ΕΘΝΙΚΗ
ΜΕΤΕΩΡΟΛΟΓΙΚΗ
ΥΠΗΡΕΣΙΑ
HELLENIC NATIONAL METEOROLOGICAL SERVICE

Annual Bulletin on the Climate in Greece 2019

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Notable weather and climate events in Greece 2019

There were many significant weather and climate events in 2019 including summer storms, floods, heavy precipitation episodes and landslides.

Snowfall and Frost

- **Janurary** 1-2, 2019: Fifty people were trapped in Fthiotida (central mainland) due to severe snowfall, while flooding and landlides occurred in (west) Crete in the area of Chania.
- **January** 3-5, 2019: Snowfall caused traffic and electricity problems in central Greece. Also three people were trapped in their cars and lost their lifes in Keratea, Attica, due to heavy flooding.
- **January** 3-17, 2019: Total frost in Florina, the minimum temperature in Florina on 8th of January reached -23^{o}C, 2nd lowest value since 1960.
- **January** 7-9, 2019: Snowfall in Skopelos island caused electricity network and traffic problems. Frost and fog caused traffic problems and cancellations of flights in Thessaloniki. Many schools in north and central Greece shut down. On 9th of Januray, Tatoi (Attica) recorded -8.9 ^{o}C, 2nd lowest value since 1960.

Heavy Precipitation, Storms and Landslides

- **January** 22–27, 2019: Intense hailstorm in Messinia caused traffic problems. Heavy precipitation caused overflow of river Evrotas in Laconia region, extensive landslides and destructions in the Peloponese road network. Nine people were trapped due to floods in Messinia. Floods also in Lesvos island, Kavala and Drama.
- **February** 5-6, 2019: Landslides in Crete due to heavy rainfall, a 25 ton rock broke off and crashed into a house in the Ammoudari village in the region of Sfakia (Crete). Floods in Peloponnese and Rhodes island. Strong gale winds in Rhodes caused fallen trees and damages to roads, homes, cars. Electricity problems in Rhodes and cancellations of scheduled ferry routes and flights.
- **February** 12-17 and 23-26, 2019: Heavy precipitation events caused severe flooding, landslides and destructions in infrastructures in the area of Crete. As a result, five people lost their lives.
- **April** 5-6, 2019: Instense rainfall caused flooding roads in eastern Crete, people were trapped and crops were destroyed.
- **June** 11th , 2019: Heavy rain caused flooding in Varkiza (suburb of southern Attica) and traffic problems.
- **June** 18th and 19th, 2019: Summer thunderstorms with insense electrical activity accompanied by hail caused flooding in Attica.
- **July** 10-11, 2019: Storm affected cental and east Macedonia, mainly the Perfecture of Halkidiki.
- **July** 14-17, 2019: Heavy thunderstorms affected mainly south Ionio, west Greece, west Crete, and Sporades islands and caused flooding and destructions.
- **November** 2019: Several short-lived precipitation events caused flooding in various regions and losses of lives in the Corinthian Gulf and in Kos and Rhodes islands.

Temperature

- **August** 2019 was very warm.
- **November** 2019: Many central and northeastern areas experienced the warmest November on record.

1. Annual Survey

This section presents an overview of the spatial patterns of mean annual climate conditions in 2019 and anomalies related mainly to the normal period 1971-2000 of the following basic climate variables: temperature and precipitation.

1.1 Temperature

Mean annual temperature in Greece varied from +0.5 to + 2.2 ^{o}C above the 1971-2000 average values. The greatest positive departures from normal values occured in the northeastern mainland and the lowest ones in west Crete (Figure 1).

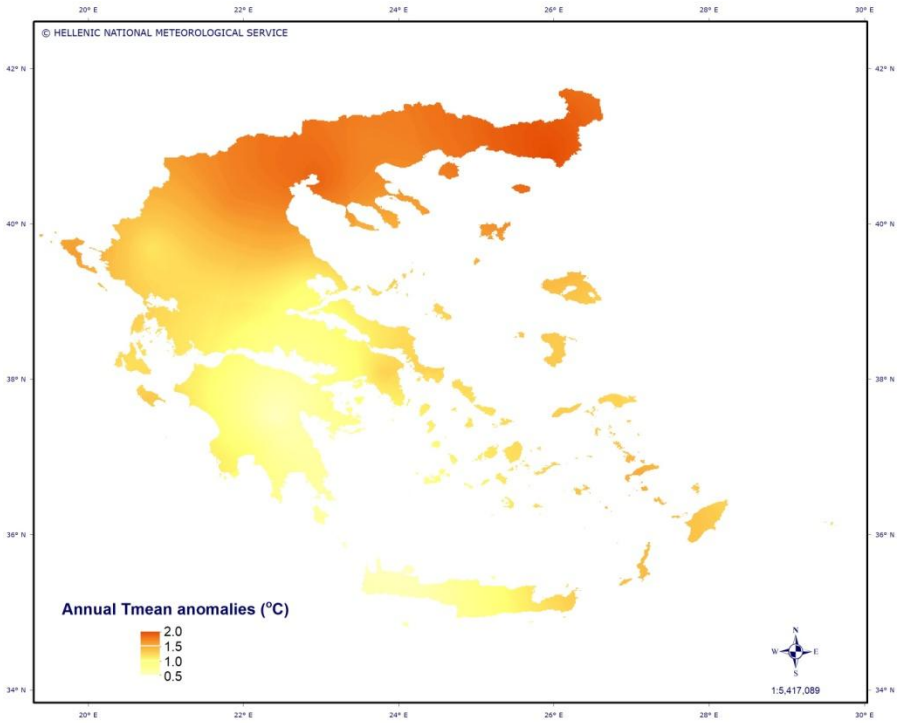


Figure 1. *Annual mean temperature anomalies (°C) in 2019 in Greece according to the 1971-2000 climatology.*

1.2 Precipitation

Above average **annual precipitation** was observed across much of the country. Annual precipitation anomalies expressed as a percentage of the (1971-2000) average, ranged from 92 % to 270 %. The highest percentage value was observed in Skyros island, which is part of the Sporades archipelago in

northwest Aegean. Also, wet conditions dominated over Attica region and west Crete. Figure 2 shows the annual precipitation anomalies, with respect to 1971-2000.

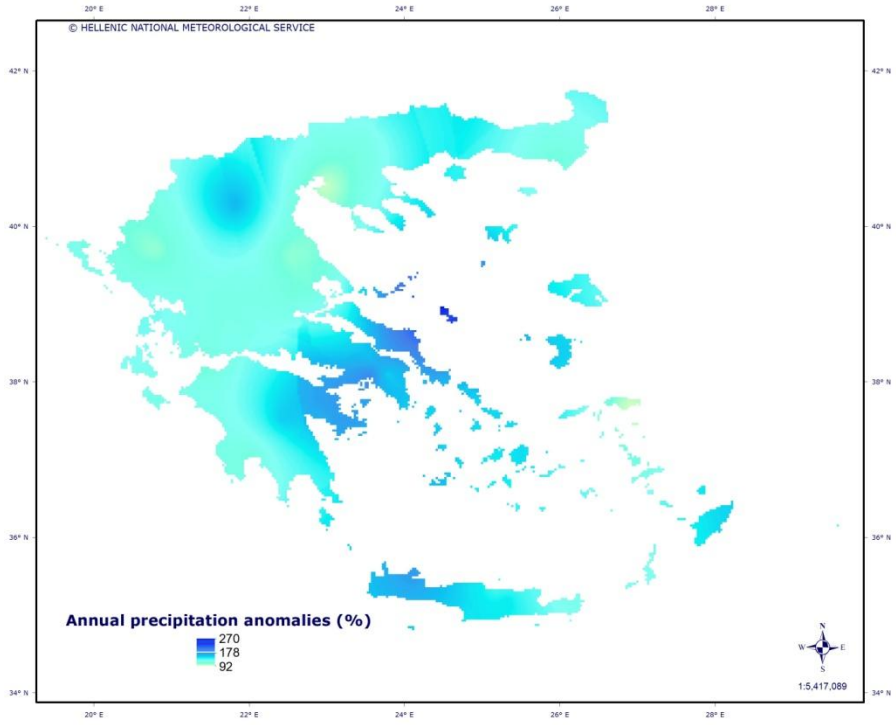


Figure 2. *Annual precipitation anomalies 2019 (%) compared to 1971-2000 climatology .*

2. Seasonal Survey

This section presents an overview of the spatial patterns of seasonal mean climate conditions in 2019 and anomalies related mainly to the normal period 1971-2000 of the following basic climate variables: temperature and precipitation.

2.1 Temperature

Mean temperature in winter of 2018/2019 (December, January, February) was below or near to normal values compared to the 1971-2000 climatology. Seasonal mean temperature anomalies ranged from -2.0 ^{o}C to +1.3 ^{o}C; positive temperature anomalies were found only in the eastern parts of the country (Figure 3).

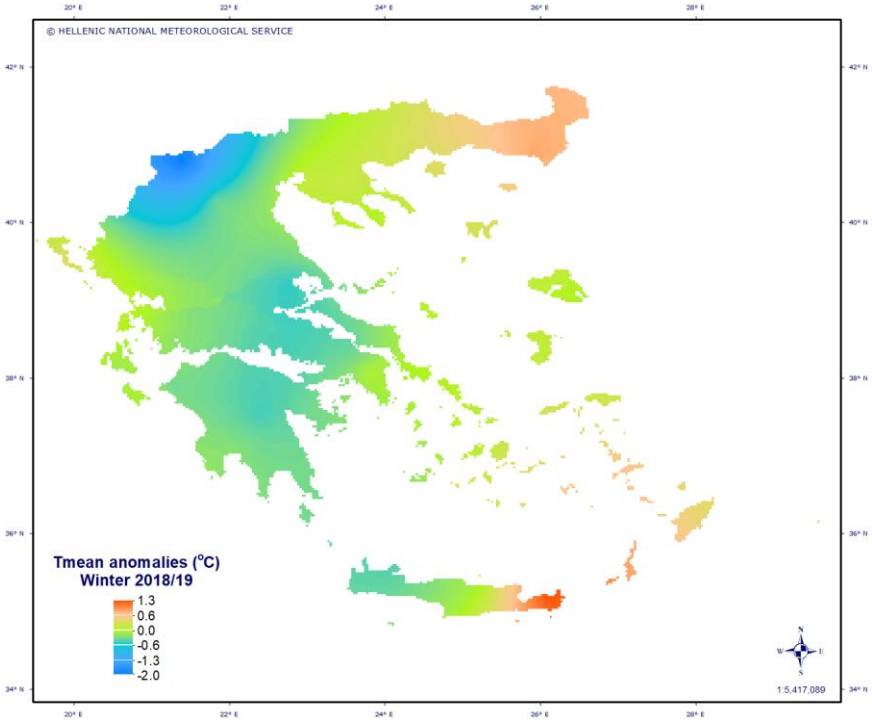


Figure 3. *Mean temperature anomalies (°C) for winter 2018/19 in Greece according to the 1971-2000 climatology.*

Mean temperature in spring 2019 (March, April, May) was generally near to normal values, except northern Greece and east Aegean islands where mean temperature anomalies ranged from +1.0 to +2.0 ^{o}C. Slightly negative mean temperature anomalies were found only in southwestern regions (Figure 4).

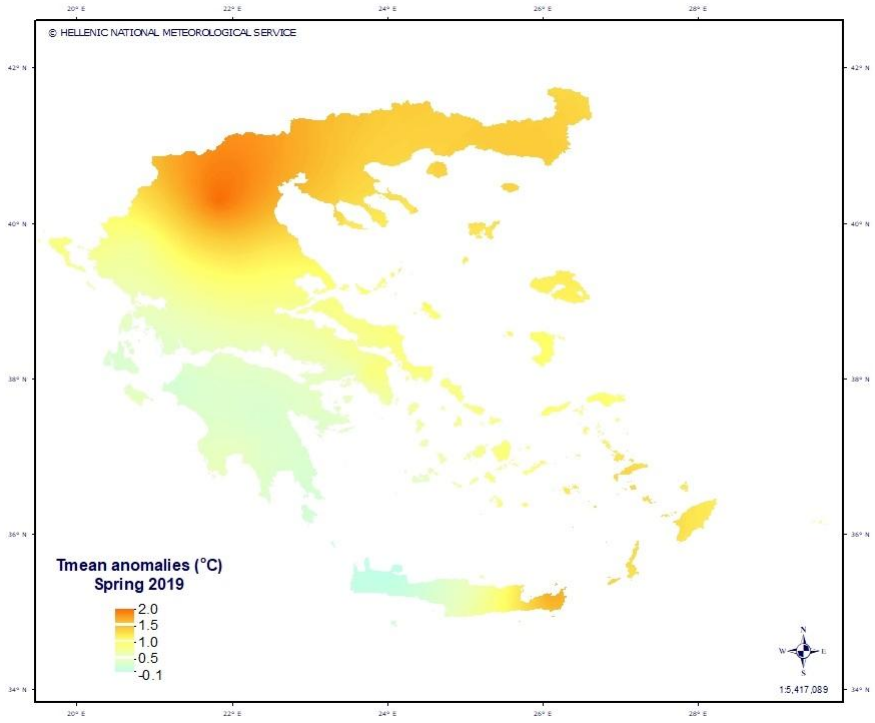


Figure 4. *Mean temperature anomalies (°C) for spring 2019 in Greece according to the 1971-2000 climatology.*

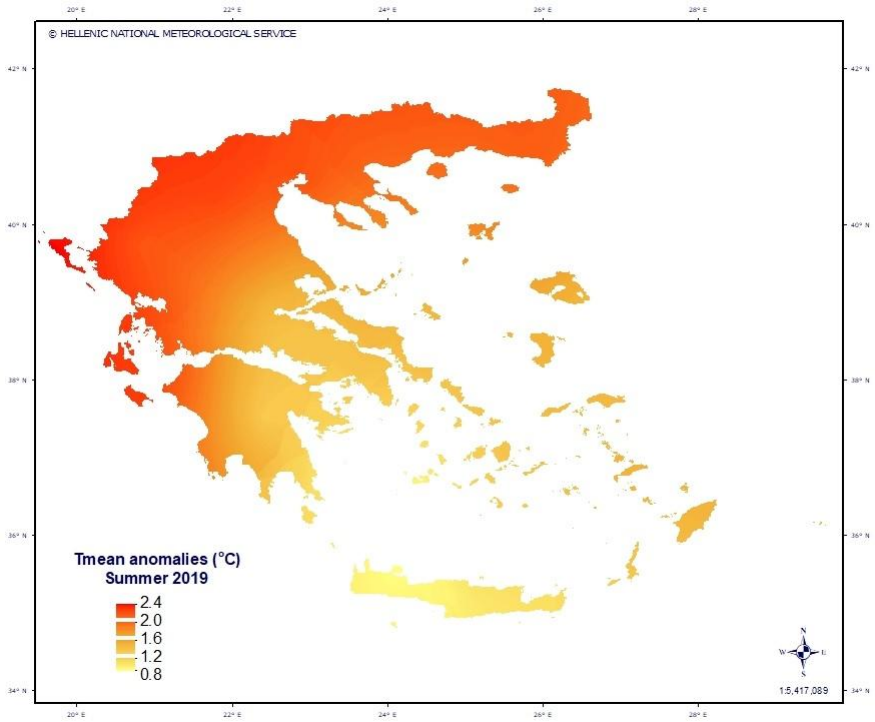


Figure 5. *Mean temperature anomalies (°C) for summer 2019 in Greece according to the 1971-2000 climatology.*

Europe experienced its warmest June on record and its fourth warmest summer. **Summer 2019** (June, July, August) in Greece is also classified as warm especially for the northern regions. Summer mean temperature anomalies ranged approximately from +0.8 to +2.4 °C (Figure 5). The highest positive anomaly occurred in northwest regions and the lowest anomaly in southewest Aegean.

The summer (June through August) 2019 average mean temperature for Greece (long term data series of 31 meteorological stations were used to derive summer average mean temperature for the whole country) was nearly 27 °C, about 1.7 °C above the normal 1971-2000. Figure 6 shows the summer average mean temperature anomalies in Greece from 1960 to 2019. It is noticable that the summer mean temperature remained relative low before 1992, and then started to rise and reached a local peak in 2012 which was the warmest summer on record. The second warmest summer in Greece remains 2007. Also during the last five summers (2015-2019) mean temperature anomaly exceeded 1.5 °C three times.

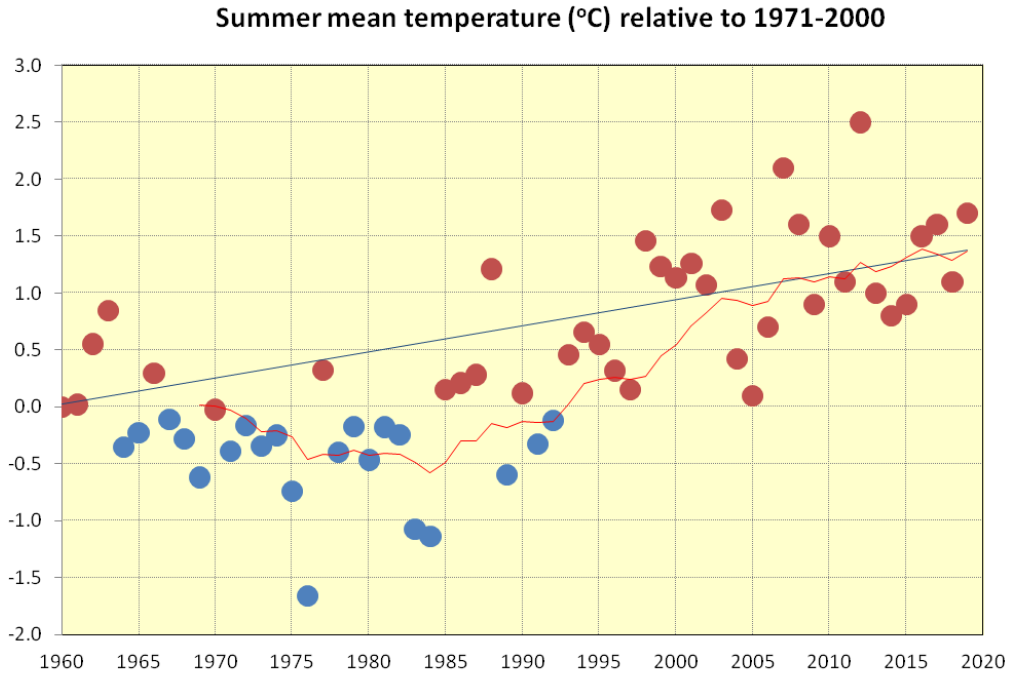


Figure 6. *Summer (June through August) 2019 averages of mean surface air temperature anomalies for Greece (taking into account 31 stations) relative to 1971-2000. The red line indicates the ten-year moving average, and the blue line indicates the long-term linear trend.*

Autumn of 2019 (September, October, November) in Greece was warm. The average mean air temperature in autumn was +2.0 to +3.0 °C above normal values (1971-2000) for the most of the territory (Figure 7). Moreover November of 2019 was exceptionally warm; mean air temperature values were +2.4 to +5.5 °C above normal (1971-2000) mainly over central and northeastern regions.

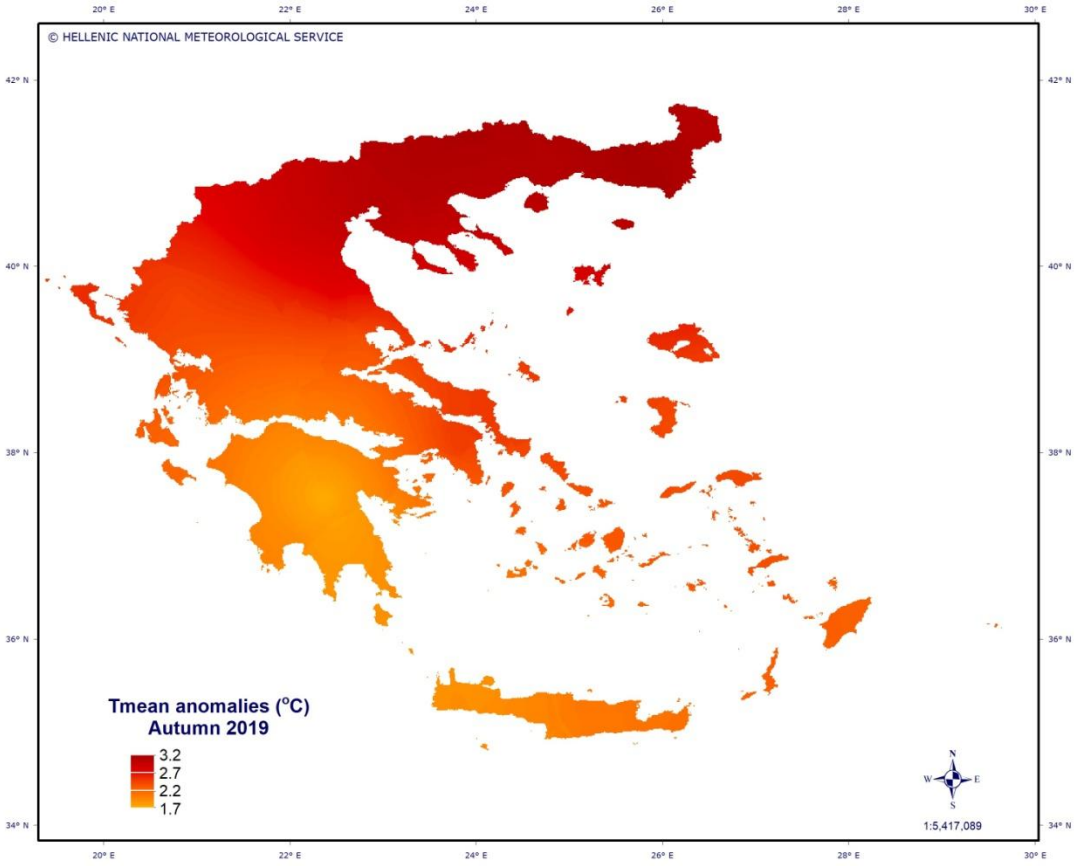


Figure 7. *Mean temperature anomalies (°C) for autumn 2019 in Greece according to the 1971-2000 climatology.*

2.2 Precipitation

Winter of 2018/19 was wetter than normal in southern parts of the Greek territory. Winter 2018/2019 precipitation anomalies ranged from 70 % to 310 %. Total winter precipitation accounted for more than 120 % of normal values (1971-2000) over southern Greece, while locally over west Crete and east Peloponnese, accounted for more than 200 % of normal values. On the other hand, total winter precipitation accounted for 70-80 % of normal values (1971-2000) over the northwest mainland (Fig. 8).

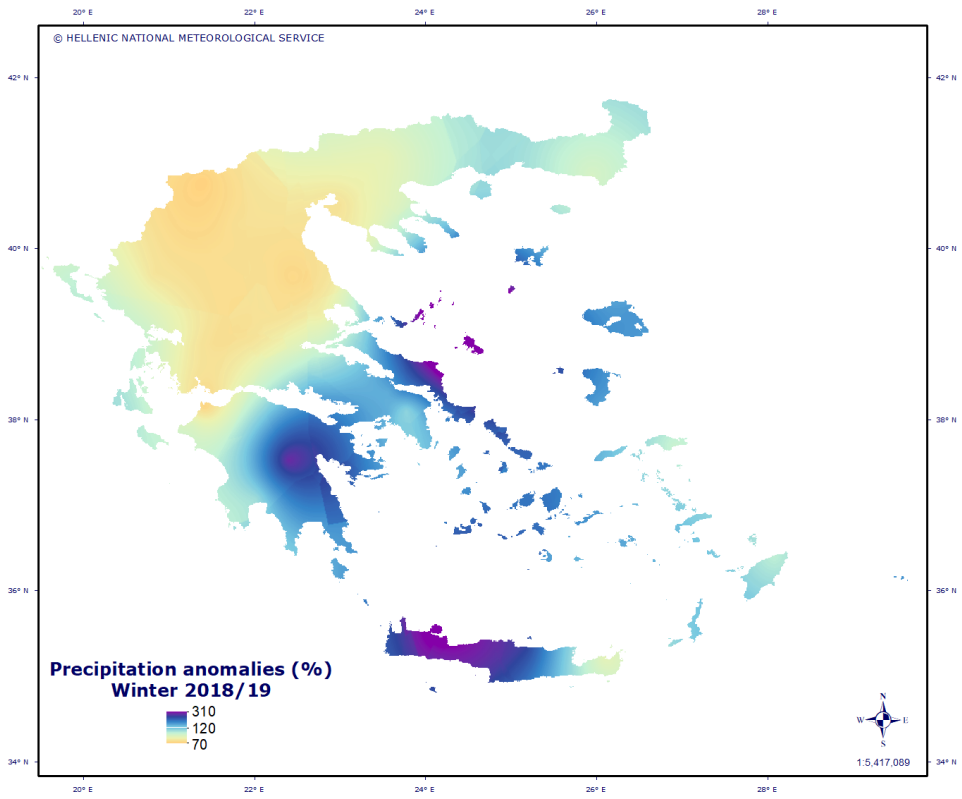


Figure 8. *Winter 2018/19 precipitation anomalies (%) compared to 1971-2000 climatology.*

Precipitation received across Greece during **spring 2019** (March, April, May) was variable by region with the eastern and southern portions of the country receiving above-average precipitation and the western parts of the country receiving below-average precipitation. More specific, spring of 2019 was drier than normal across Ionian islands, west Peloponnese and most of regions in central and north mainland, where spring precipitation totals accounted for 50 % - 90% of normal values (1971-2000). On the other hand, it was wetter than normal across the southern regions and especially the south Aegean islands, where spring precipitation totals accounted for 120% - 160% of normal values (1971-2000). Dry conditions dominated during March and May across most of the parts of the country, while rainy conditions dominated during April mainly across eastern Greece. The average precipitation in April (taking into account 31 stations) was about 65mm accounted for 170 % of normal value. It is woth to

mention that Elefsis station reported monthly total precipitation approximately 172 mm while the 1971-2000 average is 27.7mm, more than six times the normal of the month.

Precipitation in **summer 2019** was generally above or near to normal values (1971-2000) for the most of the country, except for some regions of Peloponnese and Sterea and few islands in the north Ionian and northeast Aegean which experienced below-average precipitation. On the contrary, west Crete experienced much above-average precipitation; the summer total precipitation for Souda was 72 mm, while the 1971-2000 average is approximately 5.0 mm. It is notable that the 72 mm of rain recorded in Souda in 8 hours (on 17th of July) and it was fifty times the normal of the month.

Autumn 2019 (September, October, November) was dry for the southern parts of the country. More spesific, below-average precipitation fell across the Crete and southeastern Aegean islands, with the expeption of Rhodes island, which experienced above-to much-above-average precipitation. On the contrary, near to or above-average precipitation was observed across west Greece and most parts of mainland. Figure 9 represents automn precipitation anomalies expressed in percentage. Despite the wetter conditions dominated in autumn 2019, September and October were drier than normal across much of the country. The average precipitation in September and October (taking into account 31 stations) was about 16mm and 42mm respectively, which accounted for 70 % of normal value. The occurrence of very high precipitation values in November ended the meteorological drought situation. The average precipitation in November (taking into account 31 stations) was about 150mm, accounted for 160 % of normal value.

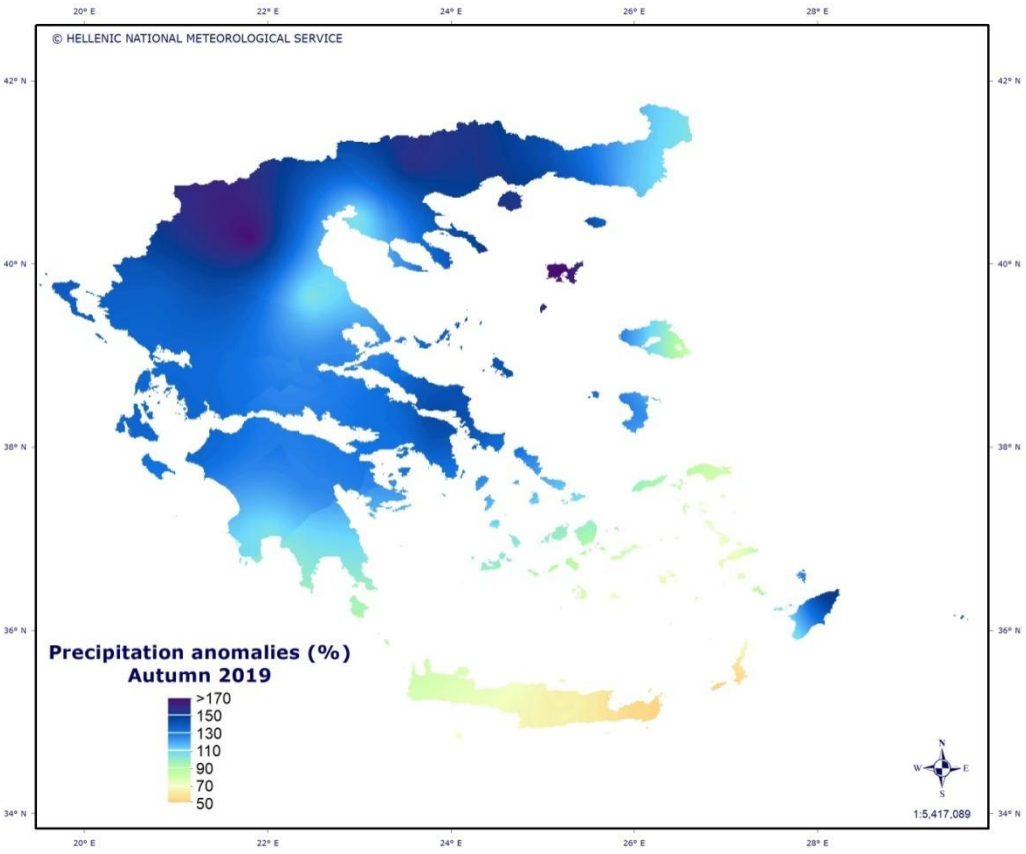


Figure 9. *Autumn 2019 precipitation anomalies (%) compared to 1971-2000 climatology.*

3. Monthly Survey

This section contains highlights, monthly means and anomalies of temperature and precipitation, as well as monthly overviews of extremes and notable weather and climate events and high impacts events.

3.1 Heavy precipitation, snowfall and cold in January 2019

Description

January 2019 was cold and rainy. The average precipitation (31 meteorological stations were used to derive the average), 187 mm, was about 2.4 times the monthly average 1971-2000. Precipitation anomalies with respect to normal values (1971-2000) for January are given in Figure 10. The total precipitation anomalies accounted for more than 200 % of 1971-2000 average for most of Greece, the higher values recorded in the northern parts, north Aegean and in the central and eastern parts of Peloponnese, where monthly precipitation accounted for more than 300 % of normal values.

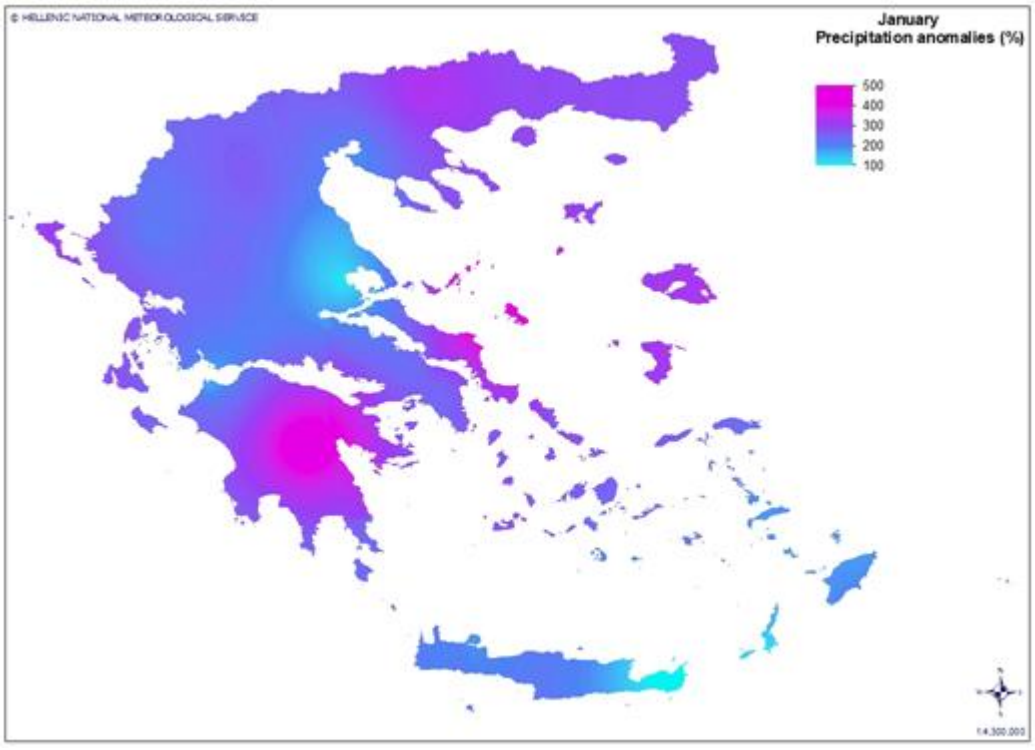


Figure 10. *Precipitation anomalies for January 2019 (%) compared to 1971-2000 climatology.*

Average monthly mean temperature in January 2019 was about 8 °C, approximately 0.5 °C below the average normal value 1971-2000. Negative departures from normal values of mean monthly air temperature were found in the greatest part of mainland, in Ionian islands and in west Crete, while positive ones were found only in the eastern parts (Figure 11). It is noteworthy to mention that the

minimum temperature in Florina reached -23 °C on 8th Januray, 2nd lowest value since 1960 and Tatoi station recorded -8.9 °C on 9th Januray, which is also the 2nd lowest minimum temperature. Also the northwest mainland experienced many frost days and nights, Florina experienced at least fifteen consecutive days and nights with total frost (days with Tmax and Tmin ≤ 0 °C).

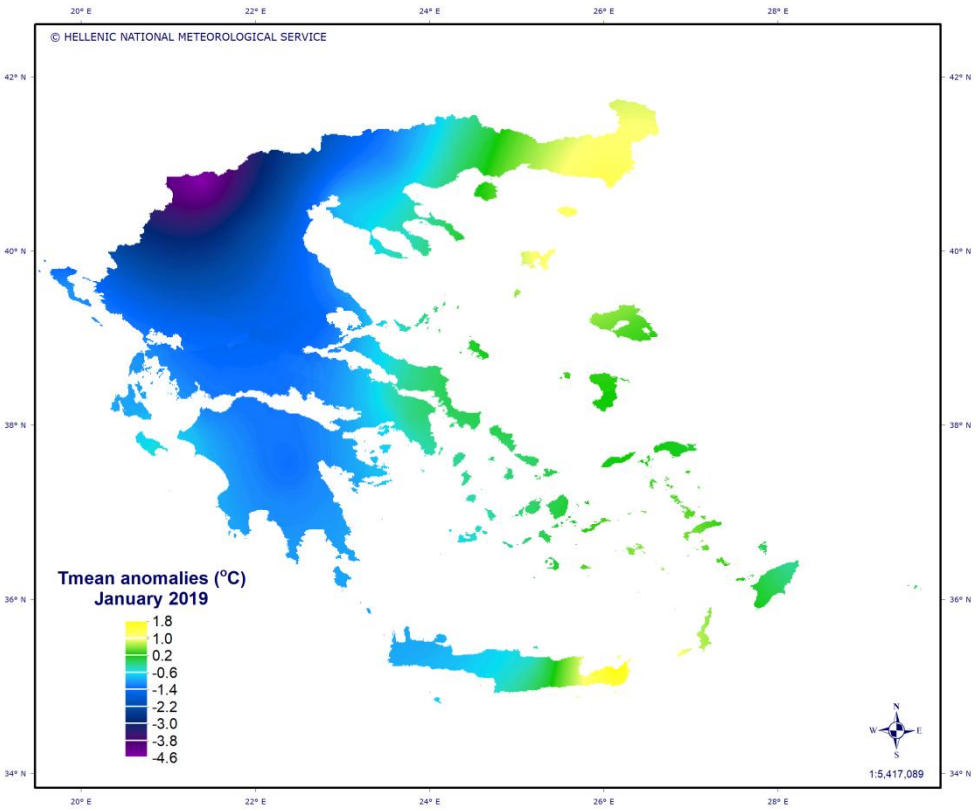


Figure 11. *Mean temperature anomalies (°C) in January 2019 according to the 1971-2000 climatology.*

High Impacts

During 1-2/1/2019 fifty people were trapped in Fthiotida (central mainland) due to snowfall; while flooding and landslides occurred in Crete in the area of Chania.

During 3-5/1/2019 snowfall caused traffic problems in national as well as in provincial road network in central mainland. Electricity problems were occurred mainly in Thessaly region and Thessaloniki. Due to heavy snowfall many towns and villages in central Greece were isolated from centers. Also three people were trapped in their cars and lost their lifes in Keratea, Attica, due to heavy flooding.

During 3-17/1/2019: Fifteen days of total frost were recorded in Florina, while the minimum temperature in Florina reached -23 °C on 8th Januray 2019, 2nd lowest value since 1960.

During 7-9/1/2019 heavy snowfall in Skopelos island caused electricity problems. Frost and fog caused traffic problems and cancellations of flights in Thessaloniki. Many schools in north and central Greece shut down. On 9th of Januray, Tatoi (Attica) recorded -8.9 ^{o}C, 2nd lowest value since 1960.

During 22-27/1/2019 heavy rainfalls caused flooding in the area of Peloponnese (Ilia, Messinia, Lakonia), where rivers overflowed, crop areas were destroyed and people were trapped in buildings and cars. Also, heavy precipitation has caused floods in Lesvos island, in Kavala and Drama.

3.2 Heavy precipitation events in February 2019

Description

Wet conditions dominated in the southeastern parts of Greece, and especially in west Crete, where the accumulated monthly precipitation was 3 or 4 times the average monthly precipitation (Reference period 1971-2000). It is noteworthy that Souda station, located in west Crete, recorded monthly total precipitation 407 mm, which is four times the monthly average and Heraklion station in central Crete recorded monthly total precipitation 200 mm, which is three times the monthly average. Moreover, in Souda and Heraklion it was the rainiest February on record. Figure 12 shows the monthly precipitation anomalies (mm) - differences from 1971-2000 normal values.

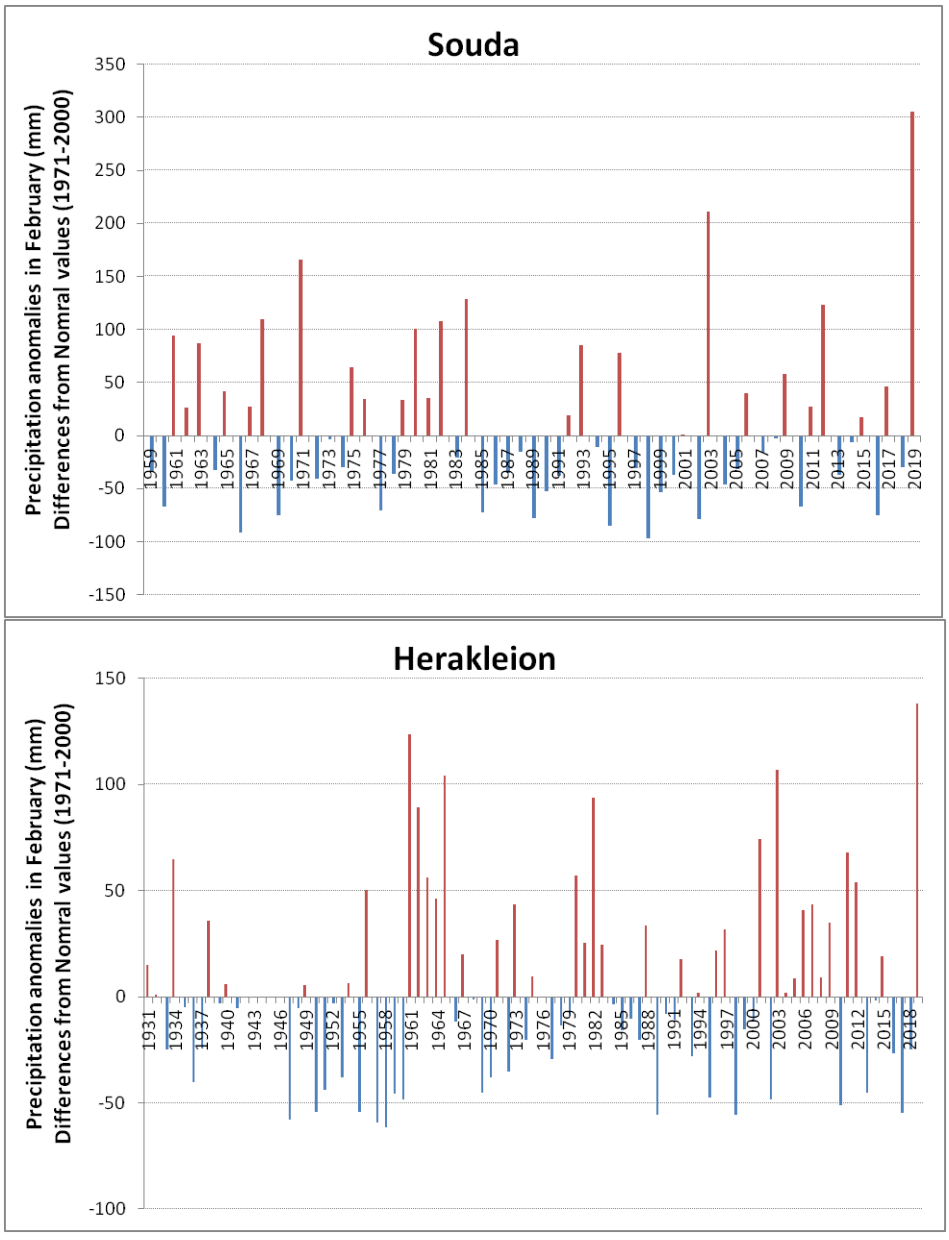


Figure 12. *Precipitation anomalies in February (mm)- Differences from 1971-2000 normal values in Souda (above) and Heraklion (bottom).*

On the other hand, the monthly precipitation anomalies over the western and northern Greece were below normal values 1971-2000. Precipitation anomalies expressed as a percentage of the (1971-2000) average are given in Figure 13.

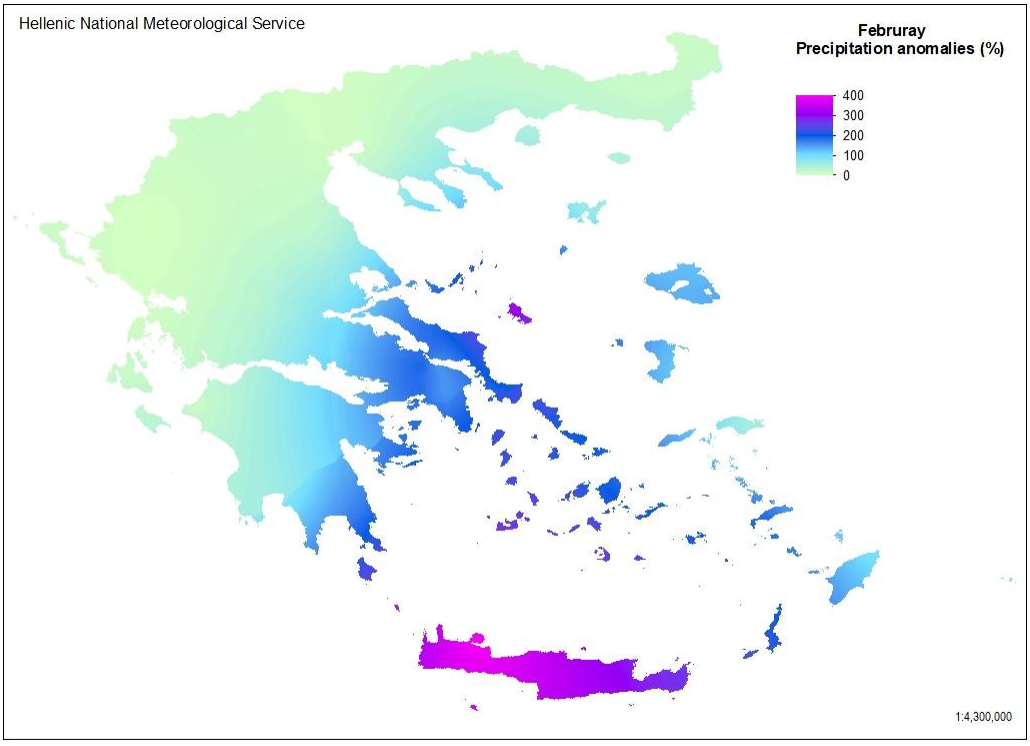


Figure 13. *Precipitation anomalies for February 2019 (%) compared to 1971-2000 climatology.*

High Impacts

During 5-6/2, 12-17/2 and 23-26/2, heavy rainfalls caused extensive flooding and landslides at the area of Crete island. Infrastructures were destroyed, roads were closed, crops were damaged and people were trapped in their cars. Also the severe flood events caused totally 5 fatalities.

3.3 March 2019

Description

March 2019 was warmer than normal in the whole territory. Monthly mean temperature anomalies ranged from 0.9 to 4.4 ^{o}C (Figure 14). The greatest positive anomalies were found over the northern mainland and the lowest ones in southwest parts.

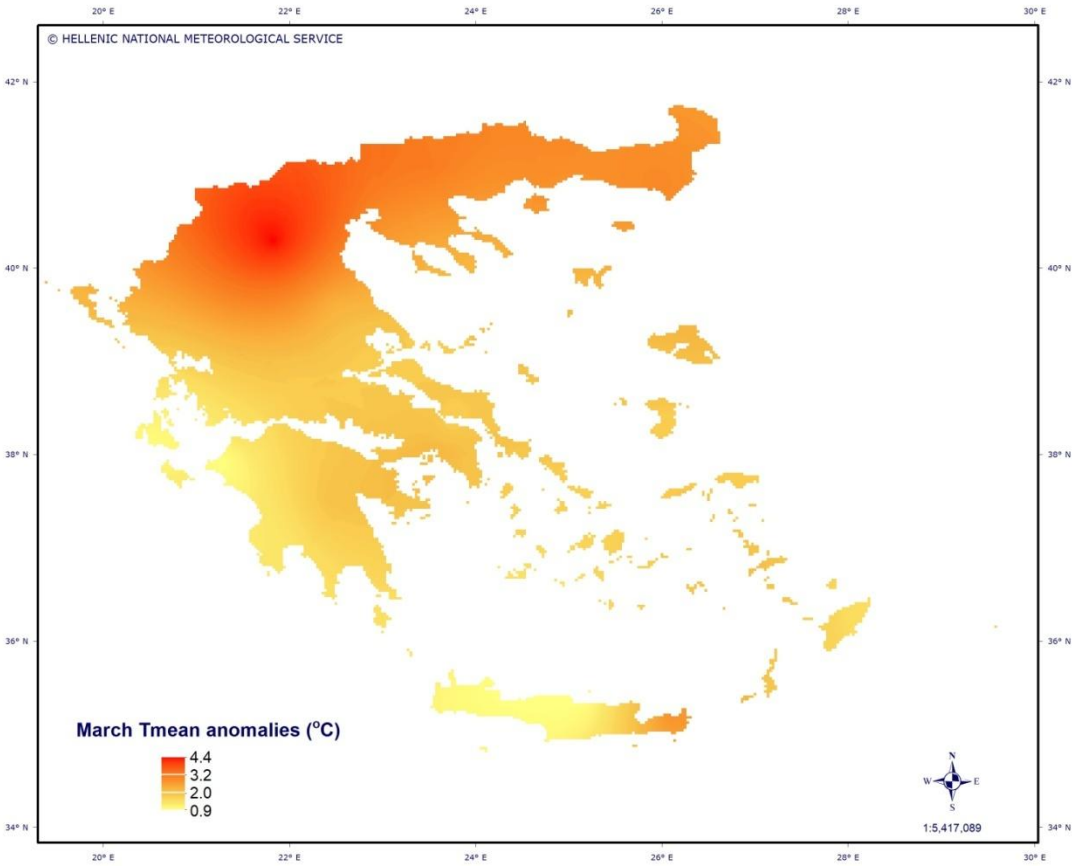


Figure 14. *Mean temperature anomalies (°C) for March 2019 in Greece according to the 1971-2000 climatology.*

Regarding precipitation March 2019 was characterized by board range of spatial anomalies. Precipitation anomalies in March showed lower than normal values (compared to 1971-2000 climatology) in northern parts of Greece. However the ten days of March was marked by heavy rainfall in Crete and in the islands of the SE Aegean, leading to above normal monthly precipitation anomalies in these regions (Figure 15).

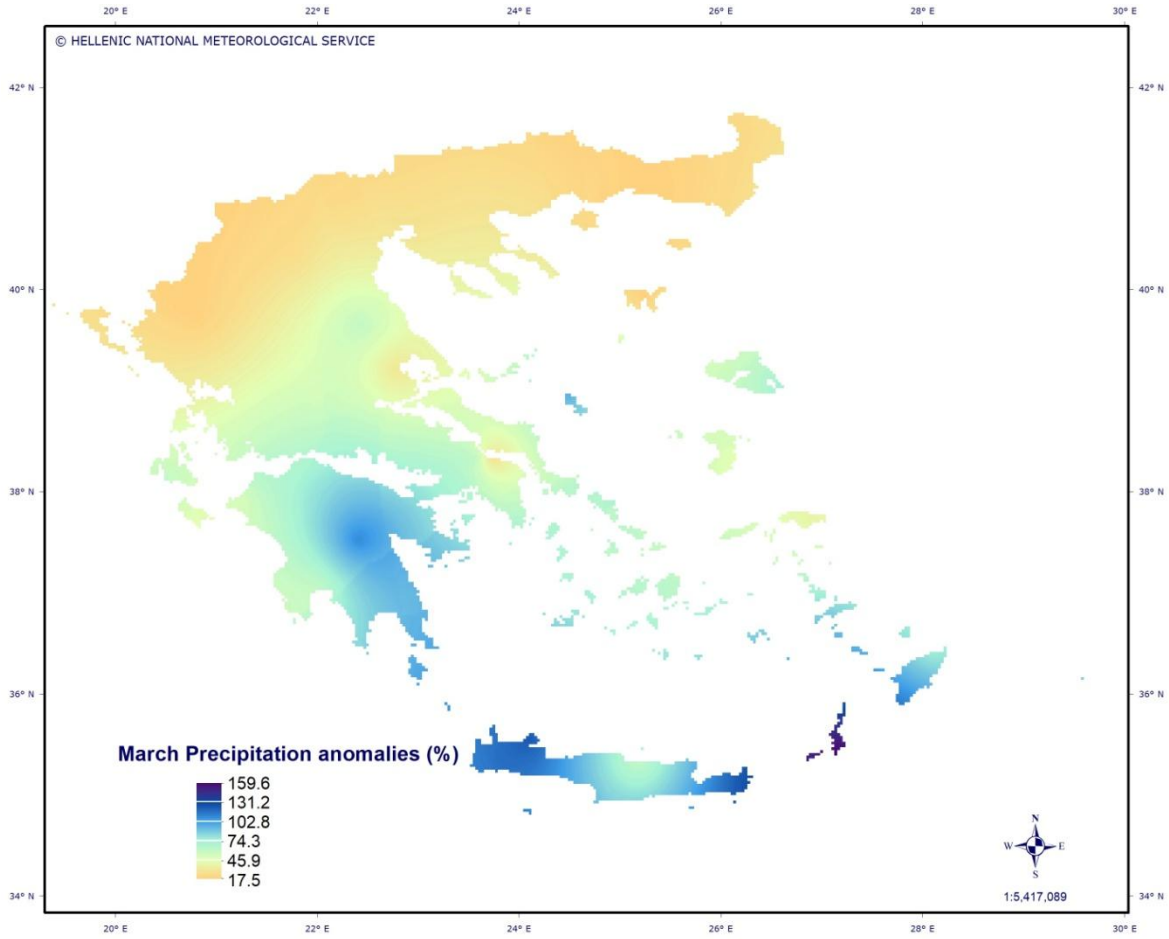


Figure 15. *Precipitation anomalies for March 2019 (%) (compared to 1971-2000 climatology.*

3.4 April 2019

Description

Monthly mean temperatures in Greece ranged near to normal values (1971-2000). However regarding precipitation, April 2019 was rainy in many parts. Especially the greater Attica region and Aegean islands were affected by heavy precipitation events. Figure 16 shows the monthly precipitation anomalies. High precipitation amounts were recorded in Elefsis station 172 mm, i.e 6 times above the normal of the month and Tanagra station 110 mm, i.e 3.5 times above the normal of the month.

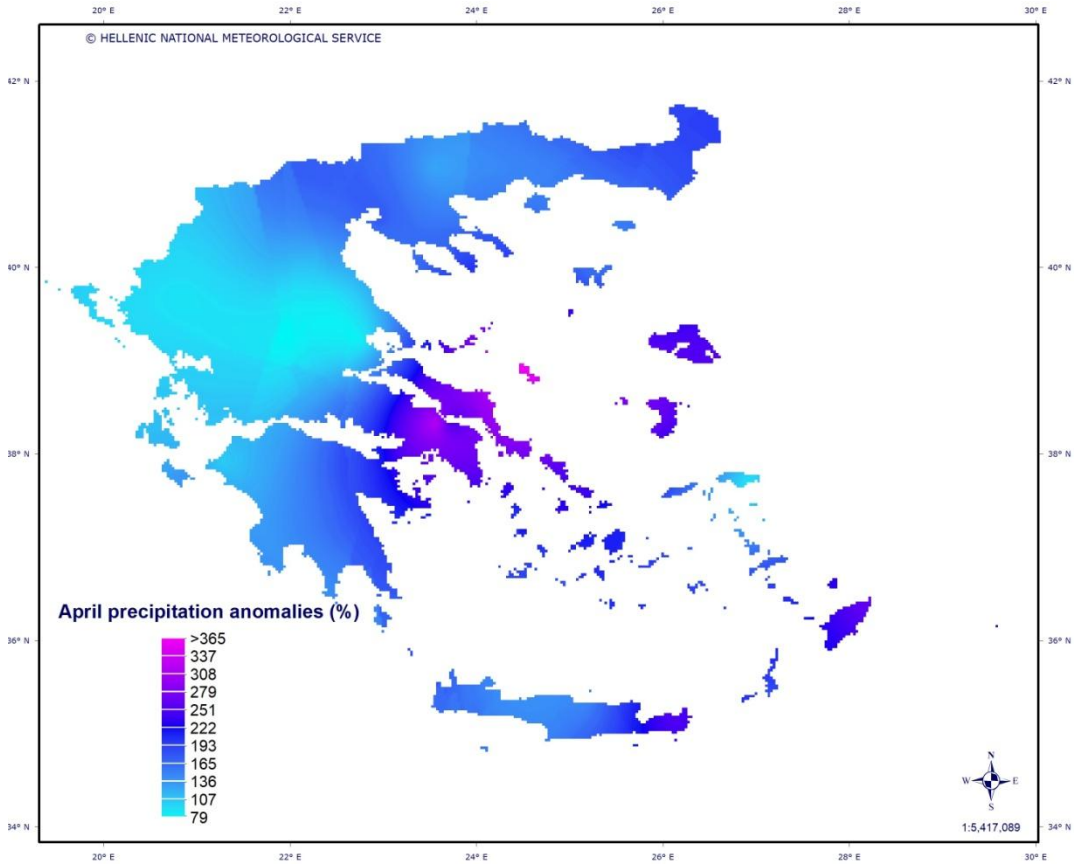


Figure 16. *Precipitation anomalies for April 2019 (%) compared to 1971-2000 climatology.*

3.5 May 2019

Description

May of 2019 was colder than normal (compared to the 1971-2000 normal values) in west Greece; but it was warmer than normal in eastern parts. Mean monthly temperatures were 1.0 - 1.5 ^{o}C below normal values in Ionian islands and northwest Greece and above normal values in eastern parts (east Crete, east Aegean islands and Thrace) (Figure 17). During the last ten days of May, several stations in eastern Greece recorded daily maximum temperature above 30.0 ^{o}C, highlights of maximum temperature recorded on 21th of May in meteorological stations of Heraklion and Siteia (Crete), 34 ^{o}C and 33.2 ^{o}C respectively.

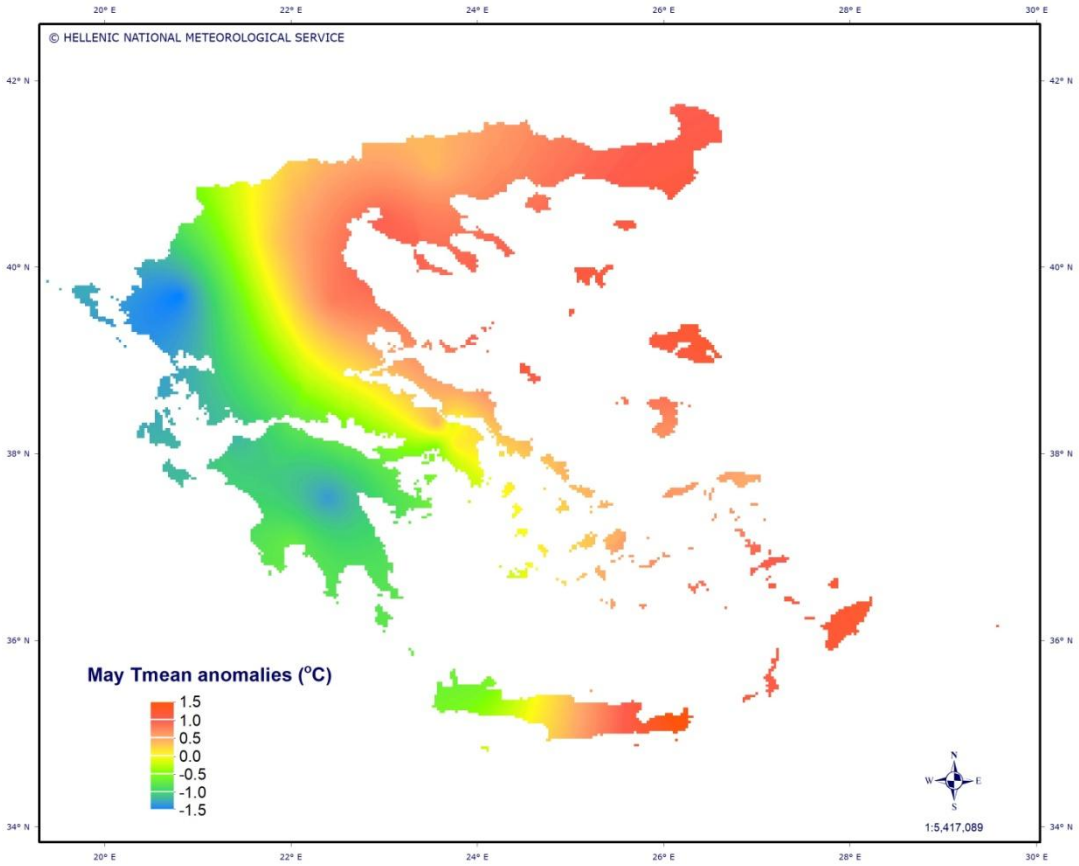


Figure 17. *Mean temperature anomalies (°C) for May 2019 in Greece according to the 1971-2000 climatology.*

Also May of 2019 was drier than normal in most of Greece. The only exception are the Ionian islands and the northwestern mainland, where the occurrence of few precipitation events resulted to monthly total precipitation above normal value, corresponded to about 200 % of the 1971-2000 normal value (Figure 18).

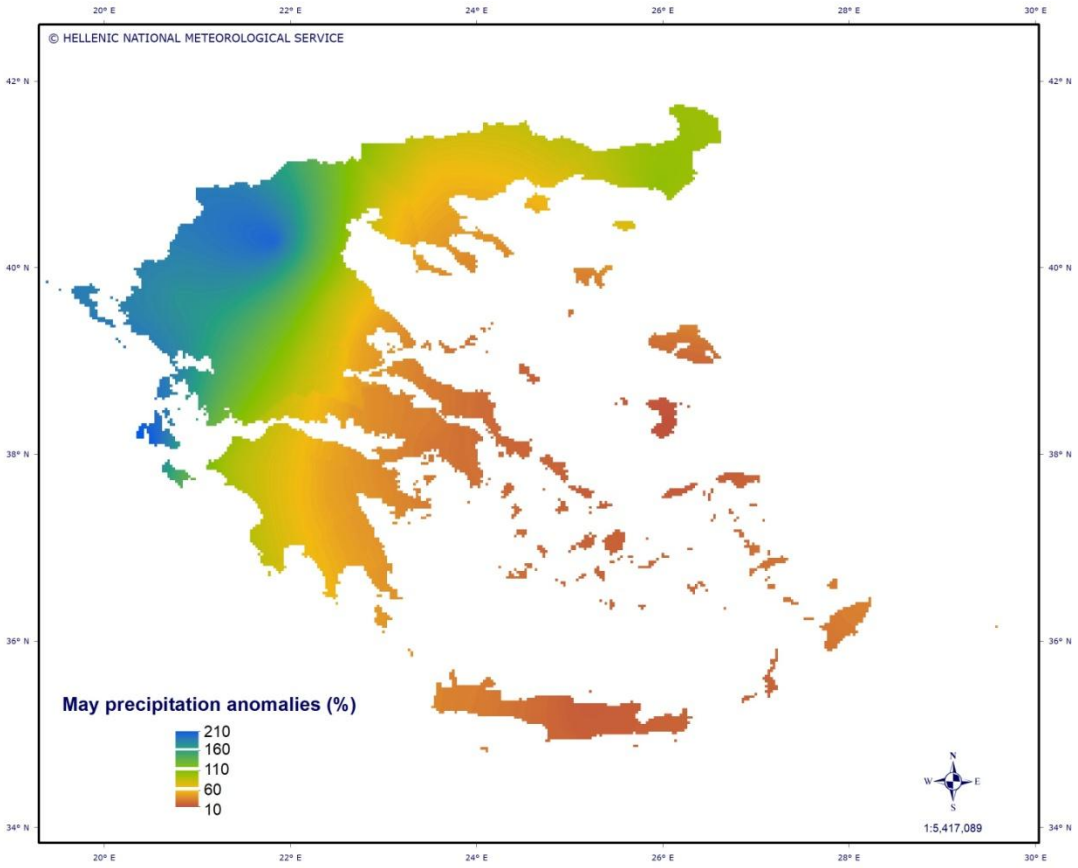


Figure 18. *Precipitation anomalies for May 2019 (%) compared to 1971-2000 climatology.*

3.6 June 2019

Description

June 2019 was warm in Greece especially in northwest parts. The average monthly temperature in the country (taking into account 31 meteorological stations) was approximately 26.0°C, about +1.9 ° C above normal 1971-2000 values. More specific high temperatures were observed on the mainland in the middle of the month.

Also thunderstorms and heavy precipitation events were recorded locally in the middle of the month mainly in mainland. The most notable recorded precipitation was the 79 mm of rain recorded in Tripoli while the monthly normal is about 14 mm. Also, Ioannina and Kozani stations reported 79 mm of monthly total precipitation, while their monthly normal values are about 35 mm and 28 mm respectively.

High Impacts

On June 11th, 2019: Heavy rain caused flooding in Varkiza (suburb of southern Attica) and traffic problems.

On June 18th and 19th, 2019: Summer thunderstorms with insense electrical activity accompanied by hail caused flooding in Attica.

3.7 July 2019

Description

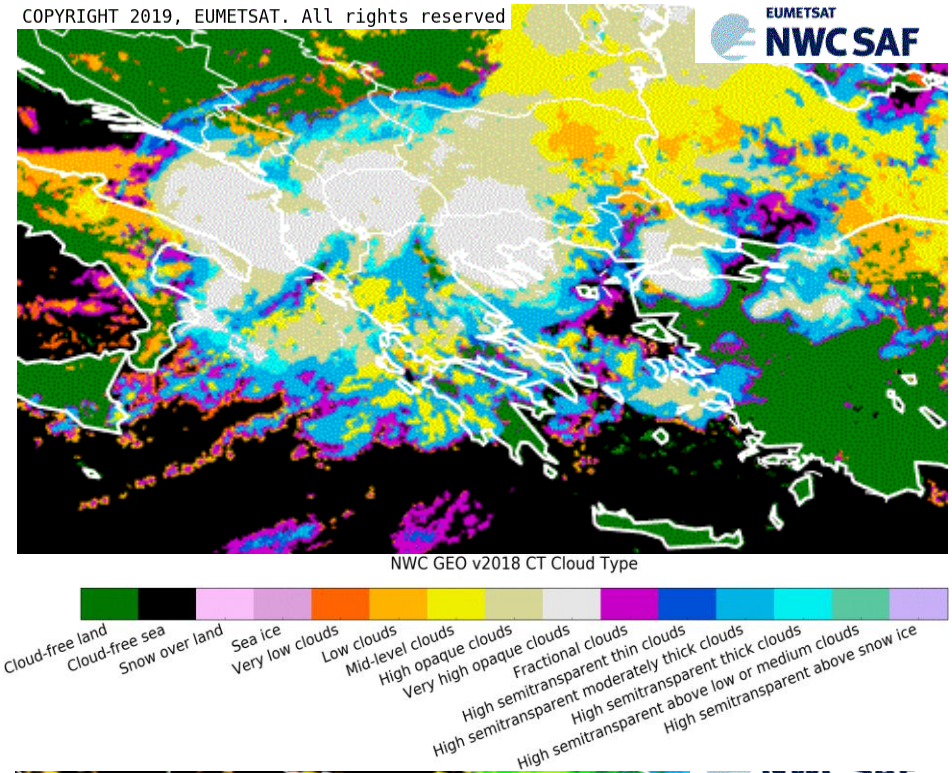
July is usually the hottest month of the year in Greece. July 2019 was warmer than normal (relatively to 1971-2000), however it does not rank among the ten warmest Julies on record. The average monthly temperature in July 2019 (taking into account 31 meteorological stations) was +27.3 °C, about +1.0 °C above the normal 1971-2000.

However, the main features of the month were thunderstorms occurred in the central and northern parts of the country and Crete, as well as the storm affected Halkidiki region, causing loss of human lives. The most notable recorded precipitation was the 72 mm of rain recorded in Souda (west Crete) in 8 hours (on 17th of July) and this was fifty times the normal of the month. In the next section there is a more detailed description of the storm event that affected Halkidiki region.

3.6.1 Storm in July 2019

Description

On 10th of July 2019, a violent storm accompanied by fierce winds, extremely strong lightning activity, rainfalls and hail of large dimension, broke out at night and hit Halkidiki region, resulting in extensive disasters and the death of 7 people and the injury of 120 people. Despite the fact that summer storms (known as bourinia in Greece) are common in the northern parts of Greece, the storm that occurred during the night of the 10th of July can be characterized as extreme episode. Similar storm hit central and northern Greece on 21 July 1983.



Very high opaque clouds surpassed the height of 13 km (Figure 19).

Figure 19: *Cloud type (top) and cloud top altitude (bottom) on 10 July 2019, 19:00Z.*

Thunderstorms from the Western Balkans through the Prespa Lake swept across the northwestern mainland and eventually moved into the Thermaikos Gulf and evolved into a supercell and bow echo. The passage of a cold front from the northern Greece and the introduction of colder but drier air trigger dynamic instability. The sinking cold air masses forced the moist and warm air in the area of the Thermaikos Gulf to rise rapidly, reinforcing further downdrafts and surface winds as well. It is noteworthy that between 7 and 10 July 2019 warm air masses originating from Africa prevailed in Greece. The existence of warm and potentially unstable air masses is a critical factor in the development of extreme weather phenomena.

On July 10th, at 18:15Z the system reached Axios valley and the western coasts of the Thermaikos Gulf. The convective available potential energy (CAPE) in the southern part of the Gulf was greater than 3000 J Kg^{-1} which reflects an extremely large instability; the lowest cloud top temperature was in the range of 210-215 K. During that time an impressive temperature drop of 7 degrees of Celsius within half an hour (drop of 9 degrees within an hour) was reordered at Thessaloniki station (WMO code: 16622) which is located at the airport.

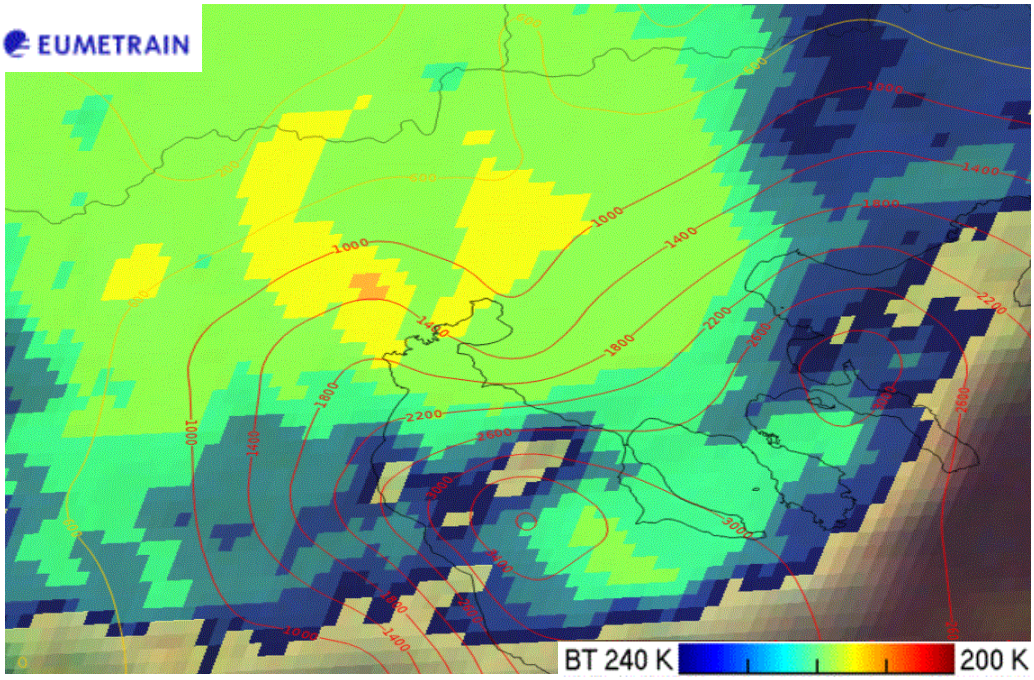


Figure 20: *Meteosat satellite image taken on 10 July 2019 at 18:00Z, visualized with colour scale (assigned to the 200-240 K BT range), red lines represent CAPE in J/kg.*

The Hellenic National Meteorological weather radars provided more realistic dynamics of the system. On July 10th, at 18:15Z, Larisa radar detected intense storm cells about 100 km north topping more than 17 km, moving east south-east (Figure 21). At the same time, Thessaloniki radar recorded reflectivity values of 65 to 70 dBZ and rainfall intensity greater than 200 mm/h (Figures 22, 23).

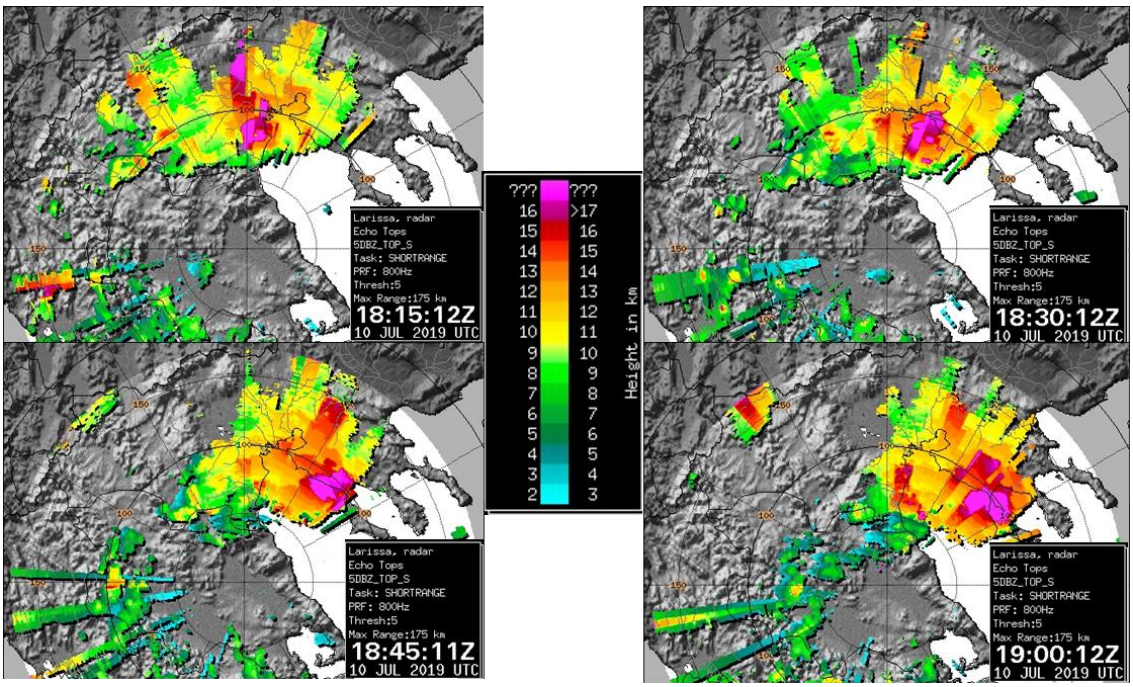


Figure 21: *Echo tops altitude in km (radar reflectivity threshold 5 dBZ) observed on 10 July 2019 from Larisa radar.*

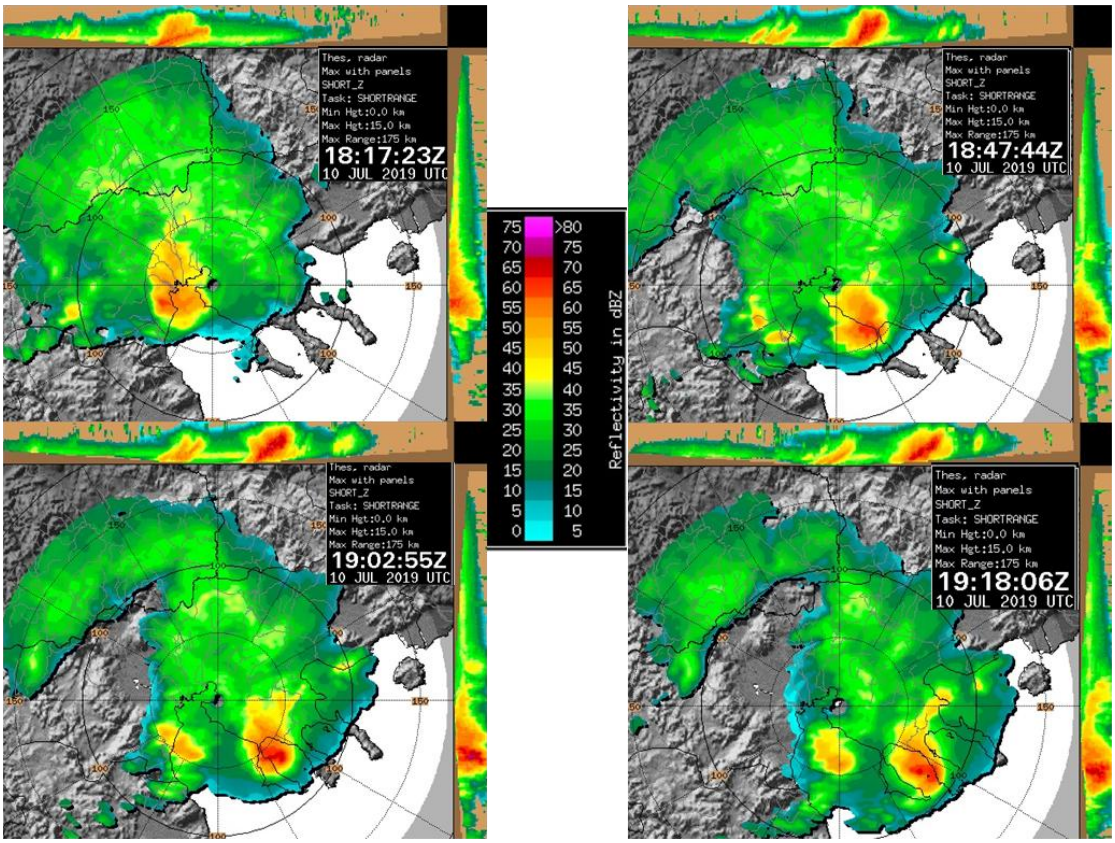


Figure 22: *Radar reflectivity values in dBZ observed on 10 July 2019 from Thessaloniki radar.*

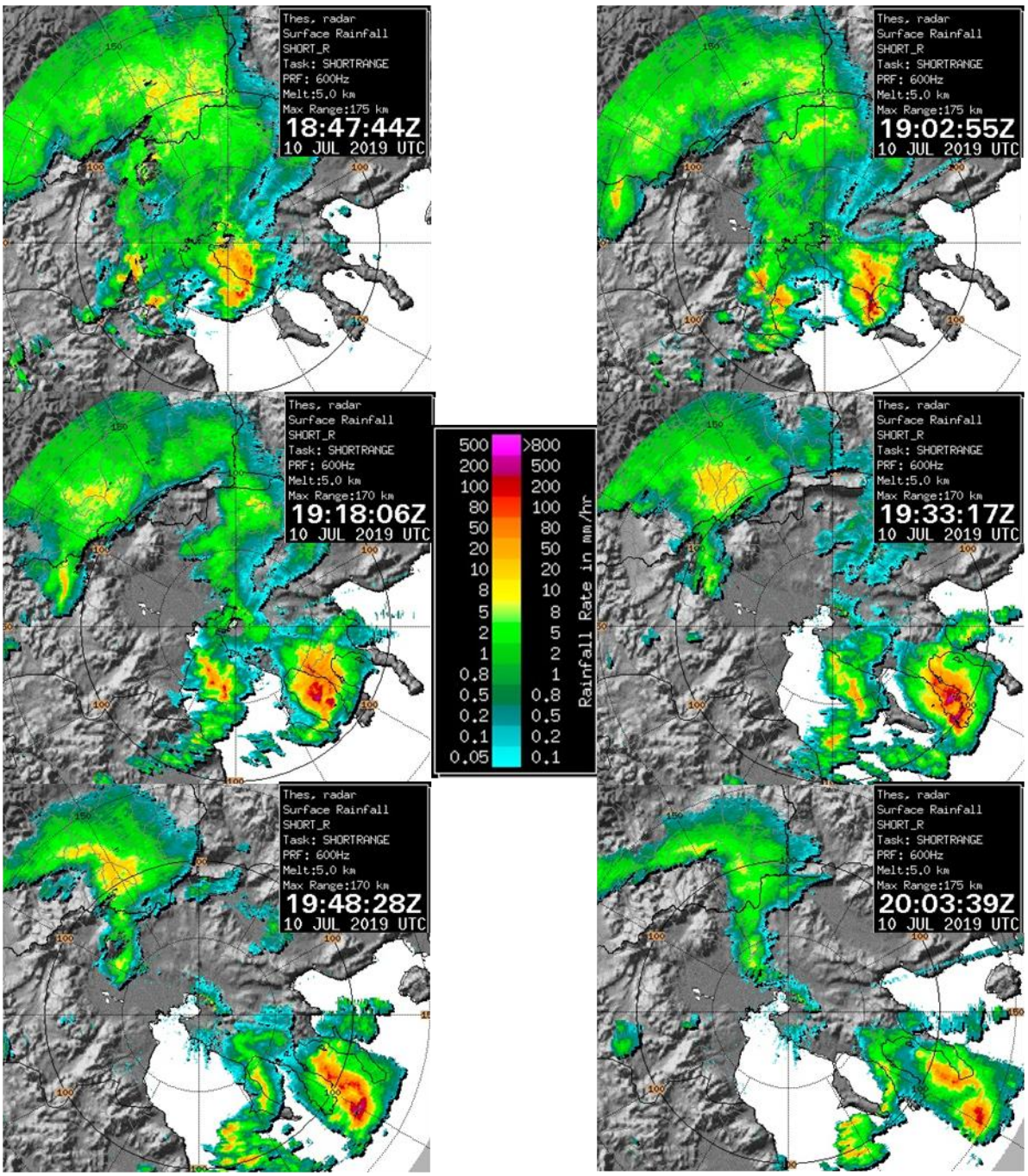


Figure 23: *Rainfall rate in mm/h observed on 10 July 2019 from Thessaloniki radar.*

<u>High Impacts</u>

Seven people died and 120 were injured, roofs collapsed, trees and electrical posts fell, caravans and boats were swept away in a storm that broke out at night. Also the violent storm led to power outages in the most of Halkidiki region. The Hellenic National Meteorological Service had issued a Red Alert of extreme weather phenomena for the regions of central and eastern Macedonia.

Photos of destructions in the area of Halkidiki, during 10-11 July 2019.

Photo CNN Greece

Photo evros24

3.8 August

Description

August 2019, was in Greece the third warmest August on record after 2010 and 2012. The average monthly temperature in the country (taking into account 31 meteorological stations) was 28.1 °C approximately, about +2.2 ° C above normal 1971-2000 values. In northern mainland monthly mean temperature anomalies surpassed 3.0 °C (Figure 24).

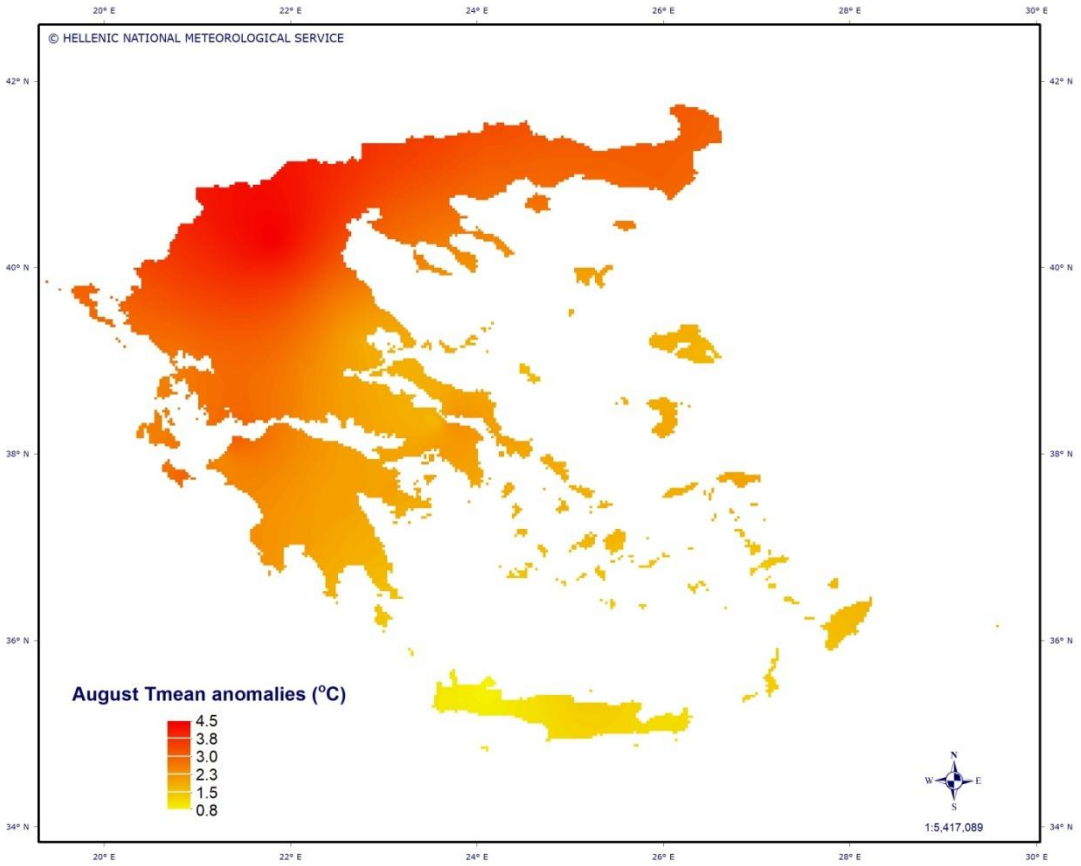


Figure 24. *Mean temperature anomalies (°C) for August 2019 in Greece according to the 1971-2000 climatology.*

3.9 September

Description

September of 2019 was warmer than normal. The monthly mean temperature anomalies, compared to normal values, varied from 0.5 to 2.7 ^{o}C (Figure 25). The higher positive mean temperature anomalies occurred in the northern parts of the country.

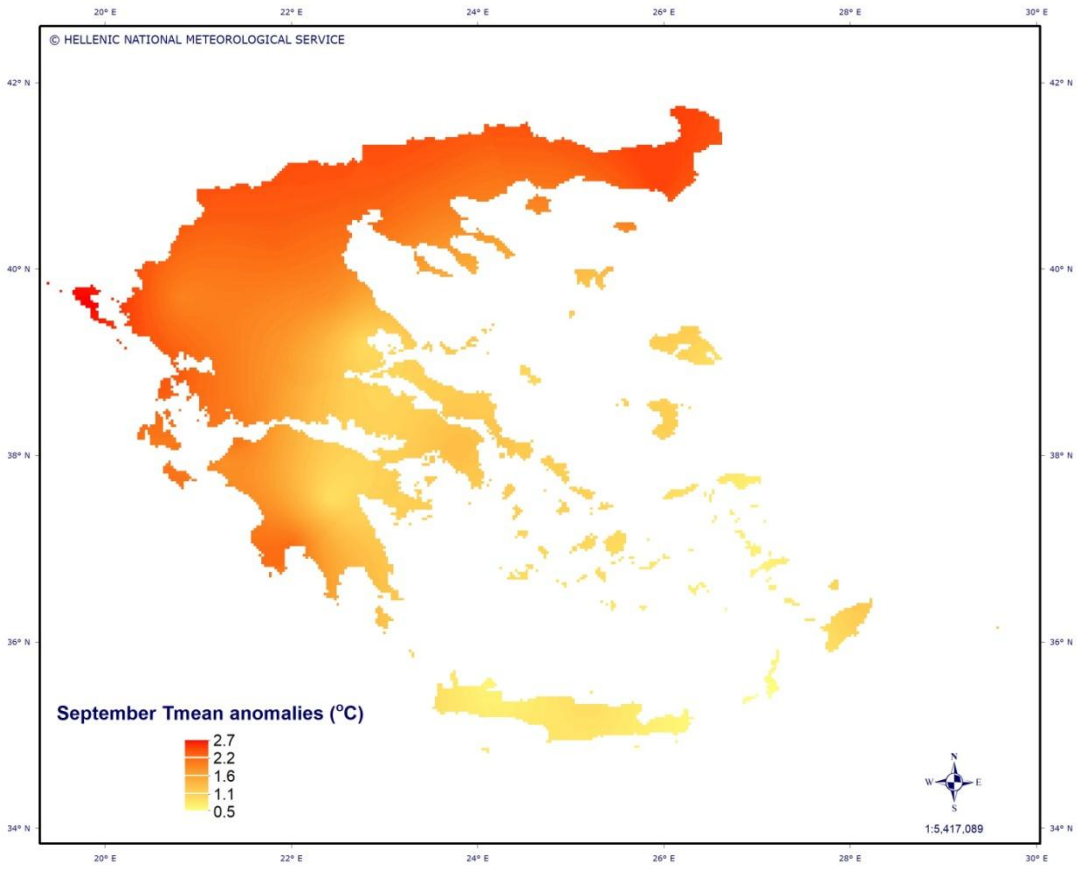


Figure 25. *Mean temperature anomalies (°C) for September 2019 in Greece according to the 1971-2000 climatology.*

Regarding precipitation, September was drier than normal mainly in Crete and southeast mainland and rainy locally in north mainland and in west Peloponnese. Monthly precipitation anomalies are shown in Figure 26.

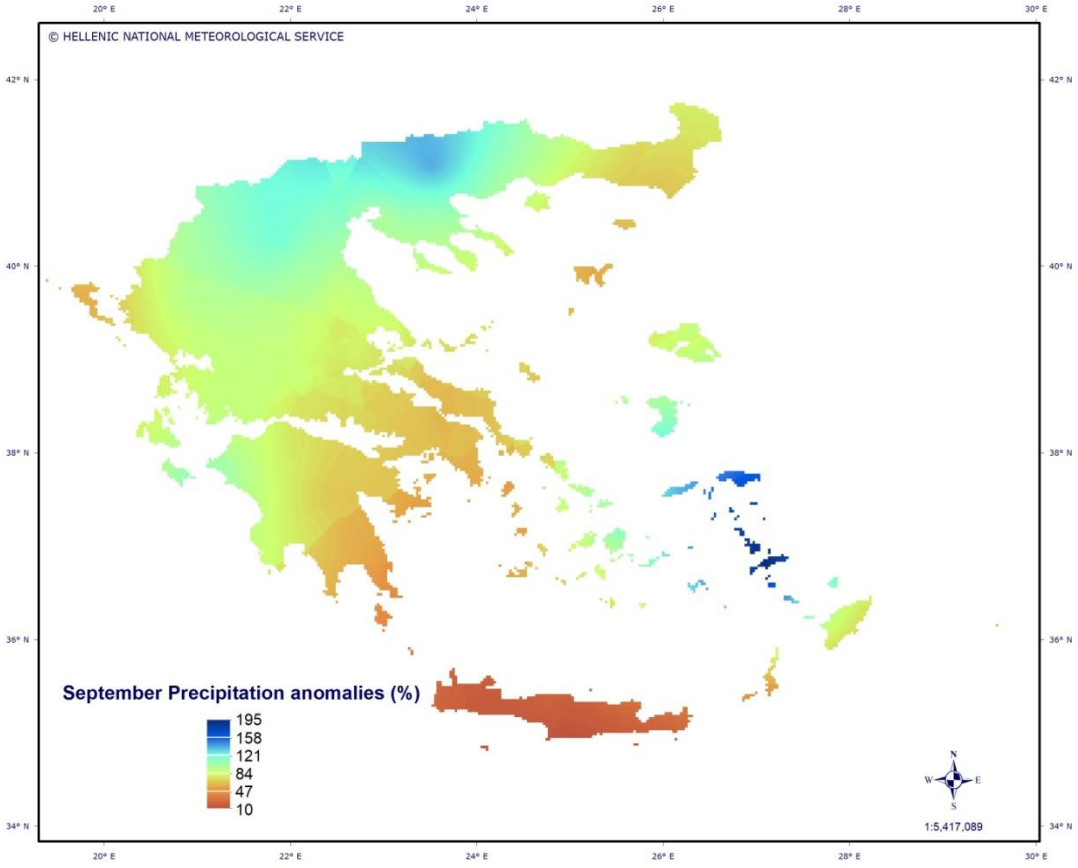


Figure 26. *Precipitation anomalies for September 2019 (%) compared to 1971-2000 climatology.*

3.10 October

Description

October of 2019, was warm concerning temperature and dry concerning precipitation. During the first days of the month many stations recorded daily maximum temperatures above 30.0 ^{o}C, highlights of daily maximum temperature recorded in meteorological stations of Heraklion (in Crete) and Soufli (in Thrace) 33.7 ^{o}C and 33.2 ^{o}C respectively. Mean monthly temperature anomalies were 2.0 – 3.0 ^{o}C above the 1971-2000 normal values in most of the north and eastern regions.

Regarding precipitation, the monthly total precipitation was below normal values mainly in southern parts of Greece, however few strong precipitation events affected locally northern Greece. Monthly precipitation anomalies are given in Figure 27.

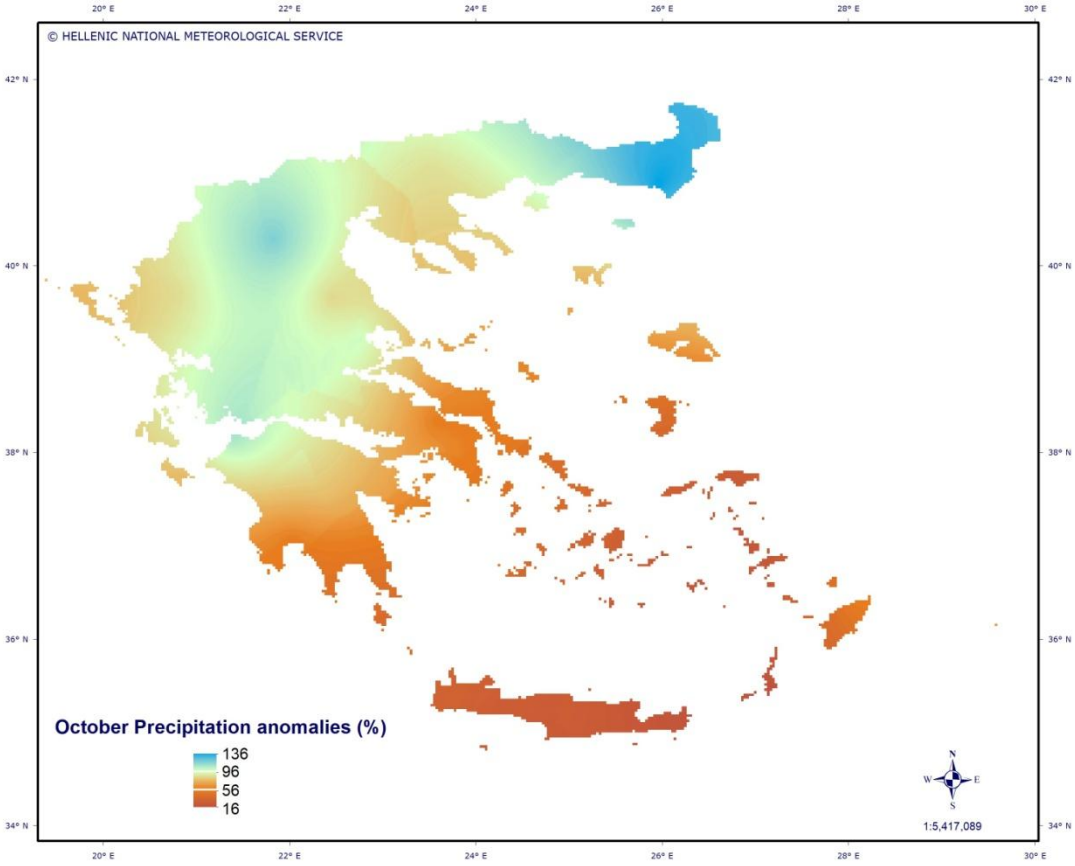


Figure 27. *Precipitation anomalies for October 2019 (%) compared to 1971-2000 climatology.*

3.11 Warm and rainy November 2019

November 2019 was very warm and rainy. Many central and northeastern areas experienced the warmest November on record. It is noteworthy to mention that average monthly minimum temperature in Alexandroupoli, the capital of Evros region in East Macedonia and Thrace, was 12.4 ^{o}C, which means 6.3 ^{o}C above the normal value. Also the average monthly maximum temperature in Thessaloniki, the second largest city in Greece located on the Thermaikos Gulf at the northwest corner of the Aegean Sea, was 19.3 ^{o}C which means 4.5 ^{o}C above the normal value. Mean temperatures in November were more than +3.0 ^{o}C above the 1971-2000 average for the month across most of the eastern parts of the country (Figure 28).

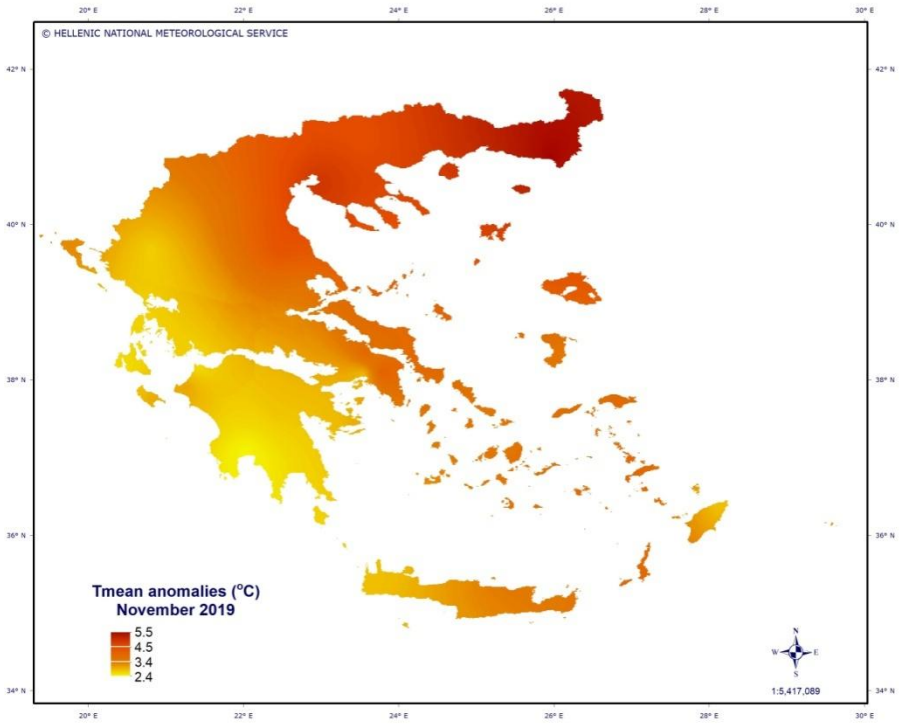


Figure 28. *Mean temperature anomalies (°C) for November 2019 in Greece according to the 1971-2000 climatology.*

The occurrence of very high precipitation values in November ended the meteorological drought situation. The average precipitation in November (taking into account 31 stations) was about 150mm, accounted for 160 % of normal value.

Many regions experienced much above average precipitation. Greece affected by few short-lived heavy precipitation events, which in many cases led to flooding with widespread impacts including losses of lives. The total precipitation anomalies accounted for more than 130 % of 1971-2000 average in multiple localities, the higher values recorded in the northwest parts, in north Aegean, in Attica region and in Rhodes island (Figure 29). In some stations it was the rainiest November since the beginning of records, e.g Kerkyra reported monthly total precipitation 446.3 mm, while its 1971-2000 average is 182 mm i.e

2.5 times above normal value. The monthly precipitation anomalies (mm) (differences from 1971-2000 normal values) in Kerkyra station are given in Figure 30.

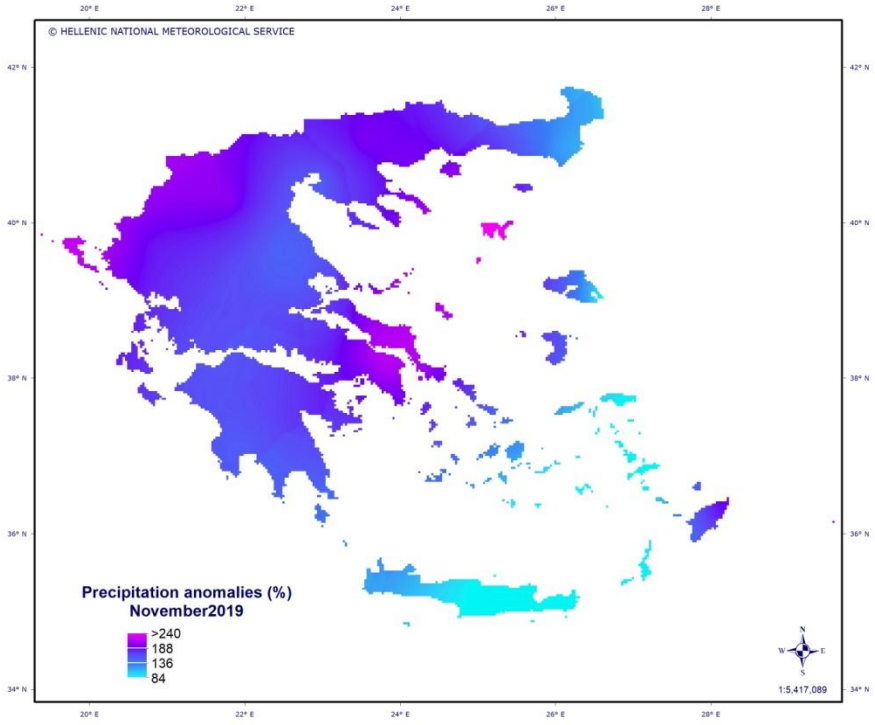


Figure 29. *Precipitation anomalies for November 2019 (%) compared to 1971-2000 climatology.*

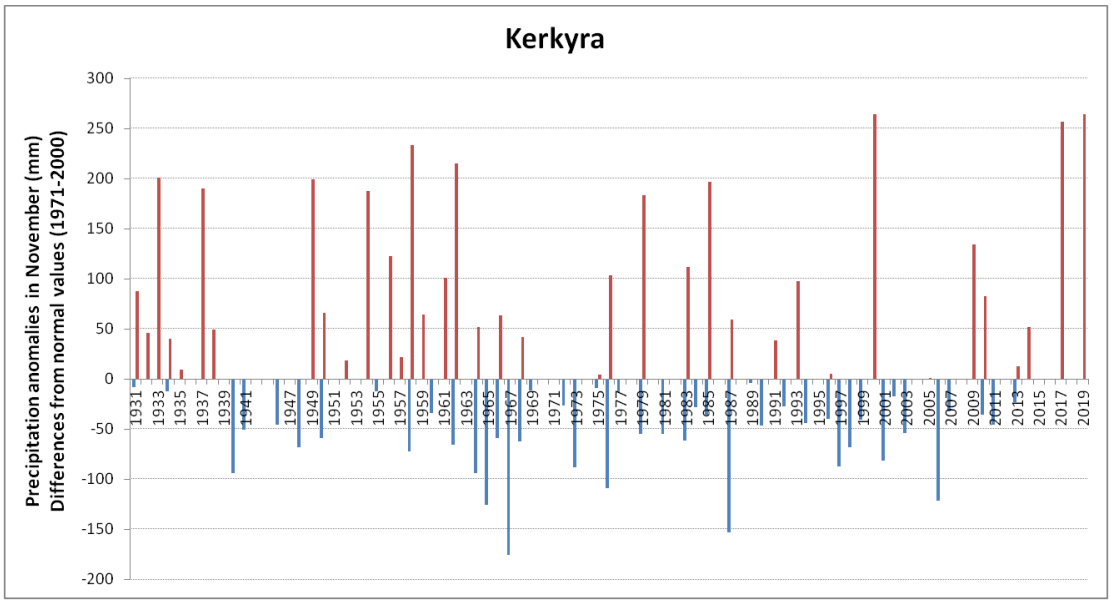


Figure 30. *Monthly precipitation anomalies differences (mm) from 1971-2000 normal values in Kekryra.*

High Impacts

During 10-14/11/2019: Home and businesses were flooded and landslides have trapped people in theirs homes in several regions of Greece. Gale-force winds caused power outages and halted sea traffic between mainland and the islands in the Ionian Sea. Heavy rain caused landslides in Kekryra and Kefalonia; tones of stones came down from the mountain in the village of Nyfi, on the island of Kefalonia.

During 20-21/11/2019: The islands of Zakynthos and Kerkyra, as well as southwest Peloponnese and Halkidiki in Central Macedonia were mostly affected by heavy precipitation event and suffered from the most damages. Homes and businesses were flooded , roads turned into rivers and agricultural land came under water, trees were uprooted and power poles were broken.

During 24-25/11/2019: Heavy rain caused flash flooding and landslides in Kineta, west of the capital Athens. Further north, buildings were damaged after flooding in Katerini in Pieria, in Halkidiki and Thassos island. Flooding was also reported in Rhodes island. Two people died after strong winds and stormy seas, that capsized a moored boat near the pier of Antirio in the Corinthian Gulf. Also a swimmer died due to stormy sea in Kos island and one woman was found dead in a flooded building in Rhodes island.