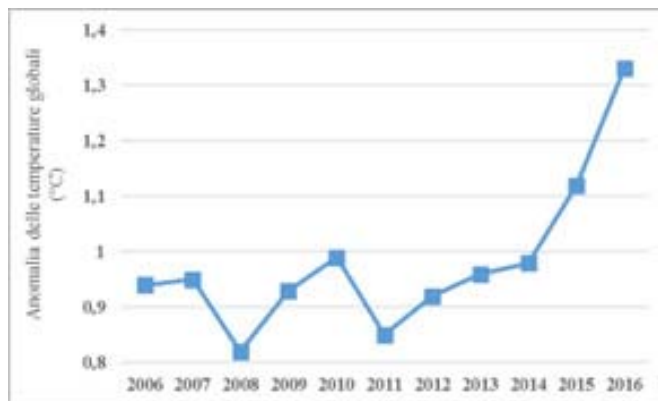


Marche Region. 2016 Climate Analysis

by Danilo Tognetti¹

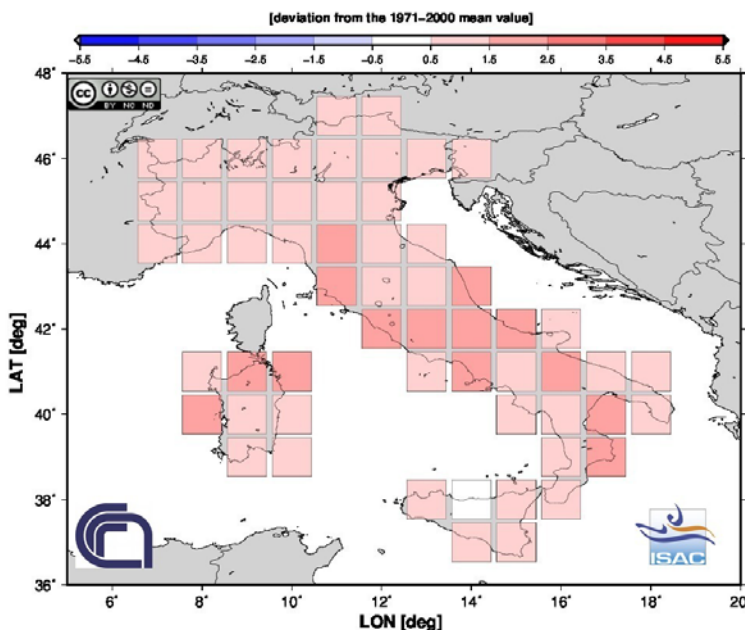
With the contribution of eight consecutive high monthly temperature records set from January to August, and the remainder of the months ranking among their five warmest, 2016 became the warmest year in NOAA's 137-year series. Remarkably, this is the third consecutive year a new global annual temperature record has been set. The average global temperature across land and ocean surface areas for 2016 was 0.94°C above the 20th century average of 13.9°C, surpassing the previous record warmth of 2015 by 0.04°C. The global temperatures in 2016 were majorly influenced by strong El Niño conditions that prevailed at the beginning of the year. ([source](#)).



Global temperatures anomaly (°C) respect to 1808-1909 average ([source](#))

In Italy, on the contrary, 2016, on a century-old scale, was one of the hottest years.

In Italy, the 2016 was less exceptional than 2014 and 2015. It was the fourth warmest year since 1800 with an average temperature of 1, 2 °C ([source](#)).



Italy. Temperature anomaly (°C) 2016 respect to 1971-2000 ([source](#))

Temperature

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As far as the Marche Region, according to the [ASSAM agrometeorological network](#), after the past two years' records (see [here](#) and [here](#)), in 2016, the average regional temperatures slightly decreased (*Figure 1*), despite the 14,3°C gained the *third place among the annual fall averages since 1961* (together with 1997, 2007, 2012).

Therefore, the average difference to 1981-2010, was of +0,7°C and for six consecutive years temperatures were hotter than the standard (2010 the coldest, 0,3°C below the 1981-2010 mean).

According to statistics, since 2000, in 13 over 17 years, the average temperature was higher than the standard.

The progressive warming of the Marche Region, during the last decades, had been confirmed, as showed by the increasing thirty-year' temperatures since 1961 (*Table 1*).

Except for May, August and October, the monthly mean temperatures were above the mean 1981-2010 (*Figure 2*). Anomalies were significant in the hottest months. In October the greater negative anomaly of 1°C, had a definitely lower deviation from the February +3,7°C (2016 had the *third hottest February in the Marche Region since 1961*).

All the 2016 seasons was warmer than the norm (*Table 2*) with significant positive differences in the first half-year: +2,1°C in Winter compared to 1981-2010 (*4th hottest Winter in the Marche Region since 1961*), Spring with +0,8°C (*9th Spring record since 1961*); afterwards these particularities decreased during the remaining part of the year.

Thirty-years	Mean (°C)	Anomaly (°C)
1961-1990	13,1	-
1971-2000	13,3	0,2
1981-2010	13,6	0,5
1987-2016	13,8	0,7

Table 1. Marche Region. Thirty-year average temperature and anomaly respect to the starting thirty years (°C)

Season	Mean temperature (°C)		
	2016	1981-2010	Anomaly
Winter (Dec 2015 – Feb 2016)	7,6	5,5	2,1
Spring (March - May)	13,1	12,3	0,8
Summer (June– August)	22,5	22,2	0,3
Fall (Sept. – Nov)	14,5	14,3	0,2

Table 2. Marche Region. Seasonal average temperature and difference to 1981-2010 (°C)

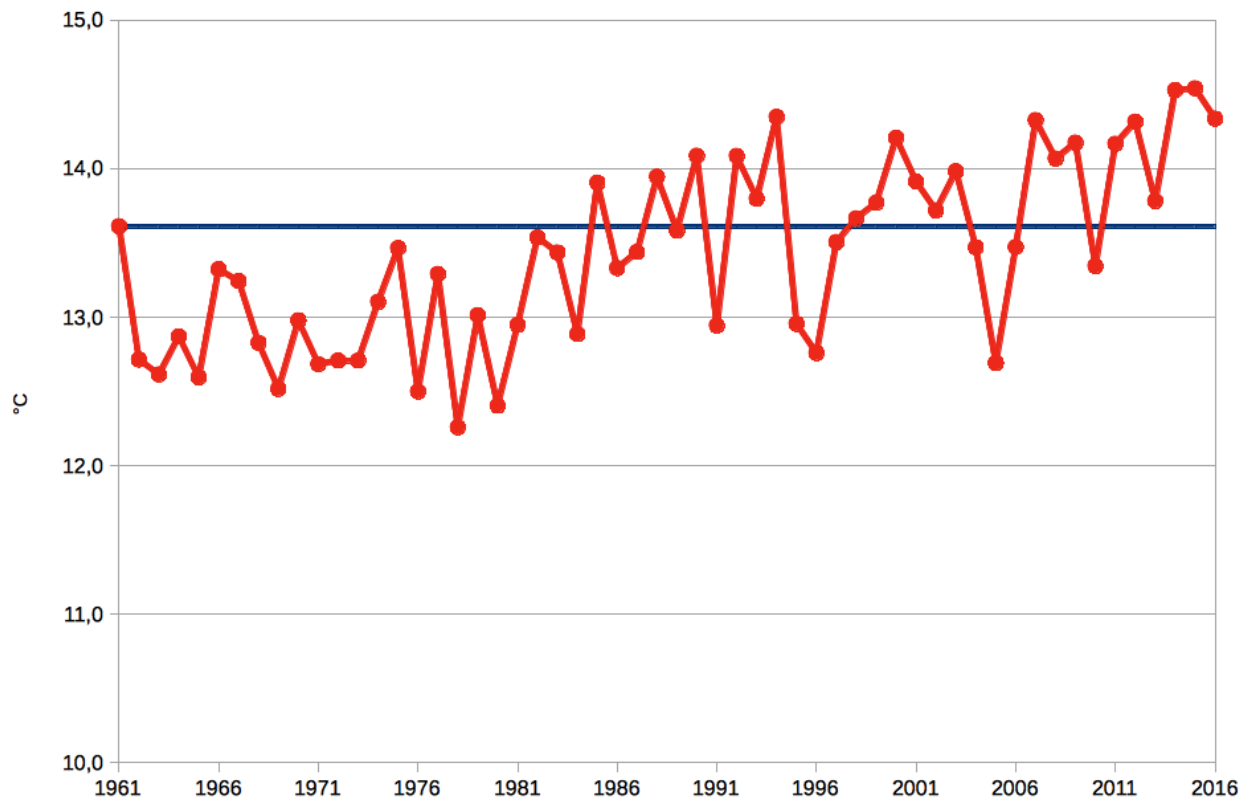


Figure 1. Marche Region. 1961-2016 annual average temperature (°C) (red line) compared with the 1981-2010 reference average (blue line)

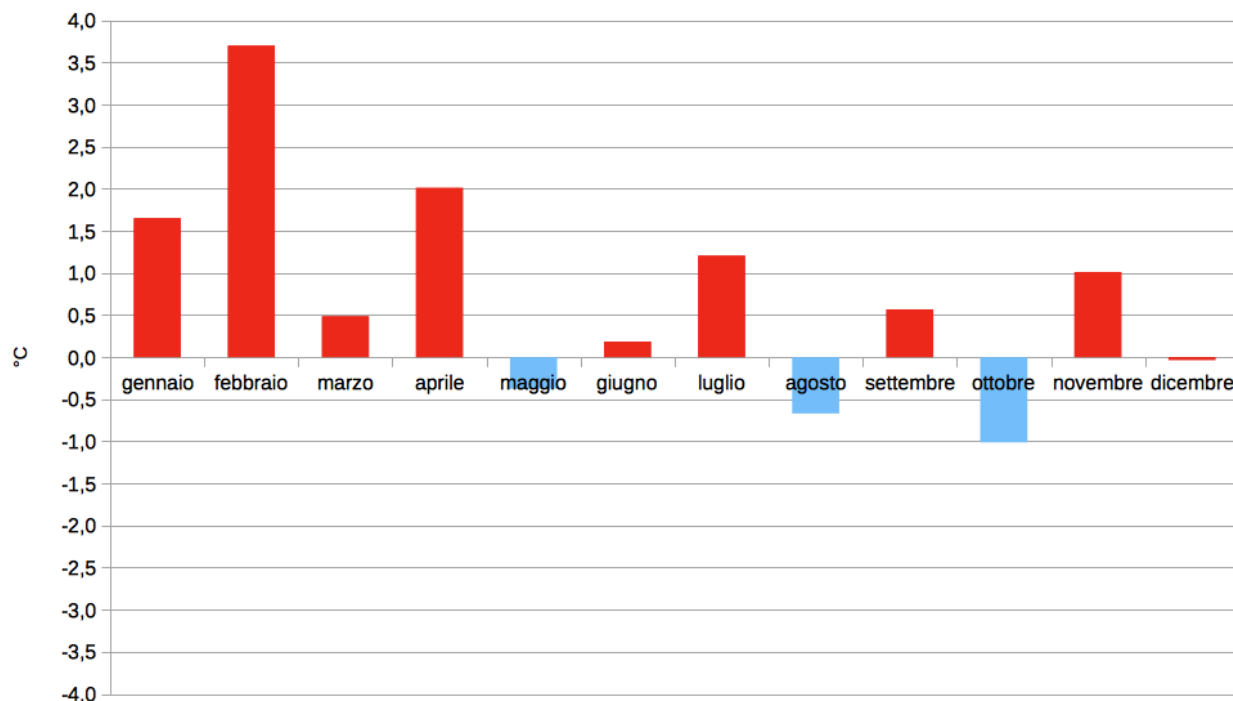


Figure 2. Marche Region. 2016 monthly average temperature (°C) compared with the 1981-2010 average

Precipitation

The anomaly of total annual precipitation had been decreasing, though remaining positive, so to confirm a particularly rainy period lasting since 2012 (*Figure 3*). In 2016, the average precipitation in the Region reached 896mm: +97mm higher than the reference thirty-year.

Since 2000, out 11 over 17 years, were most rainy over the average.

Unlike temperatures, precipitations, after a gradual decreasing, settled down in those last years (*Table 3*).

In monthly detail (*Figure 4*), the first quarter was on average rainier. March was the rainiest month in 2016, with a total average regional precipitation of 125mm i.e. an increase of +60mm on the 1981-2010 average, 8th March record since 1961.

The quarter May-July was also rainy with a pick of 107mm in June, 7th June record since 1961.

Moreover, the last part of the year was characterized by a precipitation-decreasing trend. Indeed, in December the 2015 disastrous negative record occurred again: almost absent precipitations of nearly 4mm regional average (!).

Despite an above the average dry Winter, positive differences were registered in Spring and Summer: +97mm in comparison with 1981-2010 in Spring, +58mm in Summer. The 2016 Spring was the 9th rainiest Spring in the Marche Region since 1961.

Thirty-years	Total (mm)	Anomaly (mm)
1961-1990	845	-
1971-2000	820	-25
1981-2010	799	-46
1987-2016	829	-16

Table 3. Marche Region. Total thirty-years average precipitation and differences from starting thirty-year period (mm)

Season	Total Precipitation (mm)		
	2016	1981-2010	Anomaly
Winter (Dec. 2015 – Feb. 2016)	147	192	-45
Spring (March - May)	289	192	97
Summer (June - August)	222	164	58
Fall (Sept. - Nov.)	237	246	-9

Table 4. Marche Region. Total seasonal precipitation and difference from the 1981-2010 (mm) average period.

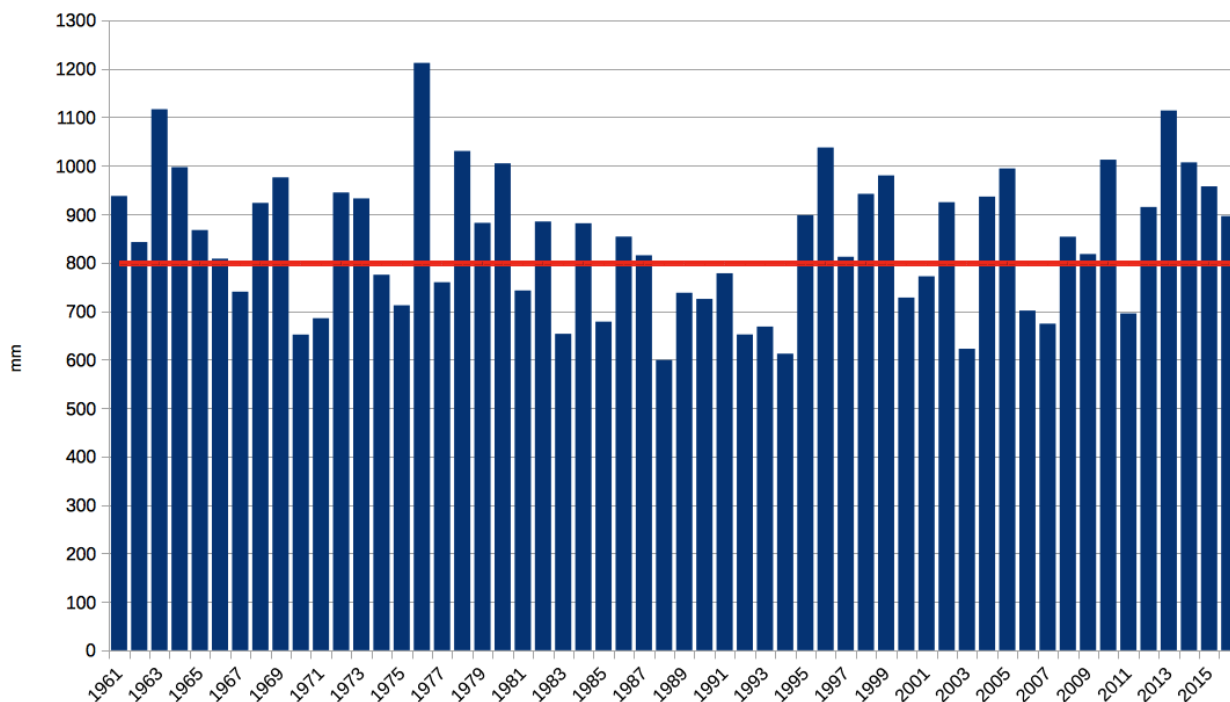


Figure 3. Marche Region. 1961-2016 total average annual precipitation (mm). The red line shows the 1981- 2010 mean (mm).

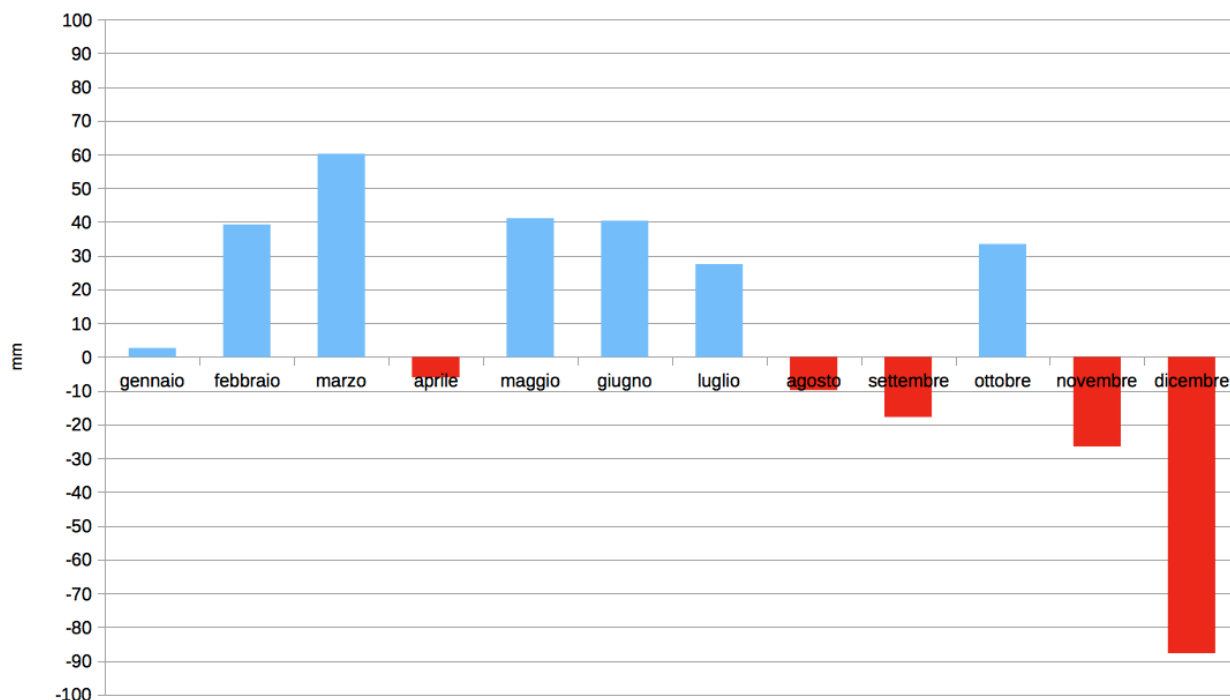


Figure 4. Marche Region. 2016 monthly precipitation (mm) anomaly respect the 1981-2010 average.

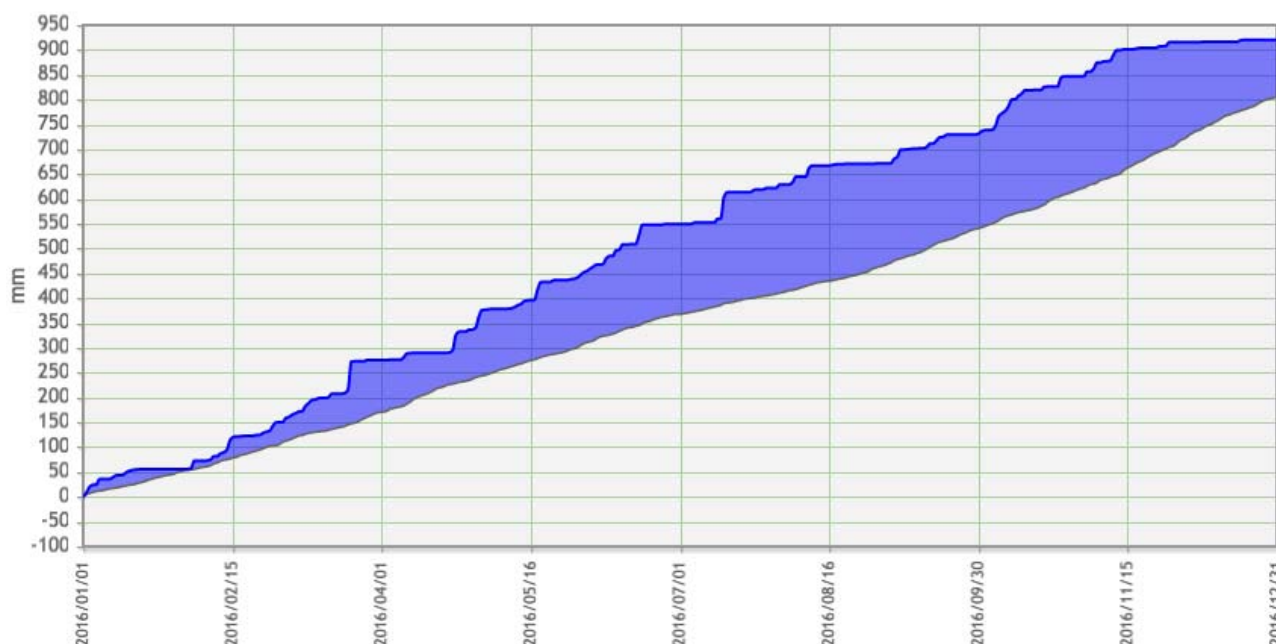


Figure 5. Marche Region. Accumulated daily precipitation based on the 1981- 2010 regional average (mm)

The 2016 in summary

Parameter	Description
Average temperature	14, 3°C, +0, 7°C compared to 1981-2010.
Monthly average temperature	February: 9,2°C, +3,7°C compared to 1981-2010; 3 rd February record since 1961. October: 13,6°C, -1°C compared to 1981-2010.
Seasonal average temperature	Winter: 7,6°C, +2, 1°C compared to 1981-2010; 4 th Winter record since 1961. 9 th coldest season above the average
Total precipitation	896mm, +97% compared to 1981-2010.
Monthly total precipitation	March: 125mm, +60mm compared to 1981-2010; 8 th March record since 1961. December: 4mm, -88mm compared to 1981-2010; 2 nd December absolute negative record since 1961.
Seasonal total precipitation	Spring: 289mm, +97mm compared to 1981-2010; 9 th Spring record since 1961. Winter: 147mm, - 45mm compared to 1981-2010.
Daily heaviest precipitation	Moltelparo, on March 23 rd : 101mm.
Hourly heaviest precipitation	Castignano, at 5:00 p.m., September 5 th : 53mm.
Heaviest precipitation in 10 minutes	Carassai, at 4:20 p.m., September 5 th .