WINDSTORM XYNTHIA: LOCAL EFFECTS AND OPERATIONAL ASPECTS IN BASQUE COUNTRY CASE.

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I. INTRODUCTION

At the end of February 2010, a strong extratropical cyclone called Xynthia brought hurricane-force winds and high waves to Western Europe. 58 deaths were reported in France, Spain, Portugal, Belgium, Germany and England. Most of deaths occurred in France as a consequence of rapid rise of water and floods in west coast.

In this paper we present, focusing on the Basque Country Area, an analysis of Windstorm Xynthia event. A study and local characterization of this severe weather episode, considering Basque Meteorology Agency (EUSKALMET) operational aspects, was made.

Data collected in Basque Country Automatic Weather Stations Network (BCAWSN) and other data available in the area including numerical models are presented. We also present some Euskalmet operational aspects related with forecast and severe weather warning issues and actions during this severe weather episode.

In the Basque country, hurricane wind gusts were recorded in various locations across the region. A 228 kilometres per hour wind gust was recorded in a mountainous area in the interior. These are some of the strongest winds observed since records are available from BCAWSN owned by the Basque Government.

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II. LOCAL CHARACTERISTICS

In the Basque Country during the morning of February 27th some strong wind gusts are registered as a consequence of first local effects of Xynthia episode over the area of study. Due to Xynthia trajectory, pressure field configuration and Basque Country topographic aspects, wind had southeast direction during the morning over the area. As Xynthia moves northwards, wind intensities increase to very strong and hurricane gusts, in the evening wind veer to southwest and finally to west direction.

Initially, due to wind direction maximum wind gusts are measured in the east of the territory, remarking the 140 km/h wind gust registered in Ordizia in the afternoon. Progressively, the wind direction changes fixing from south with maximum wind gusts in the central area. Afterwards, when wind turn to southwest, wind speed increases in an extraordinary way affecting mainly the west areas of the Basque Country (see fig 1).

In mountainous areas values superior to 150 km/h are reached, remarking exceedingly the 228 km/h in Orduña (see fig 2). In the south and in the west of the territory south gusts in non-exposed areas surpass the 100-120 km/h values, e.g. Gasteiz station register 135 km/h (see fig 3). The coast is the least affected area, since in the westwards wind shift no intensification is produced (see fig 4). With south winds the most affected zones are high areas in the interior (see table 1 and table 2).

Mean wind registered at some exposed AWS surpass 100km/h during the event, in Orduña station a value of 177 km/h was reached (See table 3).

Pressure data registered in the AWS network shows values dropped by more than 15 hPa in twelve hours.

On the other hand Xynthia has little effect on sea state. The southwest-northwards cyclone trajectory and its quick displacement over Cantabric Sea not permit the necessary time to generate significant swell. During Sunday morning, significant high wave reaches 3.5 m on the Basque Coast.

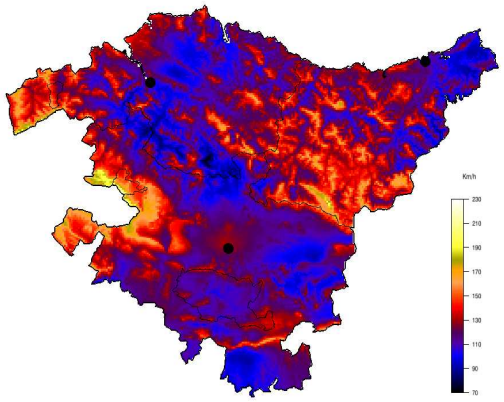

FIG. 1: Max wind gust analysis for 27th February 2010.

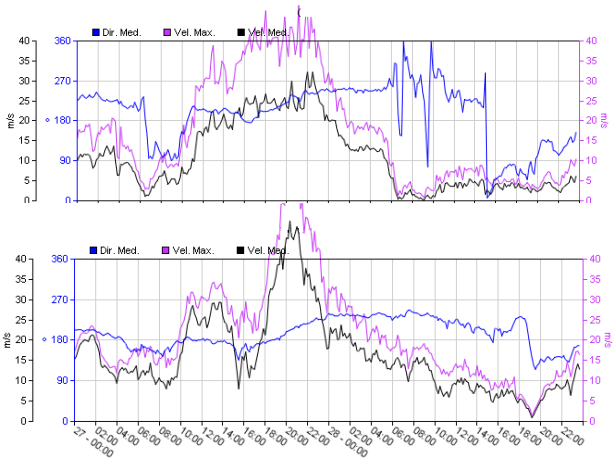

FIG. 2 Mean wind, wind gust and wind direction, during day 27 and 28 for Cerroja and Orduña AWS, located on mountain area.

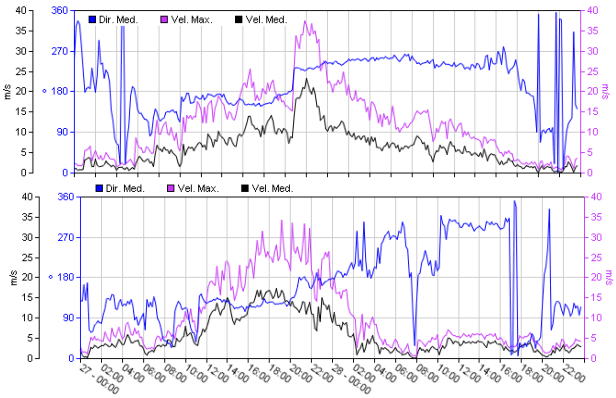

FIG. 3: Mean wind, wind gust and wind direction, during day 27 and 28 for Gasteiz and Deusto AWS, located on non exposed area in Vitoria-Gasteiz and Bilbao city respectively.

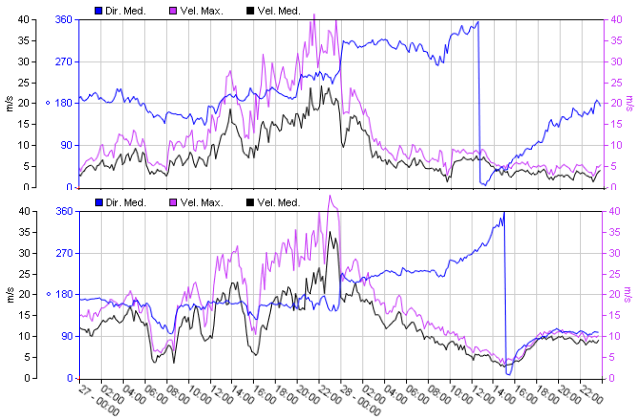

FIG. 4: Mean wind, wind gust and wind direction, during day 27 and 28 for Punta Galea and Matxitxako AWS located on coastal area.

AWS	Max wind gust (km/h)	time (UTC)
C072 Orduña	228,3	20:00
C065 Cerroja	176,4	21:10
C046 Oiz	174,3	17:20
C045 La Garbea	160,9	18:30
C025 Beluntza	158	20:40
C019 Matxitxako	158	23:00
G022 Urkiola	150,1	21:20
C042 Punta Galea	148,9	21:30
C070 Zaldiaran	143,2	22:30
G059 Ordunte	140,8	20:30

TABLE I: Most significant wind gust data registered on BCAWSN for exposed areas (mountain and coastal areas)

AWS	Max wind gust (km/h)	time (UTC)
C043 Ordizia	140,4	17:40
C040 Gasteiz	135,1	21:50
C029 Zizurkil	127,7	17:00
C001 Arkaute I	127	21:30
C039 Deusto	123,1	19:10
C050 Zambrana	122,4	23:20
C058 Bidania	120,3	16:20
C023 Arrasate	118,5	16:40
C051 Saratxo	118,2	20:10
C036 Iurreta	117,5	21:40

TABLE 2: Most significant wind gust data registered on BCAWSN for non-exposed areas.

AWS	Max wind (km/h)
C072 Orduña	177
C019 Matxitxako	126
C046 Oiz	118
C065 Cerroja	116
C045 La Garbea	108

TABLE 3: Most significant maximum wind (ten-minute average) registered on BCAWSN.

III. EUSKALMET OPERATIONAL ASPECTS

On February 21, EUSKALMET prognosis products showed the possible formation of a deep depression in the vicinity of Canary Islands with a probable evolution and trajectory from southwest to northeast that can affect Basque Country area. Euskalmet mesoscalar numerical models and others available tools showed potential risk of local severe weather related with this explosive cyclogenesis event.

On successive days forecast products showed the formation and evolution of a wind-storm event with a trajectory that could affect Basque Country. Mesoscale numerical available products showed probability of wind gusts surpassing established thresholds for severe weather for exposed and non-exposed areas during 27 and 28 days. According with operational warnings procedure awareness reports was delivered during morning and evening on 25th February and successive days.

On 25th February, available information confirms a probable explosive cyclogenesis phenomenon and shows a depression trajectory with potential risk to Basque Country area. Mesoscale numerical available products shows probability of wind gust greater than that 120 km/h for exposed areas and greater than 80 km/h for non-exposed areas in Basque Country surpassing thresholds of severe weather for the area during 27 and 28 days. A warning bulletin for wind risk was prepared for public dissemination. For non-exposed areas all over the territory we establish a yellow level (80-100km/h wind gust) from 12 to 18 UTC, orange level (100-120 km/h) from 18 to 21 UTC, red level (more than 120km/h) from 21 to 03 UTC specially for Araba Region (south part of territory), orange (100-120km/h) from 03 to 06 UTC and yellow level (around 80km/h) from 06 to 12 UTC. In exposed areas all over the territory we establish a yellow level (100-120km/h wind gust) from 09 to 12 UTC, orange level (120-140 km/h) from 12 to 15 UTC, red level (more than 140km/h) from 15 to 03 UTC, orange (140-120km/h) from 03 to 06 UTC and yellow level (around 100km/h) from 06 to 12 UTC. In all cases we mention southerly wind gusts.

On 26th February, after morning briefing where MSG and synoptic and mesoscale numerical data was analyzed, was introduced some changes in warning bulletin. We establish the yellow level for all the areas from 12 to 15 UTC, orange from 15 to 18 UTC, red for 18 to 03 UTC, orange for 03 to 06 UTC and yellow from 06 to 12 UTC. For exposed areas we mention that mountainous region are going to be affected much far than coastal areas. We mention southerly wind gusts on day 27 and westerly wind gusts for day 28.

On 27th February, some minor changes in the warning bulletin were done. We establish the yellow period from 09 to 12 UTC, and we mention that westerly component may be present during the night of day 27. We also introduced a yellow level warning for significant wave high surpassing 4 meters for 00 to 12 UTC on 28th.

On the other hand especial press notes were prepared during days 25, 26 and 27 for media dissemination, with a brief and concise explanation of phenomena development and clear information addressing the importance of stay alert with possible evolution of event and authorities recommendations.

On day 24 severity and exceptionality of this event is clear to us, so especial reinforcement on severe weather usual procedure is applied. Routine operative staff is reinforced with additional surveillance and forecast personnel, and special severe weather briefing is planned. In those situations, is important to consider that small perturbations at synoptic level, specially related with final track and final pressure values, are critical in final local effects.

IV. CONCLUSIONS

Xynthia brought hurricane-force winds and high waves to Western Europe. 58 deaths are reported in France, Spain, Portugal, Belgium, Germany and England. Most of the deaths occurred in France as a consequence of rapid rise of water and floods in west coast. In Iberian Peninsula 4 people were killed by the storm in accidents related with falling trees. In Basque Country material losses were very important but nobody died.

It is important to consider exceptional safety measures applied by Basque authorities and the fact that this severe windstorm affects Basque Country only one year after “Klaus” event. In general, people well understand the potential risk of the situation, and stay at home during Saturday evening.

During the days and hours before Xynthia passage, a special effort is made in order to explain risk and the unusual nature of situation. Basque Government applies civil protection plan and summon “crisis table” for actions coordination among different agents (civil protection, police, firemen, municipalities, etc.) In EUSKALMET the monitoring of the situation was continuous, providing forecast, analysis and data reports for authorities and public before, during and after the episode.

Some preventive measures are considered, such as cancellation of some public transport over the area on Saturday, including buses, train and flights. On the other hand, several public activities were canceled; including some sport events and some recommendation were made in order to close commercial centers some hours earlier than usual. All this preventive actions, including calls to population be home look for reducing people mobility and personal risk during the event.

During Xynthia event, maximum gusts are southerly, with south component and depending on the exact direction of wind; in Basque Country canalizations and high degree of turbulence were produced, implying large deviation from gusts values to average wind speeds.

Measured data shows the virulence of Xynthia, especially, in high areas and places in the interior, where in several stations are exceeded the values never registered. The least affected area in the territory is the coastal area. The maximum wind gusts are observed with southerly winds, first with south-easterly winds is the east part of Basque Country the most affected (Ordizia: 140 km/h) and later with south-westerly winds, are registered the maximum values in the west of Basque Country (Orduña: 228 km/h, Cerroja: 176,4 km/h, Punta Galea: 148,9 km/h). During the 28th early morning the wind veer to west without further intensification.

At the end, material losses were very important, thousands of trees were pulled down, some roofs blown off, electricity power disruptions where produced on some areas and some wildfires were uncontrolled during the event especially in Bilbao area (see fig 5).

FIG. 5: Some fires in Bilbao area.

IV. AKNOWLEDGMENTS

The authors would like to thank the Emergencies and Meteorology Directorate - Interior Department - Basque Government for public provision of data and operational service financial support. We also would like to thank all our colleagues from EUSKALMET for their daily effort in promoting valuable services for the Basque community.

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