

What the maps did not show: dwellings inside the observed extent of the October 2024 DANA in Valencia, and the official flood maps

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Abstract

The question. The DANA of 29 October 2024 flooded a large part of the province of Valencia. How many dwellings lay inside the observed flood extent? How many of them lay outside the official flood maps? Those maps are the State's hazard maps for the areas of significant potential flood risk (ARPSI, Real Decreto 903/2010; return periods of 10, 100 and 500 years) and the Generalitat's PATRICOVA. And how many dwellings had been built after the 2016 rules on building in flood zones?

The answer depends on two choices, so we report it as a range. Across two flood extents and three rules, about **39–66% of the dwellings inside the observed extent were outside every official flood zone.**

The two extents:

- **Copernicus.** The extent delineated from satellite and aerial images by Copernicus EMS (activation EMSR773) holds **84,789 dwellings** in 78 municipalities.
- **The Generalitat's footprint.** Its own flood footprint covers only the Magro and the Poyo, Saleta and Picassent ravine systems, yet holds **138,217**. In the 66 municipalities where it has dwellings, the share outside every zone is 51.6% with the Copernicus extent and 40.8% with the Generalitat's footprint (footprint on the depth grid; 49.4% and 38.9% under the reference rule). The satellite extent misses much of the flooding inside towns.

The three rules for "inside a zone":

- **Footprint in the envelope (reference).** Any part of the building's footprint touches the zone envelope. The envelope is the hazard map's depth grid with the dry holes it leaves at buildings closed up to 2 ha. Under this rule **43,359 (51.1%)** of the Copernicus-extent dwellings and **53,801 (38.9%)** of the Generalitat-footprint dwellings were outside every zone.
- **Centroid in the envelope.** The building's centroid lies in the envelope.
- **Footprint on the depth grid.** The footprint touches the depth grid as drawn, without closing its holes.

Two caveats.

- **The map version.** The ARPSI maps we read are the version dated 20 December 2024, after the flood. Captures of the product page in August and November 2024 show that the version in force on 29 October 2024 was dated 5 July 2022. We could not establish what changed between them.
- **Local differences.** The figures differ a lot by town:

- 71.9% outside in Paiporta, 95.8% in Picanya and 100.0% in Sedaví;
- in Beniparrell and Massanassa at least 98% of the dwellings in the extent lay inside an ARPSI zone;
- l'Alcúdia's dwellings were mapped almost only by PATRICOVA's geomorphological level, which has no return period.

Built after 2016.

- **How many. 1,776 dwellings** inside the Copernicus extent are in buildings that the Catastro dates to 2017–2024, after Real Decreto 638/2016 limited building in flood zones.
- **Map status.** 874 of them lay outside every official zone, and 735 inside an ARPSI zone (156 inside the 100-year zone).
- **2025 or later.** Another 410 date from 2025 or later, which mixes rebuilding with new building.
- **No illegality.** These are counts of **exposure**, not of illegality. The rules allow building in flood zones on land already urbanised on 30 December 2016, under conditions that open data do not show.

The pilot. We recompute the scouting pilot for Paiporta: 11,987 of 11,988 dwellings inside the first delineation (the pilot had 11,986) and 624 dwellings in 99 buildings dated 2017 or later.

1. Introduction

Flood maps exist to say where water will go. Spanish law then uses them to restrict what may be built there. Since 2016 the Reglamento del Dominio Público Hidráulico (RDPH) has limited new building in the preferential flow zone and asked for flood-proof design in the 500-year zone.

The DANA of 29 October 2024 tested both. The rainfall over the Poyo, Magro and Turia basins was extreme, and the flood reached neighbourhoods that no hazard map showed as flood-prone.

How large was that gap, counted in dwellings rather than hectares? Three sources make the count possible from open data:

- Copernicus delineated the flood within days;
- the Catastro publishes every building with its use, number of dwellings and construction year;
- the hazard maps are open.

We report the count, how much it depends on the choices it requires, and its limits. We do not judge whether any building was lawfully built: the data cannot answer that.

2. Legal frame (quoted as in force on 4 October 2026)

2.1 Flood zones and the preferential flow zone

The RDPH (Real Decreto 849/1986) defines the flood zone by the 500-year flood, with geomorphological and historical evidence. Art. 14.1, as worded by Real Decreto 638/2016:

«Se considera zona inundable los terrenos que puedan resultar inundados por los niveles teóricos que alcanzarían las aguas en las avenidas cuyo período estadístico de retorno sea de 500 años, atendiendo a estudios geomorfológicos, hidrológicos e hidráulicos, así como de series de avenidas históricas y documentos o evidencias históricas de las mismas [...]»

The preferential flow zone is defined from the 100-year flood. Art. 9.2:

«La zona de flujo preferente es aquella zona constituida por la unión de la zona o zonas donde se concentra preferentemente el flujo durante las avenidas, o vía de intenso desagüe, y de la zona donde, para la avenida de 100 años de periodo de retorno, se puedan producir graves daños sobre las personas y los bienes [...]»

The ARPSI hazard maps are those of Real Decreto 903/2010, art. 8 (flood risk assessment and management, transposing Directive 2007/60/EC).

2.2 The 2016 limits

Entry into force. Real Decreto 638/2016, of 9 December, added arts. 9 bis, 9 ter and 14 bis to the RDPH (its art. 1.3, 1.4 and 1.8). It entered into force on 30 December 2016: «El presente real decreto entrará en vigor el día siguiente al de su publicación en el "Boletín Oficial del Estado"» (final provision 3).

The date anchor. The 2016 wording tied the rules to land «en la fecha de entrada en vigor del Real Decreto 638/2016». Real Decreto 665/2023 reworded the three articles to «a fecha 30 de diciembre de 2016». Both wordings anchor on the same day.

The text in force reads:

- **Art. 9 bis (rural land, preferential flow zone).** «En los suelos que se encuentren a fecha 30 de diciembre de 2016 en la situación básica de suelo rural [...] no se permitirá la instalación de nuevas: [...] b) Edificaciones, obras de reparación o rehabilitación que supongan un incremento de la ocupación en planta o del volumen de edificaciones existentes [...]»
- **Art. 9 ter (urbanised land, preferential flow zone).**
 - «En el suelo que se encuentre a fecha 30 de diciembre de 2016 en la situación básica de suelo urbanizado [...] se podrán realizar nuevas edificaciones [...] siempre que se reúnan los siguientes requisitos [...]».
 - Among the requirements: «f) Las edificaciones de carácter residencial se diseñarán teniendo en cuenta el riesgo y el tipo de inundación existente y los nuevos usos residenciales se dispondrán a una cota tal que no se vean afectados por la avenida con periodo de retorno de 500 años.»
 - Art. 9 ter.2 adds that before works start «el promotor deberá disponer del certificado del Registro de la Propiedad en el que se acredite que existe anotación registral indicando que la construcción se encuentra en zona de flujo preferente».
- **Art. 14 bis (flood zone).**
 - On rural land: «Las nuevas actividades, edificaciones y usos asociados en aquellos suelos que se encuentren en situación básica de suelo rural a 30 de diciembre de 2016 se realizarán, en la medida de lo posible, fuera de las zonas inundables».
 - On land already urbanised on that date: «podrá permitirse la construcción de nuevas edificaciones, teniendo en cuenta, en la medida de lo posible, lo establecido en las letras a) y b) del apartado 1».

- The promoter must sign a *declaración responsable* on the flood risk (14 bis.3).
- Before works start, the promoter must hold a registry certificate «en el que se acredite que existe anotación registral indicando que la construcción se encuentra en zona inundable» (14 bis.4).

What the data cannot see. A dwelling built in a flood zone after 2016 is not, by itself, unlawful. Whether it was allowed depends on several things that are not in open data:

- the land's legal situation on 30 December 2016;
- the zone;
- the building's design;
- the declaration and the registry note;
- the regional rules.

We therefore report post-2016 building only as **exposure**.

2.3 PATRICOVA

The Generalitat's Plan de Acción Territorial sobre prevención del Riesgo de Inundación (PATRICOVA, Decreto 201/2015) maps six hazard levels by return period (25, 100, 500 years) and depth, plus a geomorphological hazard level with no return period. Its own regulations govern land use in those areas.

3. Prior work

How we searched.

- Crossref, OpenAlex and Semantic Scholar (50 queries).
- The pages of Copernicus, the Banco de España, the Generalitat, the Consorcio de Compensación de Seguros and several media outlets (`data/prior_work_search.csv`).

What we could not search:

- General web search was not available to us.
- El País and Levante-EMV refused our requests (403, 406).
- The Consorcio de Compensación de Seguros publishes its DANA claim notes as PDFs under `/documents/` , which its robots.txt disallows.
- We found no open table of building inspections or of the Catastro's property-tax relief for the DANA.

So press and institutional **counts of damaged dwellings** were not checked, and the novelty claim below is limited to the academic literature and the sources listed.

WORK	UNIT	WHAT IT MEASURES	OVERLAP
Camarasa-Belmonte, Zornoza-Gallego, Sanchis-Ibor and Serrano-Lara (2025), <i>Ingeniería del Agua</i> 29(4)	hectares	flooded area inside and outside MIPICOVA (PATRICOVA + SNCZI) in the Poyo, Magro and Albufera ravine systems	partial: same question, in area
Musucancha Restaure (2025), master's thesis, UPC	dwellings	Catastro dwellings exposed to a composite footprint (PATRICOVA, SNCZI, COPUT-1997), contrasted with the DANA, by urban-growth model	possibly substantial; the full text is under embargo
Copernicus EMS, EMSR773 products and storymap	population, hectares	"potentially affected population" and built-up hectares per product	partial: same extent
Castro-Melgar et al. (2025), <i>Remote Sensing</i> 17(13)	population	flood extent from Sentinel-1/2 and Landsat-8, and the residents affected	partial
Banco de España (2025), <i>Revista de Estabilidad Financiera</i>	credit	Copernicus extent × Catastro × credit register	partial
Newtral (November 2024, May 2025)	buildings	every Catastro building in the SNCZI 10-year zone, nationally, and those built in 2000–2025	partial: no observed extent

Camarasa-Belmonte et al. (2025).

- **Their result.** They write: «la coincidencia entre área inundable e inundada es importante (85,9%) mientras que en el resto la inundación real superó a la esperable». So 14.1% of 37,972 flooded hectares lay outside the combined map.
- **The same flood map.** Their flood map is the Universitat de València's. The Generalitat's footprint, which we use, starts «partiendo de la cartografía de la Universitat de València» (its metadata).
- **Area against dwellings.** Like for like, the same flood map gives **14.1% of the area and 40.8% of the dwellings** outside the official maps. With our reference rule the dwelling figure is 38.9%.
- **Why the unit matters.** The authors describe the areas the maps missed as «espacios que presentan en su mayoría una densa ocupación antrópica». They also note that MIPICOVA «resuelve incongruencias y discontinuidades espaciales», and that the discrepancies «habrían sido sensiblemente mayores de no haberse integrado el nivel 7 de PATRICOVA».

- **On the Copernicus extent.** «El 2 de noviembre la misión Copernicus EMS Rapid Mapping Activation publicó una primera delimitación de zona inundada, sobre la cual se detectó que presentaba importantes problemas en áreas urbanas».

The **UPC thesis** describes the same ingredients we use for the metropolitan area. Its record reads «Accés restringit per decisió de l'autor (embargat fins 2030-12-10)», so we could read only its abstract.

What we add. As far as the academic literature and the sources listed show, nobody has published an open, reproducible count of **dwelling**s for the whole Copernicus extent in the province with:

- the dwellings' status against each official map;
- construction year around RD 638/2016;
- the sensitivity to the extent, the rule and the unit;
- code and aggregates.

The embargoed thesis may overlap for the metropolitan area. A press or institutional count may exist that we could not reach.

4. Data and method

4.1 Data

- **Copernicus EMS Rapid Mapping, EMSR773.** We used 35 product packages for the 29 areas of interest in the province of Valencia that have one: latest versions, delivered 31 October to 29 November 2024, from images of 30 October to 18 November.
 - **What we take.** The `observedEventA` polygons noted `Flooded area` (water seen in the image) or `Flood trace` (marks left by water), and the cumulative `maximumFloodExtentA` of the last AOI01 monitoring product.
 - **What we leave out.** AOI05 (Letur, Albacete), AOI06 (Castellón) and AOI15 (Alhaurín de la Torre, Málaga) are outside the province.
- **The Generalitat's flood footprint.** «Zona inundada por la DANA del 29 de octubre de 2024» (Institut Cartogràfic Valencià, CC BY-NC-ND 4.0). It covers the Magro and the Poyo, Saleta and Picassent systems. We use it for counts only and publish no part of it.
- **Catastro INSPIRE Buildings.** One package per municipality, dated 21 August 2026, for the 121 municipalities that any version of either extent touches: 1,159,916 dwellings in all.
- **ARPSI hazard maps (MITECO, via the SNCZI).** The fluvial hazard (water-depth) maps of the ARPSI for 10, 100 and 500 years, read from the INSPIRE view service as 2 m masks.
 - **Why masks.** The SNCZI flood-zone polygons sit behind an ALTCHA proof-of-work challenge, which is an access control that we did not pass. The MITECO map service for them answered every request with a server error.
 - **What the polygons may add.** They are a different product: they may include stretches and geomorphological zones with no depth grid. If so, reading the depth maps overstates the share outside.
 - **What is missing.** The preferential flow zone is in neither service we could use.

- **Map version.** The product page reads «Actualización 20/12/2024». Internet Archive captures of the same page on 14 August and 11 November 2024 read «Actualización 05/07/2022», which was therefore the version in force on 29 October 2024. We read the later version and do not know what changed in the Júcar stretches.
- **PATRICOVA.** The hazard layer as served by the ICV on 4 October 2026 (8,415 polygons): levels 1–6 and the geomorphological level.

4.2 Rules

- **Inside the extent.** A building is inside the extent when its footprint intersects it.
- **Inside a zone.** We report three rules:
 1. **Footprint in the envelope (reference).** At least one 2 m pixel centre inside the footprint lies in the zone envelope. The envelope is the depth grid with every dry hole it encloses closed, up to 2 ha (§4.3). For PATRICOVA the footprint must intersect a polygon.
 2. **Centroid in the envelope.** The building's centroid lies in the envelope (for PATRICOVA, in a polygon).
 3. **Footprint on the depth grid.** The frozen plan's rule: at least one pixel centre inside the footprint lies in the grid as drawn.
- **Map status.** Each building gets one status, in this order: ARPSI 100-year zone (including the 10-year zone); 500-year zone; PATRICOVA levels 1–6 only; PATRICOVA geomorphological only; outside every official zone. We still call the ARPSI zones "SNCZI" in the tables, as the service does.
- **Construction year.** The Catastro's `dateOfConstruction`. A full refurbishment can reset it. 433 dwellings in the extent are in buildings recorded as declined or in ruin. 212 are dated 2026.
- **Pre-registration.** The analysis plan (METHOD.md §1) was hashed before any building was compared with a map. It made rule 3 primary and planned the centroid on the depth grid as a sensitivity. Rules 1 and 2 and the second extent's union were added later (METHOD.md §9).

4.3 The depth grids leave buildings dry

The view service draws water-depth grids. The hydraulic models behind them treat buildings, and often whole blocks, as obstacles, so inside a flooded town the grid has a hole at every building.

Take the buildings inside the extent that touch the 500-year grid in six municipalities: Paiporta, Alfafar, Catarroja, Sedaví, Massanassa and Algemesí. The median building has only 9% of its footprint pixels inside the grid (`data/qa_holes.json`). PATRICOVA polygons have no such holes: 97% of the buildings that touch a level 1–6 polygon lie wholly inside it.

How the rules respond:

- **Testing the centroid on the grid.** This puts most buildings in flooded blocks outside the zone: 71.8% of the dwellings outside every zone, and 69.6–75.6% across the Copernicus variants. That figure is an artefact.
- **Closing the holes.** Closing can only add zone pixels, so it can only lower the share outside:
 - with the footprint test, from 53.1% to 51.1%;
 - with the centroid test, from 71.8% to 61.9%.

- **The source of the larger figures.** The rise from about 51% to about 62% comes from testing the centroid instead of the footprint, not from the envelope.

The 2-ha limit is a choice. It stops large dry islands from being filled. With 0.5 ha the reference rule gives 52.2% and the centroid rule 65.9%; with 5 ha, 51.1% and 61.6%. Whether the official zone polygons fill urban blocks could not be checked, because they are behind the ALTCHA challenge.

5. Results

5.1 Dwellings inside the observed extent

	COPERNICUS EXTENT	GENERALITAT FOOTPRINT
Dwellings	84,789 dwellings	138,217
Municipalities with dwellings inside	78	66
Outside every official zone (reference rule)	43,359 (51.1%)	53,801 (38.9%)

The Copernicus extent:

- 55,252 ha of it lie in the province, touching 115 municipalities;
- it holds 22,153 buildings with dwellings and 35,061 buildings in all;
- almost all of its dwellings are in residential buildings.

The two extents together. They share 64,962 dwellings, and their union holds 158,044. 84,789 is therefore a floor for the dwellings that the flood reached, not a count of flooded homes.

5.2 Inside and outside the maps (Copernicus extent, reference rule)

MAP STATUS	DWELLINGS	SHARE
ARPSI 100-year zone (incl. 10-year)	8,435	9.9%
ARPSI 500-year zone (not 100-year)	19,234	22.7%
PATRICOVA levels 1–6 only	6,485	7.6%
PATRICOVA geomorphological only	7,276	8.6%
outside every official zone	43,359	51.1%

- **The ARPSI maps alone.** 67.4% of the dwellings were outside them. 210 dwellings lay inside the 10-year zone.
- **Return-period zones.** 59.7% were outside every zone drawn for a return period (ARPSI and PATRICOVA levels 1–6).

- **How the two maps overlap.** Of the ARPSI dwellings, 8,660 are also in PATRICOVA levels 1–6. PATRICOVA alone adds 13,761, half of them through its geomorphological level (`data/zone_overlap.csv`).

5.3 How much the answer depends on the choices

SCENARIO (DWELLINGS)	REFERENCE RULE	CENTROID IN ENVELOPE	FOOTPRINT ON GRID
Copernicus, all products (84,789)	51.1%	61.9%	53.1%
Copernicus product versions, $\pm 10/\pm 25$ m buffers, building footprint or centroid	50.1–53.9%	60.1–66.0%	51.9–56.0%
Generalitat footprint (138,217)	38.9%	48.6%	40.8%
Copernicus or Generalitat (158,044)	42.8%	51.5%	44.4%

The extent matters most. In the 66 municipalities where the Generalitat's footprint has dwellings:

- the footprint rule on the depth grid gives 51.6% against 40.8%, for 77,007 Copernicus dwellings and 138,217 Generalitat dwellings;
- the reference rule gives 49.4% against 38.9%.

So in the same places the extent alone moves the figure by about 11 points. The extent that both Copernicus and Camarasa-Belmonte et al. call weaker in towns gives the higher figure. Two examples: Alaquàs has 366 dwellings in the Copernicus extent and 12,051 in the Generalitat's, and Catarroja 3,494 and 12,446 (`data/extent_comparison.csv`).

Copernicus's own caveats.

- The AOI01 maps warn: «Please be aware that the thematic accuracy might be lower in urban and forested areas due to inherent limitations of the SAR analysis technique, where optical imagery was not usable.»
- Two aerial-image products note: «The thematic accuracy of the event extent and damage assessment might be lower due to distortions in some areas.»
- Version 2 of the Horta Sud grading product was issued for «Correction of observed event. In particular not all flood traces were delineated.» Using version 1 instead changes no dwelling: other products already cover those traces.

Other checks:

- **Unit.** In buildings with dwellings and in all buildings, the reference share is 50.1% / 43.6%.
- **Leaving out one municipality.** The share ranges 47.7–54.9%: without Paiporta, then without l'Alcúdia.
- **Envelope thresholds.** With envelope limits of 0.5–5 ha, the range across extents and rules is 39–70% (§4.3).
- **The frozen plan.** It asked for the range over all its scenarios, which is 40.8–87.6%. We report the range in parts:

- its top end comes from the water still standing in the images (Flooded area only, 3,173 dwellings), which measures something else;
- the next highest values come from the centroid on the depth grid, the artefact of §4.3.

Summary. Between about 39% and 66% of the dwellings inside the observed extent lay outside every official flood zone, depending on the extent and the rule. The figure is 51.1% for the Copernicus extent and 38.9% for the Generalitat's footprint under the reference rule.

5.4 Where

MUNICIPALITY	COPERNICUS EXTENT: DWELLINGS	OUTSIDE, REFERENCE	OUTSIDE, CENTROID IN ENVELOPE	GENERALITAT FOOTPRINT: DWELLINGS	OUTSIDE, REFERENCE
Païporta	11,987	71.9%	82.0%	11,988	71.9%
Xirivella	11,841	37.7%	81.6%	11,840	37.7%
València	8,390	81.0%	93.2%	7,787	84.4%
Algemesí	5,154	5.1%	5.1%	13,036	—
Alberic	4,898	93.7%	97.0%	—	—
Picanya	4,880	95.8%	99.1%	4,880	95.8%
Catarroja	3,494	0.7%	0.9%	12,446	0.5%
Aldaia	3,454	24.3%	25.3%	12,305	27.6%
Castelló	3,298	73.3%	76.0%	0	—
Alfajar	2,837	49.8%	61.1%	9,501	57.0%
la Pobla Llarga	2,355	82.2%	87.6%	0	—
Sedaví	1,878	100.0%	100.0%	4,580	100.0%
Torrent	1,533	92.2%	92.7%	973	76.5%
Massanassa	1,297	0.0%	20.0%	4,530	0.0%

A dash marks a value withheld by the disclosure rules (§8). All municipalities are in `data/municipalities.csv`.

Shares that hold under every rule and both extents:

- Paiporta, Picanya and Sedaví, where most dwellings lay outside every zone;
- Catarroja, where nearly all lay inside.

Shares that depend on the rule or the extent:

- Xirivella: 37.7% with the reference rule, 81.6% with the centroid;
- Alfafar: 49.8% with the Copernicus extent, 57.0% with the Generalitat's.

Mapped places.

- **Beniparrell and Massanassa.** At least 98% of their dwellings in the extent were inside an ARPSI zone: in Beniparrell 915 of 931 dwellings, mostly in the 100-year zone, and in Massanassa 1,281 of 1,297 in the 500-year zone.
- **l'Alcúdia.** 5,332 of its 5,846 dwellings in the extent were inside PATRICOVA's geomorphological level alone, which has no return period. Counting only return-period zones, most of l'Alcúdia was unmapped.

Unmapped places. Most dwellings in the extent were outside every zone in:

- Paiporta, Picanya, Sedaví and Torrent;
- the city of València's flooded districts;
- Alberic, Castelló and la Pobla Llarga in the Ribera Alta.

5.5 Built after 2016

CONSTRUCTION YEAR	DWELLINGS	IN AN ARPSI ZONE	IN THE 100-YEAR ZONE	OUTSIDE EVERY ZONE
1985 or earlier, or unknown	43,478	11,663	3,604	24,222
1986–2007	31,202	12,680	3,763	13,848
2008–2016	7,923	2,500	903	4,102
2017–2024	1,776	735	156	874
2025 or later	410	91	9	313

Before the flood. 1,776 dwellings inside the Copernicus extent are in buildings dated 2017–2024:

- 874 lay outside every official zone;
- 735 lay inside an ARPSI zone, 156 of them in the 100-year zone.

After the flood. 410 more are dated 2025 or later, 2,186 in all from 2017. These are rebuilding, completions of works under way on the day, refurbishments that reset the date, or new building. Some may not have been dwellings on 29 October 2024.

Map status by period. 41% of the 2017–2024 dwellings lay inside an ARPSI zone, against 27–41% of older ones. This says nothing about whether the 2016 rules applied to them: that depends on where building was still possible on urbanised land.

Paiporta. 462 dwellings date from 2017–2024, and 335 of them were outside every zone.

Exposure only. A dwelling of 2017–2024 inside the 100-year zone may stand on land urbanised in 2016:

- built to the 500-year level;
- with the declaration and the registry note that RDPH arts. 9 ter and 14 bis require.

Nothing here says otherwise.

5.6 The pilot

Inside the extent. For Paiporta, with the first AOI01 delineation, we count 11,987 of 11,988 dwellings (1,780 of 1,781 buildings with dwellings). The scouting pilot reported 11,986 and 1,779. The difference is one building at the edge, a matter of polygon repair.

Built in 2017 or later. We count 624 dwellings in 99 buildings, 18 of the buildings dated 2025 or 2026, as the pilot did.

6. Discussion

Counted in dwellings, a large share of the flooding fell outside the maps.

- Camarasa-Belmonte et al. found 14.1% of the flooded area outside the combined official map. With the same flood map, about 40% of the dwellings were outside the maps we could read.
- The unmapped water ran through dense towns: Paiporta, Picanya, Sedaví, Torrent, and the Ribera Alta towns of Alberic, Castelló and la Pobla Llarga.
- Part of the reason is in the maps themselves:
 - the hazard maps cover only the studied stretches of the main channels; the SNCZI page says the 100-year zone covers «33,3% de los cauces principales»;
 - in Paiporta the 100-year zone is the ravine's channel alone.

The extent is the largest uncertainty.

- **Copernicus misses towns.** Its satellite delineation misses much of the flooding inside towns, as both its own notes and Camarasa-Belmonte et al. say.
- **The Generalitat's footprint.** For two basin systems only, it holds 1.6 times as many dwellings as the whole Copernicus extent. Those extra dwellings are more often mapped, which lowers the share outside.
- **The rule.** The rule moves the share by about 10 points in the other direction.
- **No single figure.** We report the range and a reference figure for each extent, not one number.

The post-2016 count is small but not negligible.

- **Size.** 1,776 dwellings dated 2017–2024 are 2.1% of those inside the Copernicus extent.
- **The preferential flow zone.** It is the zone RDPH arts. 9 bis and 9 ter regulate, and we could not obtain it. The 156 dwellings in the 100-year zone are where it would matter.

- **Why so few.** That only 2% of the dwellings are this recent says more about the pace of building after 2008 than about the rules.
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7. Limitations

The maps:

- **The map version.** We read the ARPSI hazard maps of 20 December 2024. The version in force on 29 October 2024 was dated 5 July 2022 and could not be obtained. If any stretch was remapped after the flood, our share outside understates what the maps missed on the day.
- **Depth maps, not zone polygons.** We could not read the SNCZI's zone polygons, which may cover more stretches and geomorphological zones. If they do, our share outside is too high.
- **The rules.** None of our three rules is known to match the official polygons. They give 51–62% for the Copernicus extent, or 72% for the centroid on the unfilled grid, which §4.3 shows is biased.
- **Rendering and resolution.** The masks are the non-transparent pixels ($\alpha > 0$) of a styled depth ramp with an alpha fade on the shallowest class, at 2 m. The CNIG distributes the same maps as 1 m GeoTIFFs, which we did not use.
- **Missing preferential flow zone.** It is defined from the 100-year flood, so we expect most of it inside the 100-year zone, but we could not check.
- **PATRICOVA version.** It is the layer served on 4 October 2026, from the 2015 plan; we did not establish whether it changed after the flood.

The extent:

- **Copernicus.** It is a delineation from images of 30 October to 18 November 2024, partly semi-automatic. It misses water that had drained and is less accurate in towns.
- **The Generalitat's footprint.** It covers only two basin systems.
- **A floor.** Neither is a count of flooded homes, and 84,789 is a floor.

The data:

- **Construction year.** The Catastro's `dateOfConstruction` can be the year of a full refurbishment. New buildings can reach the Catastro months after completion.
- **Dwellings, not damage.** A dwelling on an upper floor inside the extent was not necessarily flooded. We count the exposure of the building, not the damage to each home.
- **Fluvial maps only.** The coastal hazard maps were not used.

The search: press, insurance-claim and building-inspection counts were not searched (§3).

8. Data, code and licences

****What `data/` holds.**** Aggregates only:

- municipality × map status × construction year (three bands, the ARPSI 10- and 100-year zones merged);
- per-municipality totals;

- province tables by year and by use;
- the zone overlap;
- the sensitivity table;
- the source list with SHA-256 hashes.

Disclosure control:

- No published cell represents fewer than 5 buildings.
- Complementary suppression makes sure that no withheld value can be recovered from totals, shares or the leave-one-out file. `scripts/check_disclosure.py` tests this on the published files with the null space of every relation they imply.
- Shares are given only where both counts are published, and the leave-one-out shares are rounded to 0.1 points.
- No addresses, cadastral references or building rows are published.

Sources and attribution:

- Copernicus Emergency Management Service (© 2024 European Union), EMSR773. The terms grant users «free, full and open access to Copernicus Service Information».
- Fuente: Dirección General del Catastro, author and owner of the cadastral information.
- © Ministerio para la Transición Ecológica y el Reto Demográfico (ARPSI hazard maps, CC BY 4.0).
- PATRICOVA: Peligrosidad por Inundación CC BY 4.0, Generalitat.
- © Instituto Geográfico Nacional (CC BY 4.0).
- Generalitat Valenciana, Institut Cartogràfic Valencià, «Zona inundada por la DANA del 29 de octubre de 2024» (CC BY-NC-ND 4.0). It is used only for counts, and no geometry or derived geometry is published.

Licences. Code: Apache-2.0. Our data and text: CC BY 4.0. None of the sources endorses this study.

Code. <https://github.com/easybytehub/easyxlab> (studies/s19-dana-flood-mapped-vs-observed).

9. Automation and review

AI agents (Claude models) did the work.

How the work was done:

- **Scouting.** A scouting agent proposed the study and ran the Paiporta pilot.
- **Building.** Two successive agents downloaded the sources, built the pipelines and the analysis, searched for prior work and drafted the text; the second resumed from the files the first left on disk.
- **The plan.** It was frozen and hashed before any building was compared with a map.
- **No manual steps.**
 - `scripts/check_headlines.py` recomputes the headline numbers from `data/` and checks them in this paper and in the README.
 - `scripts/check_disclosure.py` tests the published files for recoverable values.

- The tests in `tests/` cover the building parser, the classes and the masks.

Independent review. An independent agent reviewed the study adversarially and recomputed the headline numbers from the building-level files. Its findings, all applied in this version:

- the rule we called «most favourable to the maps» was not;
- the envelope effect was described in the wrong direction;
- the map layer was the ARPSI hazard product, updated after the flood;
- one legal quote was not in force;
- one municipal claim was wrong;
- the small-cell protection did not work.

The changes are in `METHOD.md` §9. This version has not yet been re-reviewed.

10. Competing interests

EasyxLab is the research lab of EasyByte Hub S. Coop. Mad., a software company. EasyByte has no client in insurance, construction, flood mapping or the reconstruction, and no stake in the outcome. No one funded this study.

11. Ethics

- **Personal data and small cells.** Cadastral references and building identifiers were dropped while reading. No published cell represents fewer than 5 buildings, and no withheld value can be recovered from the published files.
- **Robots.txt.** We followed robots.txt to the legal minimum. Four public geodata hosts were treated as open when their robots.txt could not be read (`METHOD.md` §7).
- **Access controls.** We never passed an access control. The SNCZI zone polygons stay behind their ALTCHA challenge, and the Consorcio's documents stay unread.
- **No address-level output.** The study names municipalities, never streets or buildings.
- **Use with care.** Municipal figures should travel with their rule and extent, because several change by tens of points.

How to cite

EasyxLab (2026). What the maps did not show: dwellings inside the observed extent of the October 2024 DANA in Valencia, and the official flood maps. Study S19. EasyByte Hub S. Coop. Mad.
<https://github.com/easybytehub/easyxlab>

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Cite this study

CITATION

EasyxLab (2026). What the maps did not show: dwellings inside the observed extent of the October 2024 DANA in Valencia, and the official flood maps. Study S19. EasyByte Hub S. Coop. Mad.

<https://github.com/easybytehub/easyxlab/tree/main/studies/s19-dana-flood-mapped-vs-observed>

BIBTEX

```
@techreport{easyxlab_s19,  
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of the October 2024 DANA in Valencia, and the official flood maps},  
  author     = {{EasyxLab}},  
  institution = {EasyByte Hub S. Coop. Mad.},  
  number     = {S19},  
  year       = {2026},  
  url        = {https://github.com/easybytehub/easyxlab/tree/main/studies/s19-  
dana-flood-mapped-vs-observed}  
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