

Annual Bulletin on the Climate in Greece 2022



Hellenic National Meteorological Service
Climate, Environment and Meteorological Observations Division
Department of Climatology

Notable weather and climate events in Greece 2022

There were few significant weather and climate events in 2022 including heavy rainfall, floods, heavy snowfall and abnormally high temperatures.

Heavy Precipitation, Storms and Floods

- On **11 to 13 January 2022** a barometric low named “Diomidis” brought prolonged rains and strong thunderstorms in the eastern parts of the country. Aghialos met. station located in Magnesia prefecture (Thessaly Periphery), recorded 125.1 mm on 11 January 2022, i.e 2.5 times above its monthly normal value 1981-2010. Heavy precipitation caused many problems in Thessaly, east Sterea and Samos island (east Aegean), such as flooding roads and homes, and power outages. Two people, a man and a woman lost their lives after being swept away by the floodwaters in Serres (Central Macedonia Periphery).
- During **9 to 11 June 2022** a storm referred as “Genesis” brought thunderstorms and gale force winds in the west and north Greece. The highest precipitation amounts were recorded in east Macedonia. Chrysoupoli met. station in Kavala recorded 66.8 mm total precipitation in the above mentioned time period, i.e 2.8 times the average monthly precipitation for 1981-2010. Thunderstorms caused infrastructure and crop damages and power and water outages.
- On **08 to 09 July 2022** Thunderstorms hit several parts of Greece. The Sporades islands, but also Thasos Island were badly affected by severe thunderstorms. Two bridges collapsed and streets turned into rivers in the island of Skyros; the meteorological station in this island recorded 117.1 mm in 24 hours i.e. 20.5 times the average monthly precipitation for 1981-2010. Also flooding homes and businesses were reported in the island of Thasos.
- On **13 July 2022** Kalamata met. station recorded 77 mm in almost three hours (88 mm total daily precipitation i.e 13.5 times the average monthly precipitation for 1981-2010); however no significant impacts were reported.
- During **21 to 25 August 2022** a cut-off low that remained above Greece for almost a week, combined with thermal instability caused thunderstorms accompanied by a high frequency of lightning, heavy rainfall and hail. Intense weather phenomena affected most of the country, mainly the continental Greece and the Aegean islands. Tatoi met. station, in the northern suburbs of Athens, recorded a 5-day total precipitation 94.8 mm, while its monthly total precipitation of 30-year (1981-2010) historical average is 7.4 mm, more than twelve times the respective normal value. Also, notable precipitation amounts were recorded locally in south Aegean islands e.g Santorini met. station, on 24 August recorded 38.7 mm while its monthly total precipitation of 30-year (1981-2010) historical average is less than 0.5 mm. Flooding roads and homes were reported in Macedonia, Attica and East Sterea. Hailstorm hit thousands of acres with crops; landslides and damages to the road network were reported in Kalavryta (Peloponnese Periphery), Trikala (Thessaly Periphery) and Santorini island (south Aegean Islands).
- On **14 to 15 October 2022** A barometric low, which reached Greece from the west, and specifically from the area of southern Italy, was intensified further by the warm Ionian Sea. As a result of this atmospheric and weather system Crete recorded the highest amounts of rain, the HNMS meteorological station in Siteia (east Crete) recorded 293mm daily precipitation (281.8mm in 12 hours) which corresponds to the 3rd national maximum rainfall ever recorded in 24 hours. Torrential rain on 15 October 2022 triggered flash floods in Heraklion and Lasithi Regional Units on the island of Crete. The flash floods caused significant damages to buildings and infrastructure, particularly in coastal areas, where flood waters dumped debris and pushed several cars into the sea along the beach of the seaside resort of Agia Pelagia (east Crete). Two casualties were reported due to this severe flash flood.

Snowfall and cold wave

- From **22 to 25 January 2022** a severe weather system named “Elpis” hit eastern parts of Greece and brought heavy snowfall and snowsquall across Aegean islands, Evia and Attica. Heavy snowfall disrupted most transportation in Athens and hundreds of drivers were stranded over 24 hours on Attiki highway road. Schools in Athens were closed for one week, public services were suspended and thousands of households in north and eastern regions of Attica were left without electricity up to 36 hours due to downed trees.
- From **9 to 16 March 2022** a storm referred as “Filippos” caused temperatures to plummet and brought a rare snowfall in the northern suburbs of Attica region and Viotia (East Sterea Periphery). During this period temperatures were unseasonably, significantly low. The maximum air temperatures in most of Greece, except the Ionian islands and the west coastal areas, were lower than 9 °C, while the 1981-2010 normal values is about 15 °C. As a result of this cold spell, **March 2022** was the **3rd coldest March since 1960**.

Heat wave and abnormally high temperatures

- On **22 to 23 June 2022** heat wave conditions prevailed on the Greek mainland. Daily maximum temperatures of above 38 °C were recorded in central and eastern mainland. Moreover, prolonged high temperatures across west-northwest Greece ranked June 2022 as the 2nd warmest June on record for that region.
- **December 2022** was **the warmest December on record in the last 62 years**. Mean monthly temperature anomaly across northwest Greece was even 4 °C above 1981-2010 average. It is noted that Florina met. station in west Macedonia had maximum temperature greater than 10 °C for 20 days while its 1981-2010 normal value is about 5.9 °C and Kerkyra station in north Ionian Sea had maximum temperature greater than 17 °C for 26 days i.e at least 2°C above 1981-2010 average. In addition, on December 16 and 17th most of the meteorological stations recorded maximum temperature above 20 °C, Florina met. station recorded 21.6 °C and 21.9 °C respectively i.e about 16 °C above 1981-2010 normal value, while Heraklio met. station in Crete recorded 25 °C and 25.4 °C respectively i.e 8 degrees above 1981-2010 normal values.

1. Annual Survey

This section presents an overview of the spatial patterns of mean annual climate conditions in 2022 and anomalies related mainly to the normal period 1981-2010 of the following basic climate variables: temperature and precipitation.

1.1 Temperature

In Greece, 2022 was the 5th warmest year on record. The country's mean annual temperature was 0.7 °C approximately above the 1981-2010 average and 0.4 °C above the 1991-2020. The two warmest years were 2018 and 2010 (Figure 1).

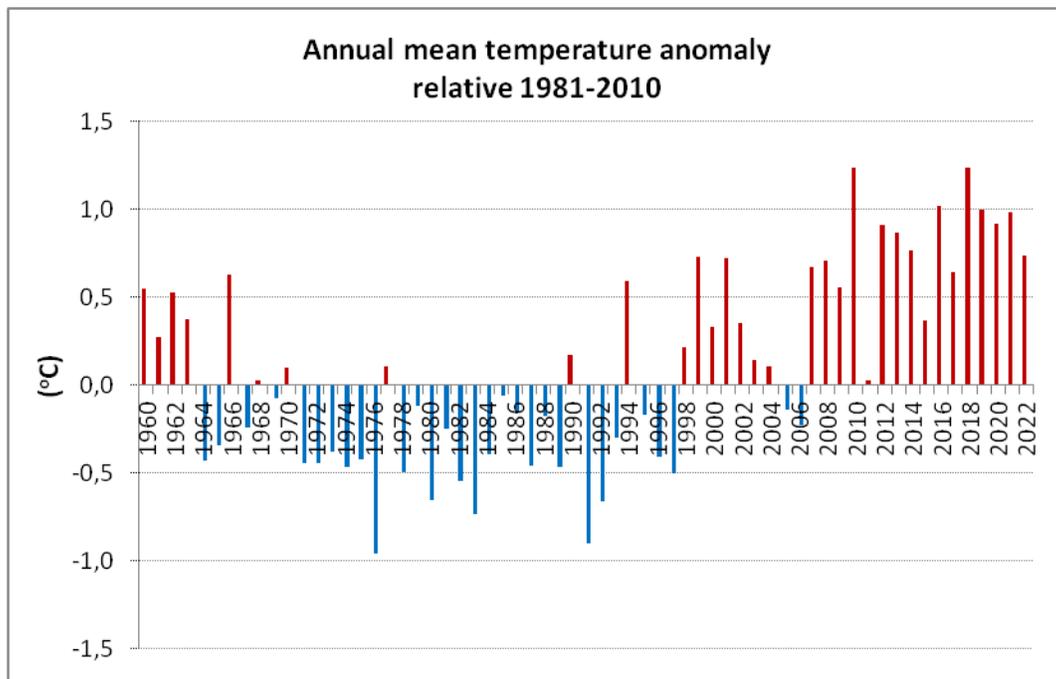


Figure 1 Annual mean temperature anomalies (°C) in Greece relative to 1981-2010, from 1960 to 2022.

Mean annual temperature anomalies relative to the respective annual average for the period 1981-2010, ranged between 0.3 °C and 1.2 °C. The greatest positive departures from 1981-2010 normal values occurred in northwest areas (Figure 2). At the end of the year 2022, Greece experienced significant positive anomalies and especially during December when mean monthly temperatures anomalies exceeded 3.0 °C over northern Greece. On the contrary, the most prominent negative temperature anomalies of -3.0 °C occurred during March which was a cold month in most of the territory.

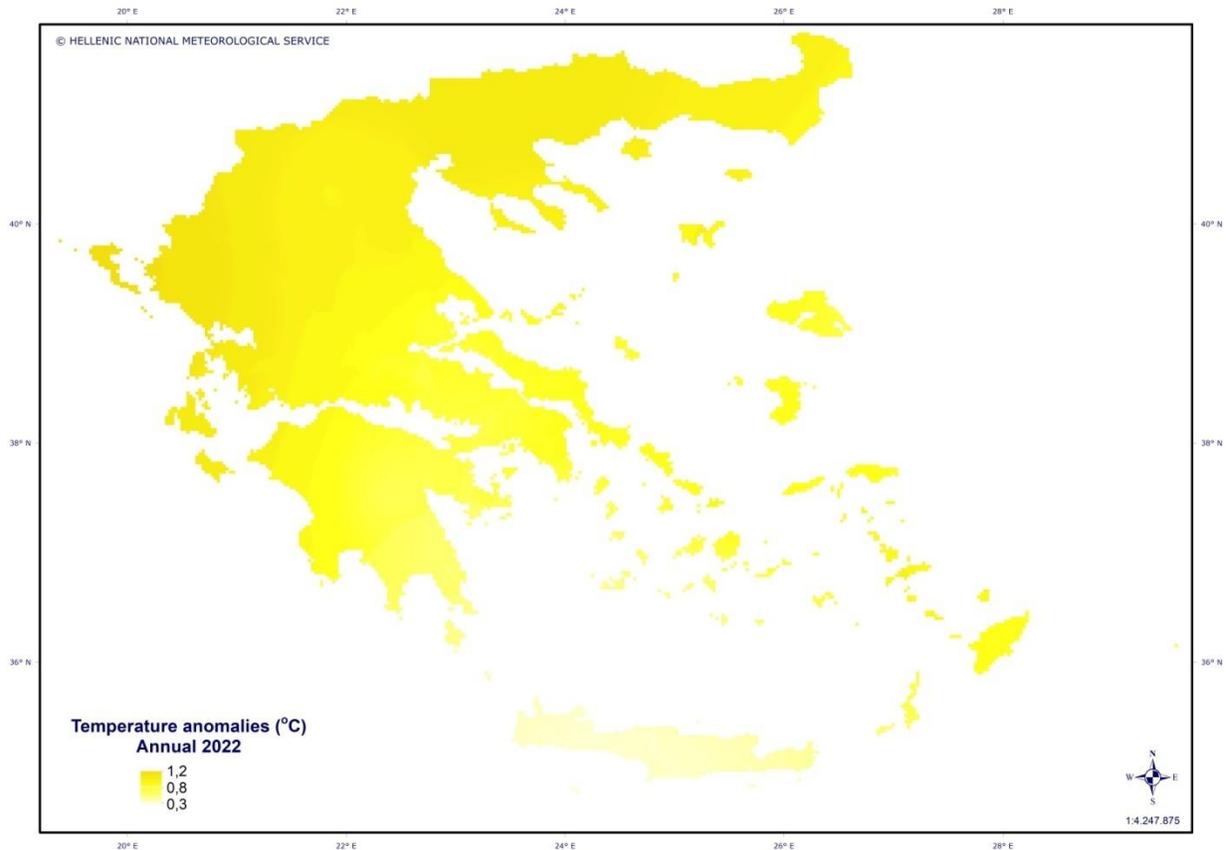


Figure 2 Annual mean temperature anomalies (°C) in 2022 in Greece according to the 1981-2010 climatology.

1.2 Precipitation

In terms of precipitation in 2022, this year was the 5th driest year on record since 1960. Figure 3 is showing the annual total precipitation anomaly (average of 43 meteorological stations), expressed in mm with respect to 1981-2010 normal value, from 1960 to 2022. The year 1989 was the driest year in Greece, to be followed by 1992 and 2000.

Figure 4 depicts the annual precipitation anomalies with respect to 1981-2010. Drier than normal conditions prevailed mainly over northwest Greece, Attica, north-northeast Peloponnese and few islands where total precipitation accounted for less than 80 % of normal values (1981-2010). In contrary, east Crete and locally northwest Macedonia and Thessaly areas received total precipitation 1.2-1.4 times above 1981-2010 average values.

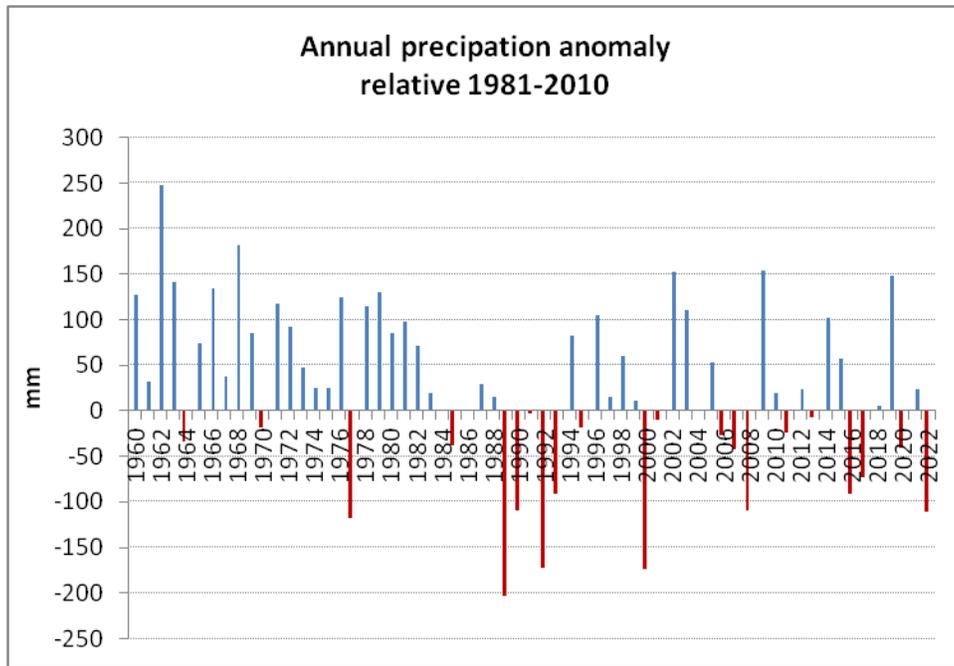


Figure 3. Average annual precipitation anomaly (expressed in mm) with respect to 1981-2010 average.

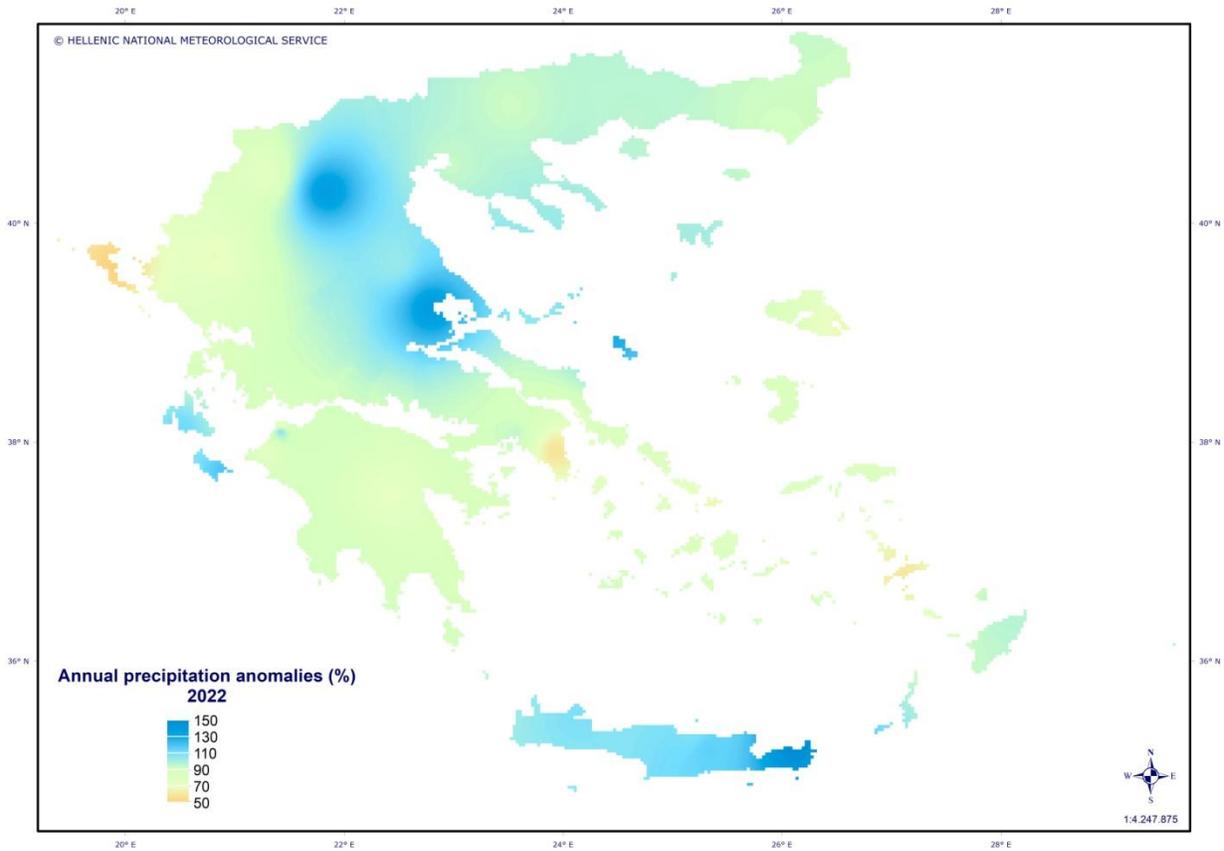


Figure 4. Annual precipitation anomalies 2022 in Greece (%) with respect to 1981-2010 average.

2. Seasonal Survey

This section presents an overview of the spatial patterns of seasonal mean climate conditions in 2022 in Greece and anomalies related mainly to the normal period 1981-2010 of the following basic climate variables: temperature and precipitation.

2.1 Temperature

Temperature anomalies in **winter 2021/22** in Greece were slightly below or near to 1981-2010 normal values for the central and south Greece and 0.7-1.0 °C above normal values for the north Greece (Figure 5).

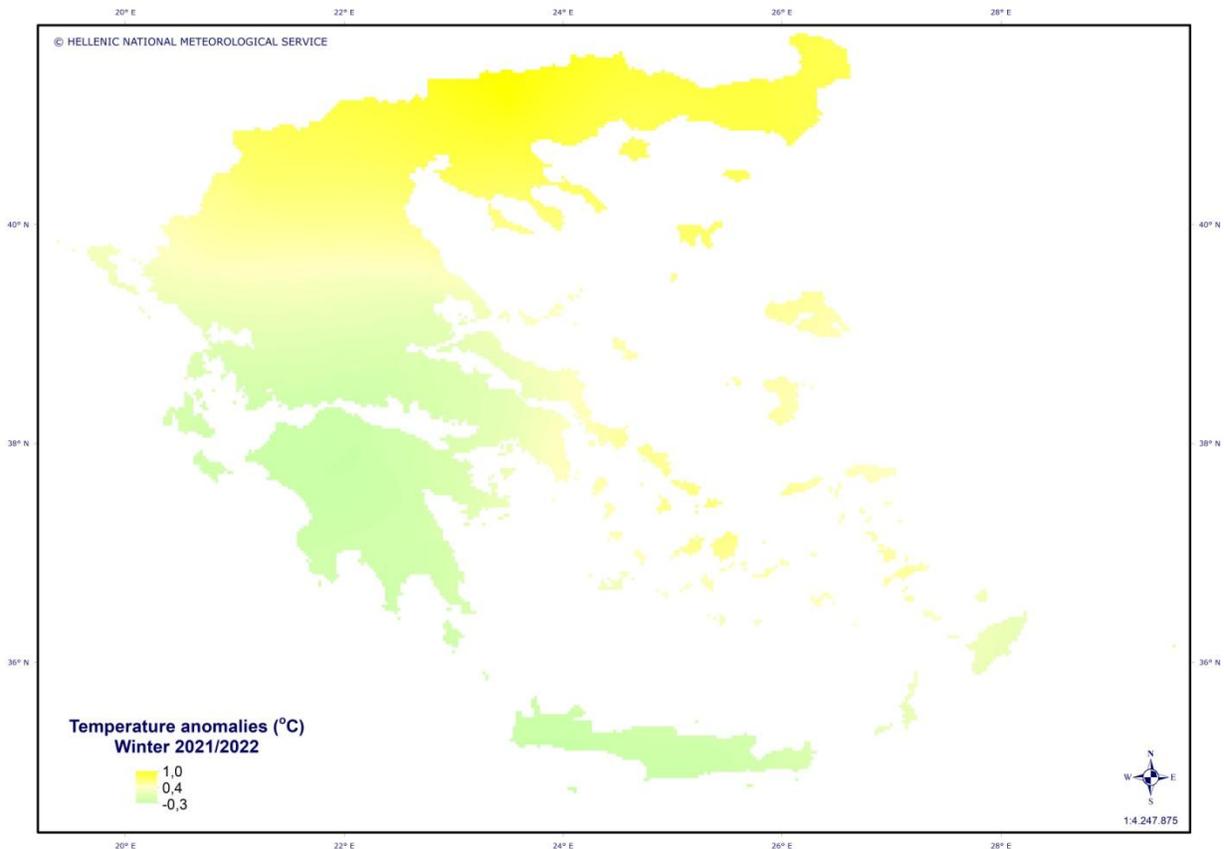


Figure 5. Mean temperature anomalies (°C) for winter 2021/22 in Greece according to the 1981-2010 climatology.

Spring of 2022 began with a much colder than average March with mean monthly temperatures being 2-3 °C lower than the mean temperatures of the 30-year (1981-2010) historical average. The next two

months were warmer than average; Mean temperatures for April 2022 were 0.2 to 1.9 °C above the 1981-2010 normal values and temperatures in May 2022 reached 2 °C above the 1981-2010 average, over the northwest Greece and on average 1.0 °C over the rest of the country. In general, mean temperatures in spring were near to 1981-2010 normal values.

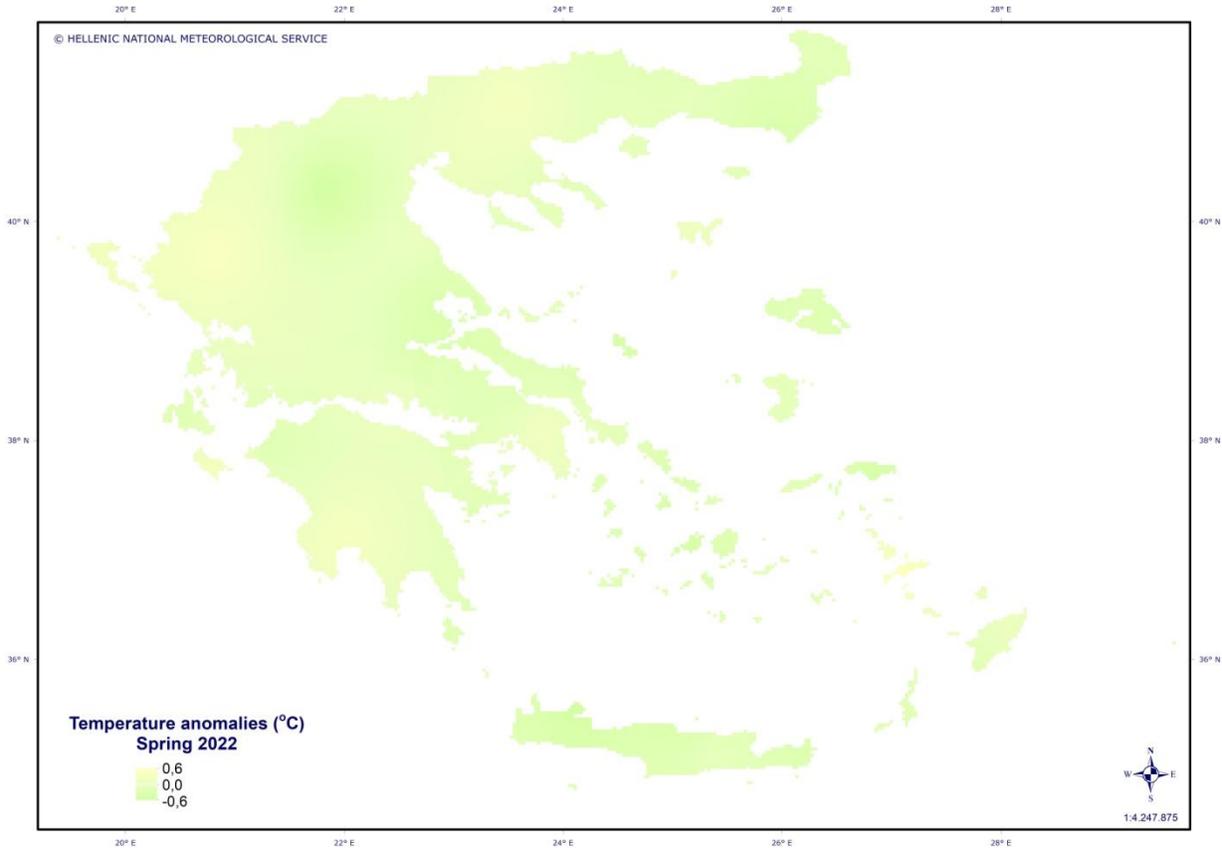


Figure 6. Mean temperature anomalies (°C) for spring 2022 in Greece according to the 1981-2010 climatology.

Temperatures in **summer 2022** varied considerably across Greece relative to their average values for 1981-2010 reference period. Mean temperature anomalies exceeded 2 °C over the Ionian islands and the west coastal regions, while they were on average 0.3 °C over Crete and south Aegean islands (Figure 7).

The summer average mean temperature anomalies in Greece from 1960 to 2022 are given in Figure 8. It is noticeable 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 average mean temperature anomaly in summer 2007, relative to 1981-2000 normal value, exceeded 1.5 °C for the first time since 1960, and two more times the mean temperature anomaly reached or exceeded 1.5 °C since

then. The **summer of 2022** was the 5th warmest summer jointly with 2016 and 1998 and it was the **2nd warmest for west Greece** after 2012 in the last 63 years.

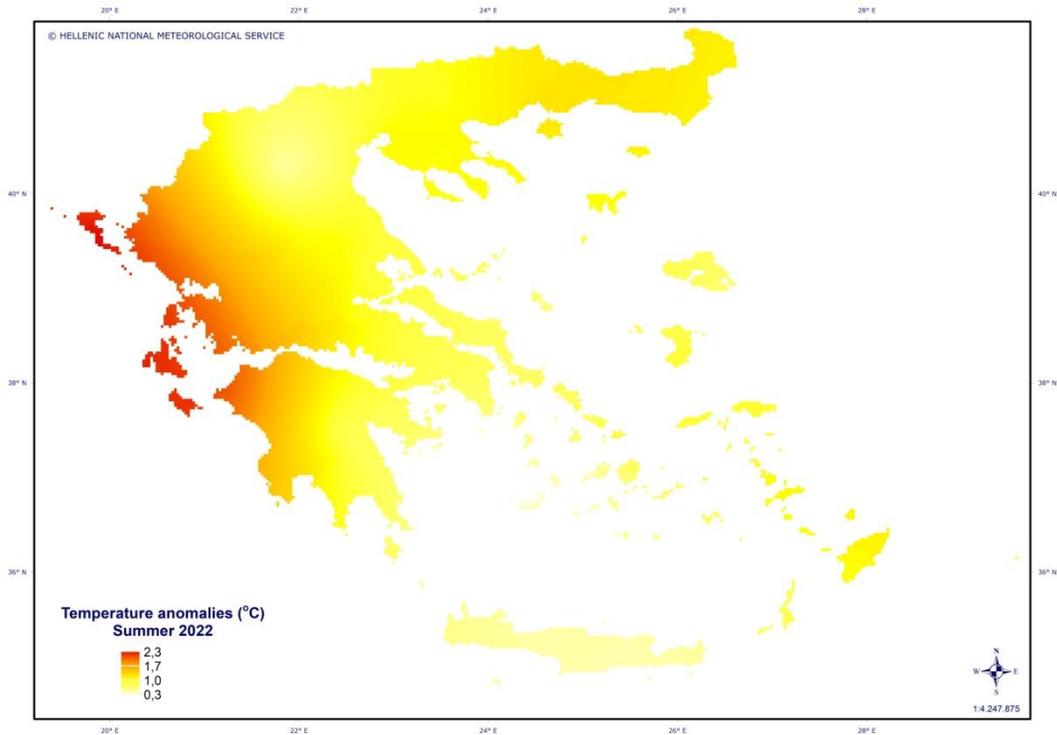


Figure 7. Mean temperature anomalies (°C) for summer 2022 in Greece according to the 1981-2010 climatology.

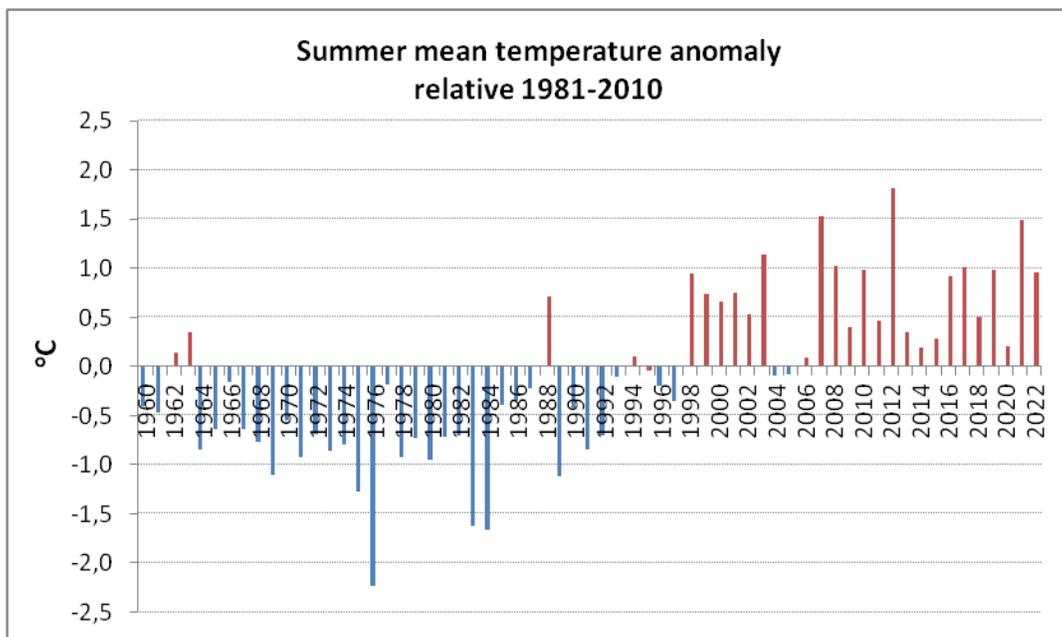


Figure 8. Summer 2022 averages of mean temperature anomalies for Greece relative to 1981-2010.

Autumn 2022 was the 6th warmest autumn on record. Mean temperature was on average 1 °C above the 1981-2010 normal value. The highest mean temperature anomalies were found in north-north east parts and southeast Aegean islands.

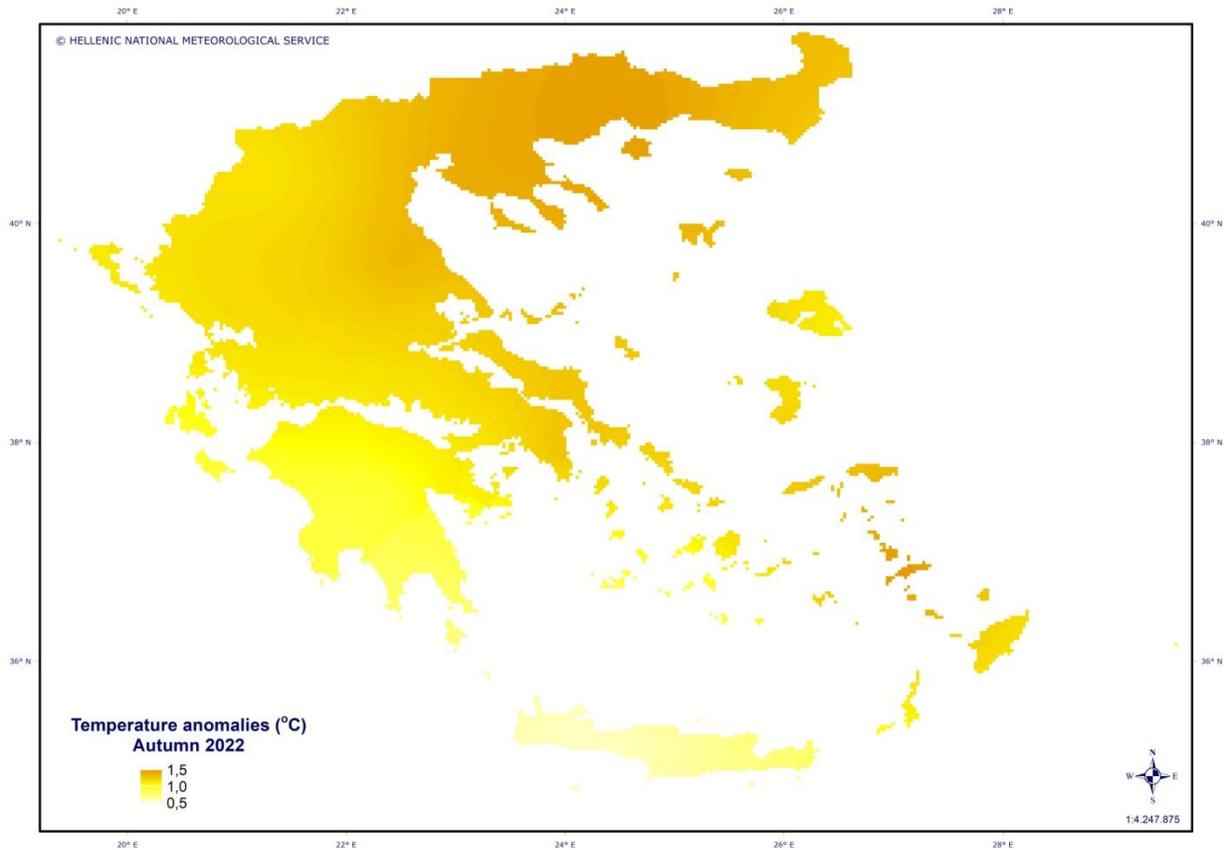


Figure 9. Mean temperature anomalies (°C) for autumn 2022 in Greece according to the 1981-2010 climatology.

2.2 Precipitation

In **Winter of 2020/21** near to normal conditions prevailed in most of Greece. However, some stations in north Greece and locally in south Aegean islands recorded high precipitation amounts, accounting for more than 150% of 1981-2010 normal values (Figure 10).

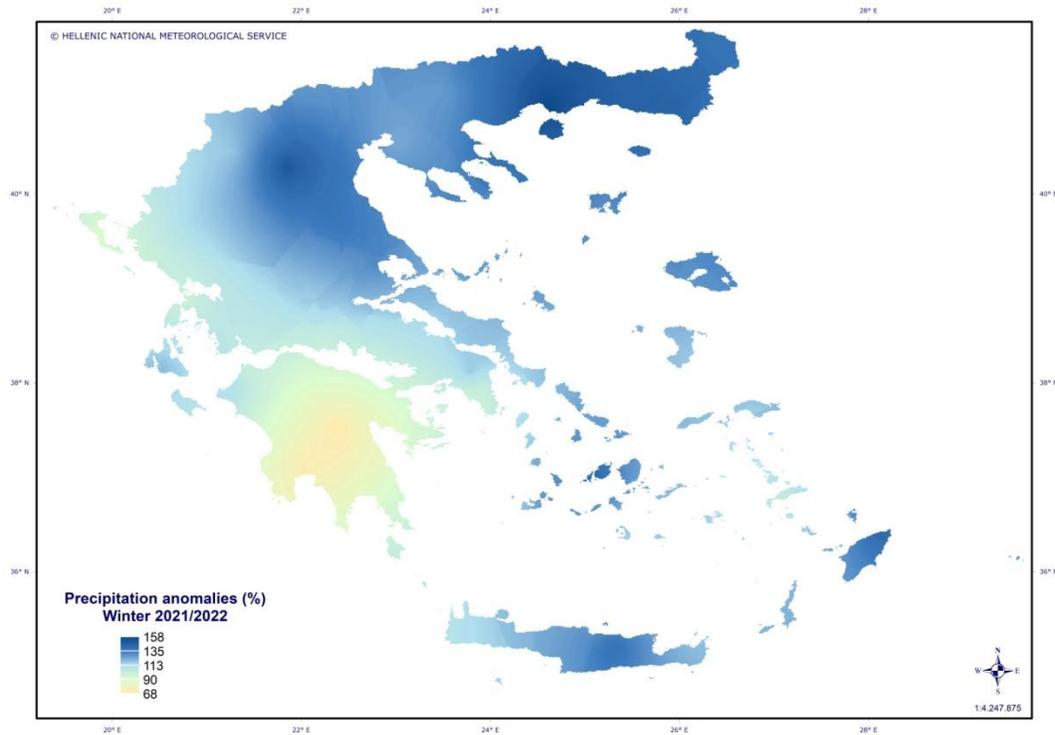


Figure 10. Winter 2020/21 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

In **Spring 2022**, most of Greece experienced drier than normal conditions. Precipitation was significantly lower than average in northwest Greece and Attica. On the other hand, Crete experienced wetter than normal conditions. In Crete some stations recorded extremely high precipitation, e.g Souda met. station recorded 211mm total precipitation, accounting for more than 190 % of normal values (1981-2010) (Figure 11).

Summer 2022 was wetter than normal in most of Greece, particularly in eastern areas. Some stations recorded extremely high precipitation e.g Skyros met. station, in central Aegean, and Kalamata met. station in south Peloponnese, recorded 192 mm and 134 mm total precipitation heights respectively, accounting for more than 500 % of 1981-2010 normal values (Figure 12).

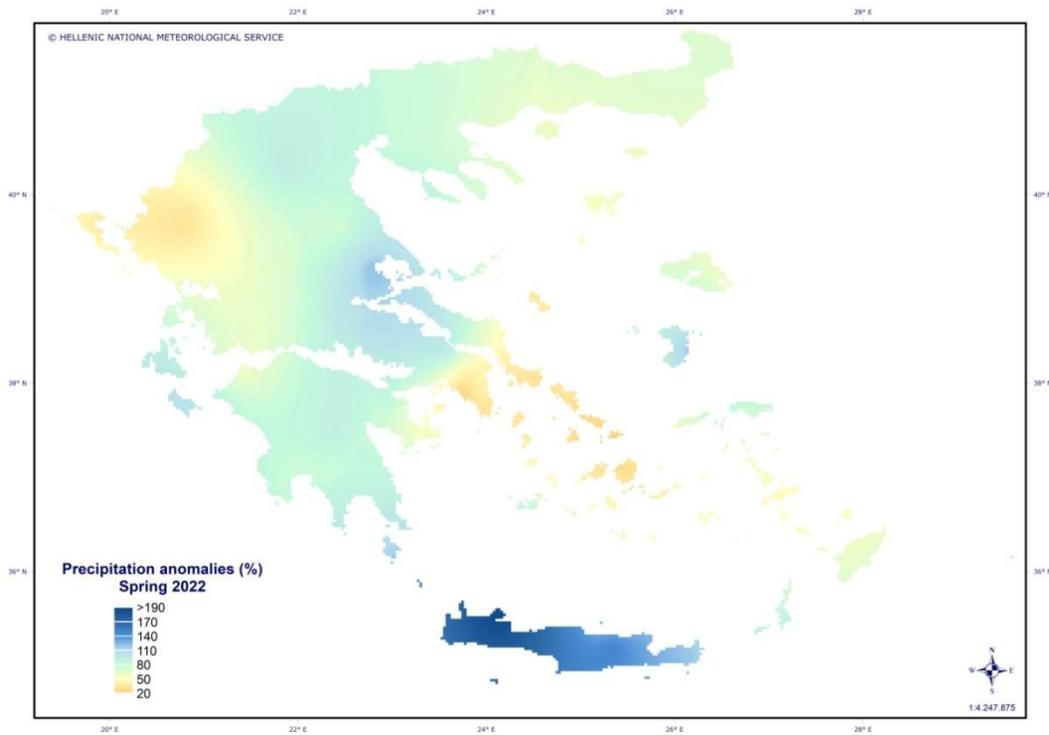


Figure 11. Spring 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

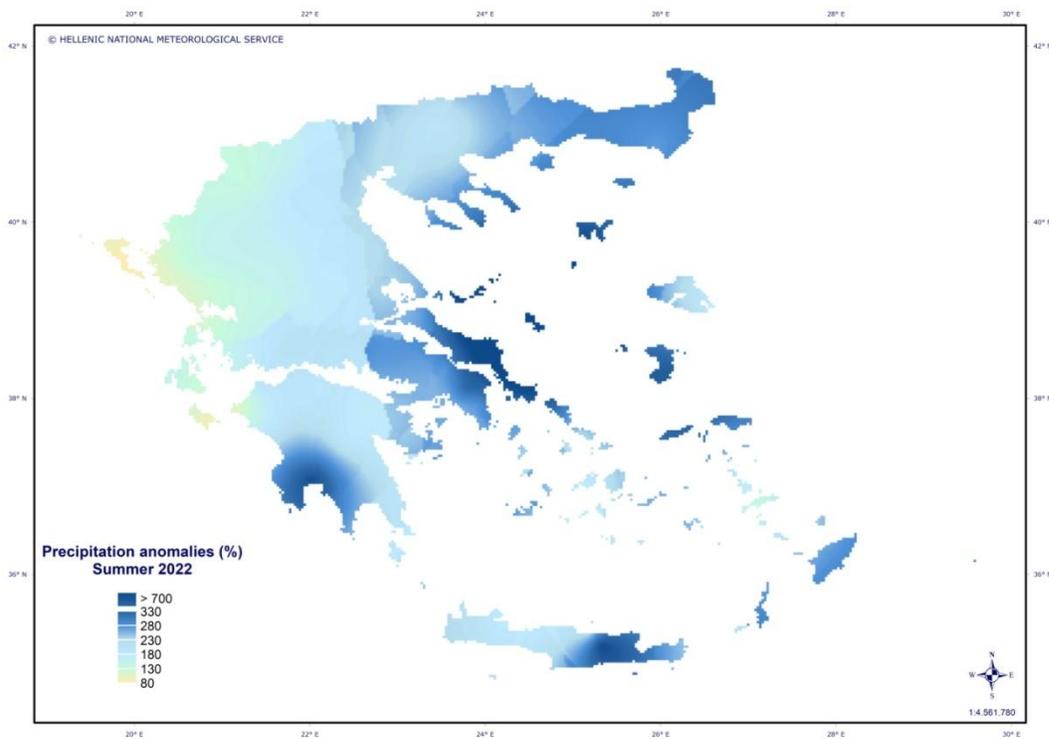


Figure 12. Summer 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

Autumn 2022, was much wetter than normal in Crete and mainly in east Crete where total precipitation was 2 times above 1981-2010 normal value. On the contrary, most of the Greek areas and especially northeast Macedonia and Thrace and north and central Aegean islands experienced drier than normal conditions, since total precipitation accounted for less than 50 % of 1981-2010 normal values (Figure 13).

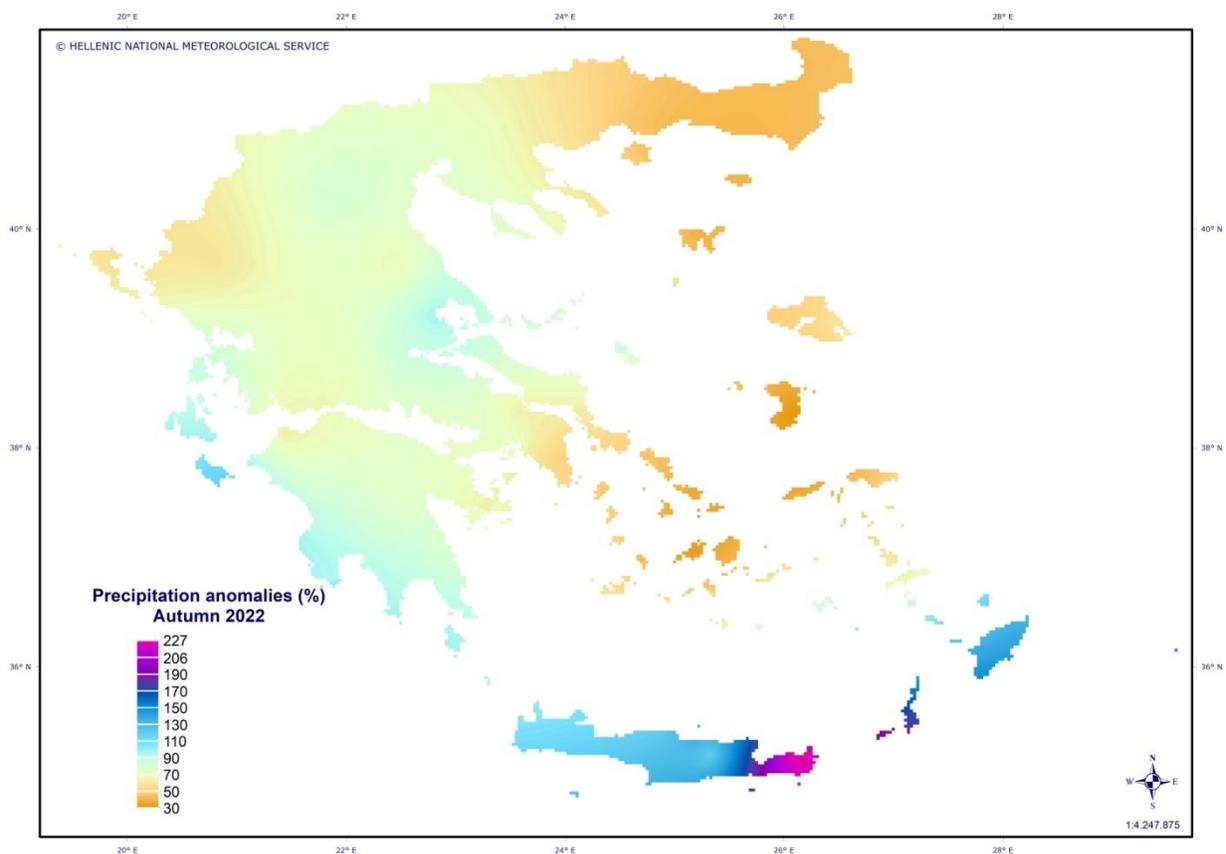


Figure 13. Autumn 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

3. Monthly Survey

This section contains notable weather and climate events, high impacts events as well as monthly means and anomalies of temperature and precipitation in 2022 in Greece.

3.1 January

January 2022 was colder than average for most of Greece. Mean temperature anomalies were 1 to 1.5°C below 1981-2010 normal values for southern areas (Peloponnese, east Sterea, Crete) (Figure 14). It was wetter than normal in eastern mainland areas mainly Thessaly, east Sterea and Attica and drier than normal in the west parts of the country (Figure 15).

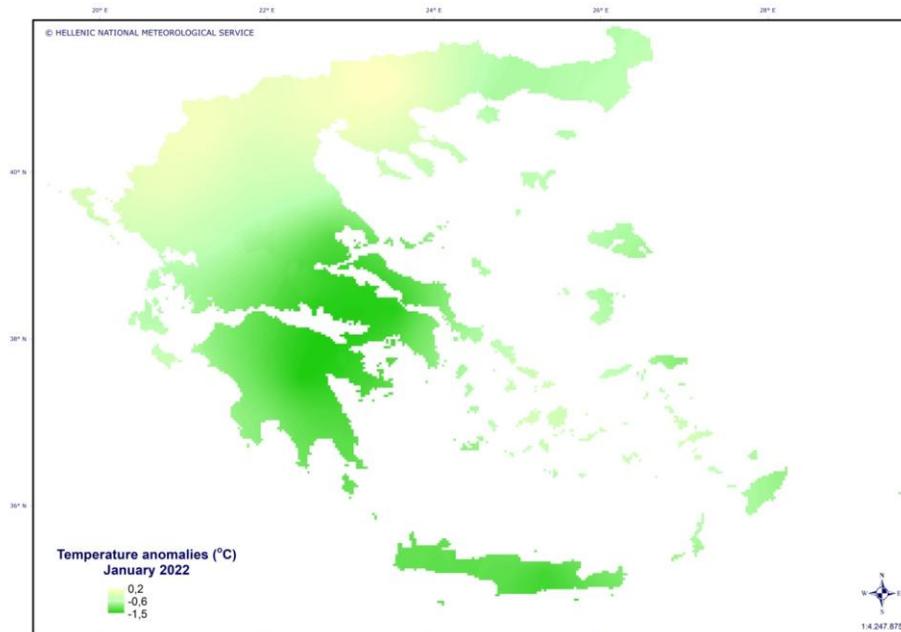


Figure 14. January 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

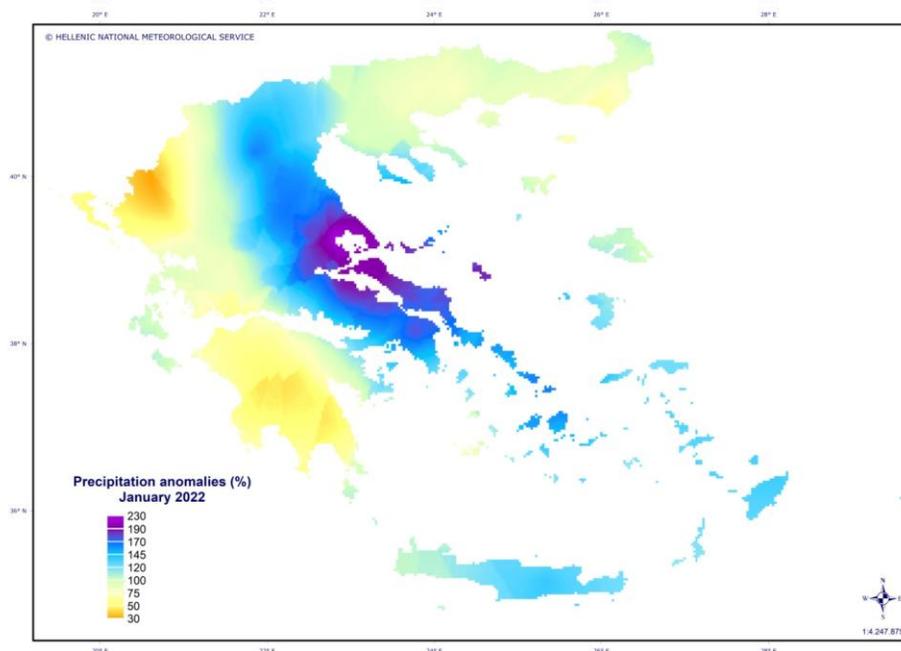


Figure 15. January 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

3.2 February

Warmer-than-average conditions occurred across Greece during February 2022. The most notable warmer-than-average February 2022 temperatures of at least 1.5°C were recorded across central Macedonia, Attica and few Aegean islands (Figure 16). Drier than normal conditions prevailed in the central and southern parts of the country in February, while in the north northeastern parts February was wetter than normal (Figure 17).

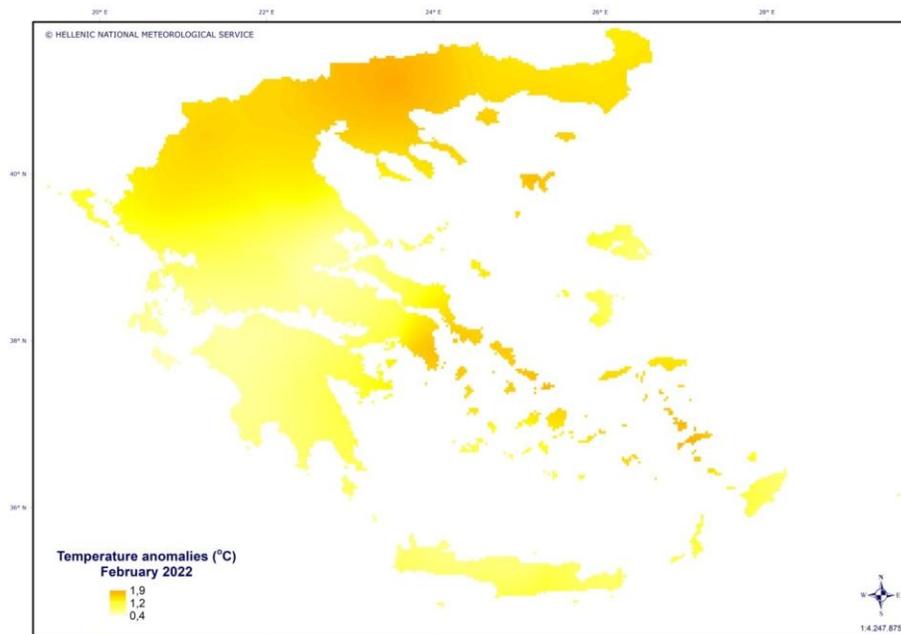


Figure 16. February 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

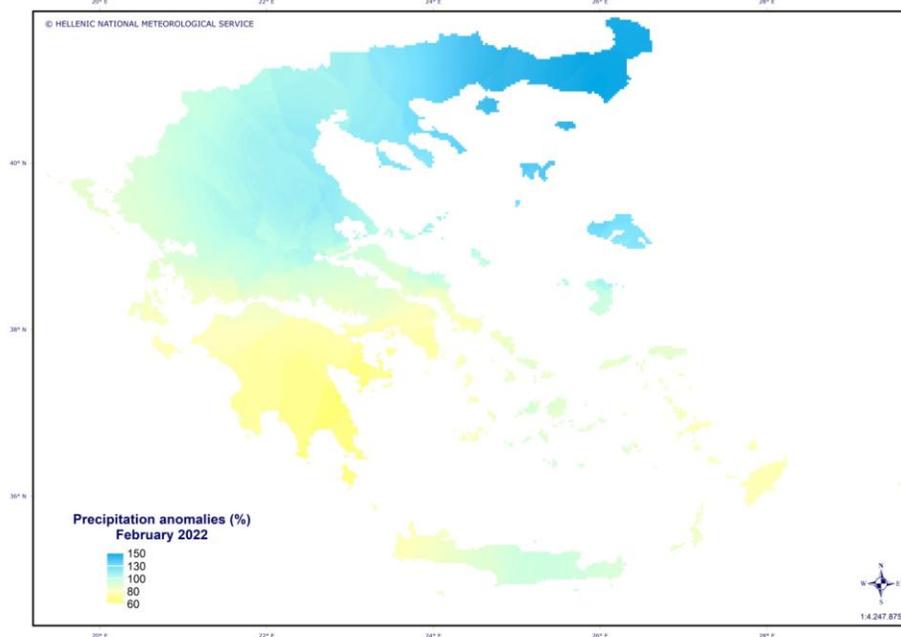


Figure 17. February 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

3.3 March

March 2022 was the **3rd coldest March in the last 63 years**. The coldest March on record was 1987 and the 2nd coldest was 1996. Mean temperature in March 2022 was 9.1 °C on average, about 2.2 °C lower than 1981-2010 normal value. The greatest negative temperature anomalies occurred across west Macedonia, Attica and east Peloponnese (Figure 18). Although March 2022 is not the coldest March ever recorded, records were set for the number of days with frost, Florina met. station (west Macedonia) recorded 24 days with frost (minimum temperature below 0 °C) and the station's previous record with frost days in March was 23 days in 1987. In Athens, March 2022 was also extremely cold, Helliniko and Elefsis met. stations recorded mean temperature below 8°C for 12 days, while the 1981-2010 normal value is 12.3 and 12.0 respectively.

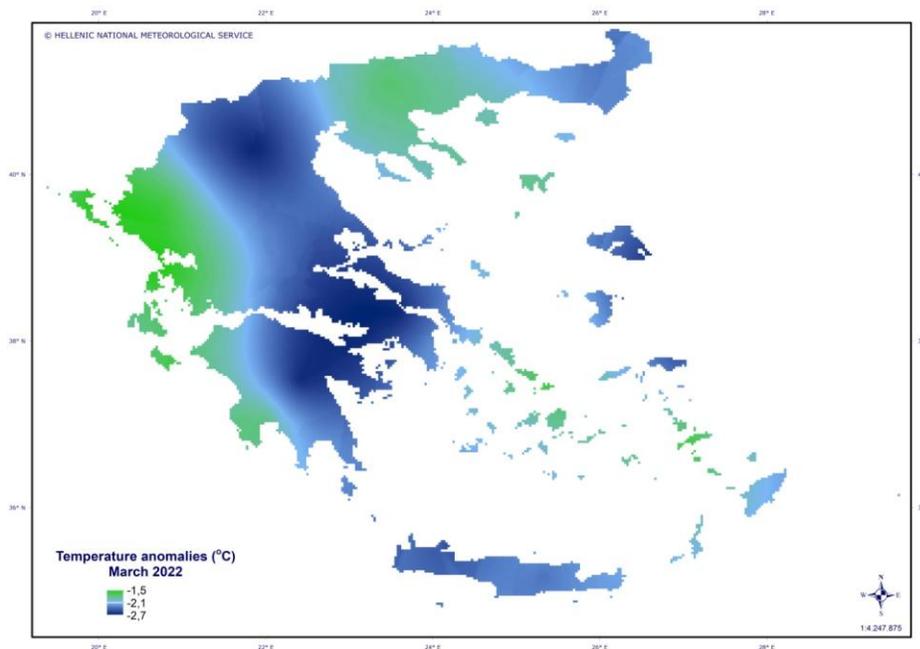


Figure 18. March 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

March 2022 presented a precipitation surplus mainly over the areas of Crete and locally over Thessaly, east Sterea and central Macedonia and a precipitation deficit in the rest of the country. Notable precipitation amounts were recorded in the area of Crete (Figure 19). Souda met. station recorded 205.6 mm total monthly precipitation i.e 3 times the 1981-2010 normal value, ranking March 2022 as the 3rd wettest March on record (Figure 20).

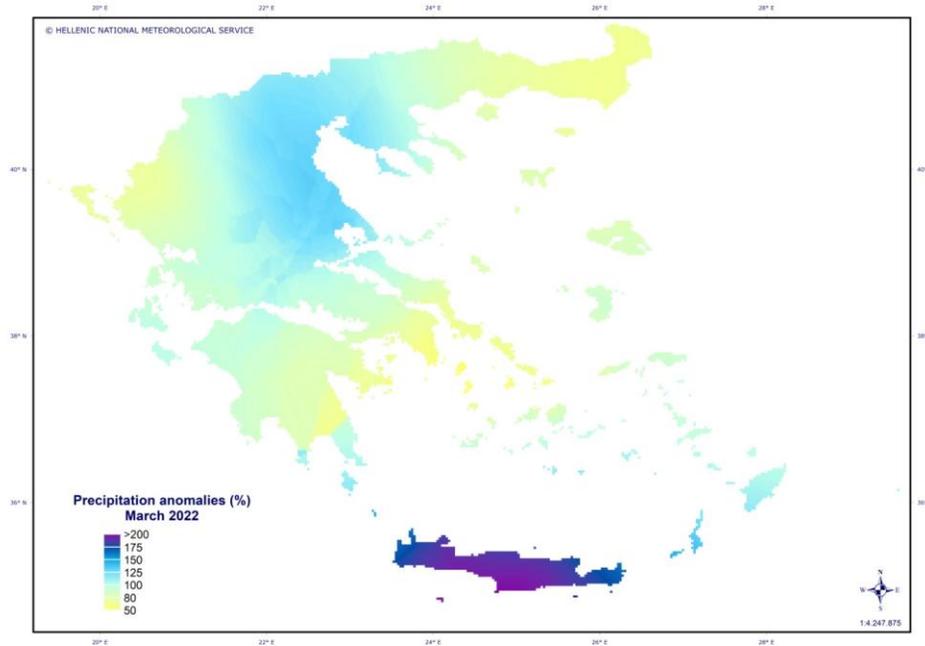


Figure 19. March 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

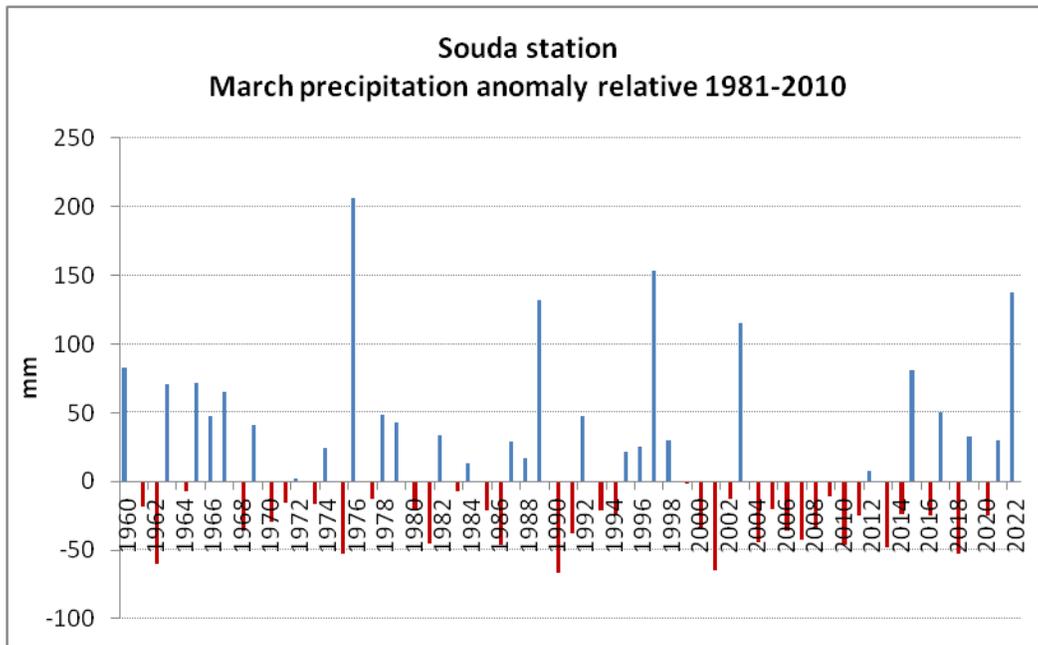


Figure 20. March's precipitation anomaly (in mm) in Souda met. station, from 1960 to 2022.

3.4 April

April 2022 registered as warmer than average over southern parts including Attica, where mean temperature anomaly exceeded 1°C (Figure 21). In terms of precipitation, drier than normal conditions were prevalent across the country and especially in the southern parts where total precipitation accounted for less than 30% of 1981-2010 average (Figure 22).

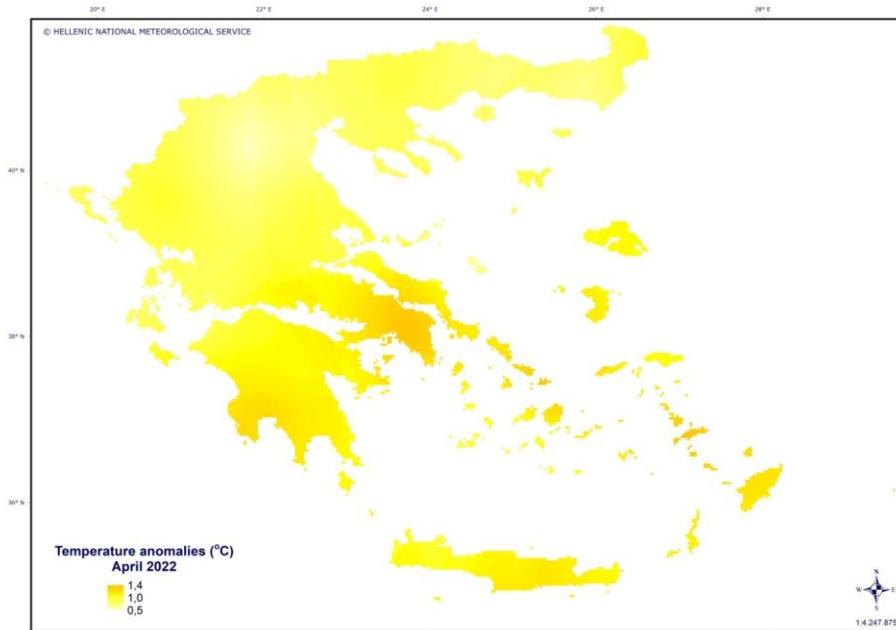


Figure 21. April 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

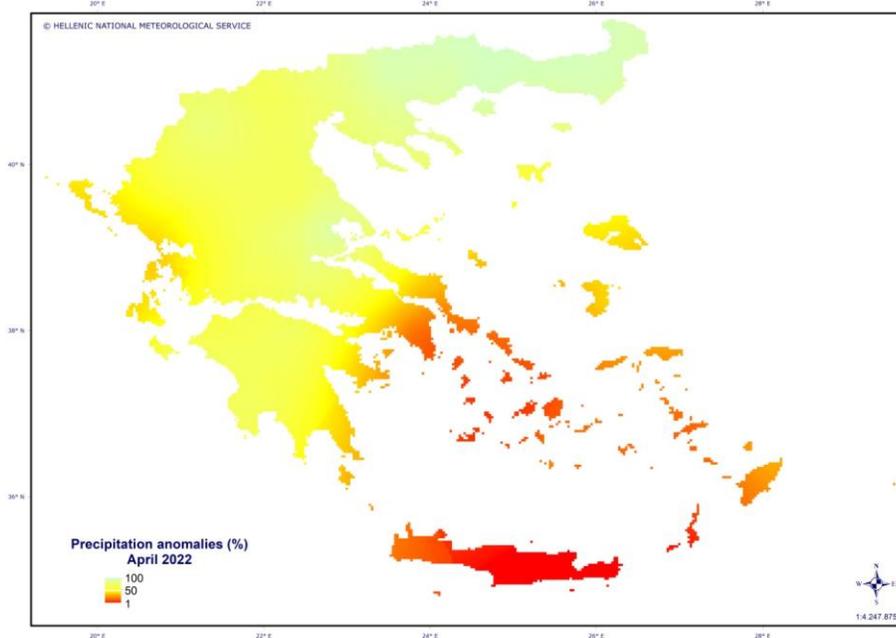


Figure 22. April 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

3.5 May

Warmer-than-average conditions occurred in May 2022 across the whole country. The mean temperature was on average +1.0°C above the 1981-2010 normal value (Figure 23).

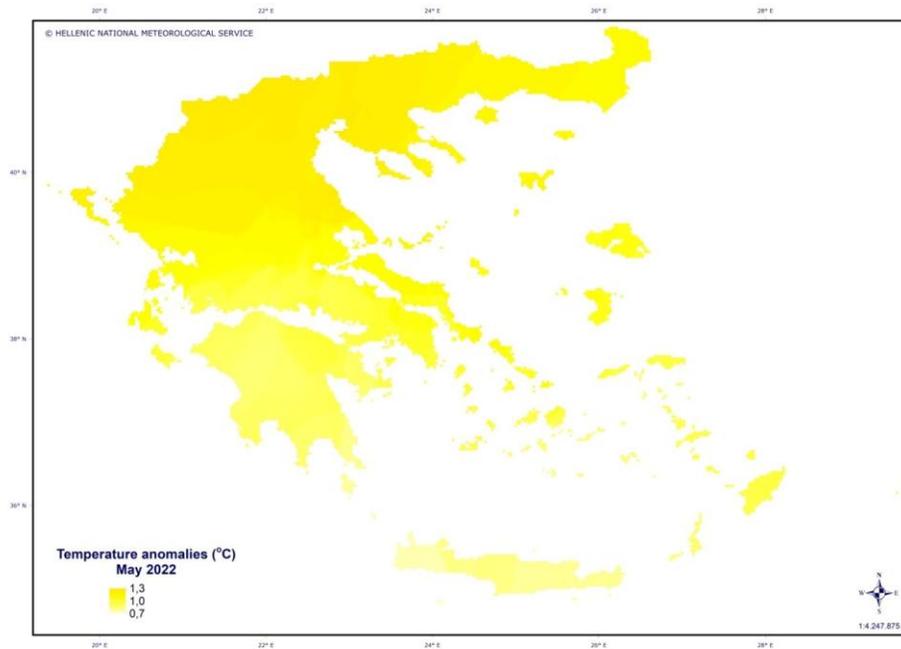


Figure 23. May 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

In May 2022, most of Greece experienced much drier-than-average conditions, with the exception of central Peloponnese area (Figure 24).

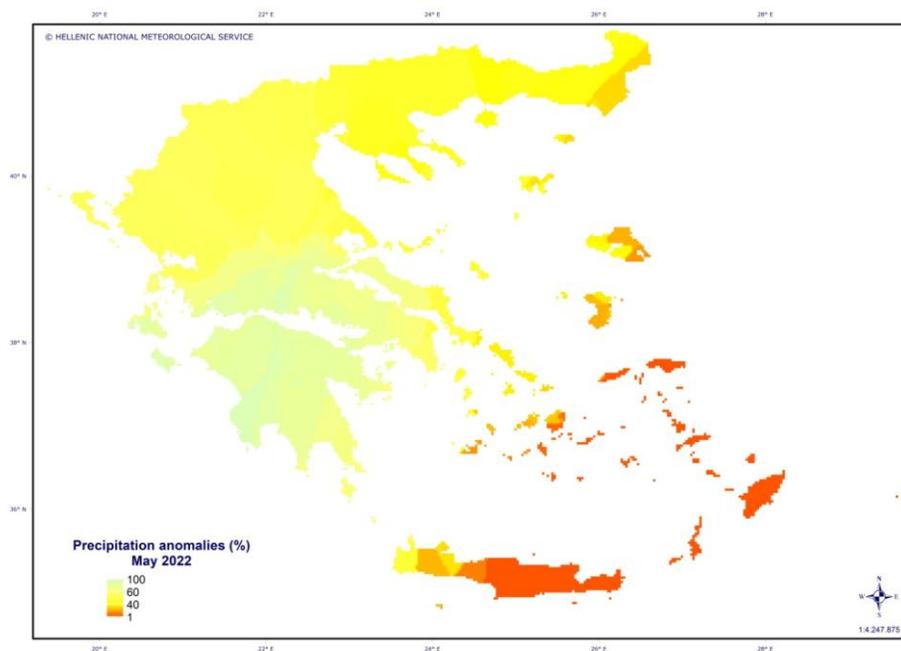


Figure 24. May 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

3.6 June

June 2022 was the 4th warmest June on record since 1960, with an average temperature of 25.9 °C, about 1.4 °C above 1981-2010 normal values. The greatest positive temperature anomalies of 2.9 °C on average occurred across west-northwest Greece (including Ionian islands, Epirus, west Sterea and northwest Peloponnese), ranking this June as the 2nd warmest after June 2003 in the last 63 years (Figure 25). It is noted that Ionnina met. station in Epirus and Kerkyra met. station in north Ionian recorded maximum temperature above 31°C for 17 and 22 days respectively i.e at least 3 °C above normal values.

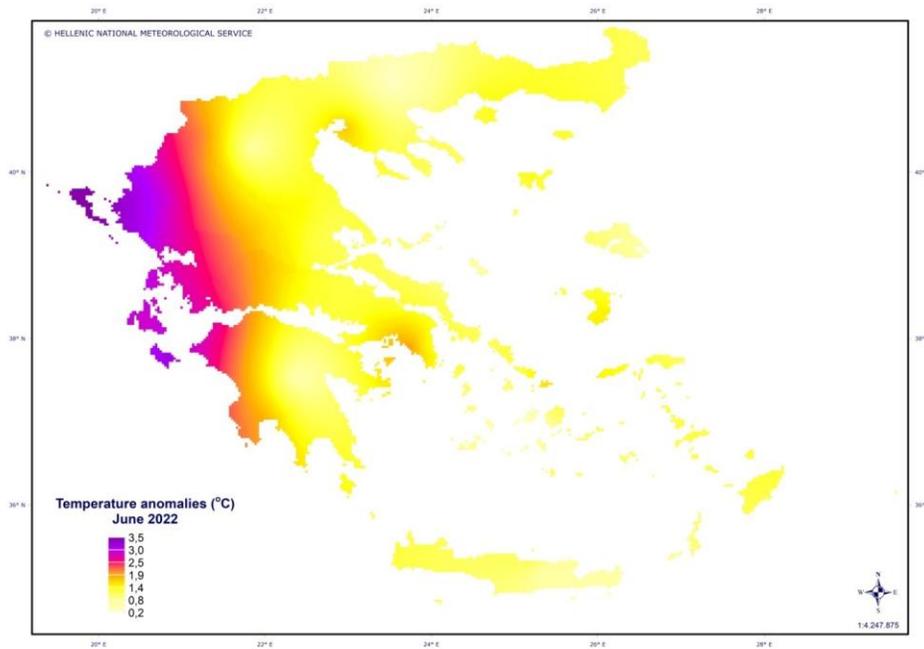


Figure 25. June 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

In June 2022 wetter than normal conditions prevailed over many areas of Greece and especially the north - northeastern parts, Thessaly and central Sterea (Figure 26).

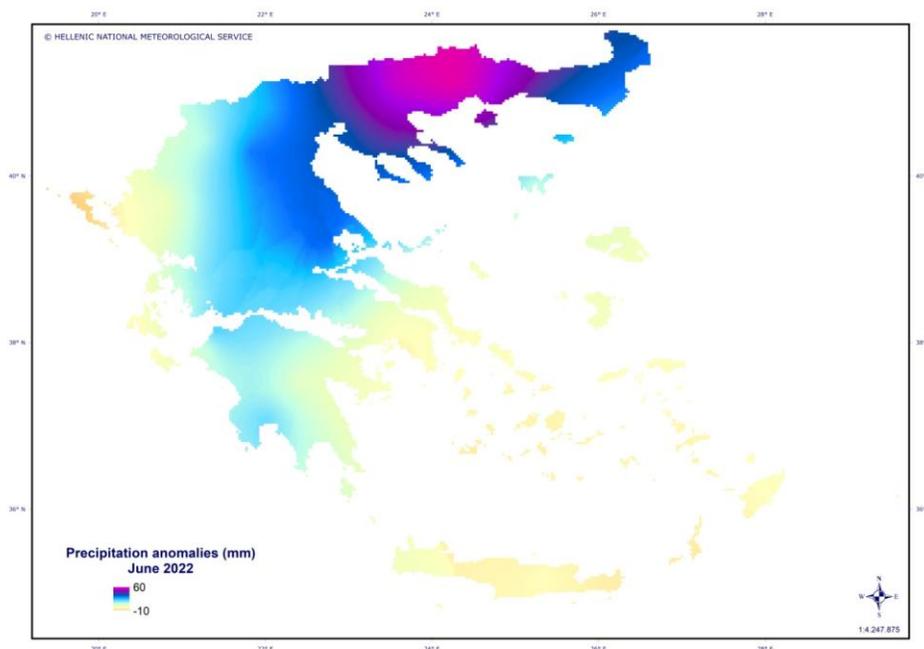


Figure 26. June 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

3.7 July

July 2022 was the 7th warmest July on record jointly with 2009 and 2015 with an average temperature of 27.6 °C, about 0.8 °C above 1981-2010 normal values. The greatest positive temperature anomalies of 2.5 °C on average occurred across west Greece (including Ionian islands, Epirus, west Sterea and northwest Peloponnese), ranking this July as the 2nd warmest after July 2012 in 63 years (Figure 27).

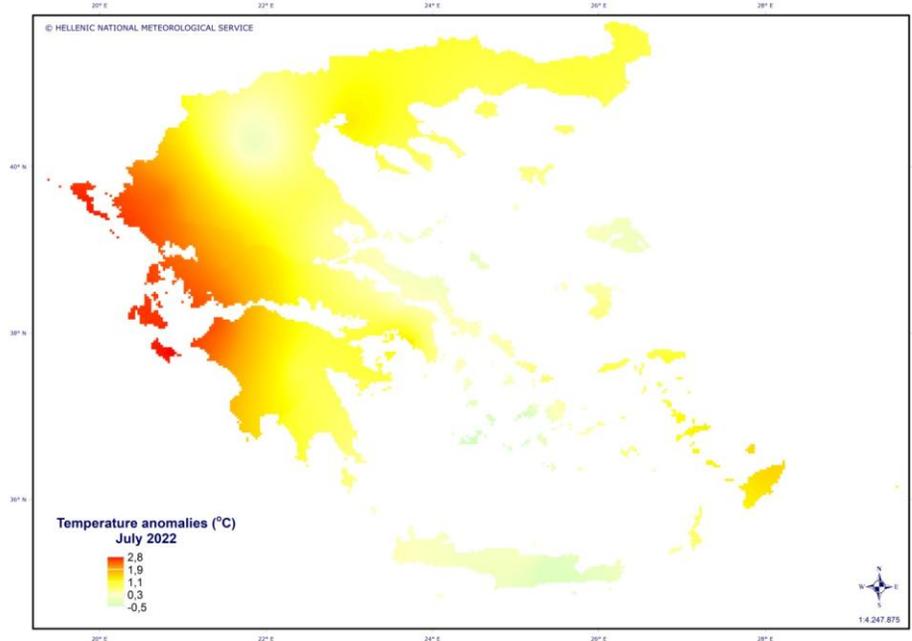


Figure 27. July 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

In July 2022, precipitation surplus was present in the areas of central Macedonia, Sporades islands and Kalamata, while in the west parts of the country precipitation was below normal values (Figure 28).

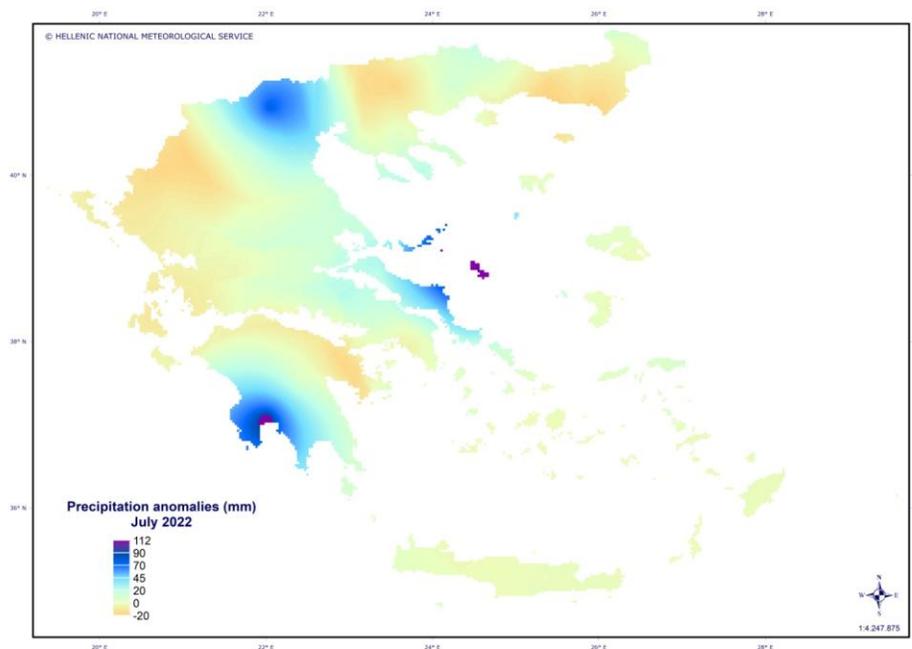


Figure 28. July 2022 precipitation anomalies (mm) with respect to 1981-2010 average.

3.8 August

August 2022 doesn't rank among the top-10 warmest Augusts. Temperature anomalies were near to normal values for many areas whereas locally over east Macedonia and Thrace and west coastal area and Ionian islands temperatures were at least 1 °C above 1981-2010 normal values.

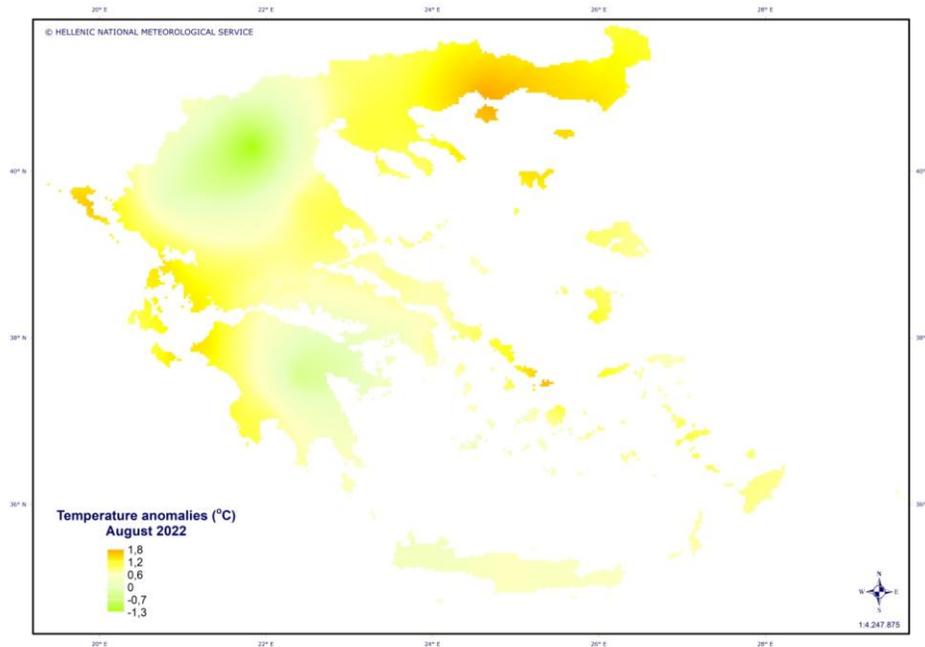


Figure 29. August 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

Wetter than normal conditions prevailed over most parts of Greece during August 2022 and mainly over the continental Greece, Macedonia, Attica and east Sterea, as well as the Aegean islands and east Crete.

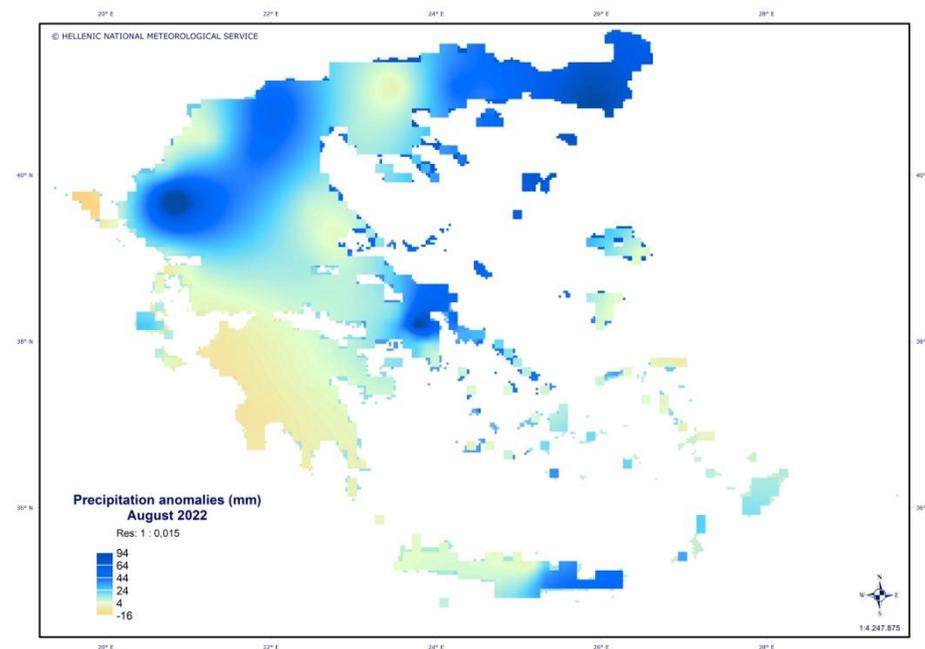


Figure 30. August 2022 precipitation anomalies (mm) in Greece with respect to 1981-2010 average.

3.9 September

September 2022, is the 13th consecutive September which is warmer than average. The mean temperature was about 0.7 °C above 1981-2010 normal value (Figure 31). In terms of precipitation, the overall monthly pattern indicates precipitation deficit across the eastern and southeastern parts of the country, and precipitation surplus in the areas of central Macedonia, Thessaly, Sterea and the western Greece (Figure 32).

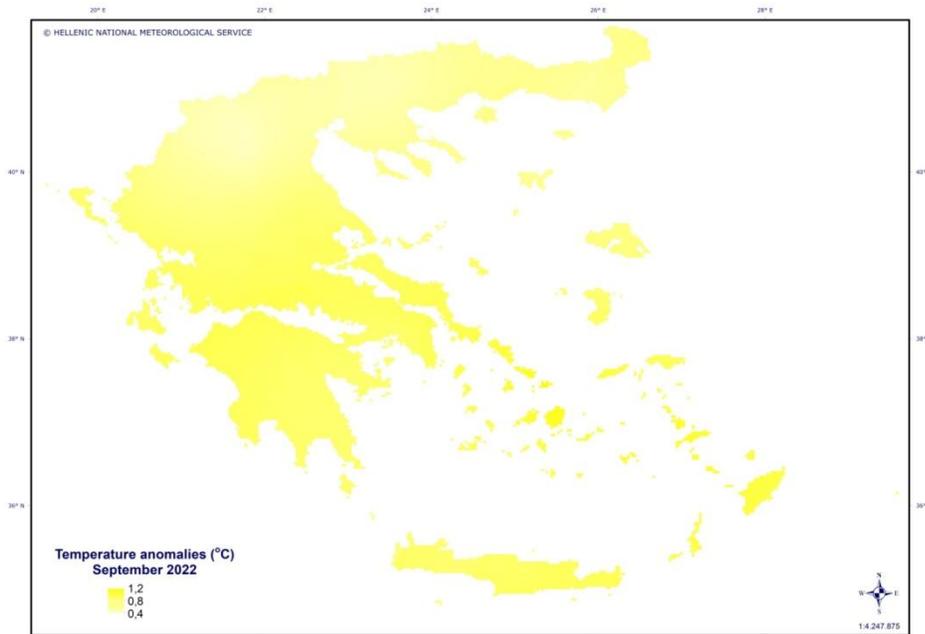


Figure 31. September 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

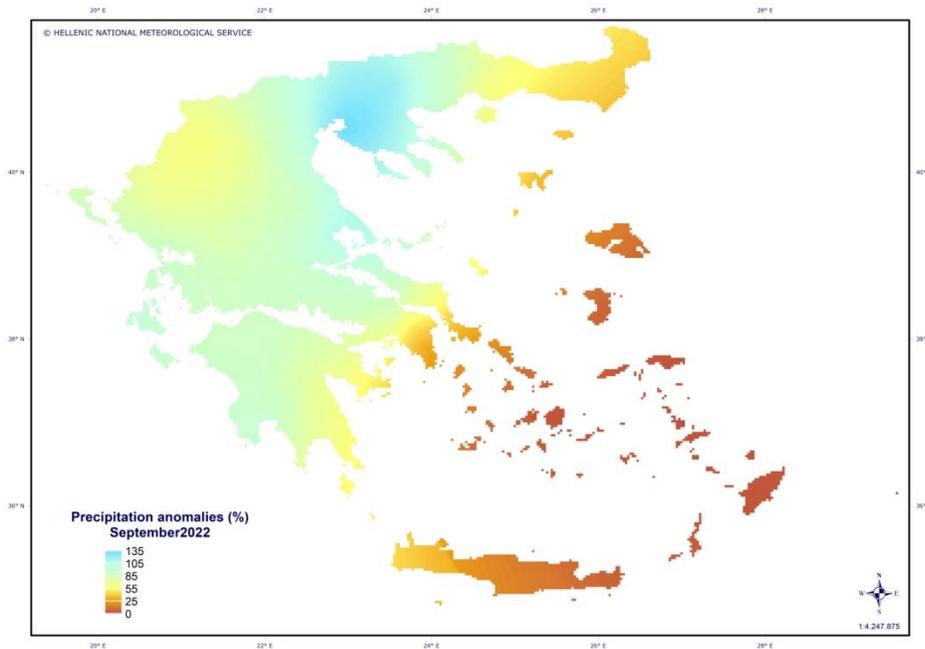


Figure 32. September 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

3.10 October

October 2022 doesn't rank among the top-10 warmest Octobers, however warmer than normal conditions prevailed in most of Greece. The mean temperature was about 0.7 °C above the 1981-2010 normal value (Figure 33).

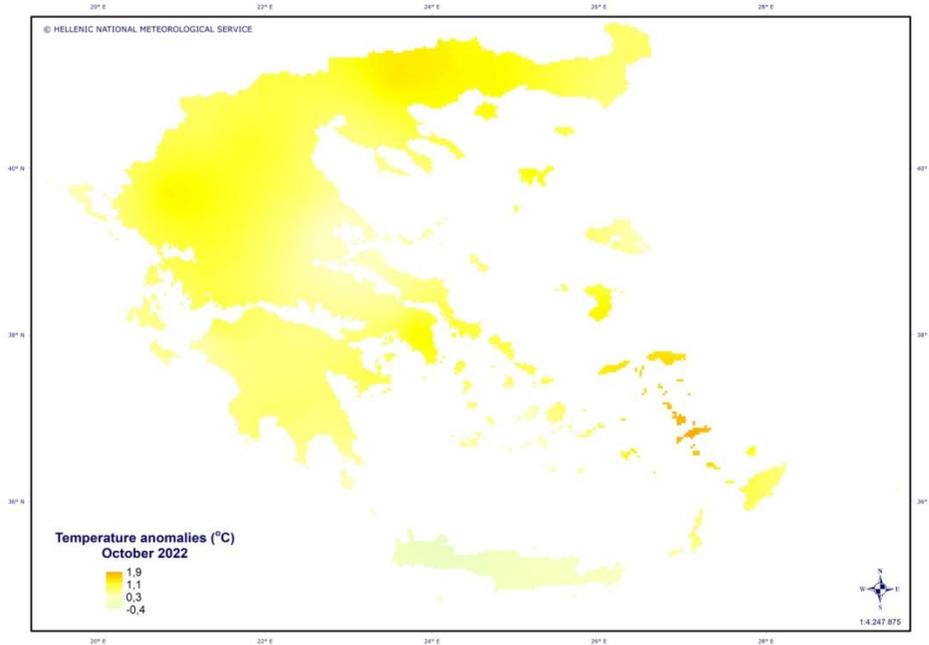


Figure 33. October 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

In October 2022, there was a striking contrast in precipitation pattern across Greece. Most of Greece experienced much drier-than-average conditions; precipitation was notably below the 1981-2010 average, accounting less than 50% of normal values in many areas. Conversely, Crete and mainly eastern parts received high precipitation amounts even 6.5 times above 1981-2010 normal values (Figure 34).

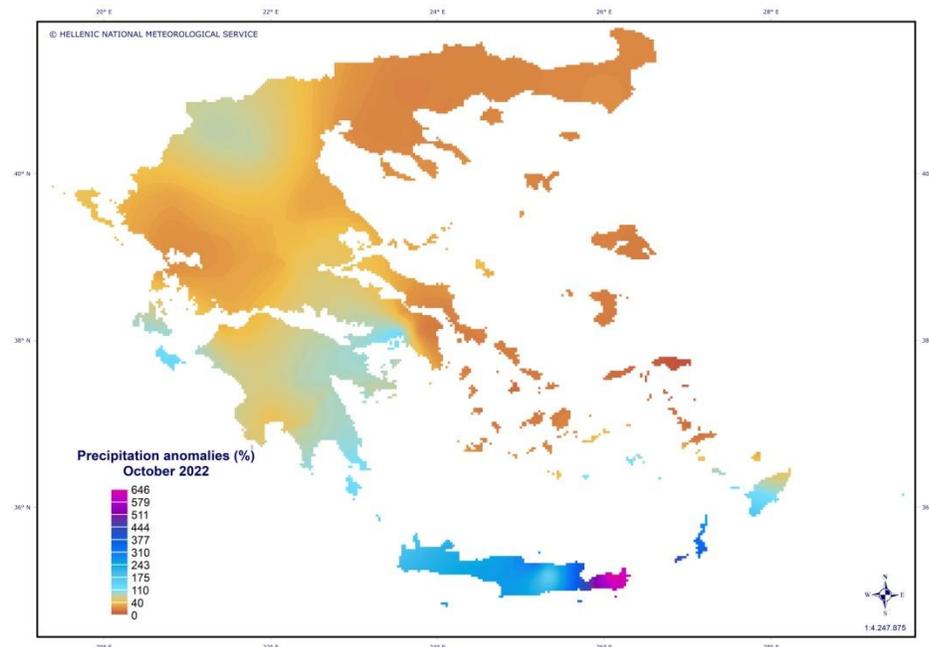


Figure 34. October 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

It is noted that Siteia met. station in east Crete recorded on 15th October 293mm daily precipitation (281.8mm in 12 hours) which means about 250mm more than the station's normal value (Figure 35). It is worth to mention that **293mm in 24 hours corresponds to the 3rd national maximum rainfall ever recorded in 24 hours.**

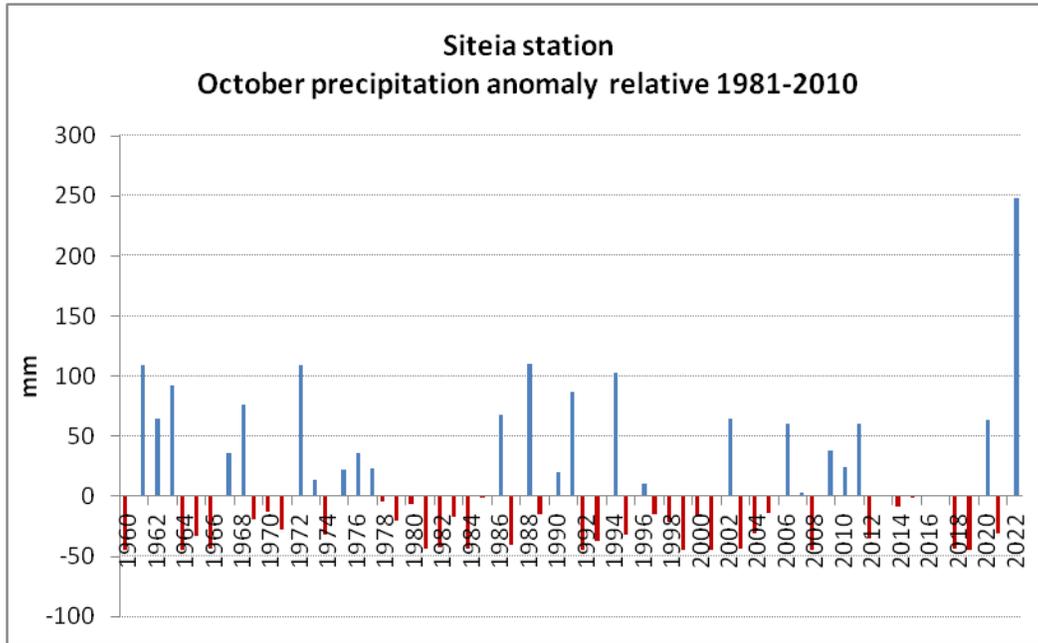


Figure 35. October's precipitation anomaly (in mm) in Siteia met. station, from 1960 to 2022.

3.11 November

November 2022, is the 11th consecutive November which is warmer than average. Mean monthly temperature was 1.7 °C on average above 1981-2010 normal value. The greatest positive temperature anomalies observed over northern parts of the country (Figure 36).

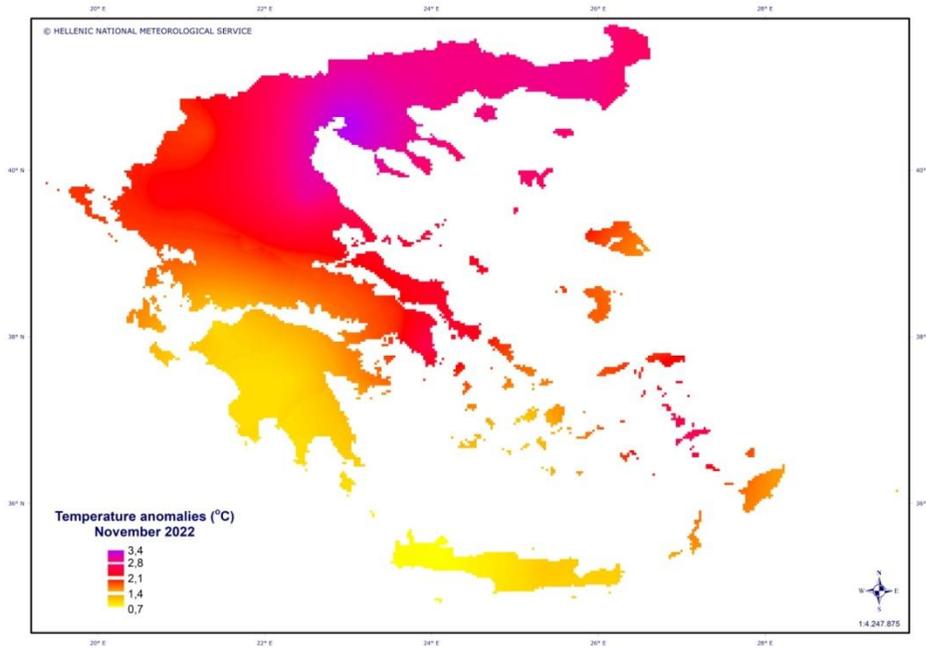


Figure 36. November 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.

In November 2022, wetter-than-average conditions established in the central, the west parts of the country and the Dodecanese islands, while drier-than-average conditions prevailed in the northeastern parts, the islands of the northeastern and south Aegean and the area of Crete (Figure 37).

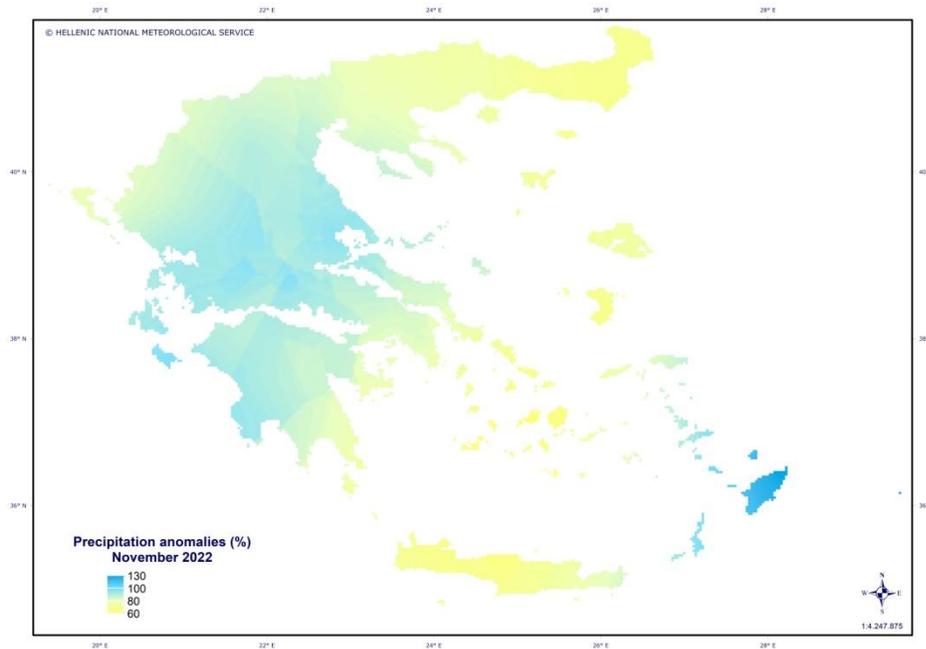


Figure 37. November 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.

3.12 December

December 2022 was the warmest December on record since 1961. Mean monthly temperature was 12.7 °C on average, about 2.6 °C above 1981-2010 normal value. The greatest positive mean temperature anomalies of even 4 °C above average occurred across northwest Greece. It is noted that Florina met. station in west Macedonia experienced maximum temperature greater than 10 °C for 20 days, while its 1981-2010 normal value is about 5.9 °C. In addition, Kerkyra met. station in north Ionian recorded maximum temperature greater than 17 °C for 26 days i.e at least 2°C above 1981-2010 average. Moreover, on December 16 and 17th most of the meteorological stations recorded maximum temperature above 20 °C, Florina met. station recorded 21.6 °C and 21.9 °C respectively i.e about 16 °C above 1981-2010 normal value and Heraklio met. station in Crete recorded 25°C and 25.4 °C respectively

i.e 8 degrees above normal values.

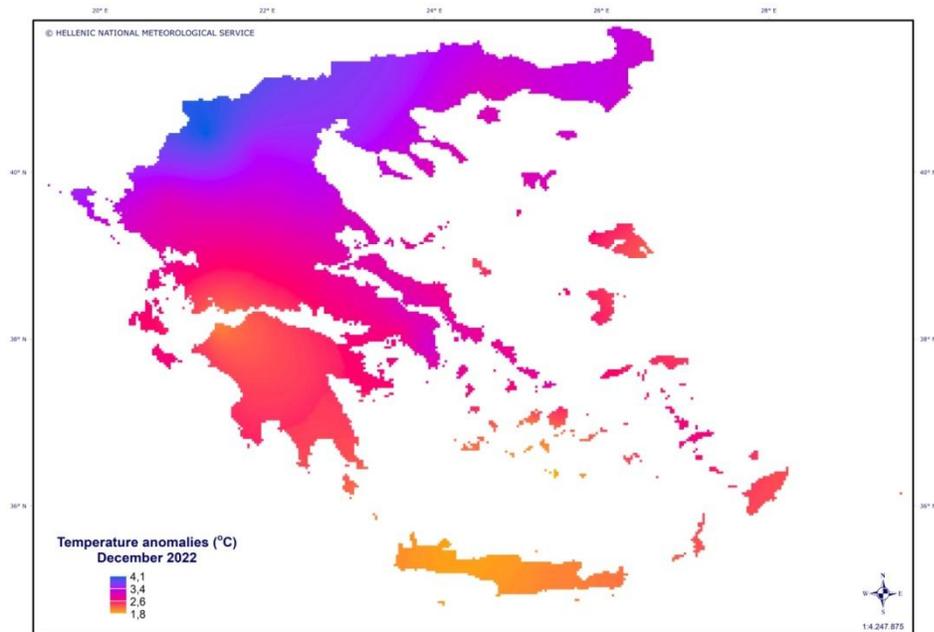
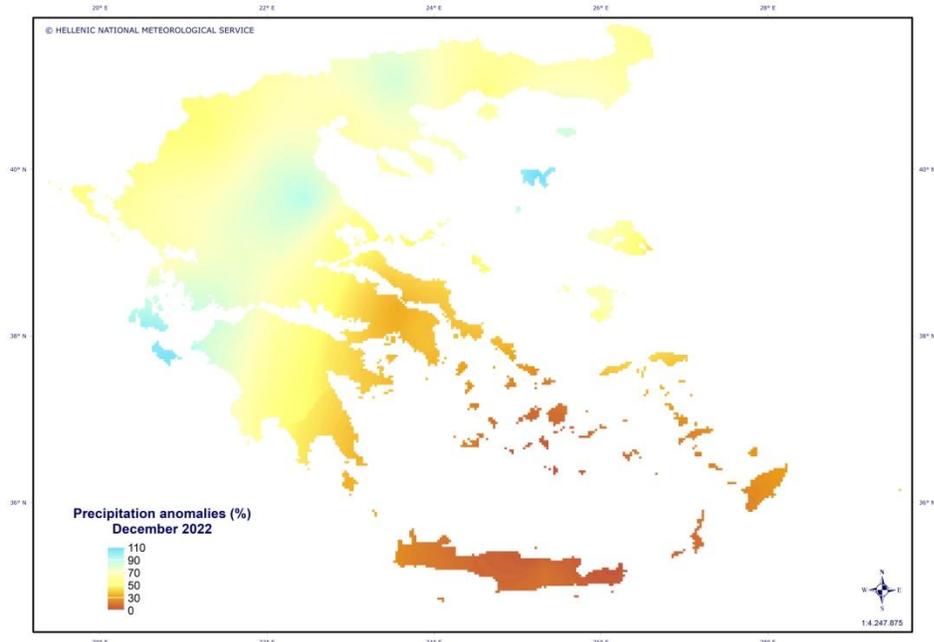


Figure 38. December 2022 mean temperature anomalies (°C) in Greece according to the 1981-2010 climatology.



In terms of precipitation December 2022 was much drier than normal mainly for southern Greece where total precipitation accounted for less than 50 % of 1981-2010 normal value.

Figure 39. December 2022 precipitation anomalies (%) in Greece with respect to 1981-2010 average.