

2014, AN UPSIDE DOWN YEAR FROM A CLIMATIC POINT OF VIEW

THE ARCIS WORKING GROUP DESCRIBES 2014 CLIMATE OVER NORTHERN AND CENTRAL ITALY: A COOL AND RAINY SUMMER, A MILD WINTER, INTENSE PRECIPITATION ANOMALIES IN ALL SEASONS AND SEVERAL EXTREME METEOROLOGICAL EVENTS, WITH SEVERE IMPACTS ON LAND AND POPULATION.

The year 2014 had a mild and extremely rainy start when the Alps were covered with the thickest snow depth since the 50ies. Then the year continued with a rainy spring and a cool and extremely rainy summer, with snow flakes outside alpine huts on the 15th of August. Autumn has been extremely rainy, but warm. During this last season, the usual daily cycle was not observed in the Po valley for days and sometimes minimum temperatures exceeded the expected values of climatic maximum temperature. The start of the last winter has badly impacted the alpine ski resorts, with very mild temperatures, especially at high locations, which made the alpine landscape more autumn-like than winter-like.

To summarize, the 2014 has been a very warm year, with intense precipitation anomalies in all seasons, except for spring, and in which several extreme meteorological events further contributed to destabilize the alpine and appennine slopes, re-activating critical hydro-geological instabilities which represent one of the most feared vulnerabilities of the Italian territory..

Facing so many and harsh climatic anomalies, the regional meteorological services of central-northern Italy, decided to publish a short report trying to describe the main characteristics of the local climate during 2014.

Let's start from temperatures.

The plots in *figure 1* present the time series of annual (a) and summer (b) mean temperatures averaged over Northern Italy. The historical data have been obtained from the time series of minimum and maximum temperatures published on the Parte Prima of the Annali Idrologici, from 1961 to 2005, while data from 2006 to 2014 have been obtained from the temperature data observed at the stations of meteorological monitoring network, made available in real-time by the Functional Centres of the Italian Civil Protection Agency.

The plots show that the mean annual temperatures in 2014 have been higher than the climate normal 1961-'90. This finding confirms that the positive trend detected in global surface temperatures is also present in the central-northern Italy time serie.. At the same time, the mean summer temperature values have come back in Northern Italy to those observed during the 1961-'90, which have not been observed in the last 15-20 years. So these plots confirm that surface temperature anomalies in our regions have been positive in all seasons but summer.

As regards the precipitations, the whole territory covered by ARCIS workgroup has experimented intense, diffuse and persistent rainfall during 2014.



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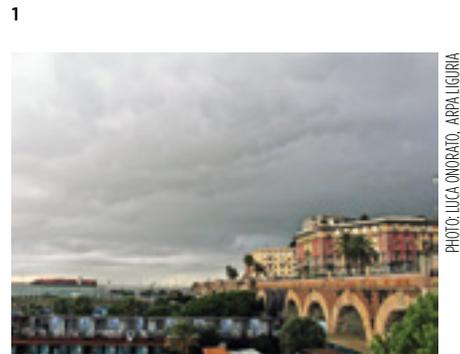


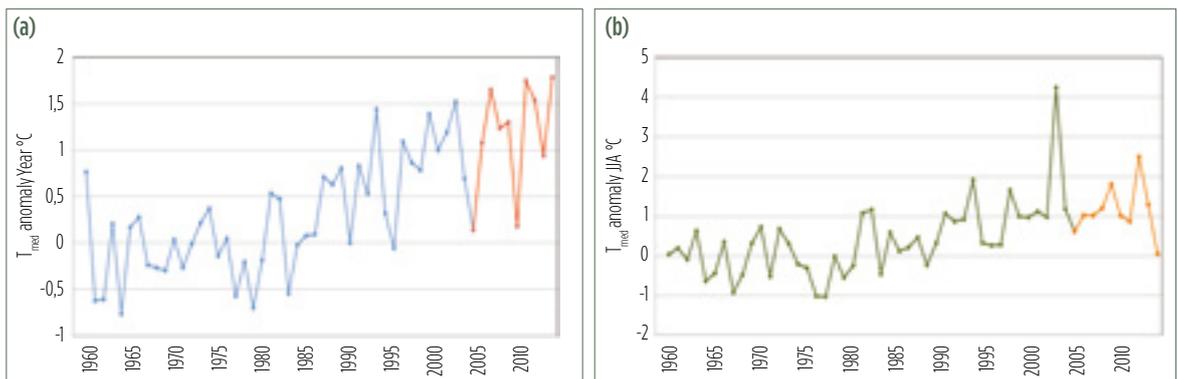
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FIG. 1
TEMPERATURE
ANOMALIES

Time series of mean annual (a) and summer (b) temperature anomalies averaged over Northern Italy, with respect to the 1961-'90 climate. Values obtained starting from historical data (1961-2005) and from the data of the stations of the meteorological monitoring network (2006-'14).



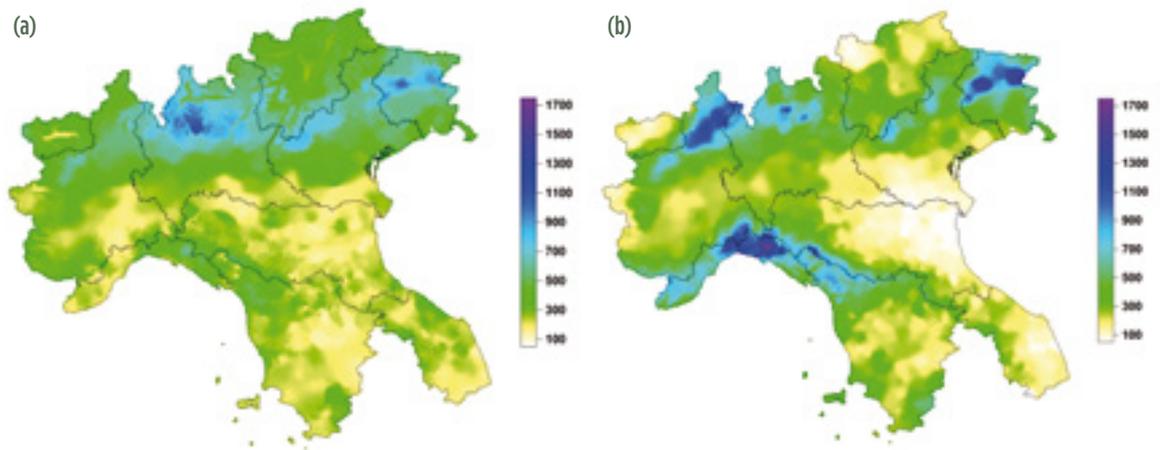


FIG. 2
CUMULATED
PRECIPITATION

Maps of cumulated precipitation in mm for summer (a) and autumn (b) 2014.

Figure 2 represents the cumulated precipitation in summer (a) and autumn (b), respectively. These maps show several similarities: the areas that account for the maxima amounts are the same in both seasons, Friuli Venezia Giulia, Lombardia, over the Prealpi, and, only for autumn, the Appennine in Liguria, Toscana and Emilia. The recorded highest values have been exceptional: over 1100 mm in summer and over 1700 mm in autumn.

Figure 3 shows the long term statistical distribution of autumn precipitation averaged over all regions participating to the ARCIS (Climatological Archive for North-Central Italy) workgroup, during the period from 1961 to 2014. It is quite clear that the value of autumn 2014, equal to 506.8 mm, represents the maximum of the distribution, well above all others and well above the 1961-'90 climate normal.

These climatic anomalies confirm the common feeling that 2014 has been an "upside-down" year, with a cool and rainy summer, instead of a hot and dry one, and a mild and rainy winter (at least for 2013-'14 and first half of 2014-'15).

But these mean anomalies tell only half of the story. The other half is represented by several extreme weather events, with heavy impacts on the local territory and on human activities. It is enough to mention the Liguria flood of the 9th and 10th of October, followed by several repeated floods in November, or the extremely intense and localized thunderstorm which hit Veneto on the 2nd and 3rd of August. These

FIG. 3
CUMULATED
PRECIPITATION

Histogram of autumn cumulated precipitation averaged over north central Italy from 1961 to 2014. 2014 value i identified by the blue line, the red and the orange line indicating the mean and the median for the 1961-'90 period and the two green line the 10th and the 90th percentile.

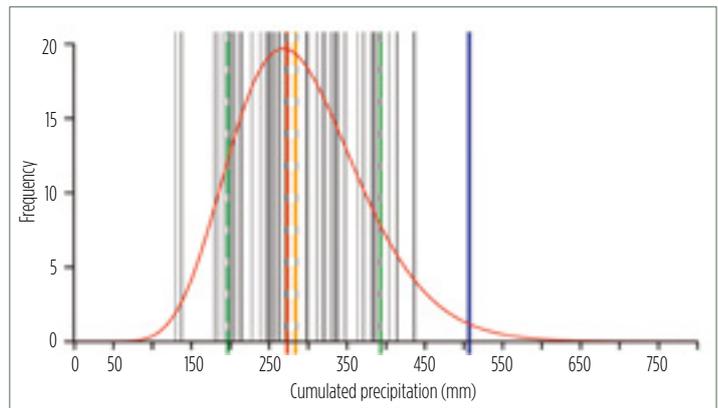


PHOTO: ARCH-ARPA-FVG

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events were characterised not only by exceptional intensity, but also by a very short horizontal scale and by an intrinsic unpredictability. In these cases, the severe destabilization of the mountain slopes and the hydrogeological instabilities due to persistent and very abundant precipitation, have been accompanied by major difficulties experienced by the regional meteorological services in issuing forecast information useful to provide a timely warning to the population and to the institutions in charge of civil and land protection, in order of limiting damages to people and to infrastructures.

The ARCIS Working Group includes now all the regions of Northern Italy plus Marche and Toscana. Further and more detailed information on climatic events occurred in this area can be found on the ARCIS website (www.arcis.it), maintained by the regional meteorological services and by the Functional Centres of the Italian Civil Protection acted in each region.

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1 Snow at Casera Tuglia (UD), 3 March 2014.

2-3 Strong thunderstorms caused the Genoa flood on 10 October 2014.

4 Waterspout in Lignano Sabbiadoro-Marano Lagunare (UD) on 8 August 2014.