The August 1983 floods in the Basque Country: events and lessons

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The city of Bilbao was founded by Diego López de Haro, *the Intruder*, in 1300. Over the course of time there have been numerous floods that have been entered into the historical record in various historic documents because of the damage they have caused. Making allowance for the uncertainties hidden by the fog of time, there appear to have been 42 episodes of flooding up to the fateful 1983 flood, with the first flood on record dating from 1403. Other episodes of flooding with less rainfall and smaller water volumes took place in the areas of the Basque Country closer to the Bay of Biscay in May, June, July and August 1977, six years before the 1983 flood, particularly in Biscay. They did not cause any victims, but they did do damage.

Subsequently, there was another flood in the Basque Country that sadly took 15 lives in 1988. The victims included a Portuguese family that was driving across the Deba River channel in their car, when the family was trapped in what turned into a floating coffin, which is not unknown in circumstances of that kind. From that time



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to the present there has been no further loss of life from flooding in the Basque Country, though several floods have caused extensive property damage.

One of the authors of this article had recently finished his university degree in geology and was living and working in Granada in 1983, where he indulged in wide-ranging interests. One such interest was what had taken place in southeastern Spain 10 years earlier, in 1973, an episode which in the region of the Granada coastal area came to be known as the "storm cloud", when, as one colleague put it, "the floodgates of heaven opened". Enormous flash floods through the watercourses running down to the Mediterranean Sea caused hundreds of victims. In just a few hours the torrent of silt rushing down from the Sierra Nevada range built up a delta that reached half a kilometre out to sea off the river mouth in Albuñol, Granada, near the border with Almería province. Ocean currents had washed it away after a few months.

When that young geologist turned on the radio on that bright, sunlit, Andalusian Saturday morning on 27 August 1983 and the first thing he heard were the words "Garaikoetxea, head of the Basque Regional Government, has taken command of military personnel", the last thing he would have imagined was that the floodgates of heaven

had also opened in the Basque Country, where his work would later take him and keep him up to this day. In the atmosphere of those times, the announcement startled him into thinking that some sort of non-natural and probably much more deadly havoc had taken place.

Looking back to August 1983, it is commonly held that what happened was unprecedented, that nothing like it had ever been seen before and that despite limited experience with situations of this kind, the institutional response and society's reaction were commendable. This last statement is indeed true. While it was not actually completely unprecedented, the fact is that no flood had ever before caused so much harm to people and the economy in Bilbao and many other towns in the Ibaizabal and Nervión river basins and large parts of Biscay. However, this was basically for the simple reason that human habitation was sparser in earlier times, with fewer people and less commercial and industrial infrastructure in the path of a river which, when it reverts to nature and rises up, takes its territory back with a vengeance that only nature can display.

The heavy, ongoing and reckless settlement of floodplains throughout a good part of the twentieth century, secondarily intensified by the fact that a truly outlandish amount of rain fell in August 1983, made for a diabolical event that the weather forecasting, communications and operational technologies of the day were ill equipped to handle.

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After a period of rain, the problems started with heavy rainfall in Gipuzkoa on 25 August 1983, causing some of the main rivers, chiefly the Oria, Urola and Deba, to overflow their channels, leading to heavy flooding in some towns on the 26th. In fact, Civil Protection personnel and volunteers were sent to Gipuzkoa from Biscay. Yet this was just a warm-up for the actual shock that came on 26 and 27 August, right in the middle of Bilbao's main annual city festival, held right on the banks of the Nervión River in the heart of the Old Town.

The rain came down hardest right in the Nervión and Ibaizabal river basins and in the area between them and the coast of Biscay. In particular, upriver from Bilbao around the junction of the Nervión and Ibaizabal rivers and a broad swath spreading out towards the Mungia region and the coast between Bermeo and Gernika. In this small area over 200 mm were recorded between 9:00 a.m. on the morning of the 26th and the same time on the 27th, spiking to over 400 mm between the junction of the Nervión and Ibaizabal rivers and Bilbao.



Figure 1. Rainfall from 9:00 a.m. on 26 August to the same time on 27 August 1983. Source: Biscay Provincial Council, 1984: "Torrential rains. August 1983: Quantifying the Disaster". These two rivers in fact form a single river basin system that empties into the ocean at the Bilbao estuary. According to reports, the most precipitation fell not at the headwaters but in the middle and lower courses where the two rivers meet and some kilometres upriver. The rainfall was so heavy and so concentrated in these sections just above the industrial centres of Galdakao, Basauri, Etxebarri and Bilbao itself that swells arrived abruptly and simultaneously with no time or space for any natural flood abatement to occur. This took place on river plains that had furthermore, been hemmed in and built up thanks to urban industrial and residential development on lands stolen from the rivers.

The combined flow of the two rivers on reaching Bilbao was more than 3,000 m³/s. In itself this figure might not say much. But to put things in perspective, flow rates approaching 1,000 mm³/s in this section are highly likely to cause appreciable damage, even today. That volume of flow came from combining the water carried by the Nervión at Basauri, around 1,650 mm³/s, and by the Ibaizabal, around 1,400 mm³/s at Galdakao. With all the reservations attaching to assertions of this kind, the return period for this flood event can quite possibly be put at more than 500 years.

The estimated peak flow rate of the Nervión at Llodio was 550 mm³/s. At Saratxo (Amurrio), just 14 kilometres upriver, it was 180 mm³/s. There were tributaries feeding in between those two locations, but not so sizeable as to account for that increase in the flow rate. As just mentioned above, the reason for this was that despite heavy rains upriver of Amurrio in the upper course of the Nervión, rainfall was not as intense as in the middle and lower courses of the river.

Water levels in Old Town of Bilbao reached as much as six metres above street level. In some districts like Iturrigorri, the torrent picked up and carried away solid material from an old, completely exposed quarry, burying some streets in debris up to the first storey of the buildings.

The splendid historical casino building in Bermeo, literally built over the Artike canal, collapsed when its foundation, the platform overlaying the channel, could not take the pressure and buckled upwards. The pictures look like scenes shown on television after a bombardment.

While the most common images of the disaster come from Bilbao, there was only one death, a man nicknamed *Madriles* who was spending the night in a shop and was trapped when the waters rose. The official death toll in Biscay as a whole and the Bay of Biscay catchment area of Álava, like Llodio, came to 34, with 5 more persons listed as missing. Most of the deaths occurred along the Nervión and Ibaizabal rivers and then from the junction of the two down to Bilbao. Some bodies washed up on the beaches of the portion of the bay known as the Outer Cove.

Damage was very great. According to some estimates just for Biscay made at the time, the damage was around 150,000,000,000 pesetas, directly equivalent to some 900 million euros, with 40% of the damage located in Bilbao. Industrial infrastructure suffered about half of the damage.

In 1984 the Biscay Provincial Council published a detailed account in a book entitled "Torrential Rains. August 1983. Quantifying the Disaster", with large volumes of data of all kinds. It includes an in-depth discussion of the need for technical improvements aimed at predicting phenomena of this type but contains no explanation of the root causes or how to address them. The most far-seeing conclusions comes in one of the paragraphs at the end, which reads: "... what we think is basic is to address such aspects as afforestation of the upper and middle courses of the rivers, designing bridges with ample clearance, restricting building on floodplains and more effectively keeping the river beds clear of building rubble and refuse". It seems somewhat vague, especially the last part, but it was written 40 years ago.

Contrast that book with another study written in 1978 after the 1977 floods in Biscay just six years earlier. Its author was Antonio Altadill Torné, a distinguished engineer with what was then the Northern Spain Basin Authority who was

for years in charge of the Authority's Planning Office. This latter study was entitled "River channel and water drainage improvements in Biscay". Altadill was at the forefront of his profession, and he did explain the reasons why things were the way they were in several places in his study. The first section of his conclusions stated that the primary reason was "Building in lowlands or regions prone to flooding. This is widespread in all areas (...) and entails filling in the land and strangling the river beds, resulting in greater flooding of the river margin on the opposite side and all those located upriver". This same conclusion is reached numerous times, case by case. For instance, when describing what happened in Arrigorriaga, the author wrote, "The factories themselves caused the floods by strangling the river channels and being built in locations exposed to floods".

As discussed below, these ideas have evolved over time into a robust body of standards and regulations focusing on prevention as an essential tool to avoid repeating the mistake of locating vulnerable infrastructure in areas prone to flooding and to apply construction to try to mitigate the legacy of flood risk inherited from poor land management in the past.

In the meantime, major actions were undertaken in the first years after the floods, e.g., drawing up a "Comprehensive Flood Prevention Plan" that included the first flood risk map in the Basque Country. That plan was implemented through the rest of the 1980s up to 1993. It contained extremely valuable hydrological information on the courses of the rivers flowing through the Bay of Biscay watershed and the Zadorra River flowing through the Mediterranean watershed. That study was an initial step and to some extent set the tone for all the flood risk studies and mapping done since then. But it did not actually propose any regulations or legislation addressing land use based on the level of flood risk.

Right away, various government administrations undertook construction projects in the immediate aftermath, for instance, replacing or modifying bridges, e.g., in Tolosa, and work on the river channels, to greater or lesser effect, e.g., in Llodio or in the La Peña district in Bilbao.

A few years later massive work on reconditioning the river channels began, as time went on less hastily planned, increasingly environmentally-friendly projects, up to today, when both ecological and hydrological considerations go hand in hand, seeking nature-based solutions.

From 1993 to the present, around 325 million euros have been invested in the Basque Country, nearly all by the Basque Regional Government (for the past 15 years under the auspices of the Basque Water Authority), mainly in the area of the bay of Biscay watershed, where the risk is higher both for the vulnerable population (currently around 70,000 in areas subject to 100-year flood events) and for vulnerable economic activity.

The largest investments have been made for the Urumea River (75 million euros) and in the Nervión-Ibaizabal rivers and the adjacent areas, most affected by the 1983 flood in Biscay (105 million euros). The remaining 145 million euros has been spent on the other river basins in the Basque Country, in particular 25 million euros on the Oria River.

Bilbao is obviously still a high-risk area. Some storm tanks have been built and more particularly the city government has dug a canal through the former Zorrozaurre peninsula, making it into an island. The result is a one-metre drop in water level in the area subject to 500-year flood events and progressive abatement upriver, so levels drop in the vicinity of City Hall and do not reach the Old Town, where the worst flooding occurred in 1983. There is no easy fix, because the river has been boxed in. A proposal to build tunnels to drain off some of the water from higher up above Bilbao into the estuary below the city has been made. However, the plan is not yet ripe, and before it can be put into effect, there are uncertainties and issues that first need to be addressed, including hydrological considerations, and not least its extremely high cost. In contrast, work to renovate management measures on the Nervión is under way at Llodio, where some of the first management works were built but proved to be inadequate. In addition, 11 years after the first stage was started, the third stage of work to improve the Ibaizabal to one kilometre downriver from the junction with the Nervión has just been completed at Galdakao, at a total cost of 36.2 million euros.

A population of some 5,200 people who were affected by the 100-year flood lives in the management area. The intent is to make the river channel capable of draining off those flood waters so that hypothetically at least no-one in that area would now be affected by a flood event of that kind. The average annual damage to be expected in the area that would be affected by a 500-year flood is now estimated at around 0.7 million euros, down from the 7 million euros estimated before the work was carried out. It is thus apparent that the work would pay for itself in just six years. From that point on, everything would be net profit depending on the estimated average annual amount of damage. So works of this kind bring tremendous benefits.



Figure 2. Flood-prone areas before and after the management work to the Ibaizabal River. In blue, by 500-year floods; in yellow, by 100-year floods and in red, by 10-year floods. Source: Basque Water Authority.

The third stage of the work on the Ibaizabal also exemplifies one of the Basque Water Authority's design objectives: to protect, and indeed preserve, the cultural heritage present in the section where the work is carried out. In this case the Medieval Mercadillo Bridge was a conspicuous barrier to flood waters and in point of fact was in peril of being swept away by the 1983 flood. Therefore, an alternative channel was built bypassing the bridge and in addition the river bed generally has been widened so that the high water can continue to pass under the bridge, no longer a barrier to flow. Not only that, the bridge has been restored under the direction of the Spanish Cultural Heritage authorities.



Figure 3. The Mercadillo Bridge in Galdakao after the August 1983 floods. The height attained by the water is clearly visible. Source: Biscay Provincial Council, 1984: "Torrential rains. August 1983. Quantifying the Disaster".



Figure 4. The Mercadillo Bridge during a flood event prior to the management work and before being restored. Source: Basque Water Authority.



Figure 5. The Mercadillo Bridge in Galdakao after the work was completed. Source: Basque Water Authority.



Figure 6. The Mercadillo Bridge during a flood in December 2021, operating with unfinished works. Source: Basque Water Authority. In other cases, like Vitoria-Gasteiz on the Zadorra River, or the management work on the Cadagua River in Zalla (Biscay), the objective has been to bring the floodplain back to its former natural ecological conditions insofar as possible based on old aerial photographs to replicate the previously existing flood abatement areas that had been filled in, so that they can once again be flooded and in that way help abate flooding and lessen risk in places where until now flooding had posed a threat to the inhabitants. These improvements have taken nearly 2,000 people out of the reach of 100-year floods at a cost of around 10 million euros.



Figure 7. Old aerial photograph of the Cadagua River in Mimetiz (Zalla) with the areas to be recovered to receive flood waters drawn in. Source: geoEuskadi viewer and the Basque Water Authority.



Figure 8. Additional water channel and recovered floodplain by the Cadagua River in Mimetiz (Zalla). Source: Basque Water Authority.



Figure 9. The Cadagua River during a flood with the recovered floodplain acting as an additional channel. Source: Basque Water Authority.

There is of course still much work to be done to protect vulnerable industrial and residential areas against flooding, especially those situated haphazardly during the last century, a poisoned flood risk legacy that needs to be corrected over time. The current Eastern Bay of Biscay River Basin Management Plan (Spanish Royal Decree 197/2023 of 21 March 2023) and hence the Water Management Plan for that same area, basically where the 1983 flood event took place, allocate investments of 101 million euros between now and 2027. The priority is to achieve a cost (both financial and environmental) – benefit (in terms of the number of people protected, damage averted and possible environmental improvements) balance yielding the most efficient use of public funds, while accepting that some small population centres could still remain exposed to situations with severe impacts.

In any event, besides the protective measures that have been taken and the preventive measures that will be discussed below, preparatory measures have also been taken. Namely, the Basque Government's Meteorology and Emergency Response Service, tasked with implementing operational civil defence and weather forecasting strategies, and the Basque Water Authority have for decades been working together to develop predictive hydrometeorological models that are run every day. The Basque Water Authority has developed a tool named UHATE (sluice in Basque) that during high water episodes can be used to test management proposals for impoundments and forecast river behaviour based on previously made weather forecasts and real-time data inputs of such parameters as water and precipitation levels from nearly a hundred hydrological and weather monitoring stations located all across the Basque Country. Clearly, the goal is to be able to provide Civil Protection with suitable information to enable it to deploy its personnel in the interest of preventing loss of life and reducing damage. In places, like Bilbao, where sufficiently effective structural protective measures are not yet in place, the expectation is that the tools currently available will ensure that no lives are lost.

If there is one thing we have learned, it is that the most effective medium and long-term measure for managing flooding is to avoid creating new situations exposed to risks, i.e., to locate new human settlements and vulnerable economic activities outside the risk footprint, which we are able to pinpoint better day by day. If you do not want to be run over by a train, stay off the railway tracks.

The first Basque Territorial Management Guidelines with clear recommendations for preventive measures were issued in 1997. Still, it took years for them to be enacted in legislation.

Starting in 2003, the predecessor of today's Basque Water Authority (the then Basque Regional Government's Department of Water Management) has been including a document designated "Flood exposure-based restrictions on land use" in its reports on urban development plans. Though a purely internal document not backed by any legislation, it was used to draw up technical reports, draw attention to risks and propose restrictions. Restrictions are specified using a double entry matrix: first, whether or not the land in question has been developed, and second, whether the intended use is vulnerable to 10, 100, or 500-year floods. Later on, a new item was specified, the Preferential Flow Zone, which replaced the 10-year flood zone as a benchmark.

Ten years later, in 2013, those "restrictions" were finally made into law compulsory for planning purposes and they were included with only minor changes in the urban planning and territorial management document entitled River and Stream Margin Sectoral Territorial Plan for the Basque Country. Next, they were included in the regulations of the 2015 Eastern Bay of Biscay River Basin Management Plan (under the responsibility of the Basque Water Authority and the Bay of Biscay Basin Authority) and from there the Basin Authority extended them to all of the Bay of Biscay Basins.

In 2016, for the first time anywhere in Spain, these regulations in the River Basin Management Plan were transposed, with minor alterations, from the Bay of Biscay region into national legislation in <u>Spanish Royal Decree 638/2016</u>, which amended the Implementing Regulations to the Public Water Management Plan (<u>Spanish Royal Decree 849/1986</u>). The Eastern Bay of Biscay River Basin Management Plan now in effect was approved by Spanish Royal Decree 29/2023 in January 2023. It is the only water management plan that aside from some minor changes, has kept its flood protection regulations intact. Today, those regulations, from their humble beginnings in that internal document the Basque Water Authority used when evaluating each individual urban development plan, benefit all of Spain.

These prevention policies are, furthermore, absolutely essential in a climate change scenario. Climate change, whatever its effects, will only worsen the problem of potential flooding, though it will not cause floods in areas not already subject to flood risk. Torrential rains may become more frequent, and the water levels assigned to certain return periods may have to be corrected, most likely upwards. The train may come by more often or go by faster, but it will only run on its tracks. The only choice that will let us gradually correct the risks that we have inherited, the perilous historic liabilities that have been handed down to us, is to stay out of its way.

While prevention is the way forward, now and in the future, close cooperation among the water management disciplines (meteorology, hydrology, water management works and the reconstruction of aquatic ecosystems) and with civil protection and land management will be called for. That cooperation is already a success story in the Basque Country, where those three facets have been working together for decades, comprising the three legs of a stool that help us all pull together to advance flood risk management.

That may well be the main lesson: effective cooperation. The stool is totally stable on all three legs, there is no wobbling, no rattling, but if you take away one of the legs, it will come crashing down. Back in 1983, that stool had not yet been built.