

The cut-off lows of 2012 and 2019 in the south-east of the Iberian Peninsula

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Introduction

As has been discussed in this and [other editions of the magazine](#), the concept of a closed upper-level low (i.e., a cut-off low) refers to a minimum of geopotential and a pocket of cold air that is cut off from the general westerly current and presents maximum baroclinity in its eastern sector. Put in layman's terms, this is a phenomenon which occurs when the undulations in the polar jet stream belt represented by Rossby waves, which circulate round the poles from west to east within the mid and upper levels of the atmosphere, bend so much that they close up on themselves and break (meaning that a cut-off low is created). This closed circulation at mid and upper levels traps part of the cold air left in the north and to the left of the polar jet stream belt and then steers it over lower latitudes, where the surface is considerably warmer. This facilitates vertical air movements (convection) on the leading edge of the cut-off low (i.e., its eastern part), particularly when the cold mass lies over sea air with a high temperature (as tends to happen in late summer in the western Mediterranean). Figure 1 illustrates this process from 27 to 30 September 2012. On the 27th we can see substantial curvature in the jet stream (shown by the yellowish colours for a geopotential of 500 hPa¹), meaning at the height over the surface of the atmospheric layer where the pressure is 500 hPa (remember that the average pressure at sea level is 1013 hPa). The average height of this 500 hPa layer is 5,500 m. 24 hours later, on 28 September, an area of circulation cut off from the jet stream now appears over the south-west of the Peninsula, which moves along the southern coast and over the Levant of the Peninsula on the 29th and the 30th, after which (although the image does not show this) it is re-absorbed and weakened by the general flow.

Together with a very extensive adjuster network comprising experts trained in different fields, the other great mechanism to afford flexibility which CCS currently has available is *shared handling for claims experiences* prompted by extraordinary risks, which enables deployment of all of CCS' claims handling units as interconnected channels to share out the workloads of all of the handlers in them equally, in both central services and the territorial offices.

Figure 2 shows the same process of the cut-off low's formation and progress in September 2019, where we can note the great similarities between both situations. This was with two differences in the 2019 event which made it even more severe: one is that the cut-off low moved backwards from east to west, which kept the adverse impact on the affected zone in play for longer, and the other is that route taken by the surface flow of winds (which can be made out in these maps from the isobars —the white lines— of the pressure field at sea level) extends further over the Mediterranean, bringing sustained winds from the east with a great deal of humidity from passing over the sea, which were also conducive to the cut-off low itself shifting backwards. This situation on the surface is what is known as an atmospheric river and it becomes highly significant when there is a major build-up of rainfall since it means that there is sustained input of humidity and heat at low levels.

¹ Hectopascal (hPa) and millibar (mb) are equivalent units although, according to the International System of Units, it is more correct to refer to the former than the latter.

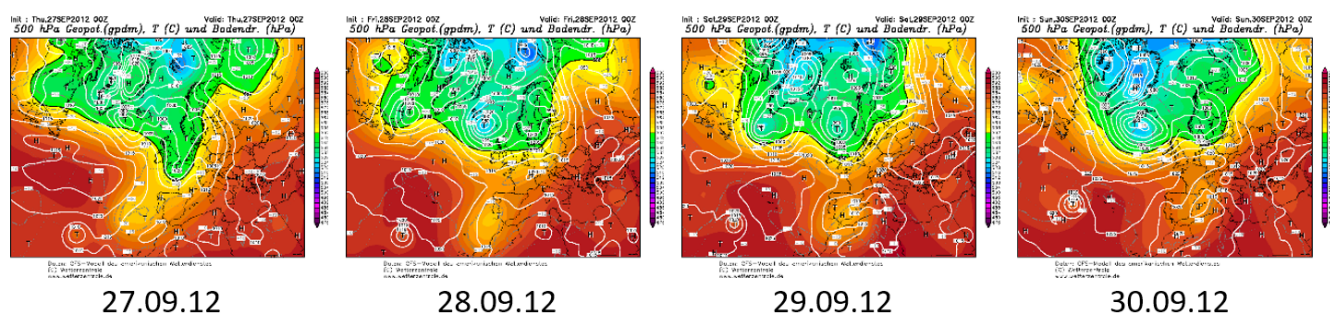


Figure 1. Height of the geo-potential of 500 hPa (m), pressure (hPa) and temperature (° C) on the surface at 00 UTC (02 AM local time) from 27 to 30 September 2012, according to the re-analysis of the GFS model (Source: Wetterzentrale).

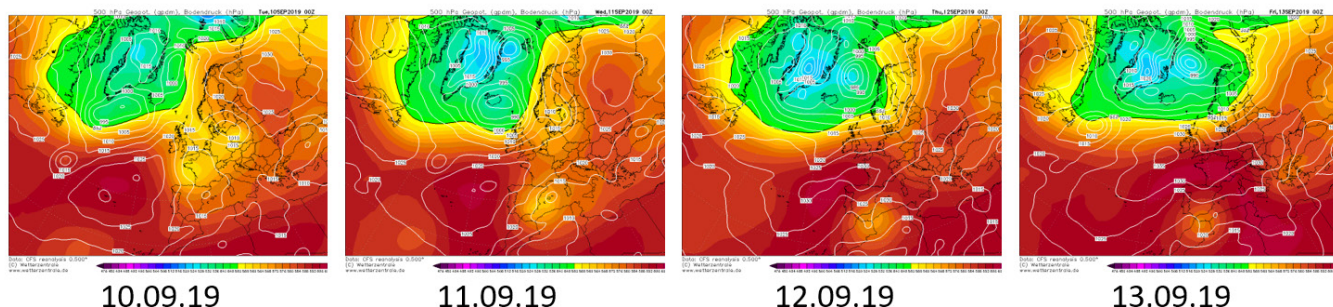


Figure 2. Height of the geo-potential of 500 hPa (m), pressure (hPa) and temperature (° C) on the surface at 00 UTC (02 AM local time) from 10 to 13 September 2019, according to the re-analysis of the GFS model (Source: Wetterzentrale).

The process of forming a cut-off low is similar to a meander cut-off on a river, with a pocket of cold air breaking away from the main circumpolar current, which is what gave rise to the German concept of *Kaltlufttropfen*, which is where we get the most famous synonym to describe these events from: “cold drop” –*gota fría*– in Spanish (due to the similarity of a drop which “falls” from the main jet stream), although it is far more correct and less confusing to use the term “cut-off low” or DANA in Spanish.

In the northern hemisphere, mid-level cut-off lows within the atmosphere mainly form at latitudes higher up (between 45° and 55° N), particularly in the north-western Atlantic and the north-eastern Pacific. Even so, because of the consequences they have, it is the secondary maximums that are of greater interest, which occur at lower latitudes (between 35° and 45° N), both in the Atlantic opposite coasts on the Iberian Peninsula (as is the case with these instances in September 2012 and 2019), and across the whole Mediterranean, especially Italy, as well as in relation to the American continent, opposite and above California (Muñoz *et al.*, 2020). It is held that the interaction of the polar jet stream belt with high-pressure zones that block it, as well as with major landforms, encourages the stream to undulate a lot and potentially come to close up over itself to create a cut-off low.

Although European cut-off lows happen over the entire year with few intra-annual variations, they are relatively more frequent in spring, with a secondary maximum in autumn. It is thus other factors, such as the ready supply of energy in the form of heat and damp which the Mediterranean provides in late summer, which are what normally make their effects more severe between August and October.

In [edition number 11 of this magazine](#) we observed the large share of total flooding indemnities from the CCS which cut-off lows represent and how these become particularly significant in September.

The cut-off lows in September 2012 (named after Saint Wenceslaus in Murcia Region, where they apply nomenclature that references the calendar of Saints' Days) and September 2019 (the Saint Mary episode) are the two most notable in the past 15 years. Both are paradigms of loss events of this type, which especially affect the south-east of the Peninsula, where an atmospheric trigger combines with seasonality, adding in interesting (and exacerbating) factors such as territorial occupancy, i.e., exposure and the vulnerability this entails (Olcina *et al.*, 2017; Giménez-García *et al.*, 2022).

The cut-off low of September 2012

Initial estimates

The floods mainly affected the south-east of the Peninsula, specifically the administrative divisions of Alto Guadalentín in Murcia and the Almería Levant, though also, albeit less intensely, other areas of Andalusia (mainly Málaga, Seville and Cadiz), the Valencian Autonomous Community and, to a lesser extent, Madrid, Castilla-La Mancha and Catalonia.

To cover this vast geographical area and produce an initial estimate of the number of property assets affected and the scale of the damage 13 preliminary reports on the number of incidents had to be drafted by adjustment departments or independent collaborating appraisal experts. According to this preliminary information, which was logged in the hours following the occurrence of the floods, it was estimated that the CCS could stand to receive some 18,500 claims applications totalling 90 million euros.

Organisation of the claims volume by the CCS

Over the first few days the high number of claims applications pouring in (in just the first week 12,200 claims files were registered) was proof that the actual magnitude of the claims experience was going to be considerably greater than first thought. Thus, it became necessary to step up the number of adjusters and gather together a team of 170 - 135 of them for housing, businesses, factories and civil works, and a further 35 to appraise motor vehicle (auto) losses.

The task of the adjusters was arranged using a geographical reporting system by geo-referencing the claims applications and setting up zones of adjustment clusters for adjusters to work in groups to reduce travel time and make the adjustment criteria for each zone more uniform.

In south-east Spain, and specifically in certain zones that had been harder hit by the floods, the urban development situation in 2012 was highly disorganised. Overlaying this, multiple rural areas were flooded which had buildings scattered about that were not accurately pinpointed on the digital mapping available at the time. On the other hand, the information on the whereabouts of damaged properties which the insured reported often failed to tally with the addresses shown on the digital mapping since many of them were given in incomplete or imprecise form (along the lines of "Saladar Property, un-numbered"; "Mediterranean Avenue, exit 583, un-numbered") or using non-standard details ("Station Road, next to the shop"). For these three reasons, in the case of this claims experience a huge effort

was required to make a manual adjustment of addresses to manage to geo-reference the claims files, although, even so, a host of errors and inaccuracies still remained.

Business data and characteristics in the claims experience

A total of 33,607 claims applications were received. Out of these, 7,198 (21.5% of the total) were rejected, either because they concerned loss or damage from causes outside extraordinary risk insurance or due to not having a currently valid insurance policy.

The average sum paid out in this claims experience was very high (8,800 euros), which is even more than in the other recent major episode that the cut-off low of September 2019 prompted.

As can be seen in Table 1, which gives the claims figures by risk class, 27.5% of property items indemnified (7,000 claims applications) relate to autos. This is a very big percentage, the more so if we recall that in 2012 only those vehicles which had some kind of own damage insurance in their policy were covered, since it was not until 2016 when extraordinary risk insurance coverage was extended to include all autos.

Amounts updated as of 12/31/2020.

Property loss	Claims paid	Claims rejected	Estimated total loss
DWELLINGS	15,164	4,588	102,119,481 €
AUTOS	7,026	1,251	23,311,582 €
SHOPS, STOREHOUSES AND OTHER RISKS	3,329	1,080	50,931,218 €
BUREAUS	269	101	5,092,021 €
INDUSTRIES	604	176	30,871,029 €
CIVIL WORKS	14	5	7,014,758 €
Total event	26,406	7,201	219,340,088 €

Table 1.

The table below shows claims applications and amounts indemnified by province.

Province	Claims paid	Estimated total loss
ALMERÍA	3,625	75,138,327 €
CÁDIZ	205	605,102 €
CÓRDOBA	52	384,731 €
GRANADA	189	680,960 €
JAÉN	12	133,840 €
MÁLAGA	1,124	11,547,115 €
SEVILLA	55	254,237 €
CEUTA	0	0 €
BARCELONA	15	51,934 €
GIRONA	2	3,015 €
LLEIDA	0	0 €
TARRAGONA	41	138,686 €

Province	Claims paid	Estimated total loss
ALACANT/ALICANTE	1,565	5,227,801 €
CASTELLÓ/CASTELLÓN	9	71,536 €
VALÈNCIA/VALENCIA	11,249	67,674,626 €
MURCIA	6,993	60,477,989 €
ALBACETE	40	131,116 €
CIUDAD REAL	6	9,514 €
CUENCA	1	529 €
TOLEDO	24	63,336 €
MADRID	429	2,233,231 €
	25,636	224,827,625 €

Table 2.

The worst affected province was Almeria, with 3,625 claims applications and a total amount of 75.1 million euros. The intensity of the damage in this province, at an average indemnified sum of 20,700 euros, is far higher than for the other zones. It is in the municipal district of Vera (in Vera-Playa to be precise) where most of the claims experience was focussed, with a little over 2,000 claims, 58.3 million euros in pay-outs and a very high average sum indemnified of close to 29,000 euros. In Vera-Playa the river Antas burst its banks along its last section (Figure 3), which provoked serious damage to the housing developments near its course, with hundreds of homes evacuated and businesses brought to a standstill, as well as to the vehicles in the area, most of which proved beyond recovery (Figure 4).



Figure 3: Overflowing of the river Antas at its mouth in Vera-Playa.
Sources: CCS and SNCZI.



Figure 4. Flooded zone in Vera-Playa.

Source: CCS.

The province with the second biggest volume of compensation pay-outs was Valencia, with 11,249 claims at a total of 67.7 million euros. Specifically, the worst hit municipal district was Paterna, with 2,141 claims at 19.7 million euros, although the intensity of the damage was far less severe than in Almeria (and than in Murcia, as we shall see below) with an average sum indemnified of 6,000 euros.

Although most of the indemnities paid out were for flooding, it is worth mentioning that there was a tornado on 28 September associated with severe convection from the cut-off low itself in the municipal districts of Gandía and Xeraco (Valencia), which triggered 1,226 claims applications and pay-outs totalling 8.7 million euros (Figure 5).



Figure 5. Tornado damage at the Gandía fairground.

Source: CCS.

In Murcia Region almost 7,000 claims applications were received, leading to a total amount paid out of 60.5 million euros. The most affected zone was the Alto Guadalentín administrative division, more precisely the municipal districts of Lorca and Puerto Lumbreras, with figures of 3,500 claims and 44.2 million euros. The most heavy damage occurred to the south of the city of Lorca, in its Campillo and Purias districts and in the Puerto Lumbreras provincial council of El Esparragal, all of which are located in the Guadalentín hollow. This is a fairly flat zone where drainage is difficult and where major watercourses flow into it from the neighbouring mountain ranges, such as those of the Murciano, Torrecilla, Béjar and Nogalte ravines. The Biznaga watercourse runs longitudinally through the plain itself and takes up the water from these watercourses until it opens out into the river Guadalentín. In 2012 the Biznaga stream-bed exemplified the disorganised urban development situation as its course lay unprotected and encroached on by buildings and farmed areas (Figure 6).

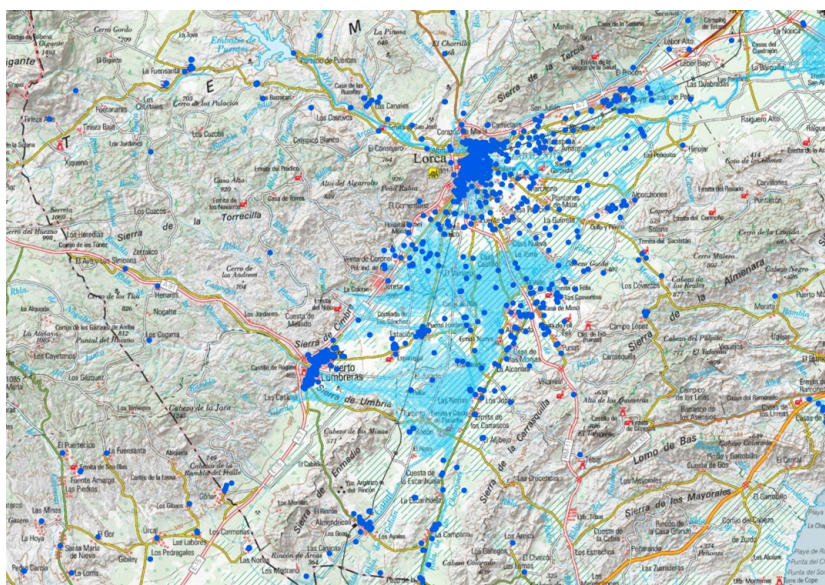


Figure 6. The Guadalentín hollow, through which the Biznaga stream-bed runs until it opens out into the river Guadalentín downstream of the city of Lorca, showing the positioning of the claims filed with the CCS.
Sources: CCS and SNCZI.

As a result of the heavy and persistent flooding, the Guadalentín plain experienced changes to drainage channels accompanied by some examples of the damming effect caused by linear civil works, as in the case of the Murcia-Águilas railway line as it runs through the station at Puerto Lumbreras (Figures 7 and 8).



Figure 7. Execution of new drainage works on the Murcia-Águilas railway line due to shifting of drainage channels following the 2012 flooding.



Figure 8. Damming effect at the Puerto Lumbreras station caused by the Murcia-Águilas railway line and the flooding of properties located upstream.

Sources: CCS and SNCZI.

At Puerto Lumbreras station, which belongs to El Esparragal council, and on the industrial estate of El Saladar de Totana sub-surface or piping erosion phenomena occurred, which consist of the formation of ducts and conduits from erosion provoked by the groundwater on certain areas of land which lend themselves to dispersal. In certain cases, the piping caved in and cracks emerged on the surface, as we can see in Figure 9.



Figure 9. Piping phenomenon at the Los Soles spot in Puerto Lumbreras station.

The cut-off low of September 2019

From 10 to 14 September 2019 a new cut-off low plagued the Spanish Levant, producing historic flooding, in terms of both its geographical reach (it affected the whole of Spain's Levant) and the volume of rainfall, since as many as six weather stations in the Valencian Region recorded historical highs on those days, according to the figures from the State Meteorological Agency¹.

Because the area affected was so enormous, the CCS immediately commissioned 18 reports on the loss rate from adjusters in the various different zones to be in a position to be able to have estimated figures to hand right from the start on the magnitude of the disaster and to scale both the adjuster network and the team of claims handlers. As a result of this cut-off low the CCS received around 70,000 claims, 58,000 of which were filed in the 33 days from Tuesday 11 September to Sunday 13 October 2019, numbers peaking at 10,175 on 18 September 2019 (Figure 10).

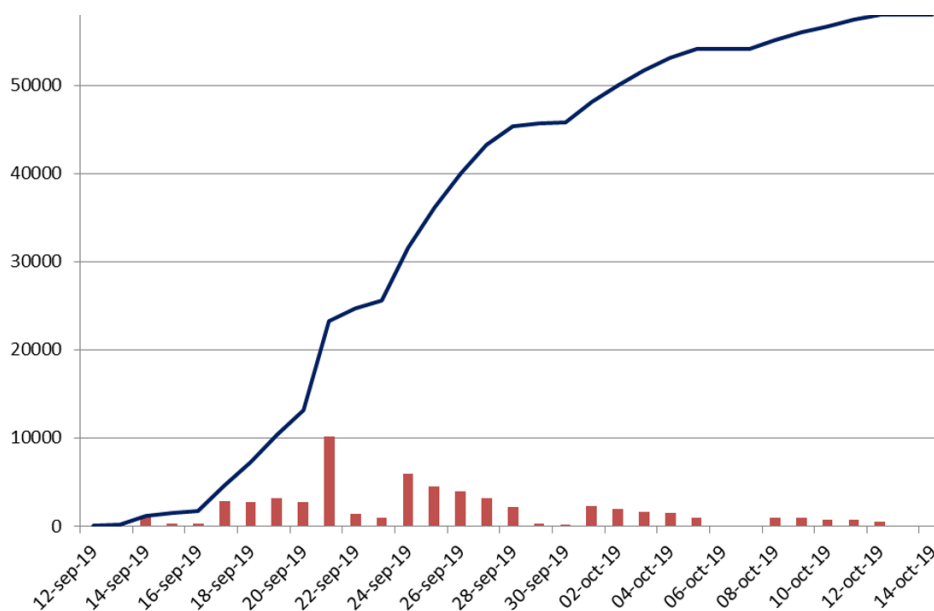


Figure 10. Number of daily claims applications received (red bars) and cumulative claims (blue line) received by the CCS in the 33 days following the occurrence of initial damage.

Source: CCS.

The figures give us some idea of the celerity with which the CCS can record claims reported by the insured by combining the internet channel with a helpline centre attended by specialist personnel which does not effectively debar those persons who are not sufficiently digitally literate from the system on account of their age or for some other reason. Moreover, filing claims (digitally or by phone) is allowed to be done by both the insured themselves and a representative acting for them (a qualified insurance broker, an employee at an insurer, a lawyer, an agent or administrator, employee of the municipal social services...).

For this event, 70% of the victims used the web, connecting directly to the CCS portal to furnish information and commence processing, whereas the other 30% approached the CCS helpline centre. It was the intermediaries

¹ Agencia Estatal de Meteorología (19 september 2019). An unprecedented rainstorm over the past 100 years in the Vega Baja del Segura administrative division <http://www.aemet.es/es>

(insurance agents or brokers) who filed most of the applications (52%), followed by the insured themselves or their representatives (family members, friends or employees) with 28% of claims registered, and lastly the insurers, who accounted for 20%.

When the damage is reported, the information on the location of the risk affected is collected, as well as its type (housing, home-owners' community, factory, business...) and both the insurer's name and the policy number. The contact details of the insured are also required, along with those of their representative if it is indeed this person who files the claim. This phase having been completed, the damage assessment process is triggered almost immediately, as every morning the notifications that have been filed the day before are codified by the Geographic Information System (GIS) at the CCS and allocated to the adjuster in charge of the zone where the risk concerned is located.

Thus the quality and reliability of the information received (via both the helpline centre and the website) are vital to the whole process although, as was mentioned in the case of the 2012 cut-off low, it is not uncommon for some of the claims reported to experience delays due to either a lack of precision or straightforward error as regards both the site of the loss (i.e., the claim is allocated to an adjuster for a different zone) and the contact details (the adjuster cannot track down the person to contact to organise an initial visit).

The number of cases of damage reported, the scale of these and the speed with which claims for them were filed make this cut-off low the most significant flood event which the Consorcio has had to deal with, even though it was surpassed in monetary terms by the rainfalls of 1983 in Bizkaia.

To take on the task of performing the loss adjustment for the damage which this cut-off low caused, CCS engaged 300 insurance adjusters with the administrative backing of their respective departments. Loss adjustment becomes more complex in the case of homeowner's policies because the properties flooded are often second homes where it is hard to match up the timing of adjuster visits with moments when the insured are staying there. This situation became even more problematic when, on 14 March 2020, the state of alert was declared at a time when around a thousand loss claims had not been reported yet and there were still six thousand assessments pending finalisation, which forced CCS to resort to remote adjustment systems, which are usually only used for checking and verification.

	Assigned to experts	Finalised by experts	Expert pending	Validated by claims manager	Claims manager pending
Property (ex. autos)	48,885	42,811	6,074	40,472	2,339
Motor vehicles	19,672	18,768	904	18,314	454
TOTALS	68,557	51,579	6,978	58,786	2,793

Table 3. Situation of adjustment work and claims settlement as at 14 March 2020.
Source: Own research.

As can be seen in Table 3, on that particular date (185 days after the flooding began) the adjusters still had a shade over 10% of their tasks to complete, while the Consorcio's claims handlers had reviewed, ordered or rejected pay-outs for almost 86% of reported claims for damage.

	Assigned to experts	Finalised by experts	Expert pending	Validated by claims manager	Claims manager pending
Property (ex. autos)	51,517	51,454	63	51,444	10
Motor vehicles	20,232	20,223	9	20,223	0
TOTALS	71,749	71,677	72	71,667	10

Table 4. Situation of adjustment work and claims settlement as at 31 May 2020.

Source: Own research.

Table 4 shows the situation for the same work as of 31 May 2020, on which date the claims processing can be considered virtually finalised with the full complement of files having been settled. Having gone through the similar, though less severe situation (involving almost half the total loss figure and somewhat less than half the number of claims applications) which the cut-off low of 2012 in the south-east of the Peninsula led to for the CCS, the cut-off low of 10 to 14 September 2019, which affected locations from Madrid to the entire Levant and the Balearic Islands while taking in Castilla-La Mancha as well, meant that the full extent of CCS' capability was put to the test.

Both the overall number of claims and the intensity of the damage as well as the swiftness in reporting it (with daily peaks of as many as 10,000 filings) meant that, even though it continued to rain, the capacity of the helpline centre adjusted and expanded accordingly, while the website's ability to cope improved too and the entire network of adjusters was contacted. Right from the start, CCS applied internal flexibility to its claims handling, launching several processing lines in parallel, from the most urgent to the most indispensable.

Together with a very extensive adjuster network comprising experts trained in different fields, the other great mechanism to afford flexibility which CCS currently has available is *shared handling for claims experiences* prompted by extraordinary risks, which enables deployment of all of CCS' claims handling units as interconnected channels to share out the workloads of all of the handlers in them equally, in both central services and the territorial offices.

The insured in the affected zones had become used to CCS operating very rapidly, with settlement of claims in under three months. In this case, given the scale of the claims experience, the arranging of zones and adjusters was more arduous than usual and arrival at the affected locations was relatively delayed as there were some risks which were impossible to visit until the water level had abated sufficiently. Despite mobilising the whole network of adjusters, the claims files to adjuster ratio topped three hundred, thereby beating another historical record and putting pressure on the pace of work. To try to offset this new cause of slowdown all of the available staff at CCS began ringing round all of the insured to provide them with a reference point in connection with the situation of their reported claims. Meanwhile, the first pay-outs were made.

The work carried out meant that claims file settlements achieved a considerable pace after the first month in spite of the initial backlog.

As a result of the magnitude of the catastrophe, as well as the need to speed up handling and attend to the insured properly, CCS took the extraordinary step of raising the threshold for losses above which it advised its partnering adjusters to check up on the sufficiency of the sums assured from 5,000 to 10,000 euros. Subsequently the measure led to the drafting of a basis of indemnification which has ultimately become established as another of the usual criteria for handling claims. CCS also drew up and sent out to its partnering adjusters a pricing table featuring the most typical work units so as to make appraisals more uniform. The prices were increased in line with the inflation that always comes into play in the worst affected zones and in the months following major claims experiences.

One of the hardest hit zones was La Vega Baja del Segura, with nearly 22,000 claims applications and pay-outs amounting to 185.2 million euros. Specifically, Orihuela saw the most damage, with 56% of indemnities for the entire administrative division. The flooding in this zone was exacerbated by the breaking open of one or two dykes and, above all, the channelling for the river Segura on its left bank level with Almoradí.



Figure 12. Breakage of the channelling of the river Segura at Almoradí.
Source: Segura River Basin Authority.

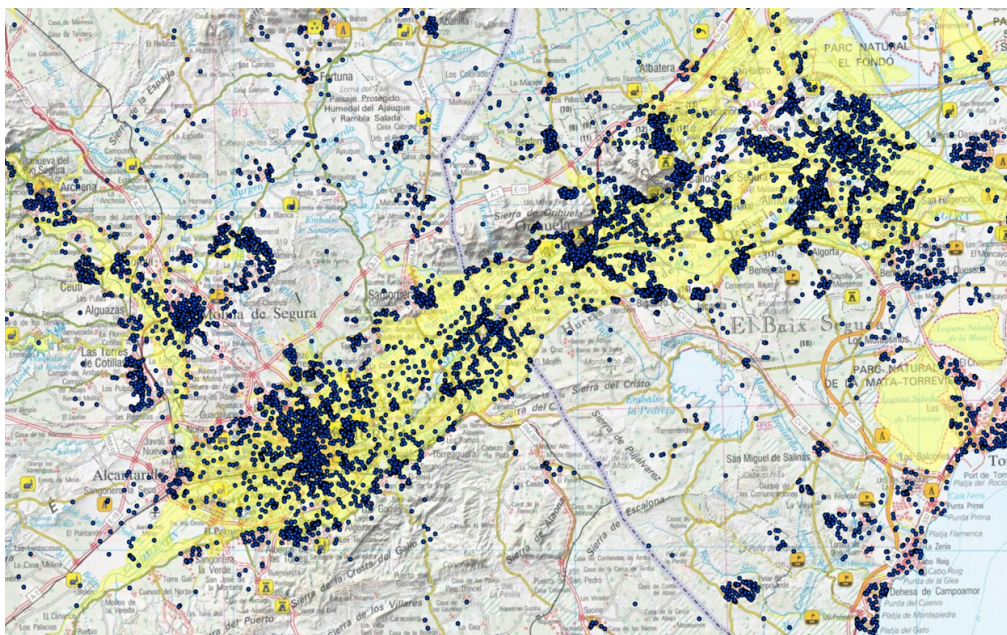


Figure 13. Flooding in La Vega Baja.
Sources: CCS and SNCZI.

The other most affected administrative division was Campo de Cartagena, with 20,300 applications and 132 million euros paid out in compensation. To be precise it was Los Alcázares which was the worst affected municipal district, accounting for 46% of the total.

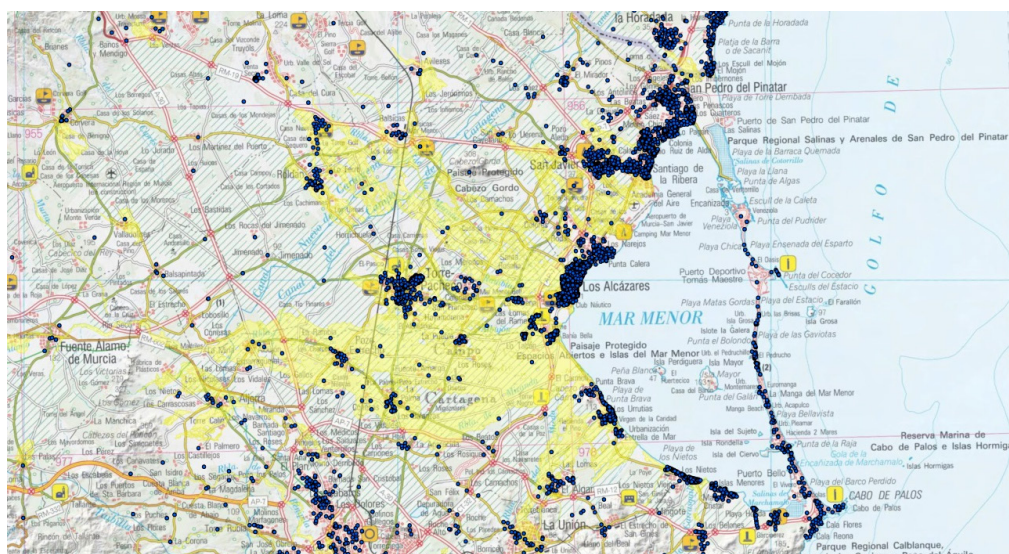


Figure 14. Flooding in Campo de Cartagena.
Sources: CCS and SNCZI.

Barely three years before the cut-off low of September 2019, in December 2016, other serious floods occurred in Los Alcázares, chiefly on account of the overflowing of the La Maraña watercourse. Between both episodes and after the 2019 cut-off low there were also other minor episodes of flooding, all of which has conspired to convert Los Alcázares in one of the most harshly punished zones by floods in the recent history of the Consorcio, as can be verified from the figures on flood damage at municipal level published in [another edition of this magazine](#). These serious and repeated episodes have led the Ministry for Ecological Transition and the Demographic Challenge to publish [Royal Decree 1158/2020](#) whereby, through its Directorate General for Water, it provides direct subsidies to five municipalities of Campo de Cartagena (Los Alcázares, San Javier, Torre-Pacheco, Cartagena and San Pedro del Pinatar) to adapt existing buildings to flood risk. The rationale for sharing out the 3 million euros available for each municipal district is based on the proportion of pay-outs from the CCS in each one of these municipalities, and Los Alcázares is thus the one which is the biggest beneficiary. At the time of writing, another similar Royal Decree for La Vega Baja del Segura is at the approval stage.

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