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The local press, a source for the study of floods: the weekly Sóller *(Mallorca) from 1900 to 2000*

I

Flooding is increasing throughout the world and becoming a risk once men are involved. To reduce such risks, protection measures are undertaken and knowledge of past events is needed to improve those measures. The EU 2007 Flood directive, which was an answer to the large floods affecting Europe at the start of the 21st century, states that "a description of the floods which have occurred in the past and an assessment of the adverse impacts they have entailed" must be included in a preliminary flood risk assessment, moreover those significant floods "where significant adverse consequences of similar future events might be envisaged."

The use of historical sources to study flood events, as suggested by the EU directive, is widely accepted by the scientific community. In Spain, research using documentary sources is also common. Historical information before the 19th century can be difficult to obtain and secondary sources like compilations of information from previous centuries can be used. A main source of data, since the 19th century, is the press, largely used in Spain as well as in other areas, such as Europe and America.

The island of Mallorca has been heavily affected by floods since the Middle Ages. Historical sources allow identifying more than 200 events from 1403 to 2010. In the 19th century, there is an increase of reports about flooding, which is related to the development of the press, with regional and local editions, of daily, weekly and even monthly appearances.

The research herein presented aims to identify the flood events that have affected the study area, with the information's obtained from a weekly newspaper as a source. Once the events are identified, they will be (1) classified into three categories, (2) the spatial and temporal distribution examined and (3) the general trends of floods analyzed.

II

Sóller is located on the North-West coast of Mallorca, within a small valley on the Tramuntana mountain range. The runoff system is organized around ephemeral streams, locally known as torrents. Three main streams converge inside the urban area to form the torrent Major, the area largest catchment, with a 50 km^2 surface. The climatological trends of the area are largely influenced by its spatial location and heavy rainfall events are common. Such events, along with the steep catchment characteristics, make the valley a flood-prone area.

Historically occupied by men, at least from the 11th century, the valley has suffered large floods events, recorded by local historians. Press references started to appear after 1885 when a catastrophic flood destroyed bridges, roads and cause heavy economical damages.

III

The source for the research has been the weekly newspaper titled "Sóller". It was founded in 1885 and

had 135 years of life. During the 20th century, the paper was published every Saturday and had a changing number of pages, from the 4 at the beginning to the 30 at the end of the century. One of the main sections was the "Local chronicle", where news about the town were included, with references to social events, market information, ships arrivals and departures, and weather news. Flood events and their damages were included in this section.

The methodology included the reading of all the numbers of the paper, 5062 in total. Each page was read using the Sóller Municipal Archive database for the period 1900 to 1960 and the Municipal Library for the final 40 years of the 20th century. The data were then classified according to the flood damages. Three levels of impact were considered:

1) Ordinary, when the floodwaters usually do not move away from the bed, even if damages on goods can be identified.
2) Extraordinary, when the water overcame the bed walls and cause damages to infrastructures and affects the population and its economical activities.
3) Catastrophic, the flooded area is larger than category 2 and the damages are more important, including the destruction of infrastructures (bridges, roads, and streets), private and public buildings affected, closure of roads or streets and even the loss of life.

Once all the events were compiled, a database was created with information fields such as event number, date, affected catchment or sub-catchment, rainfall amount (when available) and damages description.

The next step is to distribute spatially and temporally the events to know where and when the flood impacts happen. Finally, the Mann-Kendall test is used to analyze the episodes trends. The Mann-Kendall test has been widely acknowledged as a proven tool to classify the distribution of temporal series. It has been used to study floods in Germany, Scandinavia and the Mediterranean basin.

IV

The analysis of the weekly newspaper identified 48 flood events in the study area. Once classified, 21 cases were considered as ordinary, 8 were included in the extraordinary category and 17 were defines as catastrophic.

Two events remained unclassified due to a lack of information. The November 11 1928 and March 1 1979 are mentioned on the paper but without details. It can be considered an example of the loss of information as other news were more important, thus reducing the available space of the newspaper.

Regarding the spatial distribution of floods, those classified as ordinary do not present a clear location within the valley. Their small impact led to generic references, such as "flooded orchards" or agricultural damages. On the other hand, the extraordinary cases have more detail, including the flooded stream or the geographical area affected, as well as damages on farms and infrastructures. The events with a large detail are those classified as catastrophic.

Three locations can be identified as the flood-prone areas of the valley, L'Horta and Campdesamar, both located at the lowest part of the catchment, the first while exiting the town, the second while arriving at the harbour neighbourhood. News also includes references about Sa Figuera stream, which causes damages inside the harbour, where the old fishermen neighbourhood was located.

The information about the flood locations highlights the 20th century evolution of the valley, related to socio-economic changes. From references to damages to agriculture and cattle during the first decades of the 20th century to the impact on roads, streets, railways and tourist industry buildings since the 1970s.

The temporal distribution can be analyzed by months and seasonally. The latter shows the importance of fall (September, October and November) as the flood-prone season, with 25 events, 11 of them catastrophic. Such affectation can be related to a large number of rainfall events during autumn, usually of high intensity. On the other hand, summer is the season which records the fewest number of cases, only 3 during the 20th century.

Monthly, October is the month with more events, 11, while November has 10 and March has 6. The damaging floods usually took place in November (6 cases) and October (5 cases). Ordinary events are equally distributed throughout the year.

The temporal distribution is similar to the one observed for the island of Mallorca and the western Mediterranean Basin, where the largest number of floods are recorded in autumn.

Finally, the Mann-Kendall analysis identifies a significant negative trend (-0.6 events/decade), mostly due to extraordinary events. However, catastrophic events show a positive trend, without being statistically signifi-

cant. This decreasing trend can be related to the improvement of protection measures although the vulnerability and exposure have increased as a result of the population growth, the rise of urbanization and the economy-related change from farming to the tourism industry.

A comparison of the results with research done in Spain confirms the decreasing trend on flood occurrence, even if, in some cases, there is not a complete coincidence regarding the category of the events. In any case, the high variability of flooding in the Mediterranean Basin can be established.

V

To conclude, a local weekly newspaper has been used to identify flood events in a small torrential valley in Mallorca during the 20th century. A total of 48 cases have been identified and divided into three categories, according to the damages caused.

The main coverage is related to catastrophic events, those causing the largest impact, both socially and economically. The reports highlight the change from an agricultural society to a tourism-related industry, with the disappearance of reports related to damages to farms and land, and the increase of news regarding damages to roads, streets, houses, hotels and vehicles. Such change allows picturing the land-use change occurring since the 1970s in the study area and the island of Mallorca.

Also important is the usefulness of local press to identify and study flood events of the past, affecting small catchments but, despite this, still significant regarding the economic and social impact on the area. Even so, the shortcomings of such a source must be considered. The lack of homogeneity and the lapses in the information are hurdles that must be taken into account, as well as the difficult task of data search and its compilation.

However, the results can improve the capacity of local and regional authorities to develop prevention and action plans, regarding the flood risk of the area.