CONVECTIVE STORMS OVER BASQUE COUNTRY: JUNE 2008 CASES STUDY

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

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

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

I. INTRODUCTION

During June 2008, different severe weather episodes related with convective storm events occur in the Basque Country area. In this paper, we present a selection of the most representative cases occurred during this month.

The first case study is related with the intense rainfall in the northwest part of the Basque Country. June the 1st, Bilbao metropolitan area was affected by showers, collecting more than one hundred and twenty millimeters precipitation in twenty four hours.

The second case study deals with moderate widespread storms, when precipitation over ten millimeters in ten minutes was collected in many points of the territory.

The third case study is related with a convective storm development event on June 16th in the central part of the country. More than twenty millimeters precipitation in ten minutes and more than thirty five millimeters precipitation in one hour were collected.

II. STUDY CASES

In order to understand the development and evolution of these severe weather situations, synoptic characteristics, mesoscale situation and other local meteorological characteristics are analyzed. In this study cases, we include datasets coming from the Basque Country Automatic Weather Station Mesonetwork (see more details in Gaztelumendi et al., 2003), MSG and numerical modelling.

In the three studied events, there is instability in the high layers of the atmosphere. Two of them, (June 1st, June 9-11th) are situations characterized by a cold pool; joint to a surface north wind providing humid air. The June 16th episode, the instability is generated by a through in the high layers of the atmosphere.

May the 30th, the cold pool locates in the centre of the Iberian Peninsula, with a slight displacement toward the North in the 31st afternoon and June 1st evening. The location of the cold pool generates a retrograde movement in the Basque Country with southeast winds in height; moving convective structures from the northeast of the Iberian Peninsula towards the Basque Country (see FIG 1). Another synoptic patterns point to the risks associated to this situation. There is convergence in the low levels of atmosphere that favor the upwards fluxes. In surface, a light north flux, due to a relative low pressure area located on the north of the Pyrenees, introduce humidity in surface. These factors could be able to generate mesoscale convective systems (MCSs) with unpredictable movements, and many times quasi-stationary situations when not exist unidirectional shear that can move easily the generated systems.

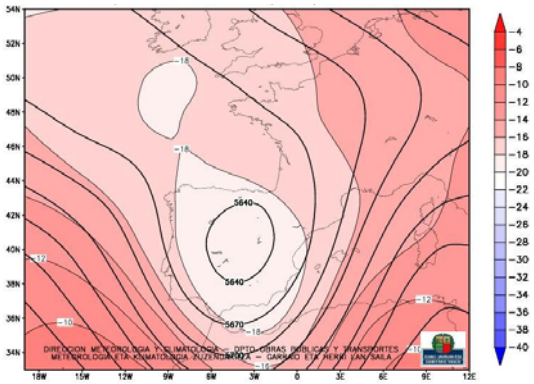

FIG. 1: 500 mb Geopotential height and isotherm 2008 June 1st at 00 UTC

In the June 9-11th event, a cold pool in the high layers of the atmosphere (500 mb) is centered in the southwest of the Iberian Peninsula favoring instability. Initially the temperature in the centre of the cold pool is -20 ºC. In June 9th evening and June 10th is filled and moves slightly eastwards, maintaining the instability. In surface the high pressures dominate, due to the 1031 mb Atlantic anticyclone, centered at the southwest of Ireland, creating north component winds that provide humid air.

The June 16th event is characterized by a through, in the 500 mb level, crossing from west to east the north of Iberian Peninsula, the temperature at this level is around -18ºC. In surface a 1004 mb low pressure centre moves rapidly over the Cantabric Sea.

In the first episode of study, especially stands out the large accumulated precipitations for the whole episode, due to the formation of a MCS. Up to six stations, all of them located in the surroundings of Bilbao, surpass the 120 mm (see FIG 2), remarking 166.3 in the Deusto station (see FIG 3).

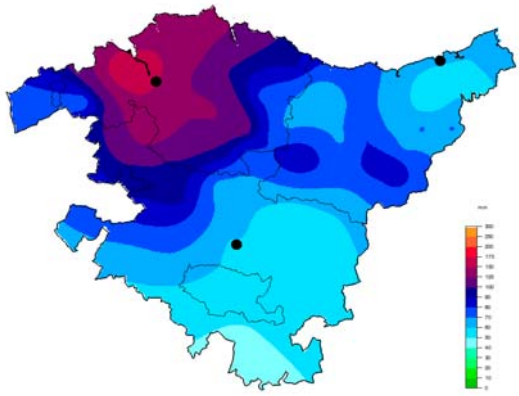

FIG. 2: Measured accumulated precipitation (mm) for 2008 May 31st and June 1st

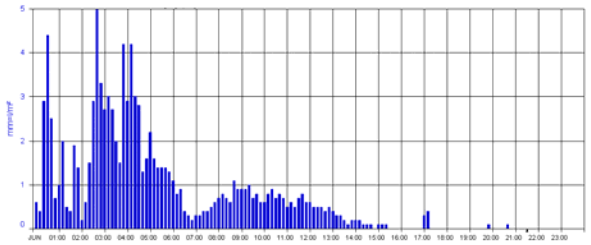

FIG. 3 Measured accumulated precipitation (mm) for 2008 June 1st in Deusto-station

During the second study case, different storms are produced, causing hourly accumulated precipitations superior to 25 mm in the area. During the evening of June 10th in Gardea-station 26 mm/h are measured, during night in Arkaute-station 26 mm/h are registered (see FIG 4).

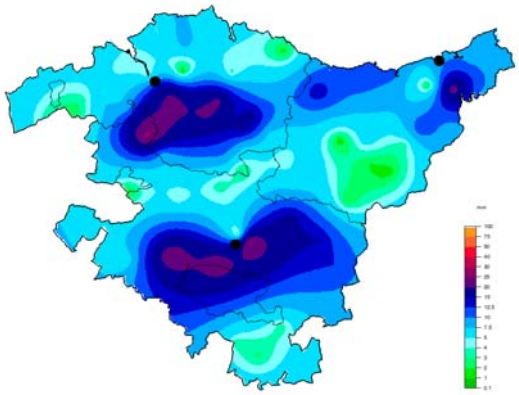

FIG. 4: Measured hourly maximum precipitation (mm) for 2008 June 10th

In the last episode, a very strong storm produces a 10-minute register of 23.6 mm in Urkiola-station, that turn into 36.7 mm in one hour. In other stations, severe storms are observed; leaving hourly registers of 29.7 mm in Aixola-station and 27.3 mm in Aitzu (see FIG 5).

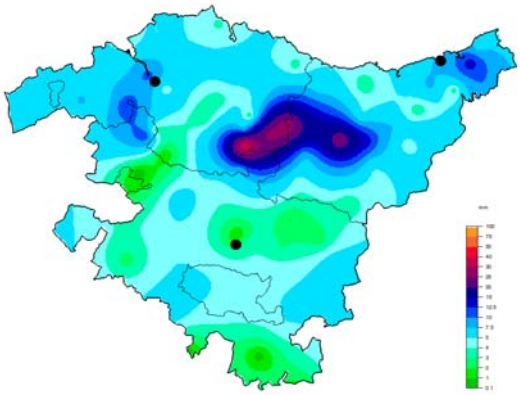

FIG. 5: Measured hourly maximum precipitation (mm) for 2008 June 16th

III. RESULTS AND CONCLUSIONS

The registered quantities of precipitation in the three events are very remarkable. In the June 1st event, is worth pointing out the accumulated data in the Bilbao City surroundings, 166.3 mm in Deusto station and 143.1 mm in Llodio station in the whole episode. In the two other events, object of this study, the episode accumulations are not so important; nevertheless the hourly intensities are superior in some stations. In Urkiola station 36.7 mm in 1 hour and 23.6 mm in 10 minutes were registered, this is a historic register (see table I and FIG 2 , 3, 4 and 5).

Station	Max (10 min)	Date	Station	Max (1 hour)	Date
Urkiola	23.6	2008/06/16	Urkiola	36.7	2008/06/16
Aixola	14.4	2008/06/16	Aixola	29.7	2008/06/16
Amorebieta	13.9	2008/06/10	Aitzu	27.3	2008/06/16
Elorrio	12.6	2008/06/16	Arkaute	26.2	2008/06/10
Aitzu	12	2008/06/16	Gardea	26	2008/06/10
Urkizu	12	2008/06/10	Deusto	19.6	2008/06/01
LLodio	11.4	2008/06/10	Mungia	19.1	2008/06/01

TABLE I: Precipitation rate (in 1 hour and in 10 minutes) for some stations of the three study cases

The risk of convective precipitations episodes is higher in June, agreeing with the days of larger insolation. The formation of convective systems that produces theses episodes is favoured by relative low pressure areas, due to heat accumulation, in the centre of Iberian Peninsula and instability areas in the forward part of the troughs. These troughs usually affect the Iberian Peninsula with a north-south axis with south winds in height in the forward part. The topography and thermal instability also contribute to the creation, development and movement of convective cells.

These troughs are created when the jet polar stream undulates and takes an accentuated north-south component, being able to generating an isolating process and strangulation of one part of this intense circulation (see FIG 1). These isolated patterns from the general circulation can generate a cold pool, i.e. a closed and isolated depression in height, which moves independently from general circulation, can be stationary o even retrograde. This synoptic environment is favourable for Mesoscale Convective System generation.

IV. AKNOWLEDGMENTS

The authors would like to thank Basque Government and specially Meteorology and Climatology Directorate staff for public provision of data from Basque Country Automatic Weather Station Network. We also want to thank rest of our colleagues from Basque Meteorology Agency involved in the elaboration of severe weather episodes reports.

V. REFERENCES

Egaña, J., S. Gaztelumendi, I.R. Gelpi, K.Otxoa de Alda, 2007: “A preliminary analysis of summer severe storms in the Basque Country area: synoptic characteristics”. ECSS 2007.

Egaña, J., S. Gaztelumendi, I. R. Gelpi, K. Otxoa de Alda, 2007: “Synoptic patterns associated to severe storms in the Basque Country”. 7th EMS 8th ECAM.

Gaztelumendi, S. Otxoa de Alda, K. Hernandez, R. 2003: “Some aspects on the operative use of the automatic stations network of the basque country” III ICEAWS.

Maddox, R. A., 1980: Mesoscale convective complexes. Bull. Amer. Meteor. Soc., 61, 1374–1387.

Medina, M.. 1976: Meteorología básica sinóptica. Editorial Paraninfo, 320 pp.

Martín León, F. Las gotas frías/ Danas ideas y conceptos. Servicio de Técnicas de Análisis y Predicción, INM.

Zipser, E. J., 1982: Use of a conceptual model of the life cycle of mesoscale convective systems to improve very-short-range forecasts. Nowcasting, K. Browning, Ed., Academic Press, 191–204.