were near normal values (1971-2000) for most of the regions except the southern and eastern Aegean islands, where they varied from 0.1 to 0.7 °C below normal values (1971-2000) (Figure 42).

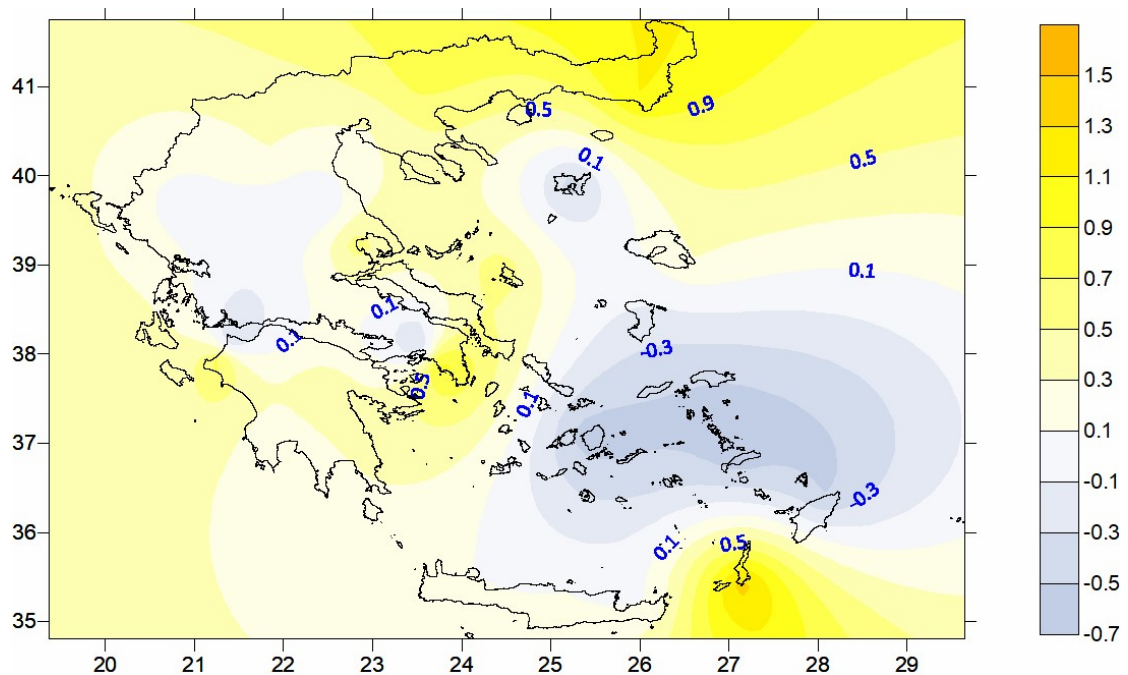


**Figure 40.** Mean temperature anomalies (°C) for November 2017 in Greece according to the 1971-2000 climatology.





**Figure 41.** Max temperature anomalies (°C) for November 2017 in Greece according to the 1971-2000 climatology.



**Figure 42.** Min temperature anomalies (°C) for November 2017 in Greece according to the 1971-2000 climatology.

### **Records**

#### **Precipitation**

- Kerkyra (airport) station (WMO-ID: 16641), located in the north Ionian Sea, reported total monthly precipitation of 439.0mm, while its monthly normal value (1971-2000) is 182.0mm. Also, the station reported its second wettest November since 1955

(previous record of monthly total precipitation was 446.0 mm on November 2000). Moreover on 11, November the station recorded daily (24-hour) precipitation of 94.0 mm.

- Elefsis (airport) station (WMO-ID: 16718), located in west Attica, reported total monthly precipitation of 194.0 mm while its monthly normal value (1971-2000) is about 64.0 mm. Moreover, the 4-day total precipitation measured between 14 and 17 November was also high (108.9mm).

### **High Impacts Events**

- On 11 November, one human fatality and dozens of trees fallen in Kerkyra island.
- On 13 November, heavy rainfall hit Symi island causing flash flooding and major problems in infrastructures, such as power and water supply. Greek authorities declared a state of emergency on the island of Symi.
- On 15 November, a sudden flash flooding over west Attica caused 23 fatalities. The flooding came after a severe overnight storm. Roads were turned into muddy rivers and dozens of people were trapped inside their flooded homes. Cars, trucks, and buses were trapped in an inundated underpass in the highway between Athens and Corinth. A state of emergency has been declared in the west Attica region.



**Figure 43.** Symi island on 13 November 2017(source: <https://www.tilegrafima.gr/nea/symi-kakokairia-se-katastasi-ektaktou-anagkis-nisi-foto/>).



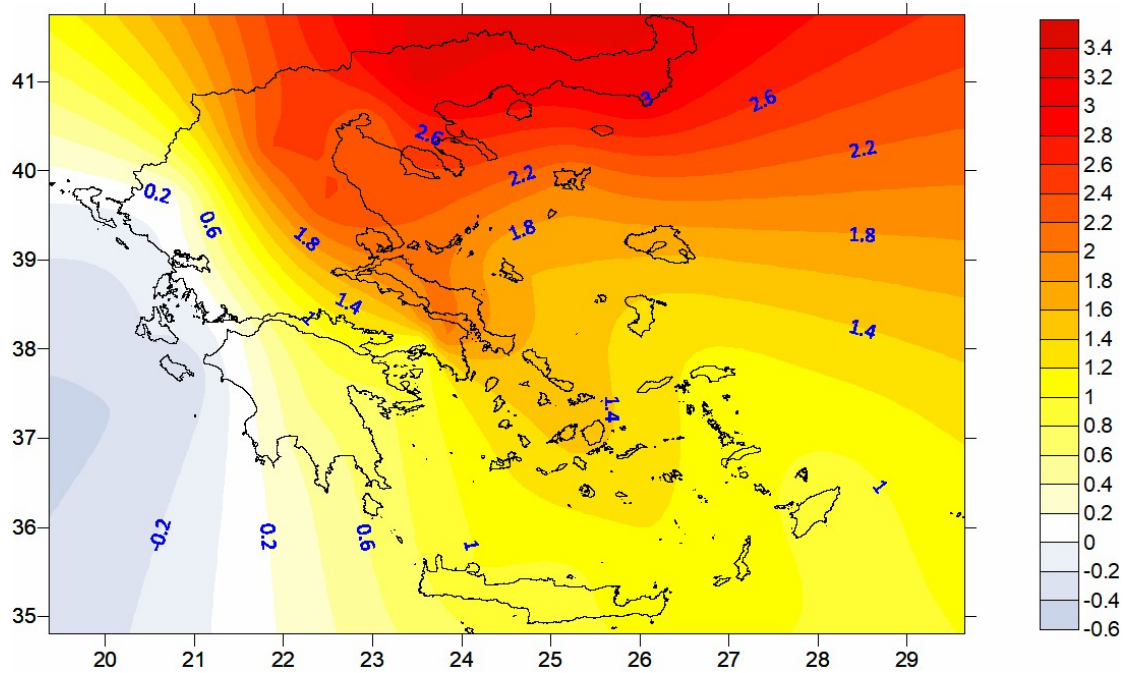
**Figure 44.** Flash flooding over Mandra (west Attica) on 15 November 2017(source: <http://www.severe-weather.eu/news/intense-flash-floods-hit-western-attica-greece-today-november-15-2017/>).



# December

## Description

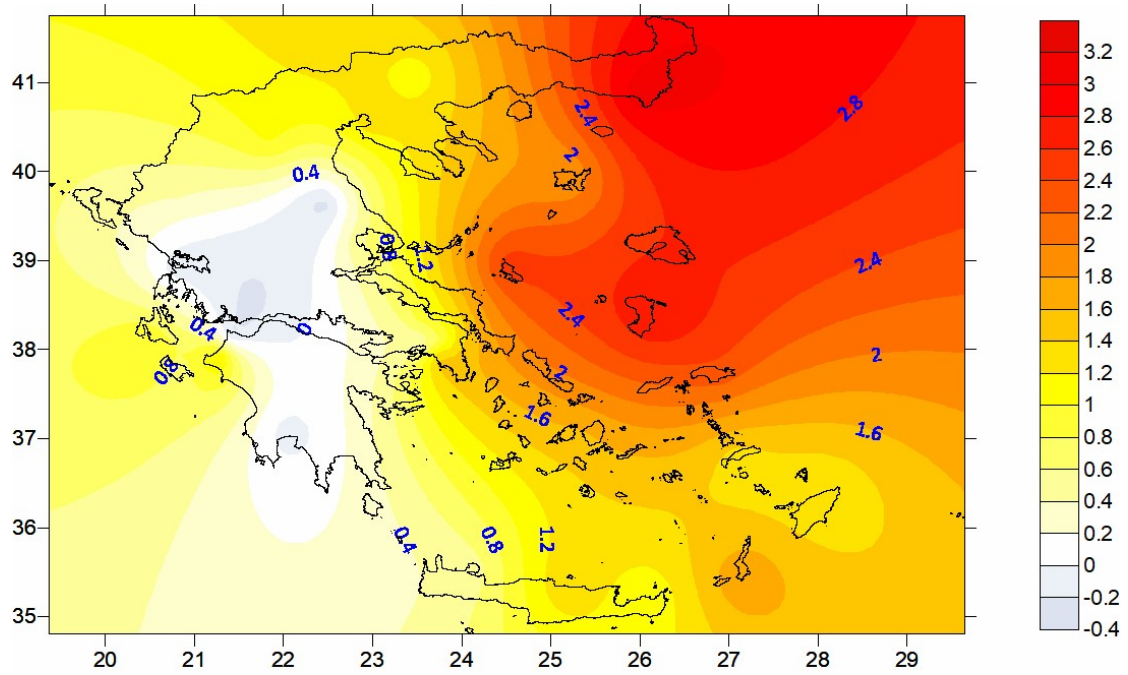
Analyzing monthly temperatures, it was identified that December was a warmer than average month. Monthly maximum temperature anomalies were positive for almost the entire country, with values ranging from 0.2 to 3.4 °C (Figure 45). The greatest positive anomalies were found in the northeastern regions. Slightly negative maximum temperature anomalies were detected only in west Greece, with values ranging from -0.2 to -0.6°C.



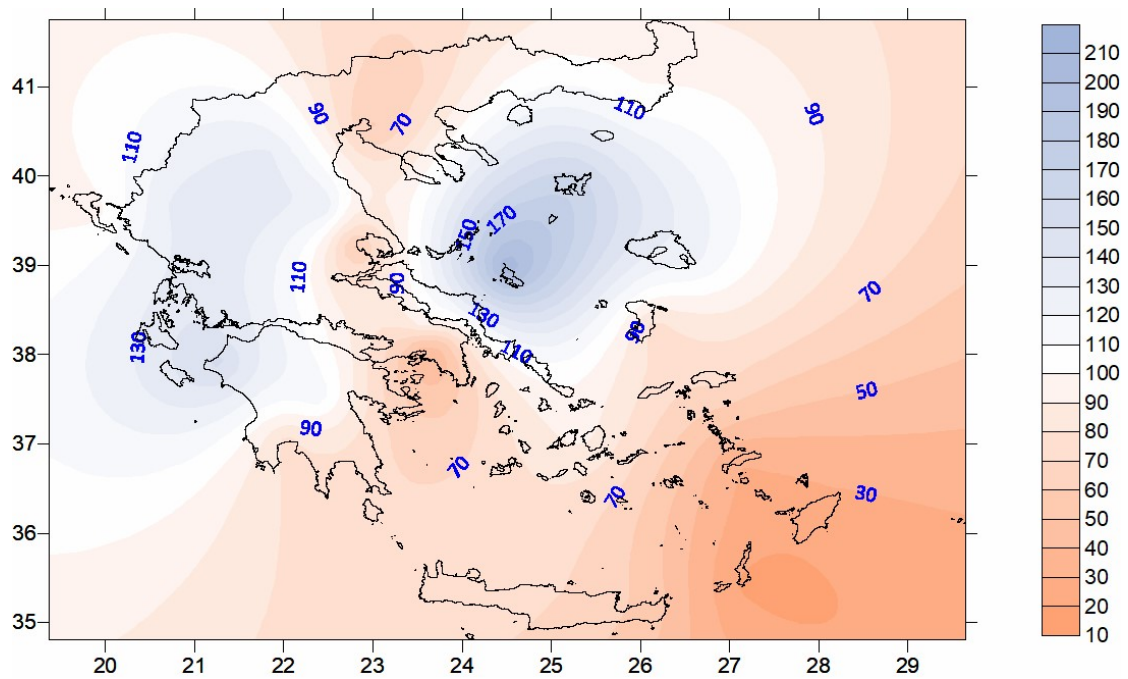
**Figure 45.** Max temperature anomalies (°C) for December 2017 in Greece according to the 1971-2000 climatology.

Also, the monthly minimum temperature anomalies were positive for the largest part of the country. The greatest positive anomalies (1.4 – 3.2 °C) were found in the eastern regions (Figure 46). Slightly negative minimum temperature anomalies were detected only in central and south mainland with values ranging from -0.2 to -0.4°C.

Figure 47 presents the monthly precipitation anomalies. West Greece and northeast Aegean received the higher amounts of precipitation, where monthly precipitation anomalies varied from 110 %- 210 % above normal values.



**Figure 46.** Min temperature anomalies (°C) for December 2017 in Greece according to the 1971-2000 climatology.



**Figure 47.** December precipitation anomalies, given in percentages, according to the 1971-2000 climatology.

### Records

#### Temperature

- At the beginning of December Alexandroupolis station (WMO-ID: 16627) recorded for 4 consecutive days daily maximum temperature equal or above 18.0 °C while its

monthly normal value (1971-2000) is about 10.0 °C. Furthermore, station's mean monthly maximum temperature was 13.5 °C.

- on December 3, Serres station (WMO-ID: 16606) reported a daily maximum temperature of 22.6 °C while its monthly normal value (1971-2000) is about 9.1 °C. Also Macedonia (airport) station (WMO-ID: 16622) recorded a daily maximum temperature of 20.5 °C while its monthly normal value (1971-2000) is about 10.8 °C.

### **High Impacts Events**

No high impact events

**End of the report**