SUMMER SHOWERS CHARACTERIZATION IN THE BASQUE COUNTRY.

S. Gaztelumendi[12], K. Otxoa de Alda [12], J. Egaña[12], I. Gelpi[12] , D. Pierna[12] , S. Carreño[12]

[1]*Basque Meteorology Agency (EUSKALMET), Miñano, Álava, (Spain).*

[2]*European Virtual Engineering Technological Centre (EUVE), Meteorology Division. Vitoria, Álava, (Spain).*

I. INTRODUCTION

In the Basque Country, severe storms take place usually from May to September. In this work, intense precipitation events related with convective summer storms in our territory are considered for a ten year period, focusing on severe convective cases.

In the Basque Country an Automatic Weather Stations (AWS) Network (BCAWSN) is present, in some sites there are some instruments called Datarains, connected to the rain gauges that record the instant (hour, minute, second) when a bucket of a rain gauge overturns. This parallel data measure system is useful to carry out a quality control of rain data as well as to perform high resolution precipitation intensity analysis.

As representative for summer showers cases, summertime events with precipitations that exceed ten millimetres in ten minutes in any rain gauge from the BCAWSN are studied based on Datarain instrumentation, using the particular features of the Datarain data to explore in detail the temporal structure and the intensity of selected events.

II. RAIN GAUGE NETWORK

Currently, the BCAWSN is a high density automatic measuring network for meteorology, hydrology, water quality and oceanography purposes. This network provides different meteorological measurements, every 10 minutes, in nearly 100 different sites all over the Basque Country area in a real time basis (see more details in Gaztelumendi et al 2003). More than 80 stations of the BCAWSN have tipping-bucket rain gauges. Since 1995, the number of AWS with rain gauges, which have incorporated Datarain instrumentation, has increased reaching practically all of them, nowadays (see FIG 1).

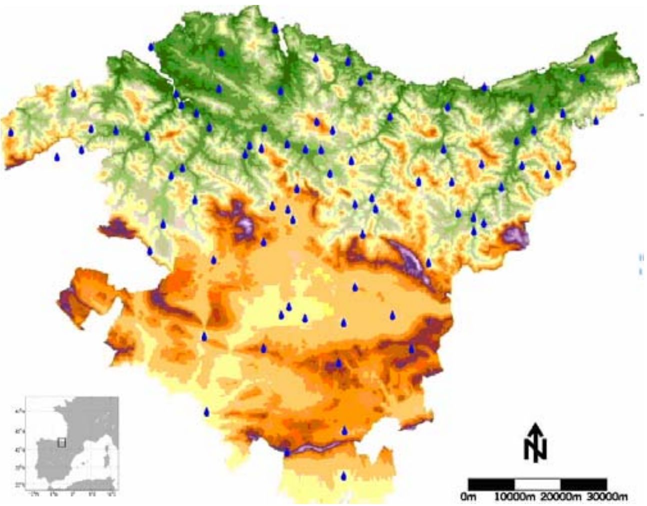

FIG. 1: Location of rain gauge with Datarains in Basque Country.

When a bucket of a tipping-bucket rain gauge overturns, it is automatically recorded by two different and independent systems: the AWSs Datalogger and the Datarains. Datarain recorded data allows to calculate the precipitation intensity with a resolution higher than 10 minutes. The Datarain register the instant in which has occurred every dump, generating a file in ascii format. In this file some relevant information is stored; the rain gauge code, the date and time of the dump, the ability of the bucket and an internal code (see more details in Otxoa de Alda K. et al 2003).

III. STUDY CASES

Intense precipitation events from 1999 to 2008 have been considered. Study cases are selected using precipitation rate threshold criteria If the threshold of ten millimetres in ten minutes is exceeded in any rain gauge of the BCAWSN, the day is selected in order to include intense precipitations events. To characterize these severe weather events and to improve its knowledge we include for each day its weather type (Egaña et al 2007). This classification of weather types is used in this work in order to find out some patterns.

For selected events, accumulated precipitation data every ten minutes, every minute and every 30 seconds are calculated. In the table 1 we present the study cases for each year detailing the number of AWS that have exceeded the record of ten litres in ten minutes. Number of events during this ten years period ranges from 6 to 13 cases, with an average value of 9.6. Respect to monthly distribution, most cases have occurred between May and September, as obvious consequence of summer convective activity (see FIG 2). Focusing on the spatial distribution, we can conclude that the majority of cases are concentrated in the east part of Basque Country and in mountainous areas (see FIG 3).

Number of AWS	1	2	3	4	5	6	7	9	13	tot
1999	5	3								8
2000	10			2						12
2001	3		2			1				6
2002	4	3	1							8
2003	1	1	1		2	1	1			7
2004	2	6						1	1	10
2005	5	1	2				1			9
2006	5	4	1	1	3					14
2007	5	1	2							8
2008	4	4		1	1					10

Table 1. Number of days where more than ten mm in ten minutes is registered and number of AWS where threshold is surpassed.

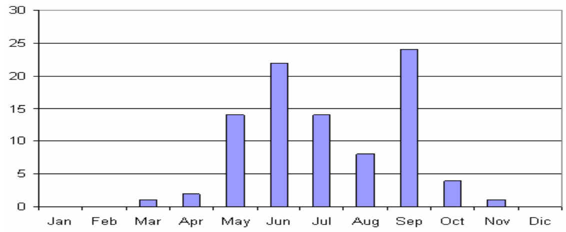

FIG.2: Number of cases by months.

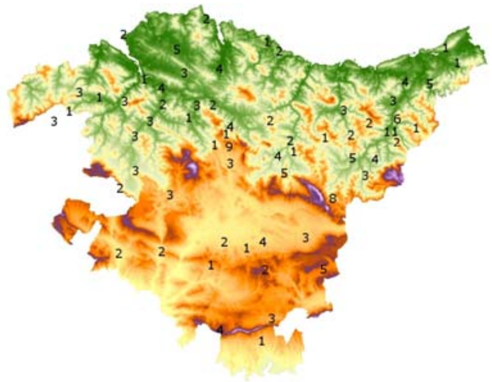

FIG. 3: Spatial distribution of the study cases.

In summary, mean accumulated precipitations are 2.4, 4.5, 9.4 and 13.1 for 1-minute, 2-minute, 5–minute and 10-minute intervals respectively. For maximum accumulated precipitations, the values are 6.1, 10.2, 23.4 and 27.6 for 1-minute, 2-minute, 5–minute and 10-minute intervals respectively. On average, the data show that, the 73.1% of the precipitation registered in 10 minutes, is measured practically in 5 minutes.

The precipitations patterns have been analysed for 1 minute an 30 seconds intervals to characterize the precipitation distributions of a single shower. The mean summer shower duration is 25 minutes long.

When radar information is available, the convective systems responsible for the intense precipitations have been identified and studied. As a case study example, in FIG 4, radar images with 1-minute precipitation distributions for some stations affected by showers for the 2006 July 4th event are shown (see more details about this event in Gaztelumendi et al., 2008 and 2007). In this case, the 1-minute precipitation patterns are quite similar in the majority of the stations, since the storm crosses the studied area in 1-hour with nearly same structure.

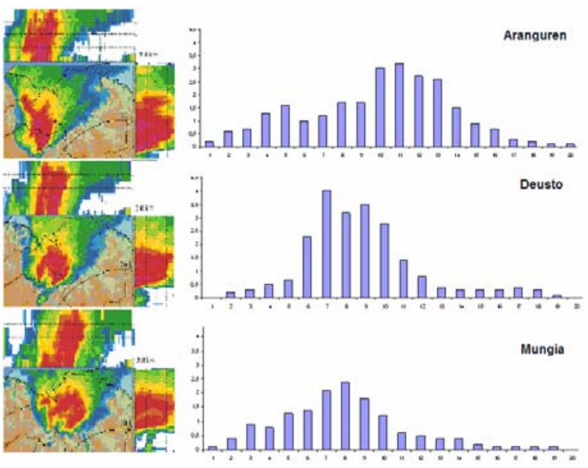

FIG.4: One-minute rain rate in Aranguren, Deusto and Mungia at showers from 4th july 2006 storm over Bilbao area.

In figure 5 a median time distribution derived from combining all the storms from the Basque Country network in the study period is shown. This curve shows that the rainfall in each quartile is 28%, 36%, 25% and 11% respectively.

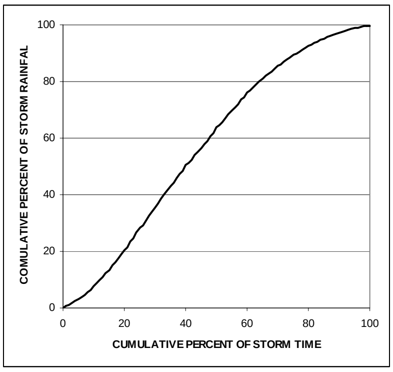

FIG 5. Median time distribution of the storms in the Basque Country (1999-2008)

IV. RESULTS AND CONCLUSIONS

In this work we have tried to characterize rain rates for intervals smaller than ten minutes in showers cases over the Basque country.

Significant rain events take place in the interval between May and September, when the troposphere is warmer and contain more water vapour.

Datarain instrumentation available in Basque Country mesonetwork seems to be useful as first attempt to characterize rain distribution smaller than 10 minutes interval, nevertheless the future incorporation of disdrometres in the network will improve this work.

V. AKNOWLEDGMENTS

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