

Precise and accurate disaster location data is central to effective disaster management. Disaster location data improves impact assessments and enables location-specific risk analysis by linking geographic factors such as environmental susceptibility, population vulnerability, and critical infrastructure exposure. Administrative unit data is important for evaluating economic damage or casualties across different levels, such as national (admin-0), regional or provincial (admin-1), and departmental or district level (admin-2). Reliable, standardized, and up-to-date administrative unit references are essential for informed decision-making and targeted response planning.

Defining the spatial boundaries of different administrative units requires that EM-DAT maintains consistent usage of a single cartographic reference. Various administrative unit references exist, each shaped by distinct data collection methods depending on the geographic area, political context, purpose, or objectives. Among the most widely used for mapping administrative units are the Global Administrative Unit Layers (GAUL) and the Global Administrative Areas (GADM) (Table 1). EM-DAT adopted GAUL in its methodology, using it in the 'Admin Unit' column to identify disaster-affected regions, with coverage up to admin-2 for all natural hazard events since 2000.

**Table 1. Difference Between the Two Main Reference Systems**

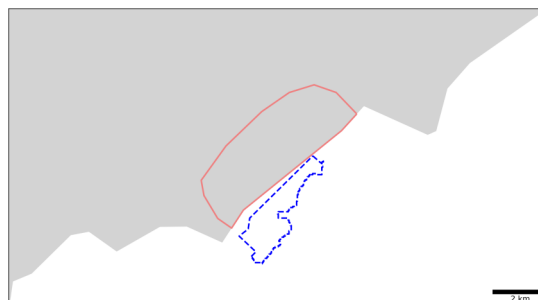
	GAUL <sup>1</sup>	GADM <sup>2</sup>
<b>Source</b>	Food and agriculture Organization (FAO)	University of Berkeley
<b>Coverage</b>	Global—up to admin-2	Global—up to admin-4
<b>First release</b>	2008	2015
<b>Last update</b>	2015	2022
<b>Data size</b>	Moderate	Large
<b>Licensing</b>	Non-commercial use	Academic/research use
<b>Known users</b>	FAO, World Bank, UN organizations	Universities, UN organizations

However, GAUL has not been updated since its last version was released in 2015, creating challenges for recording events in areas affected by administrative changes. For example, disasters occurring within locations associated with France’s regional mergers in 2015<sup>3</sup> appear to occur in the wrong region. To address this, EM-DAT has transitioned to the GADM referential, which is more current and detailed, with its last release in 2022. This decision was made after evaluating the limitations of the previous reference system, GAUL, and recognizing the need for more current and comprehensive administrative data.

### Challenges in Translating GAUL to GADM

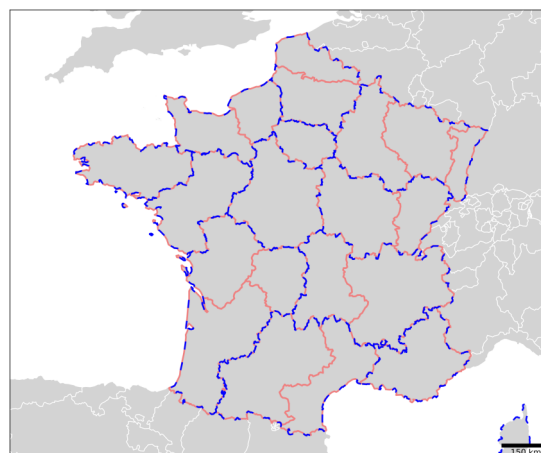
The shift from GAUL to GADM involves reconciling topological differences between datasets:

- Precision difference: misaligned entities due to varying levels of detail (e.g., small states like Monaco or certain islands).

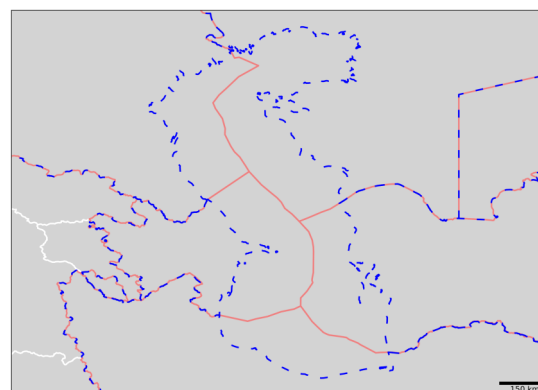


GADM Boundaries GAUL Boundaries

- Boundaries difference: mergers, splits, or alterations in administrative boundaries (e.g., French regions).



- Geocoding discrepancies: inclusion of maritime areas (e.g., Caspian Sea countries) or disputed territories (e.g., Jammu & Kashmir region).

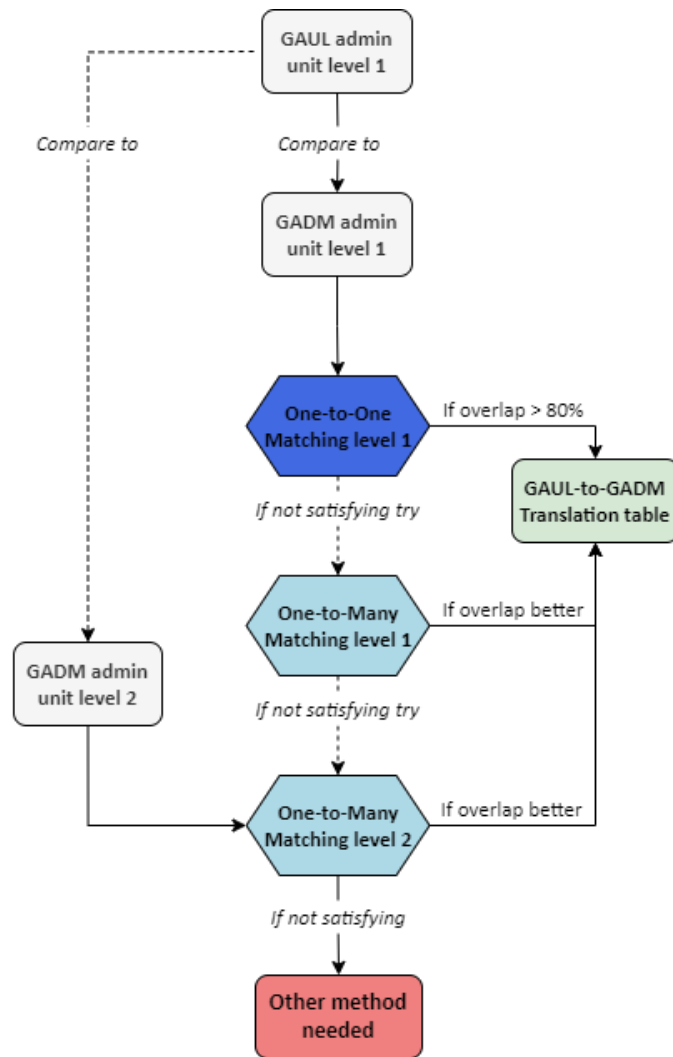


**Fig. 1. Administrative Unit Mapping Differences Between GAUL and GADM**

## Methodology for Matching GAUL to GADM

EM-DAT developed an SQL-based methodology using PostGIS\* to address the existing discrepancies and to achieve maximum overlap between GAUL and GADM entities (Figure 2).

- **One-to-one Matching** : identifies a single GADM entity with at least 80% overlap with a GAUL entity for direct translation.
- **One-to-many Matching** : groups multiple GADM entities to match a single GAUL entity when boundaries have changed (e.g., splits or mergers). This method is more complex to integrate but handles nuanced changes effectively.

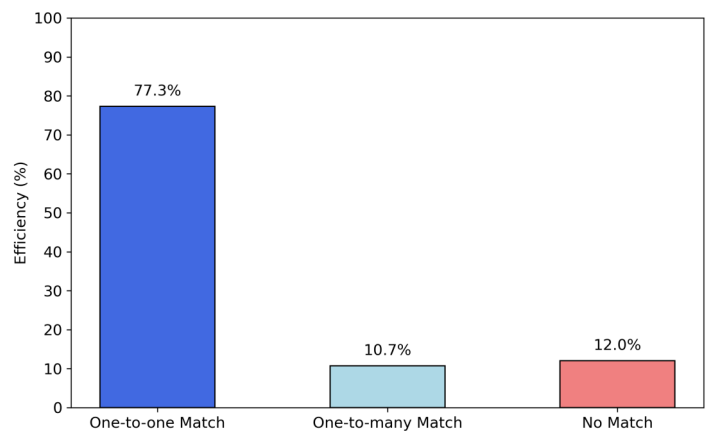


**Fig. 2. Workflow for Matching GAUL Level 1 Administrative Units to GADM**

\* SQL and PostGIS are query language and software to operate with spatial databases.

## Results and Remaining Challenges

Using the aforementioned methods, most GAUL entities were successfully matched to GADM entities (Figure 3).



**Fig. 3. Number of Entities Matched by Each Method**

However, 12% of the entities remain unmatched due to boundary complexities or insufficient overlap. Resolving these cases may require higher-level aggregation, manual validation, or advanced techniques.

## Future Steps and Integration

Improving and updating the reference system, as with the replacement of the GAUL repository by GADM, is vital for supporting EM-DAT's geospatial data capabilities. Collaboration with the user community and validation against external studies could strengthen the results, such as the Rosvold & Buhaug (2017) independent matching method between EM-DAT and GADM<sup>4</sup>. Future efforts may include harnessing AI-based tools to enhance accuracy and usability.

To ensure continuity, EM-DAT will provide geocoded events in both GAUL and GADM formats during a transition phase, minimizing disruptions and reducing errors.

We refer to the EM-DAT documentation for the latest and up-to-date information on this topic.

<sup>1</sup> Global Administrative Unit Layer (2015). Food and Agriculture Organization. Available at : <https://sdi.eea.europa.eu/catalogue/srv/api/records/68d5de61-3af4-4520-a877-49580c98c583> (Accessed: December 17, 2024).

<sup>2</sup> Global Administrative Areas (2022). University of California, Berkeley. Available at: <http://www.gadm.org> (Accessed: December 17, 2024).

<sup>3</sup> Decree No. 2015-899 of 23 July 2015 on public procurement. (2015). *Official Journal of the French Republic*. Available at: <https://www.legifrance.gouv.fr/loda/id/JORFTEXT000030985460> (Accessed: December 17, 2024).

<sup>4</sup> Rosvold, E. L., & Buhaug, H. (2021). GDIS, a global dataset of geocoded disaster locations. *Scientific Data*, 8, 61. Available at: <https://www.nature.com/articles/s41597-021-00846-6> (Accessed: December 17, 2024).

## CRED Updates

- Access the new EM-DAT flyer at : [https://files.emdat.be/2024/10/EM-DAT\\_leaflet\\_2024.pdf](https://files.emdat.be/2024/10/EM-DAT_leaflet_2024.pdf)

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