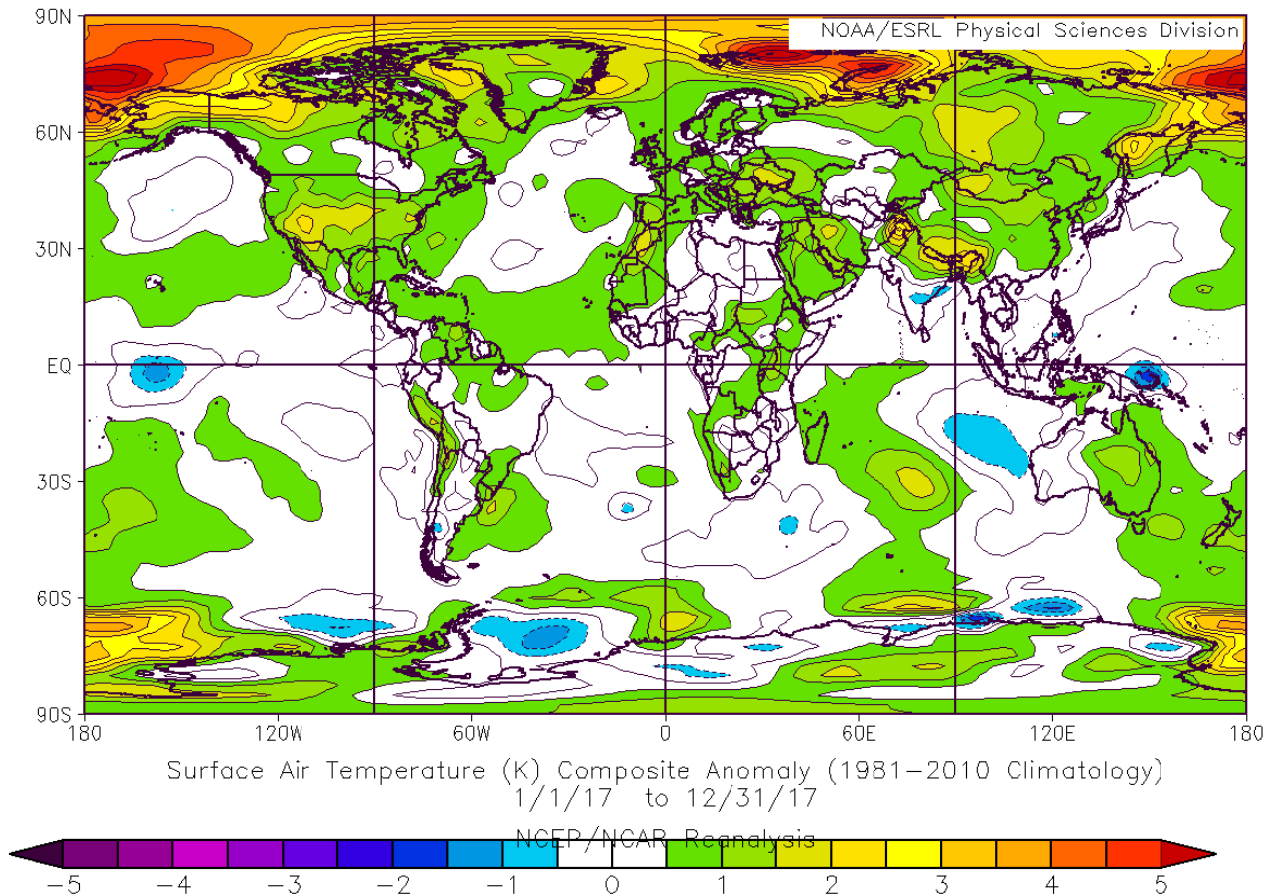


## Marche Region. 2017 Climate Analysis

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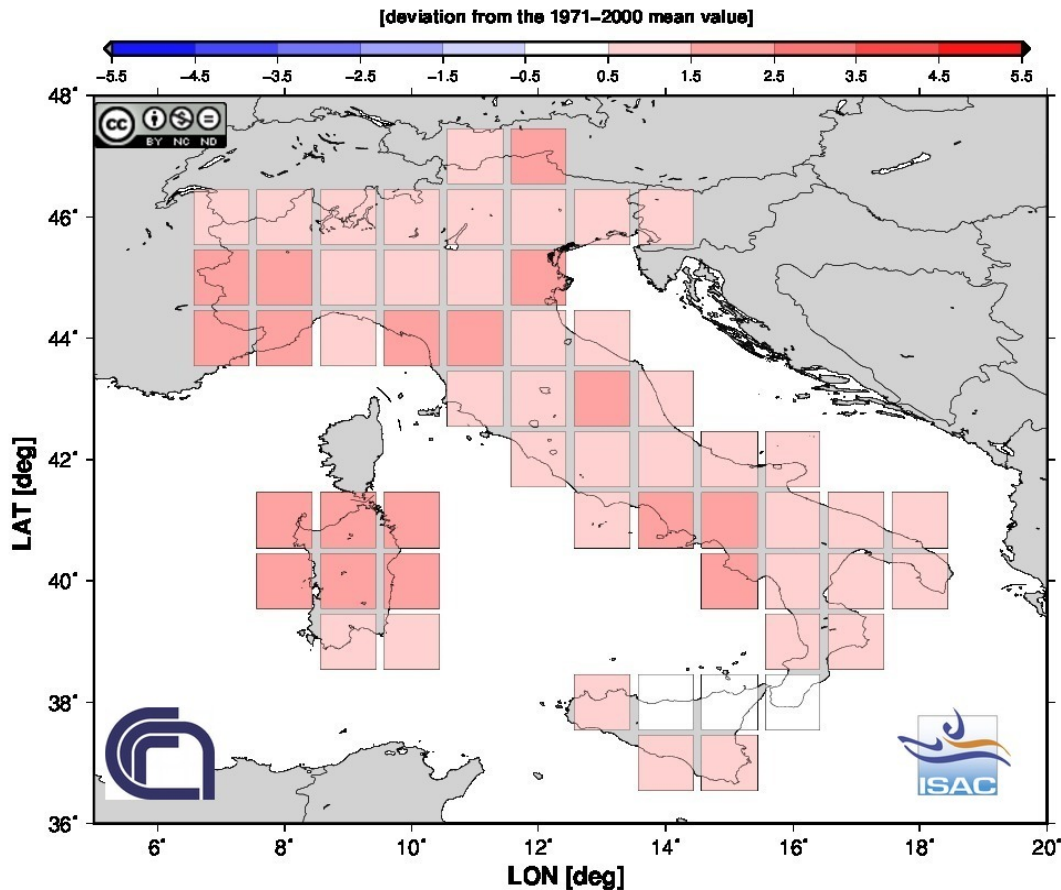
Globally, after three years of broken warmth records, 2017 **was not the hottest one**. Nevertheless 2017 came second in the list of the hottest years with an anomaly of +0,51°C compared to 1981-2010. Taking into account that this exploit was set with a neutral ENSO index in the first part of the year, which became negative in the second one ([here for](#) further details), there is not much to feel reassured by...



2017 abnormal temperatures compared to 1981-2010. Note the strong warming of the Arctic Ocean at very high latitudes ([source](#)).

On the other hand, in Italy 2017 was 4<sup>th</sup> hottest year since 1800 with an average thermic anomaly of +1,3 °C as to the 1971-2000 reference period ([source](#)).

<sup>1</sup> The ASSAM AGROMETEOROLOGICAL SERVICE Marche Region



Italy. 2017 average abnormal temperature (°C) compared to 1971-2000 (source)

## Temperatures

As for the Marche Region, according to data from the [ASSAM Agrometeorological network](#), in 2017 shared the [2014](#) and [2015](#) heat set record.

The regional mean temperature was 14,5°C<sup>2</sup>, nearly + 1°C than the 1981-2010<sup>3</sup> average (+0,93°C).

2017 marks the 7<sup>th</sup> above-the-average hotter consecutive year (2010, the last coldest year, -0,3°C compared to the thirty years).

As for statistics, since 2000, the average temperature in 14 out of 18 years were over the standard.

Therefore the progressive warming of the Marche Region during in the last decades has been confirmed, as shown by the increasing trend of the three decade temperatures since 1961 (Table 1).

2017 was characterized by an extremely hot summer<sup>4</sup> (Table 2). Its 24,9°C regional average temperature, set the 2<sup>nd</sup> hottest summer since 1961, only behind the 2003 hottest summer (25,3°C), shared with 2012.

The regional average temperature entered an anomaly of +2,8°C compared to the 1981-2010 reference period. The heat during all three summer months was above the average. Particularly June and August resulted the 2<sup>nd</sup>

<sup>2</sup> The regional summered up values are drawn by the temperature and precipitation detected by 14 meteorological stations representative of the entire Region. The since 1961 historical series are derived merging data of the 14 stations with those from the ex Neighbouring Hydrographic Service.

<sup>3</sup> 1981-2010 Climatic Normals (Cli.No.,) period chosen according to the instructions of the World Meteorological Organization (WMO, 1989: "Calculation of Monthly and Annual 30-Year Standard Normals", WCPD-n.10, WMO-TD/N.341, Geneva, CH)

<sup>4</sup> Meteorological season: Winter: December previous year - February; Spring: March - May; Summer: June-August; Fall September-November.

warmest months in the respective series since 1961; +3,3°C the June anomaly compared to the three decade; +2,9°C the August anomaly. July set the 5<sup>th</sup> record.

The year started off with an intense cold January, with a -2,6°C anomaly compared to 1981-2010.

Nevertheless this anomaly had been made up in February with +2,6°C above the same three decade average, as a result of the + 8,1°C average regional temperature, 7<sup>th</sup> February record since 1961.

Of note the warmer-than-average conditions went on in spring 2017 with a average temperature of 13.8°C, 0.8°C above the 1981–2010 average. This was the 2<sup>nd</sup> spring record since 1961.

In the spring quarter, noteworthy were the March +2,3°C above the thirty years average as well as an harsh cold period, between end of April and beginning of May. Nevertheless those just mentioned two months resulted warmer-than-average.

Thankfully, after summer, the course changed due to a “cooler” climate, so that the 2017 last fourth months were colder-than-average and dampened the overall thermic anomaly, which otherwise would have led to another warm fall record.

Thirty-years	Average (°C)	Anomaly
1961-1990	13,1	-
1971-2000	13,3	+0,2
1981-2010	13,6	+0,5
1988-2017	13,8	+0,7

Table 1. Marche Region. Thirty-years abnormal average temperature compared to the starting thirty years (°C). Note the raising trend of the thirty-years' anomalies based on 1961-1990.

Season	Mean Temperature (°C)		
	2017	1981-2010	Anomaly
Winter (Dec. 2016 – Feb. 2017)	5,6	5,5	+0,1
Spring (March – May)	13,8	12,2	+1,6
Summer (Juni – August)	24,9	22,1	+2,8
Fall (Sept. – Nov.)	14,0	14,3	-0,3

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

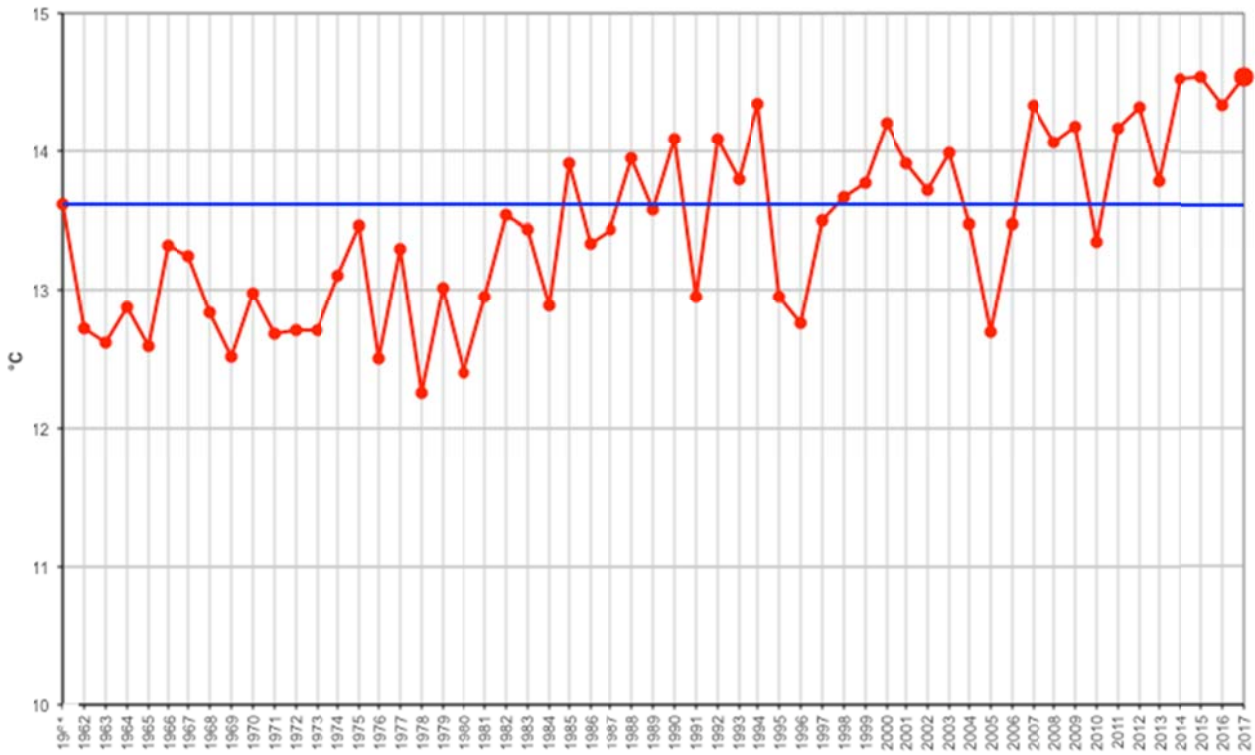


Figure 1. Marche Region. 1961-2016 annual average temperature (°C) (red line) compared to the 1981-2010 reference average (blue line)

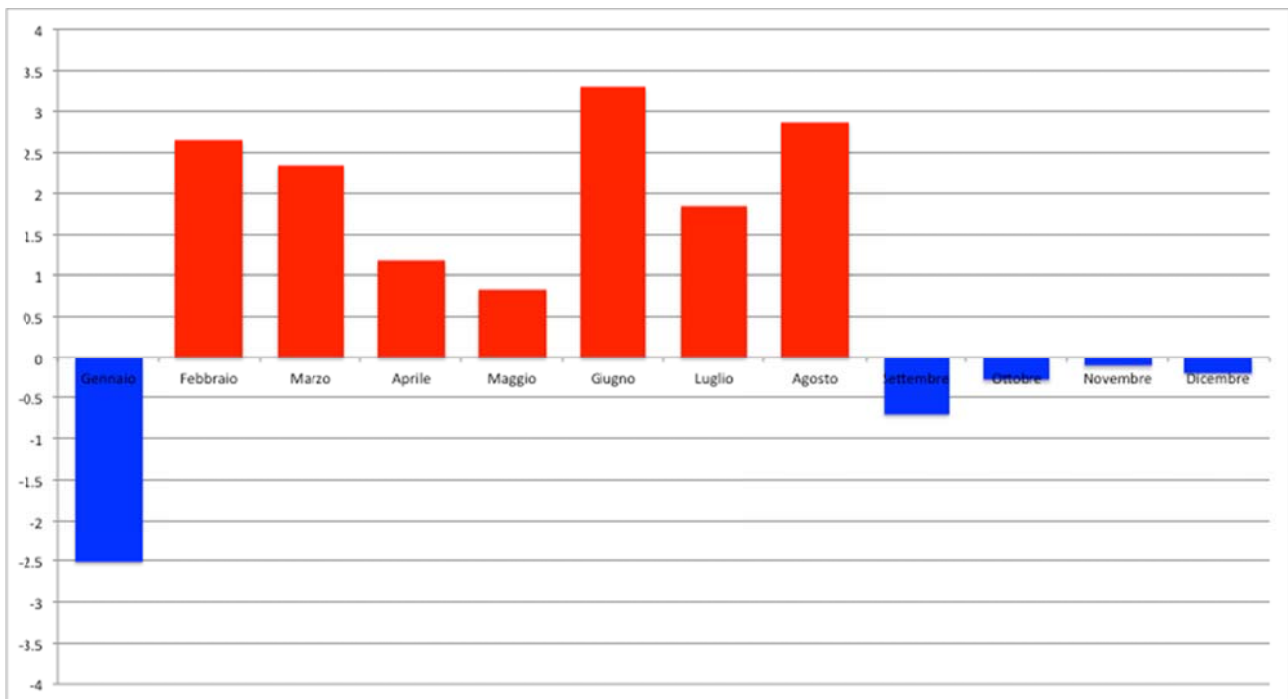


Figure 2. Marche Region. 2017 monthly average temperature (°C) compared with the 1981-2010 average.

## Precipitation

The wetter-than-average period across the Marche Region since 2012, went on in 2017 with an above the average total annual precipitation (*figure 3*). The 2017 regional average annual rainfall totals were of 920mm with an increase of +120mm compared to 1981-2010.

Since 2000, 12 years out of 18 were rainier-than-average. *Unlike temperatures, precipitation in the last years seems to change its course, making up for the previous drop (Table 3).*

As for precipitations as well, summer was surely the driest one for the Region since 1961. The total regional average rainfall was barely 42mm, 74% lower than in 1981-2010, *according to our data, there has never been so little rain in summer.* All three-summer months were characterized by severe precipitation deficits; both in terms of fallen millimeters (*Figure 4*) as well as of rainy days<sup>5</sup> (*Figure 5*). Drought was particularly consistent in August with only one day of rain and 3mm on the average regional total.

The first part of the year had a completely different character with above—the-average precipitations in January and February.

In detail, January with its 39mm copious rain was the 2<sup>nd</sup> rainiest January in the Marche Region since 1961 (the 1<sup>st</sup> was in 1963); in February 2017 the 8<sup>th</sup> record for the month was set with 101mm rainfall.

In spring 2017, the amount of rainfall was extremely regular both in terms of monthly as well as of seasonal totals, which were in step with the respective 1981-2010 reference values.

Notwithstanding the rain relevant decrease in March (-31%) highlights the intense nature of the single rainy events.

In the end Fall was also wetter-than-average, placed 7<sup>th</sup> in the list of the rainiest falls in the Marche Region since 1961. 343mm of average regional total of rainfall; +38% compared to the 1981-2010 average.

The September 149mm and November 156mm copious precipitation registered a respective increase of +96% e +71% as to the thirty-years reference value.

On the other side, October was marked by a -52% below-the-average precipitation with barely 38mm of regional mean rainfall.

Thirty-years	Total (mm)	Anomaly (mm)
1961-1990	845	-
1971-2000	820	-25
1981-2010	799	-46
1988-2017	833	-12

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

Season	Total Precipitation (mm)		
	2017	1981-2010	Anomaly
Winter (Dec. 2016 – Feb. 2017)	245	192	+53
Spring (March – May)	198	192	+6
Summer (Juni – August)	42	164	-122
Fall (Sept. – Nov.)	343	246	+97

Table 4. Marche Region. Total seasonal precipitation and anomaly compared to 1981-2010 (mm).

<sup>5</sup> Heavy rainy day with daily total precipitation  $\geq 1$ mm.

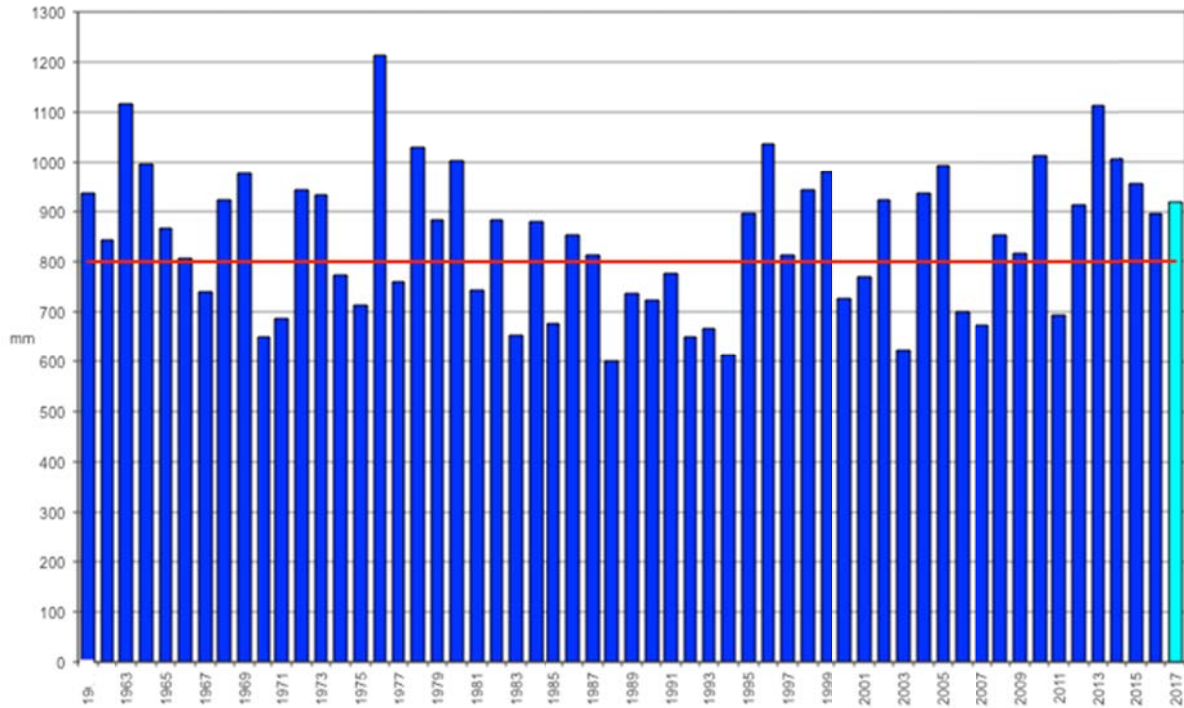


Table 3. Marche Region. 1961-2017 annual total average precipitation (mm). The red line shows the 1981-2010 average (mm).

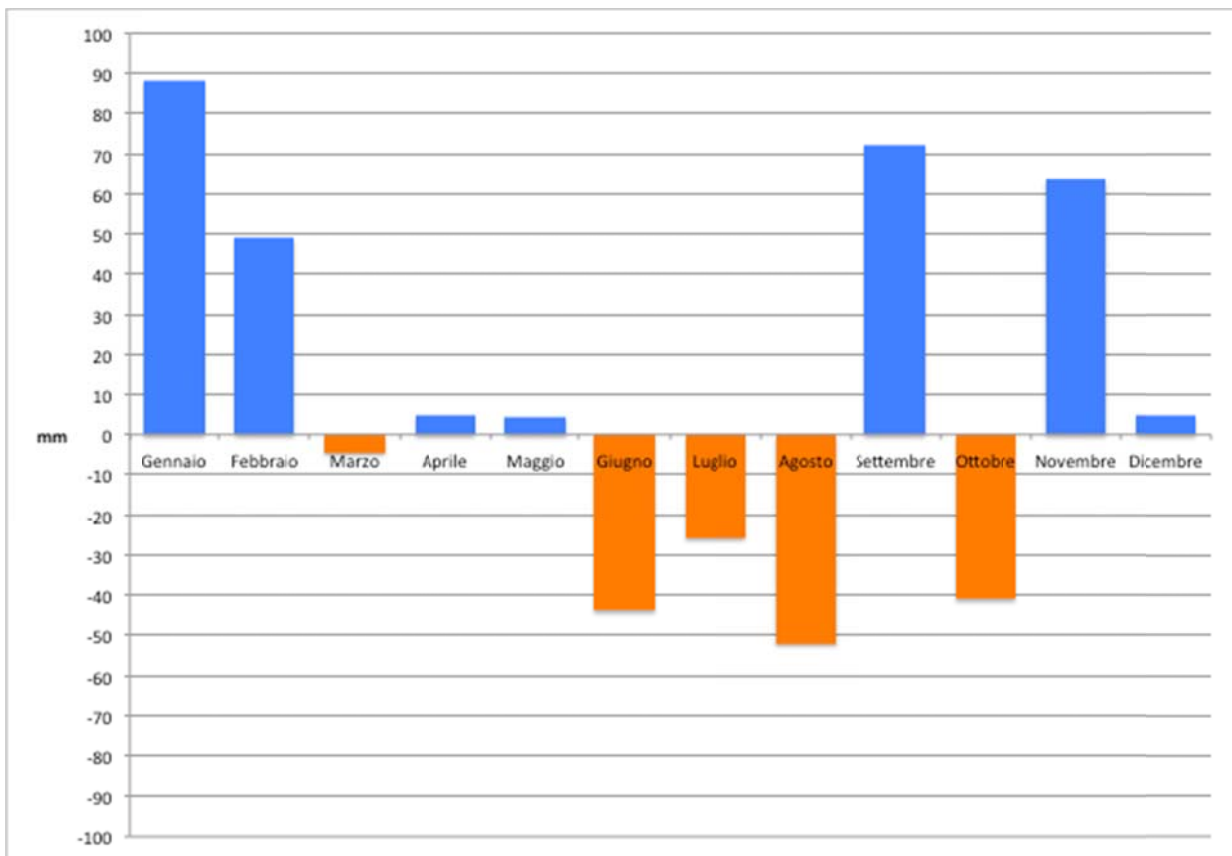


Figure 4. Marche Region. Total seasonal precipitation and difference from the 1981-2010 (mm) average period.

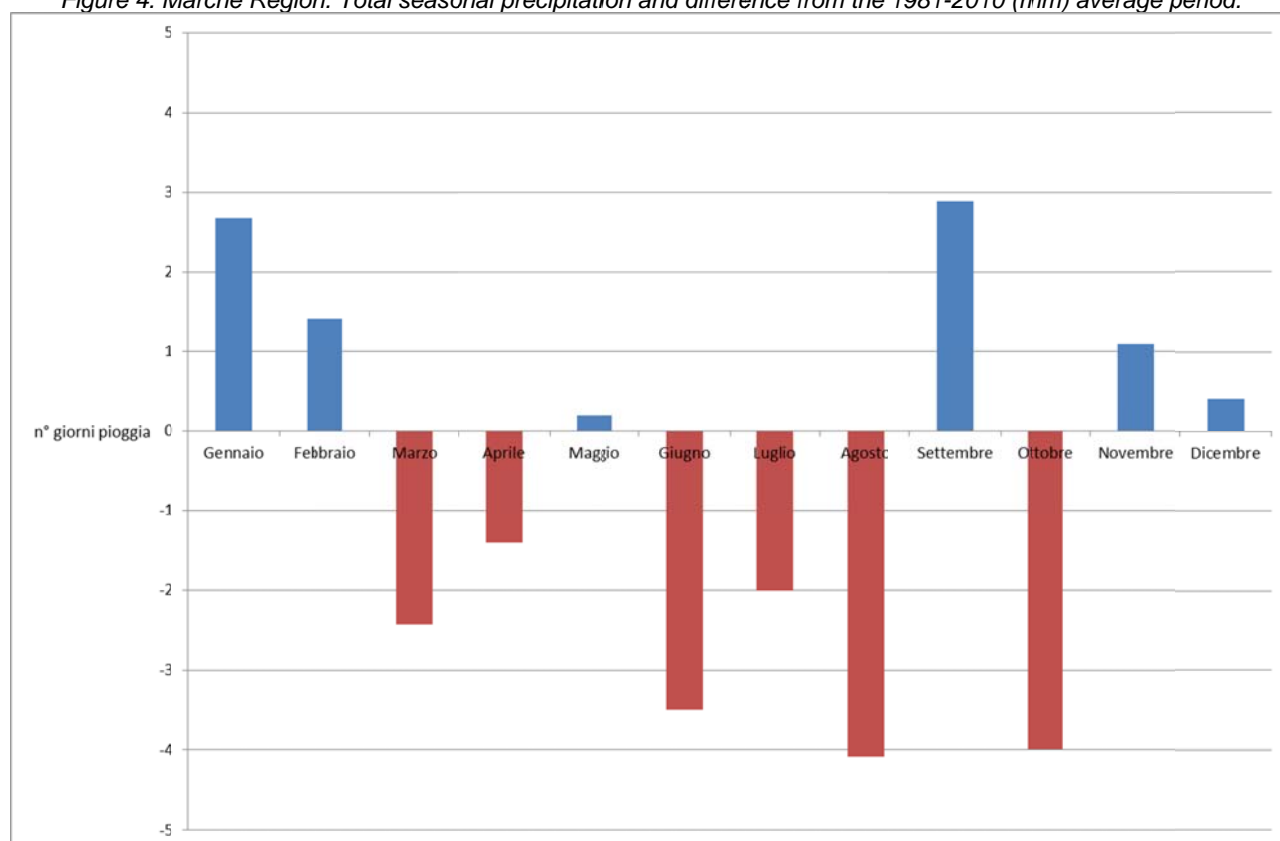


Figure 5. Marche Region. 2017 monthly abnormal number of rainy days, compared to the 1981-2010 average. Note that the 2017 regional average of rainy days was 80,1 with about 10% decrease as to 1981-2010. As already observed, in the same year the increase of the rainfall was of 15% on the total (920mm compared to the 799mm thirty-years). From these data a rainfall higher concentration with a potential increase of heavy precipitations is inferable.

### 2017 in summery

Parameter	Descrizione
Average temperature	14,5°C, +0,93°C compared to 1981-2010, Marche record since 1961, shared with 2014 and 2015.
Monthly average temperature	January: 2,5°C, -2,5°C compared to 1981-2010, the Marche coldest January for the last thirty years. June: 23,7°C, +3,3°C compared to 1981-2010, 2 <sup>nd</sup> June record since 1961.
Seasonal average temperature	Summer: 24,9°C, +2,8°C compared to 1981-2010, 2 <sup>nd</sup> Summer record since 1961. Fall: 14°C, -0,3°C compared to 1981-2010.
Total precipitation	920mm, +15% compared to 1981-2010, 6 <sup>th</sup> above the average rainiest consecutive year.
Monthly total precipitation	January: 139mm, +88mm compared to 1981-2010, 2 <sup>nd</sup> January record since 1961. August: 3mm, -52mm compared to 1981-2010.
Seasonal total precipitation	Fall: 343mm, +97mm compared to 1981-2010, 7 <sup>th</sup> Fall seasonal record since 1961. Summer: 42mm, -122mm compared to 1981-2010, the Marche driest Summer since 1961.
Daily heaviest precipitation	Falconara M., September 11 <sup>th</sup> : 150mm.
Hourly heaviest precipitation	Falconara M., at 02.00 p.m. September 11 <sup>th</sup> : 82mm.

Heaviest precipitation in 10 minutes

Falconara M., ore 13:20 dell'11 settembre: 75mm.

