HELLENIC NATIONAL METEOROLOGICAL SERVICE
ΕΘΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΚΗ ΥΠΗΡΕΣΙΑ

National Climate Bulletin and the assessment of the SEECOF-21 Climate state outlook for the 2019 summer season

DIVISION of CLIMATOLOGY – APPLICATIONS

HELLENIC NATIONAL METEOROLOGICAL SERVICE

A. Mamara, E. Chatziapostolou, N.Karatarakis

Part A

1. Temperature

1.1. Analysis of the 2019 summer air temperatures anomalies for Greece

The summer (June through August) average mean temperatures 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 ^{o}C, about 1.7 ^{o}C above the normals of 1971-2000. The summer mean temperature anomalies ranged from +0.8 to +2.4 ^{o}C (Figure 1). The greatest mean temperature anomalies were detected over the northwest mainland as well as in the Ionian islands and the lowest ones over southwest Aegean and west Crete.

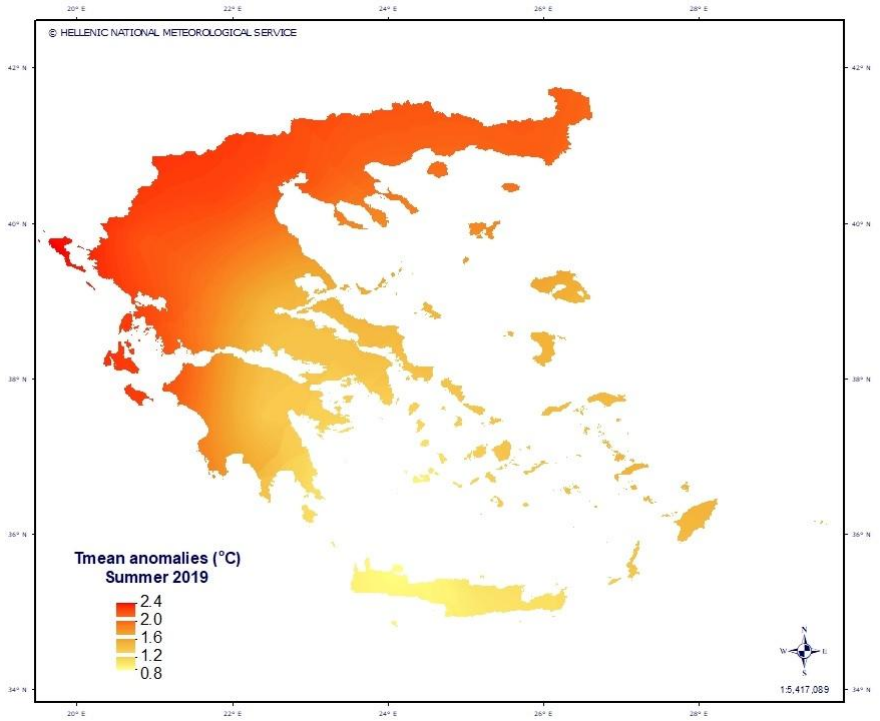

Figure 1. *Mean temperature anomalies (°C) for summer 2019 in Greece according to the 1971-2000 climatology.*

Figure 2 shows the summer average mean temperature anomalies in Greece from 1960 to 2019. It is noticeable that the summer mean temperature remained relatively 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 in 2007. Also during the last five summers (2015-2019) mean temperature anomaly exceeded 1.5 ^{o}C three times.

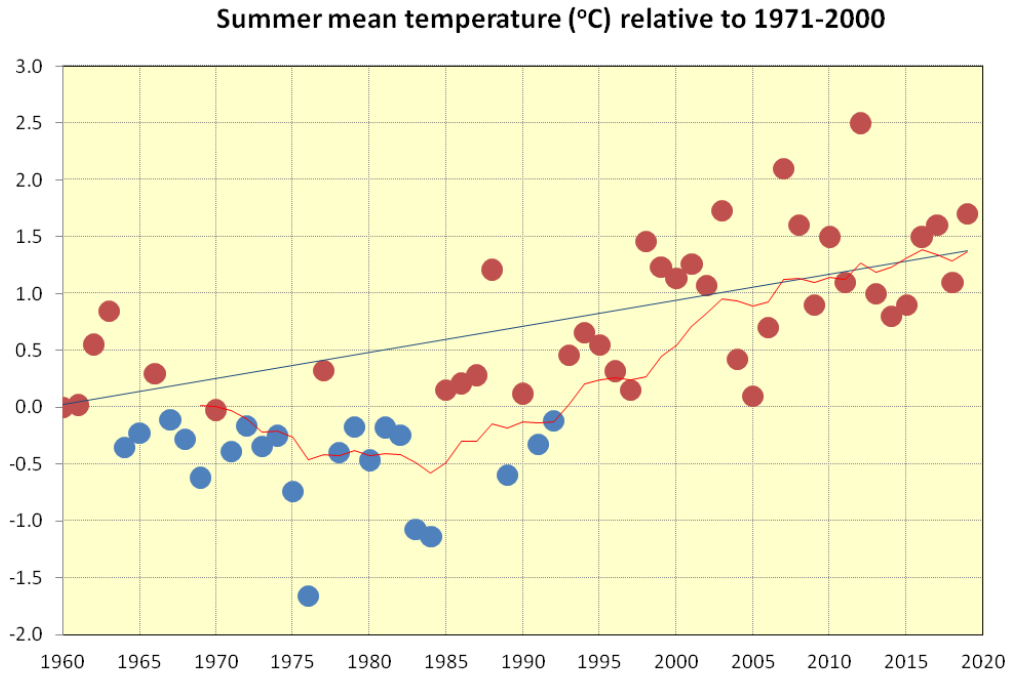

Figure 2. *Summer (June through August) 2019 averages of mean surface air temperature anomalies for Greece (taking into account 31 stations) relative to 1971-2000. The red line indicates the ten-year moving average, and the blue line indicates the long-term linear trend.*

June 2019 in Greece was the fourth warmest June on record. 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.

July is usually the hottest month of the year in Greece. July 2019 was warmer than normal (relatively to 1971-2000) but 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 °C above normals of 1971-2000.

August 2019, was the third warmest August on record for Greece. 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 order to quantify the observed seasonal temperatures in terms of cold, warm and normal, we have used the percentile method. The percentiles were calculated for each station and are based on homogenized mean temperature series for the period 1971-2000. According to percentile ranks (Figure 3) **extremely warm** and **very warm** conditions prevailed over Greece (93% of the examined stations) during summer 2019, while only two stations were found to have **warm** conditions.

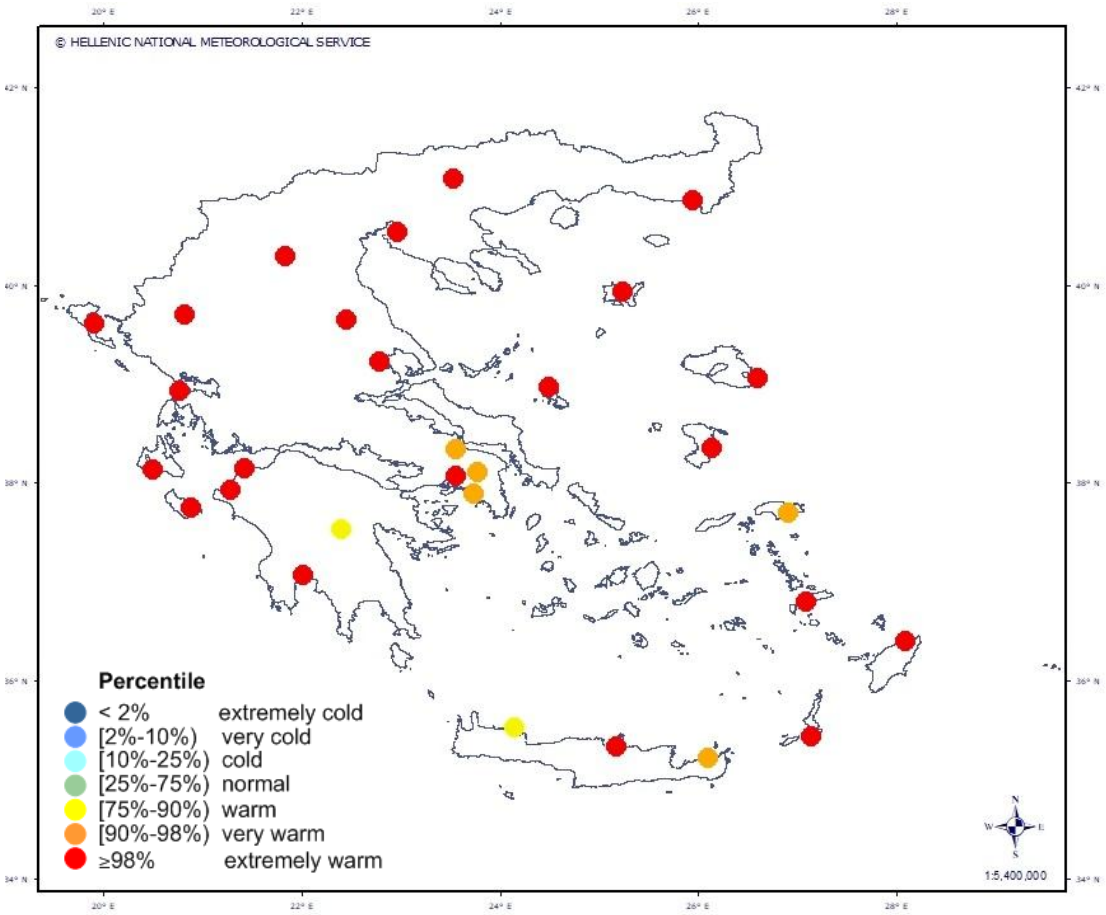

Figure 3. *Mean temperature percentiles for summer 2019 (based period 1971-2000).*

1.2. Verification of the SEECOF-21 summer 2019 temperature outlook for Greece

The seasonal forecast for summer suggested that the mean temperature would be above normal in mainland areas with the greatest temperature anomaly (above 2 °C) occurring in the north and central Greece and also in the areas of western Peloponnese (Figure 4).

Verifying the seasonal forecast for summer (although this is relative to the 1981-2010 normal values): in general, the seasonal forecast was successful since the summer mean temperatures anomalies in north and central parts ranged between 1.3°C and 2.5 °C approximately.

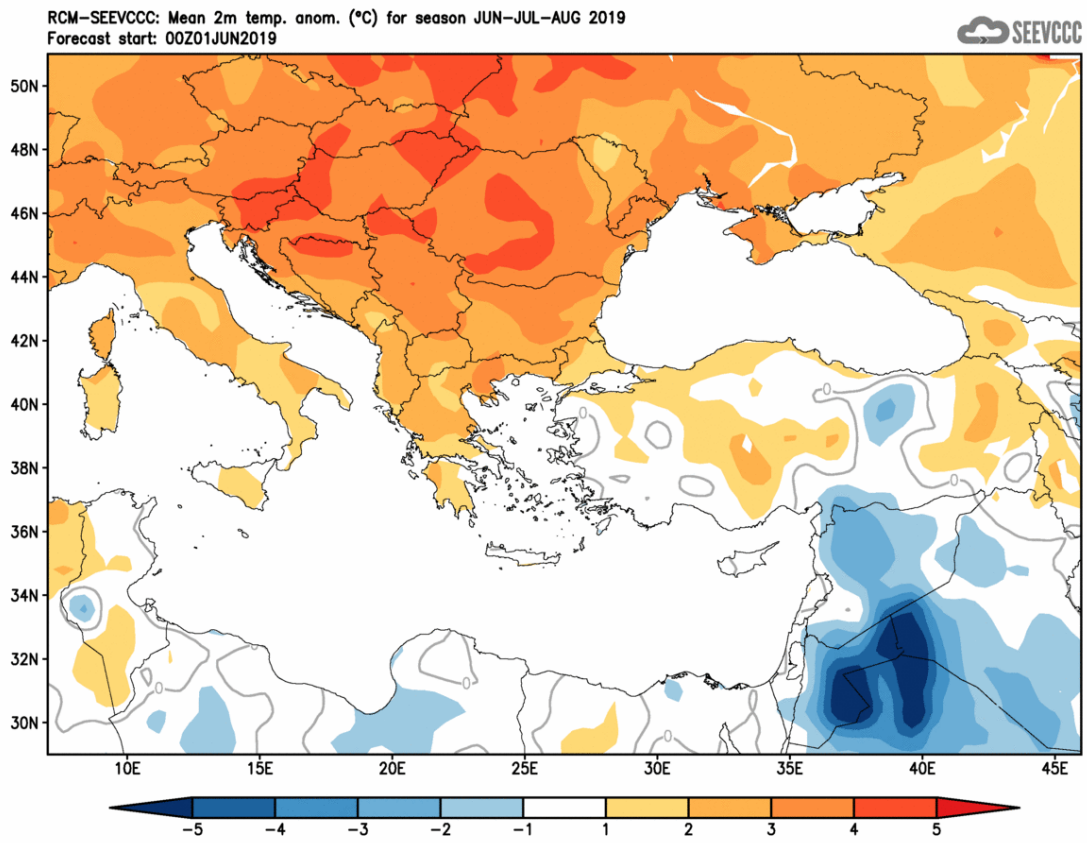

Figure 4. *Mean temperature anomaly (1981-2010) for summer 2019.*

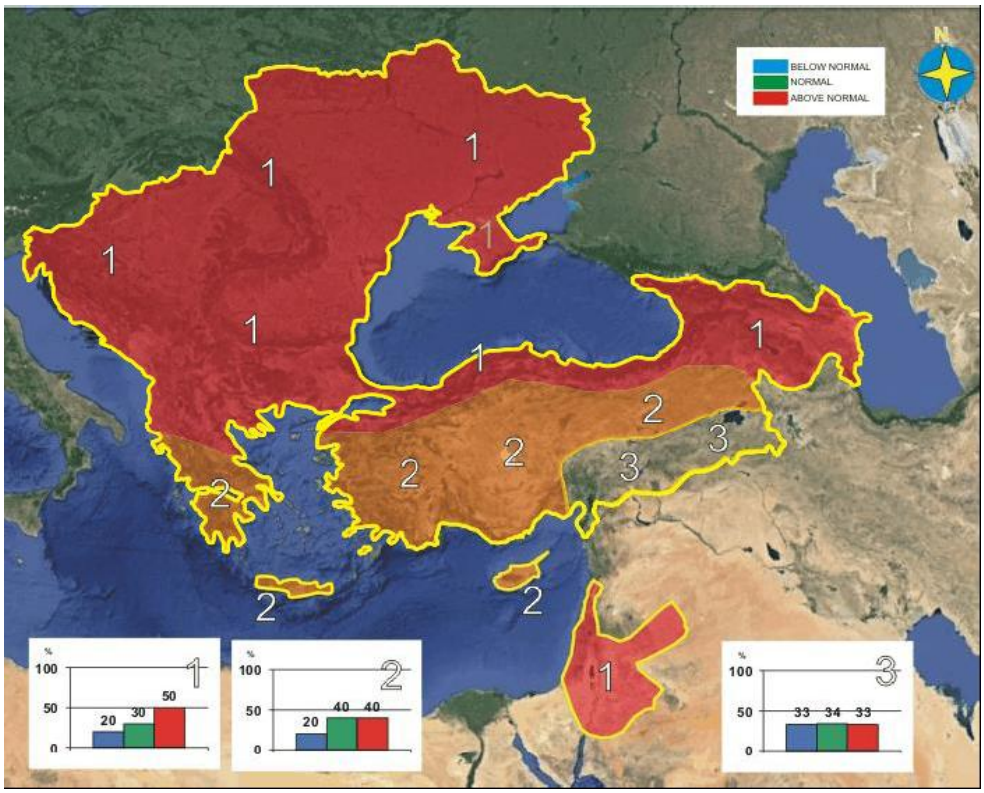

Figure 5. *Graphical presentation of the 2019 summer temperature outlook.*

The consensus statement of SEECOF-21 mentioned that the northern parts of Greece were likely to experience above average summer temperatures relative to the period 1981-2010 (zone 1: 20% below normal, 30% around normal, 50% above normal), while the central and southern parts of the country were likely to have near- or above normal summer temperature conditions (zone 2: 20% below normal, 40% around normal, 40% above normal) (Figure 5).

Verifying the seasonal forecast for summer (although this is relative to the 1981-2010 normal values): in general, the prediction was partially successful, because the summer mean temperatures were above normal values in the whole country.

Part B

2. Precipitation

2.1. Analysis of the 2019 summer precipitation anomalies in Greece

The analysis of seasonal precipitation amounts throughout Greece is based on data from 30 meteorological stations distributed evenly in the country. Figure 6 shows the total precipitation amounts in summer 2019 Precipitation in summer 2019 was generally near to or above normal values (1971-2000) for central and north Greece, as well as for south Ionio, southeast Peloponnese and Crete, while it was below normal values in the north Ionian and east Aegean islands and northwest Peloponnese. The most notable recorded precipitation was the 72 mm of rainfall recorded in Souda (west Crete) in 8 hours (on 17th of July) and this was fifty times the normal of the month. The summer precipitation ratios to the normal values (1971-2000) (the normal values are based on homogenized data series) were computed and are given in percentages in Figure 7.

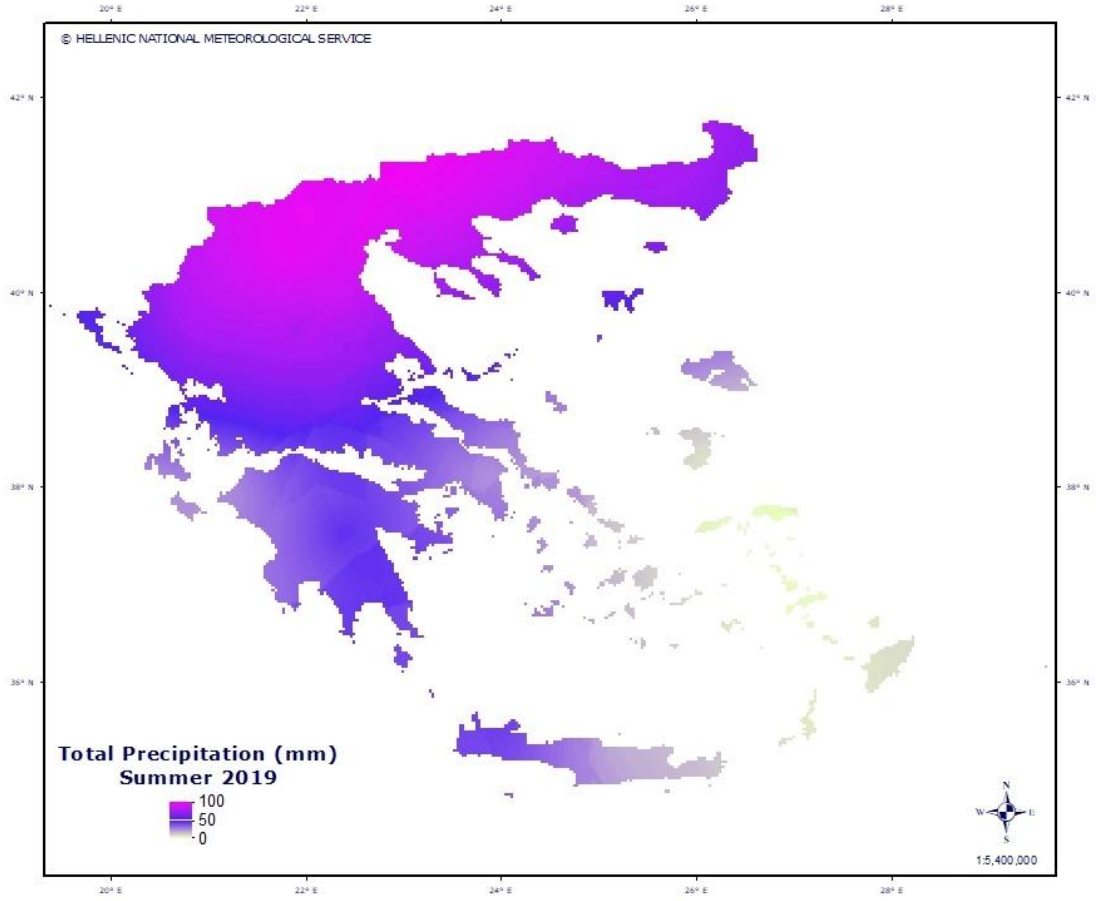

Figure 6. Spatial distribution of summer 2019 precipitation totals expressed in mm.

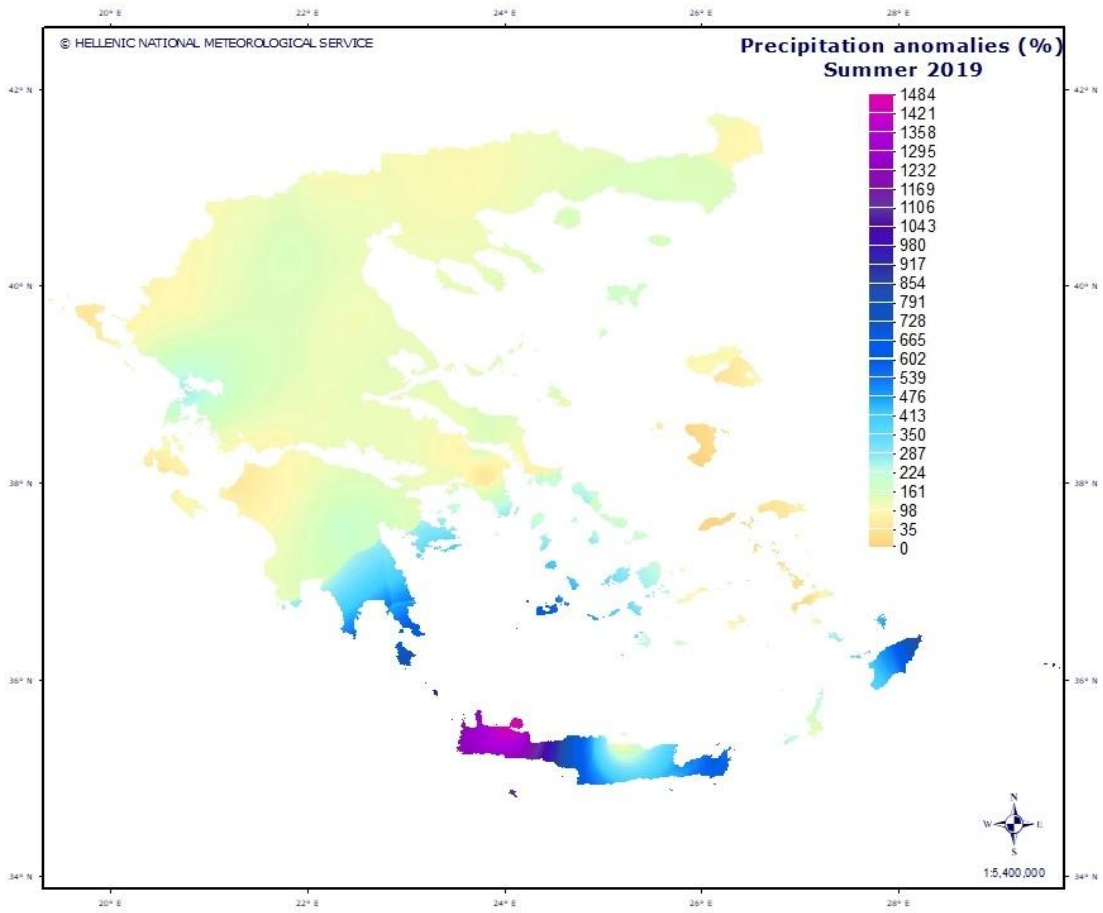

Figure 7. Summer 2019 precipitation anomalies (1971-2000) given in percentages.

In order to quantify the observed precipitation height in terms of wet, dry and normal we have used the percentile method. The percentiles were calculated for each station and are based on homogenized precipitation series for the period 1971-2000.

According to percentile ranks (Figure 8) precipitation amounts for summer 2019 have been described by the following categories:

- normal conditions prevailed to most of the country (60% of the examined stations)
- wet to extremely wet conditions (11 stations, 36% of the examined stations).

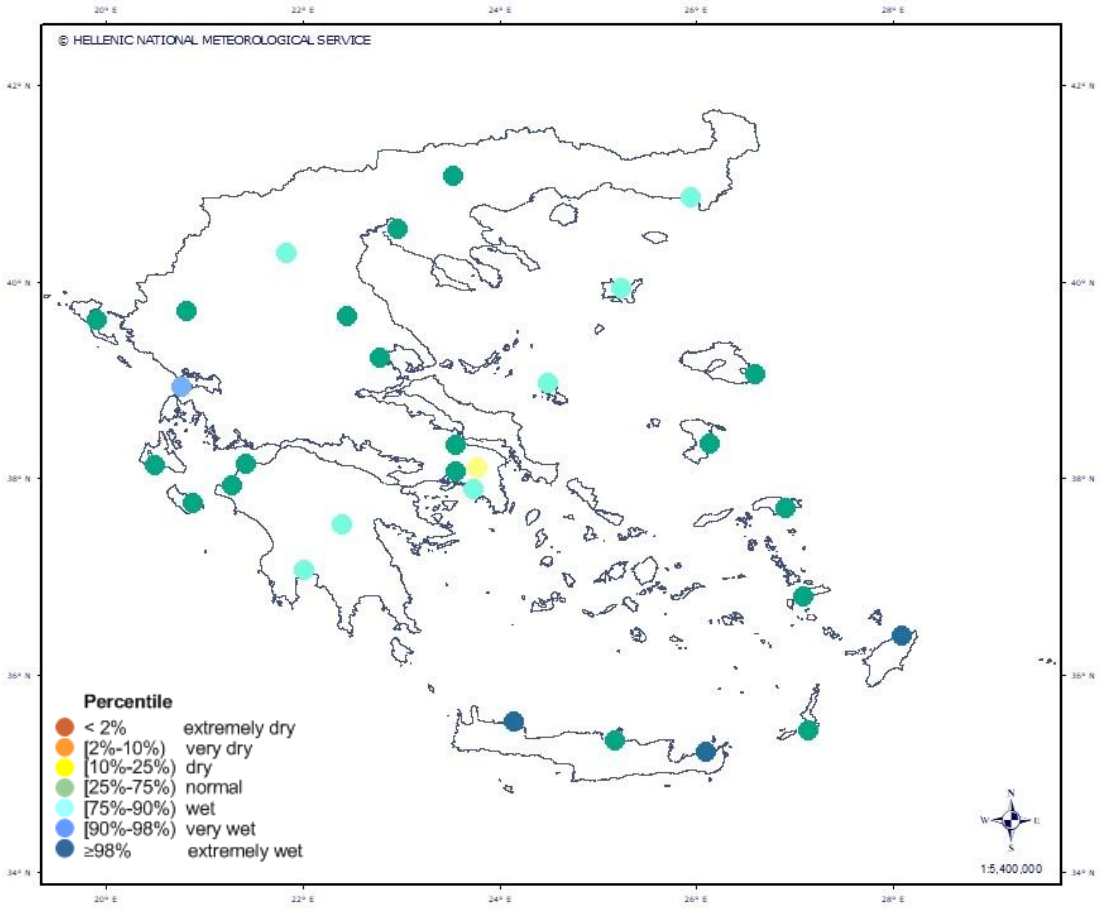

Figure 8. Precipitation percentiles for summer 2019 (based period 1971-2000).

2.2. Verification of the SEECOF-21 summer 2019 precipitation outlook for Greece

The seasonal forecast for precipitation predicted a dry summer for the western, central and southern parts of the country, with accumulated precipitation below normal values, while the precipitation ranged above normal in the northern parts of the country (Figure 9).

Verifying the seasonal forecast for summer (although this is relative to the 1981-2010 normal values): in general, the seasonal forecast failed to predict the observed accumulated precipitation anomalies.

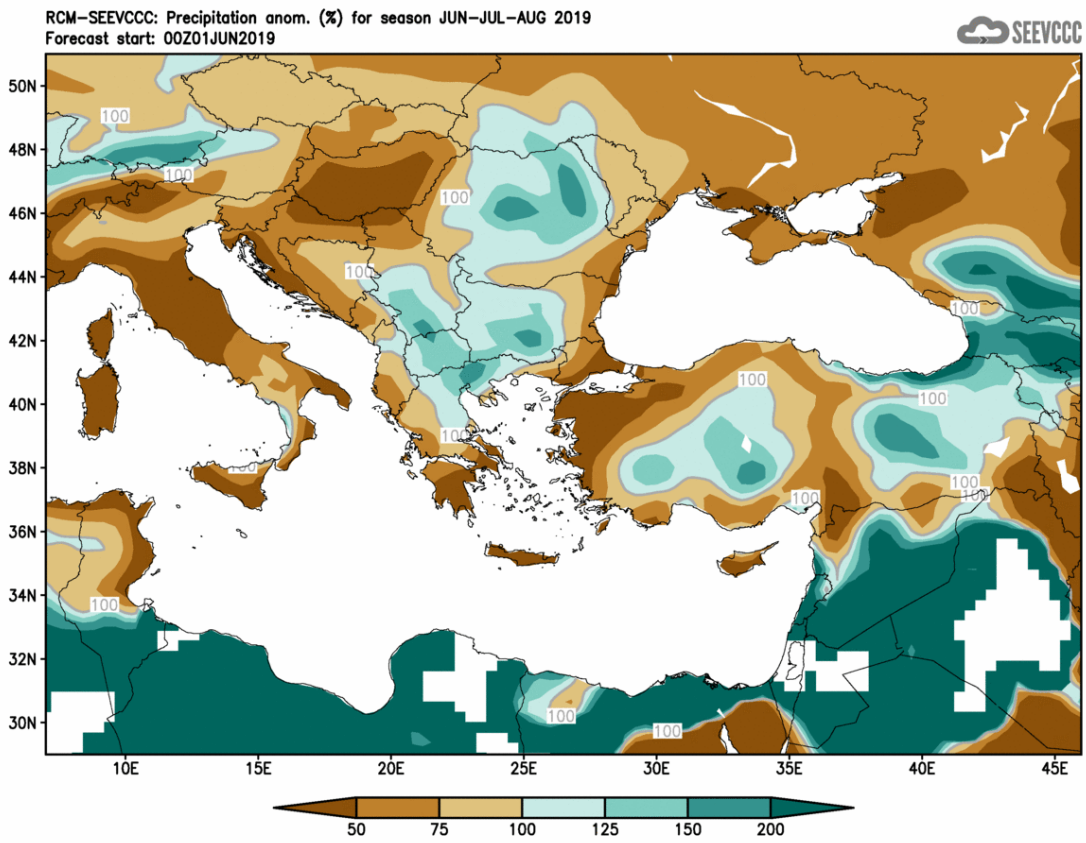

Figure 9. Precipitation anomaly (1981-2010) for summer 2019.

According to SEECOF–21, summer precipitation sums in most of Greece (zone 1, 20% below normal, 30% around normal, 50% above normal, in Figure 10) were likely to be above-average. It should be noted that it was not possible to forecast summer precipitation totals for Crete.

Verifying the SEECOF–21 precipitation outlook (although this is relative to the 1981-2010 normal values): the prediction was partly successful.

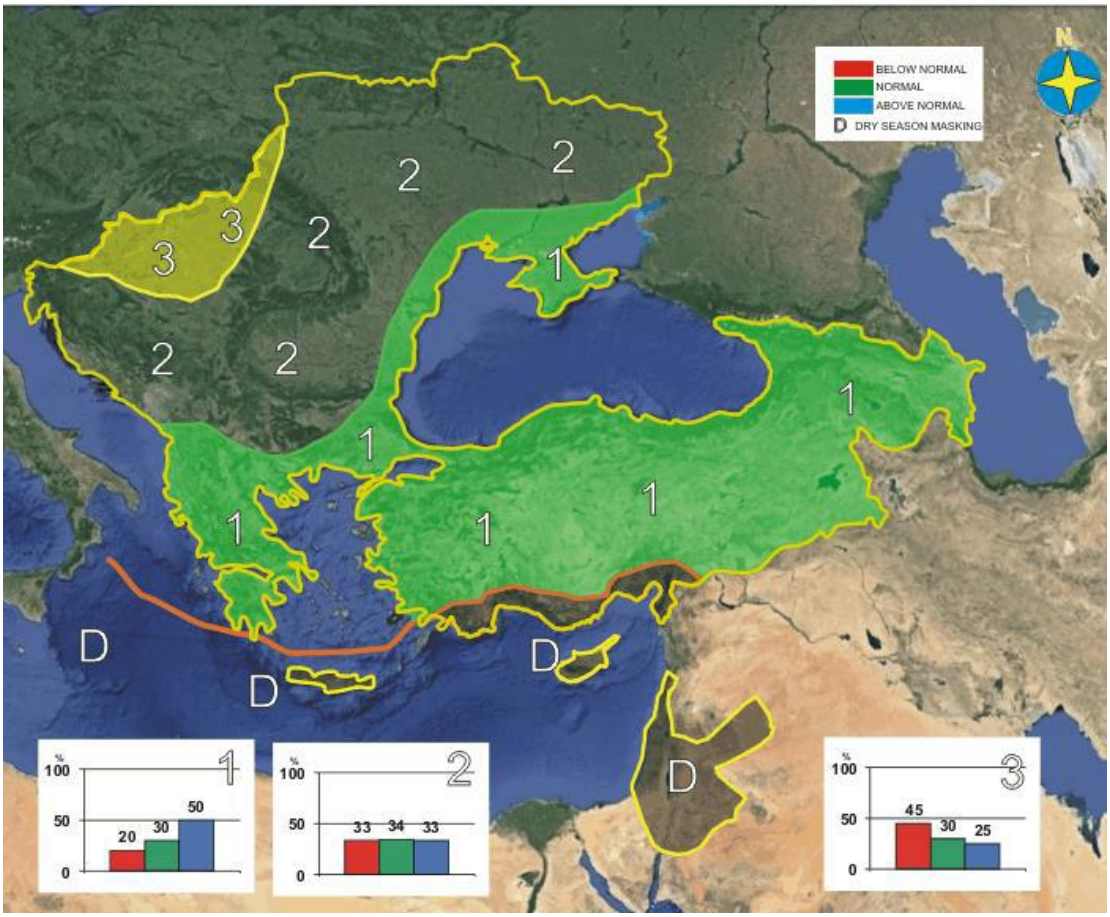

Figure 10. Graphical presentation of the 2019 summer precipitation outlook.

Table 1. Seasonal air temperature and precipitation sums - Ranks

Summer 2019		Seasonal air temperature (°C)					Seasonal precipitation sums (mm)			
Station	Rank*	33	50	66	Observed value	Rank**	33	50	66	Observed Value
Thessaloniki	1	25.4	25.8	26.1	28.1	10	54.2	64.3	84.7	87
Helliniko	3	26.6	26.8	27.3	28.7	6	7.6	16.6	21.9	38
Souda	6	25.5	25.7	26.0	26.4	1	0.1	1.4	3.4	72
Zakynthos	1	25.9	26.1	26.5	28.5	11	2.8	8.2	25.3	21

*Rank: period 1971-2000 (warmest season)

**Rank: period 1971-2000 (highest seasonal precipitation)

Table 2. Verification of the SEECOF-21 Climate Outlook in Greece for Summer 2019.

Country	Seasonal temperature		Seasonal precipitation		High Impact Events
	Observed	SEECOF-21 climate outlook for temperature	Observed	SEECOF-21 climate outlook for precipitation	
Greece	Above normal (relative to the period 1971-2000) for most of the country	Above normal for north Greece	Above or near to normal values (1971-2000) for the most of the country and especially for west Crete, except the north Ionian and east Aegean islands and northwest Peloponnese	Above normal for most of Greece	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. On July 10-11, 2019: Storm affected cental and east Macedonia, mainly the Perfecture of Halkidiki. Seven people died and 120 were injured, roofs collapsed, trees and electrical posts fell, caravans and boats were swept away in the storm that broke out at night. Also the violent storm led to power outages in the most of Halkidiki region. On July 14-17, 2019: Heavy thunderstorms affected mainly south Ionio, west Greece, west Crete, and Sporades islands and caused flooding and destructions.

Contact details
HELLENIC NATIONAL METEOROLOGICAL SERVICE
Division of Climatology - Applications
14 E. Venizelou Str.,
GR - 16777 Hellinikon, Greece
Phone: +302109699030, fax: +302109628952
http://www.hnms.gr ,
emails: 1. anna.mamara@hnms.gr
2. eleni.chatziapostolou@hnms.gr
3. karatarakis@hnms.gr