TORNADOES AND SEVERE STORMS IN SPAIN Miquel Gayà

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I. INTRODUCTION

Tornadoes and other severe winds associated to thunderstorms are relatively frequent in Spain. This was yet performed for the Balearics Islands (Gayà, 2001) and for a contiguous Spain (Gayà, 2005) and the present work is devoted to investigate how severe storm distributions have evolved through the last five centuries or more.

The complex orography of the Iberian Peninsula and the Mediterranean Sea play a determinant role in the Geographic distributions of severe weather, but the economic and societal perception seems to be an important factor in their apparent changes.

II. DATABASE

The database has been developed collecting information from different sources. In the last twenty years, many cases have been surveyed by the author or other meteorological teams.

According to its origen, the database have divided into three periods, the first one contains the most ancient times until 1825. The oldest times information is kept in archives and the notice are usually picked up by an official chronicler. Many cases are linked to magic or mythic event. some battles are 'lighted' with a religious vision and God operates through a vortex or by severe storm. All these cases are not included in this study.

On the second period (1826-1975) the information is mainly collected from journalists and are kept in newspaper archives. The most recent times (1976-nowadays) combines newspapers, tv, internet, and personal survey.



FIG. 1: Tornadoes, waterspouts, and downburst in the three selected periods.

III. TIME AND GEOGRAPHYCAL DISTRIBUTIONS

In the most recent times (1976-2009), the number of severe winds has increased to 1995 when it stabilizes

and seems to have the inherent variability of rare phenomena of one year to another.

The attention paid to these phenomena and the quick diffusion of the news via television and internet, and the increase of insurance policies in an increasingly complex society, seem to be the cause of this behavior.

Much more difficult is to explain the evolution in the period from 1825 to 1975. Whether in the early years the press barely pays attention to topics other than political, the presence of remarkable events is increasing steadily. The decrease in cases since 1900 is probably due to a progressive journalistic disinterest in these subjects and progressive industrialization of the country that would become less vulnerable. However, political upheavals (World Wars and Civil Spanish War) seem to have a decisive effect on this anomalous behavior.

Adverse events in the period between 1400 and 1825 are usually described in a context where, few exceptions, the news is not the weather but the politics or military action that is told. However, some very notable cases are described by themselves, such is the 1671 tornado case, where damage was very extensive and the number of deaths so remarkable that make it one of the most notable tornadoes in the world.



FIG. 2: Monthly distribution of tornadoes, waterspouts, and downbursts (complete database).

It is clear on the figure 2, that warm season is when all kind of severe weather can be generated.

In the most recent time period (see Fig. 3) the density distributions of tornadoes are similar to the lapse (1826-1975), with small weight differences. But in earliest period, before 1826, Southwestern part

of the Iberian Peninsula and Northern Plateau (Castilia) present higher severe activity than the Mediterreanean areas. It is obvious that this 'anomalous' distribution is not due to climatic change but for the location of the ancient official chroniclers and economic and political power.



FIG. 3: Tornadic density in the most recent period (1975-August 2009).

Most of tornadoes are weak and only a small part is strong. In the complete database, only one case can be violent (Fig. 4).

Because the comments are always limited in the ancient records, the difficulty to assign an F scale is high. Then, the database probably understimates the F in the older cases, and F is overestimated in some of the recent cases if they have not surveyed.



FIG. 4: F-Scale in the tornadic cases (complete database)

The strongest tornado in Spain is the event of March 1671 where it seems died more than 600 people and destroyed many houses in Cadiz. This case was preliminary studied by Sánchez-Lauhle (2005) and rated as F3. But it is plausible that this event was stronger because some documents writen by other chroniclers were not considered.

IV. CONCLUSIONS

A climatology of tornadoes, waterspouts, and downbursts in Spain is presented. It shows the spatial and temporal distribution in three periods: before 1826, 1826 to 1975, and 1975 to Agust 2009.

The spatial distribution is significantly different when taking into account the reference

periods past and present. But these remarkable differences are due to other causes not attributable to climate change, but to sociological reasons. When time distributions are observed, the difference is not significative.

The downburst cases are underestimated when comparing with severe vortex in the recent times, but they are probably overestimated when ancient times are considered.

The shape of the distributions of the maximum velocity is similar to other countries or regions, perhaps the number of events in the violent lapse is too small.

V. REFERENCES

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