State of meteorology and weather conditions that led to the flooding in the Basque Country in August 1983

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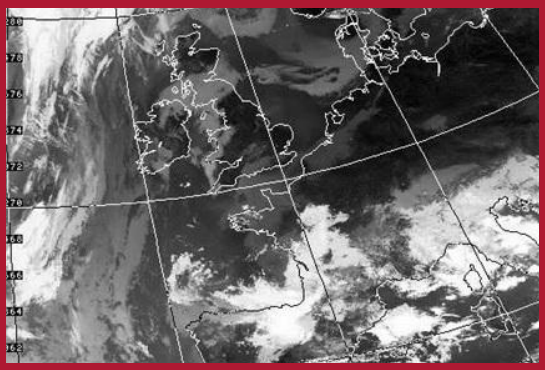
Introduction

Issue no. 19 of the *Consorseguros Digital magazine* [Consorcio Magazine Online] is dedicated to the flooding in the city of Bilbao and a series of other towns in the provinces of Biscay and Álava, considered to have been the greatest natural disaster ever to strike the Basque Country in Spain. The analysis of the weather conditions that produced this event and the severe floods in Eastern Spain in 1982 proved to be a watershed moment for weather forecasting in Spain, marking the launch of a far-reaching plan to revamp both the operating procedures and the technology of what was then named the National Meteorological Institute.

With this in mind, we have interviewed Ángel Rivera. This article starts off by recapitulating some highlights of his career before segueing into the interview proper.



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Ángel Rivera worked as a certified meteorologist with the State Meteorological Agency, formerly the National Meteorological Institute [*Instituto Nacional de Meteorología* (abbreviated INM in Spanish)], for 38 years until his voluntary retirement in March 2012. After stints at the Almería and Girona airports, he transferred to the Central Weather Forecasting Service in Madrid in 1978, where he worked under Mariano Medina and Francisco García Dana. He was an active participant in the INM's Technology Revamp and held a series of technical and organisational postings, working on weather forecasting in the Mediterranean region. From 1990 to 2005 he was head of the Forecasting Department and oversaw the organisation of the then newly created National Forecasting System and the Weather Warning Programme. From that date until his retirement, he was the AEMET's Head of Communications and spokesman. From the mid-1990s he was in nearly daily contact with the mass media and appeared on numerous radio and television shows while also working with the print media, newspapers and magazines.

He was a founding member and president of the Association of Weather Communications Specialists [abbreviated ACOMET in Spanish] and published a memoir of his career entitled "Recuerdos del tiempo" [Memories of the Weather] in September 2013. That book was followed by another three books for popular audiences, "Meses y tiempos" [Weather by the Month], "Compartiendo el tiempo" [Weather Talk] and "El tiempo compartido" [Shared Weather[1]]. His most recent book, "Recuerdos del tren" [Railway Chronicles], this time on railways, again intended for popular audiences, was published in June 2021. He is currently quite active on social media, where he writes two blogs about his two passions, weather forecasting and the history of railways in Spain.

Interview

What were the weather conditions that produced the flooding in eastern Cantabria, particularly in the region of the Bilbao estuary, in August 1983?

That was quite an unusual case. There was a current of winds from the northeast in the upper levels of the atmosphere that was dynamically highly unstable. This gave rise to a small low-pressure area aloft —what would today be called a cut-off low— that in turn led to tremendous convection and probably produced a structure known as a mesoscale convective system that can cause heavy precipitation to fall in just a few hours. Thus, those heavy rains falling in the Basque Country, amounting to more than 500 mm in some places in 24 hours, caused heavy flooding in some locations, including Bilbao and its surrounding areas.

The convective activity was fed by a flow of maritime air from the northeast at the surface and low altitudes, and the sea water temperature in the Bay of Biscay that August could well have contributed to the heavy rainfall. This produced a large influx of warm, moist air, the best "fuel" for convective processes.

Could the INM issue warnings about situations of this kind back then? How have its capabilities changed since that time?

We had only been receiving the first maps from the European Centre for Medium-Range Weather Forecasts (ECMWF) for a few years, and they still had very low spatial resolution and still rather rudimentary convective parameterization, making detailed representation of phenomena of this nature impossible. The models therefore predicted a scenario of high instability but by no means the torrential rains that came about in the end. "Heavy cloud cover with moderate rain showers, more frequent in the eastern half (of the Bay of Biscay)" was the official forecast for the day in question.

Also, back then, we were starting to get images from the first generation of Meteosat satellites. However, not only were these images received a half hour's delay from when they were taken; interpreting them was still no easy matter. So they were not a big help to be able to issue short-term warnings or to arrange suitable monitoring. The high-resolution images the INM obtained afterwards did help us study the situation that had arisen and design a system to monitor adverse atmospheric weather conditions.

[1] All titles play with the double meaning of the word 'tiempo' in Spanish that means both 'time' and 'weather'.

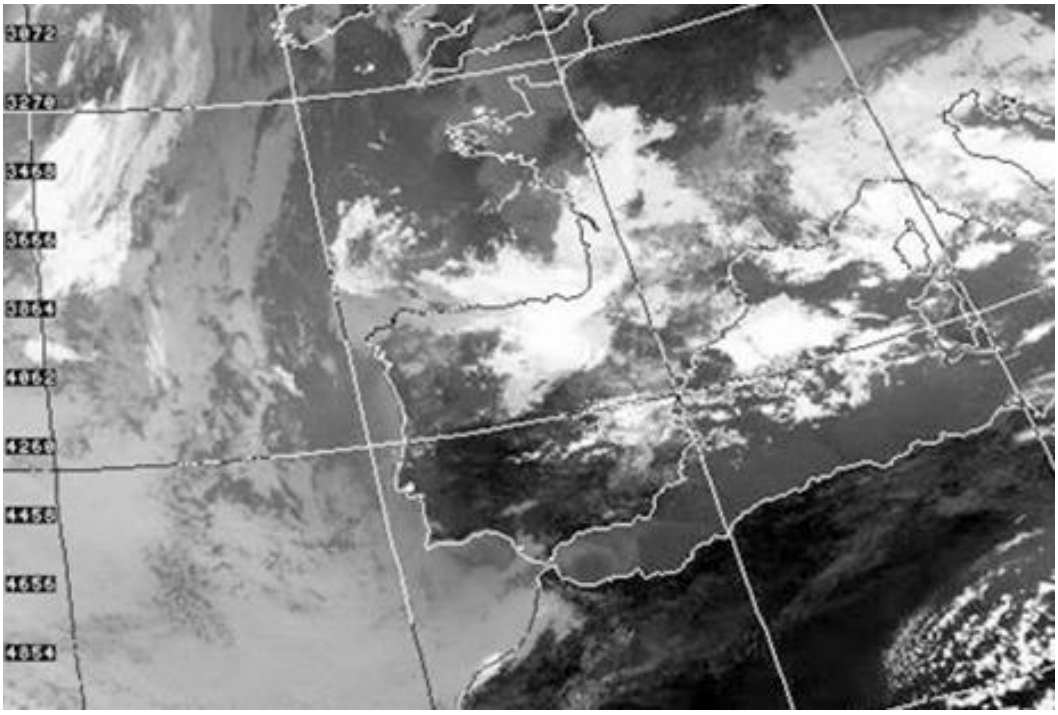

Figure 1. Satellite image of 26 August 1983.
Source: University of Dundee.

Professionally speaking, what do you remember about managing that scenario and similar situations like the flooding in Eastern Spain (in Tous) the year before?

I was on holiday at the time, so I was not on the job when the episode in the Basque Country took place, but I was at work at the time of the Tous event in 1982. In that case we knew that there was a high risk of very heavy rains, but with the tools available at the time, we were only able to pinpoint the area at risk as running from the Ebro River mouth to the Murcia region. That was the best we could do with the maps we were working with in 1982. They did not have a high enough spatial or temporal resolution, and from the standpoint of physics they were not suitable for more accurate forecasting. They did not have tools capable of predicting precipitation, or what tools they did have were inadequate. For that reason, the forecast made on the morning of the day before made reference only to scattered cloudbursts and storms over Eastern Spain. At a meeting on the afternoon of the day in question, various meteorologists concluded, based on new data, that the situation was more dangerous than it had seemed at first, and it was decided to issue an advisory of some sort. But back then there was no effective system for issuing warnings or for informing the public, at most some hourly news bulletins broadcast by Radio Nacional de España [Spanish National Public Radio] that included a brief weather report prepared by INM meteorologists. The situation was discussed with them and they did mention it, but I don't think they did so in any way that could be considered by the populace to be an actual alert. On the other hand, the Service of Hydrological Meteorology higher-ups did contact water resources management administrators to advise them of the potentially adverse situation so that measures could be taken. Basically, it seems to me that we did the best we could with the technical tools that were available to us and the scant means available for getting the word out.

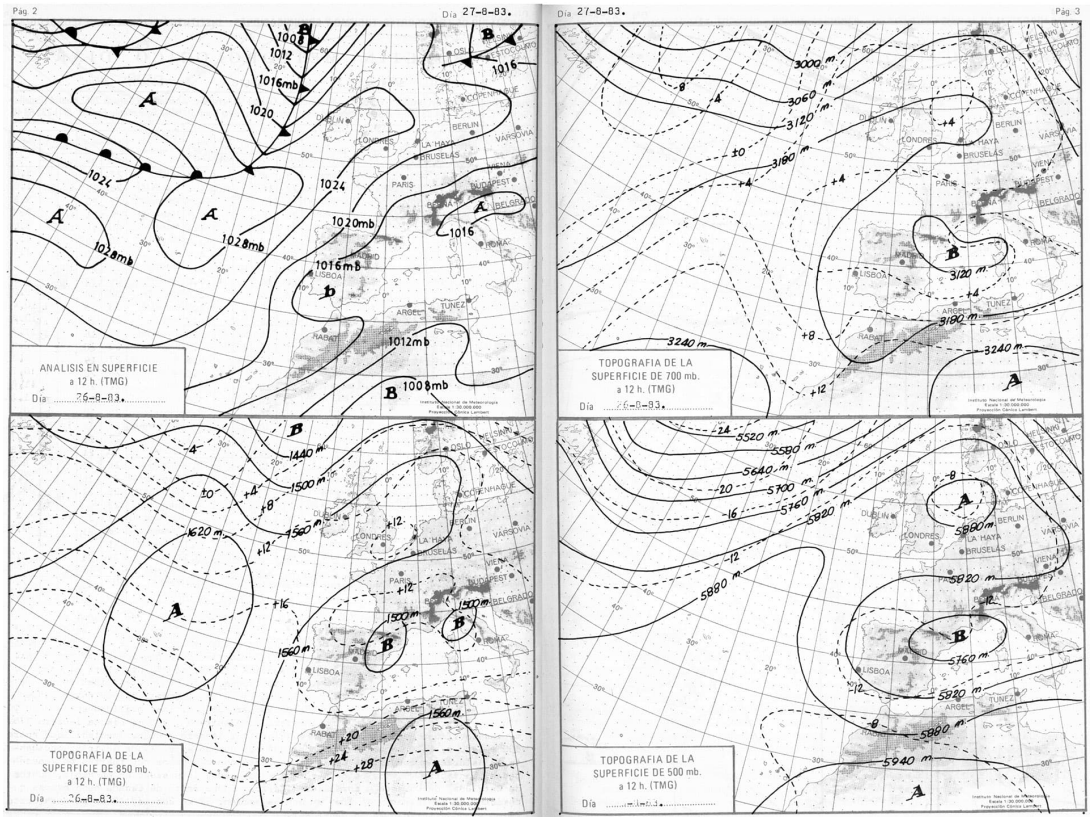

Figure 2. Pressure fields at surface level and 850, 700, and 500-hPa geopotential fields (at altitudes of approximately 1,500, 3,200, and 5,800 m) at 12:00 noon on 26 August 1983 showing a cut-off low at middle and high levels located over the northeastern part of mainland Spain.
Source: National Meteorological Institute's Boletín Meteorológico Diario [Daily Weather Bulletin] for 27 August 1983.

What changes did the INM undergo subsequent to the events in the summers of 1982 and 1983?

Those two events ushered in sweeping changes in weather forecasting in Spain. Specifically, they drove a modernising push that resulted in the technical and operational restructuring of the INM, with the government's full support. To begin with, a technology revamp was designed to equip the INM with cutting-edge technical infrastructure, both weather monitoring systems and computing equipment to process numerical weather prediction models. So high-resolution satellite image receiving equipment was purchased, an extensive network of radars and lightning discharge detection systems was installed and a computer system that was groundbreaking for the time was built to integrate and process the data collected from all those different sources. At the same time, a programme to train meteorologists in these new methods was undertaken with extensive involvement of meteorologists from the United States, and gradually the INM's outlying network was thoroughly restructured into eleven regional forecasting groups called Weather Watch and Forecasting Units [abbreviated GPV in Spanish].

In addition, and just as importantly as the preceding preparations, a system for issuing alerts to the general public in cases of severe weather events was designed and put in place in close cooperation with the Directorate General of Civil Protection. This in turn gave rise to a series of "Previmet" (in Spanish, Predicción y Vigilancia Meteorológica [*Weather Watch and Forecasting*]) plans. At first they focused on individual phenomena at specific times of year, leading to the "Mediterranean Previmet" plan in 1987 and subsequently to the "Windstorm Previmet" and the "Snowstorm Previmet". At any rate, it soon became clear that what was needed was a single overarching "Previmet" covering all forms of adverse

weather phenomena in operation all year round. This approach first gave rise to the "National Severe Weather Watch and Forecasting Plan" [abbreviated PNPVFA in Spanish], which a number of years later became Spain's "Meteoalerta" system, a part of Europe's "Meteoalarm" network.

Do you think the citizenry understand the risks posed by these extreme events? Over these past 40 years, has there been any change in society's perception of severe weather?

There has been spectacular improvement in weather forecasting, with huge strides in communications technology and methods. So people now consider weather reporting to be much more reliable, especially adverse weather alerts. Even so, in my opinion there is still a long way to go. While certain regions have implemented mobile telephone messaging systems to alert the populace to severe weather events in their jurisdictions, these systems are needed in all regions. Clear criteria for sending out alerts of this kind must be put in place and explained to the populace, and people have to be made aware of how these messages should be used. In addition, the alerts should contain more information besides details about the weather. Alerts should tell people how they might be affected and explain what measures can be taken.

This means that the criteria for sending out alerts should be based not just on whether certain quantitative weather thresholds have been reached or exceeded but should focus on the potential impact on the populace. Obviously, a consensus about who will be in charge of issuing the alerts needs to be reached. The meteorological services themselves? The Civil Protection authorities? I have spoken out about my own thoughts on the subject any number of times: I think the best solution would be to create a single operational unit made up of meteorologists, Civil Protection technicians, and possibly some social psychologists.

Whatever the case, the preceding approach may well be rapidly outstripped by the tremendous advances being made in artificial intelligence. It looks as if in just a few years' time we will be carrying a specialised risk advisory service around in our own pockets, with our mobile phones issuing advisories well in advance based on real-time "smart" processing, where necessary with extrapolation of the potential risks likely to arise, together with recommendations concerning suitable protective or mitigating measures. If this comes to pass, the questions that could arise might revolve around the quality and reliability of the data sources, whether the advisories are in line with official alerts, and potential liability in case of mistakes or losses attributable to those advisories.