ClimActor 2.0: A spatialized database of subnational climate pledges and emissions data

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Abstract

ClimActor 2.0 is an open, spatialized database that compiles climate targets, action plans, and self-reported emission inventories from subnational governments, including cities, municipalities, states and regions, worldwide. The dataset provides standardized administrative boundaries for each entity, enabling direct linkage to geospatial data such as population, GDP, land cover, and other globally-gridded datasets. Each record is anchored to a unique identifier that connects decision-making authorities to their corresponding geometries. The database integrates information from 14 major climate disclosure platforms and reporting initiatives, complemented with a few national-level datasets. In total, ClimActor includes over 15,000 entities that participate in a national or transnational climate initiative, of which more than 10,000 of these entities have adopted either a climate mitigation target or plan. In addition to the harmonized spatial boundaries, ClimActor 2.0 provides four harmonized core datasets: aggregated emissions, sectoral emissions, climate targets, and climate plans, in addition to network participation data. Users can utilize the data as a standalone dataset or as an open-source R statistical computing software package, which includes a set of cleaning and matching functions that allow users to easily combine other datasets with ClimActor 2.0 for a wide range of subnational climate action analyses.

Background & Summary

Cities and subnational governments, broadly defined as administrative levels below national governments, remain central actors in addressing climate change. Since the 2015 Paris Agreement officially recognized the importance of engagement of "all levels of government,"[1] the number of city and regional governments participating in transnational climate initiatives or pledging their own mitigation, adaptation or other climate effort has exceeded more than 15,000 recorded on the UN's Non-State Actor Zone for Climate Action (NAZCA) platform as of September 2025. These efforts have been considered critical in supporting implementation of national climate goals, building capacity at local levels, allowing for policy experimentation and innovation, and filling leadership voids in countries where national governments have backslided. [2–5]

In 2020 we developed the first version of the ClimActor dataset,[6] which represented the first systematic effort to compile and harmonize around 10,000 subnational entities pledging climate actions worldwide. It created a foundation for comparative analysis of subnational climate action by introducing a standardized naming convention that enabled cross-identification across datasets. Each record was accompanied by information on population, administrative hierarchy, approximate geographic location (identified by latitude/longitude), and participation in climate initiatives and reporting platforms, such as CDP (formerly the Carbon Disclosure Project) or the Global Covenant of Mayors for Climate and Energy (GCoM).

Here we present ClimActor 2.0, a major update that expands the original dataset with spatialized boundaries for all covered entities, which includes over 15,000 entities that participate in national or transnational climate initiative. The spatialization and identification of spatial boundaries allows users to directly link subnational climate pledges and self-reported climate plan and emissions data to globally-

gridded datasets on population, GDP, land cover, or observed and projected emissions. By embedding each subnational entity's commitments in geographic space, ClimActor 2.0 enables applications that extend beyond policy analysis and supports integration with earth system modeling, climate risk assessments, and other analyses of climate policy co-benefits such as air quality, biodiversity conservation, or equity impacts, among other questions.

Method

The methodological updates underlying ClimActor 2.0 combine nominal matching, geographical boundary harmonization and climate data integration to ensure that all climate data is linked to both a specific decision-making entity (i.e., municipal, local/city-level, city or regional government) and a specific geographical location (i.e., region, city, district, etc.). A summarized view of the workflow is shown in Figure 1.

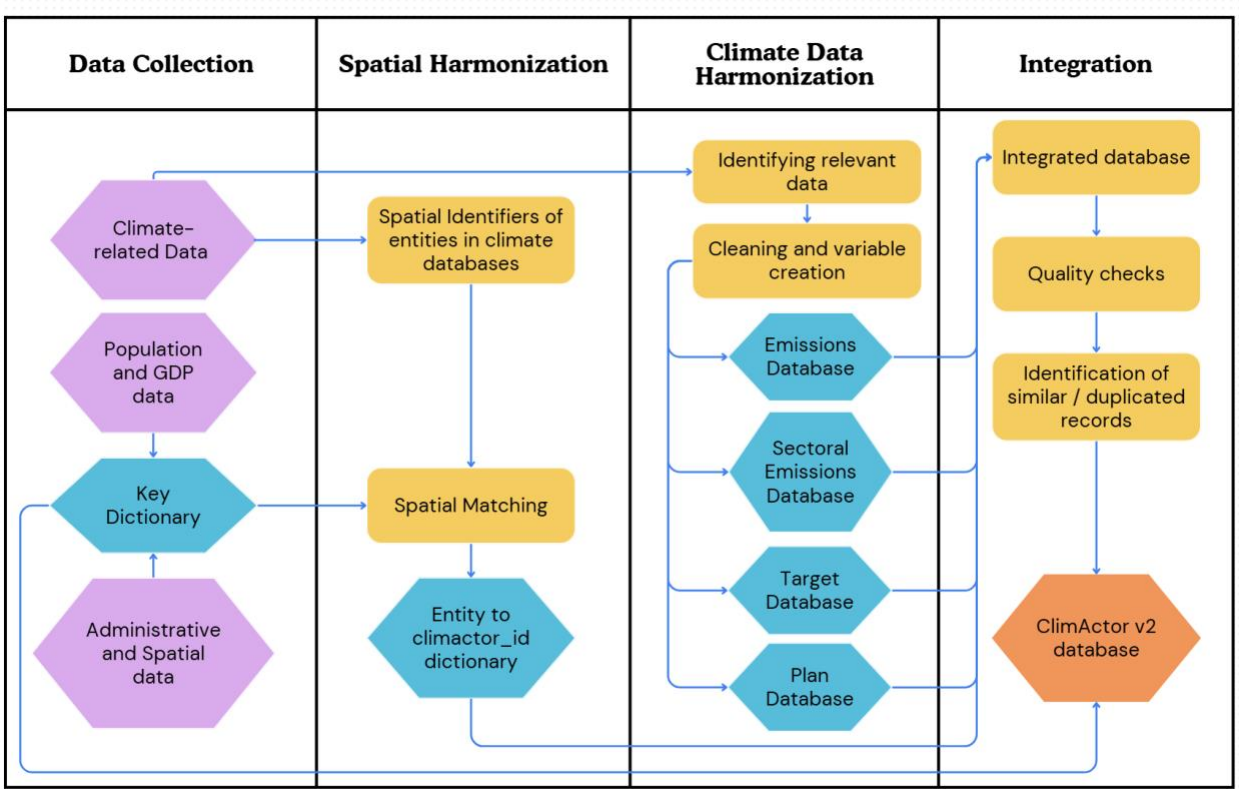

Figure 1. Workflow for development of the ClimActor 2.0 database.

In order to implement our matching and data harmonization process, we constructed a key dictionary that integrates both spatial information (i.e., administrative subdivisions) as well as descriptive information of the administrative entities established by each country, particularly their name and entity type as defined within the respective national administrative system. We obtained this information from multiple data sources (see Online Table 1), most notably the Global Administrative Database (GDAM v 4.1),[7] as well as from national sources for 36 countries where we found the GDAM data to be outdated or insufficiently detailed. Using this information, we built a key dictionary that includes the complete name of each entity and its entity type in English and national languages, geographical location and structure within its country, population and GDP data from the EU's Global Human Settlement Layer dataset (GHSL)[8] and Kummu et. al (2025)[9] respectively, and phonetic representations of its name produced by a set of phonetic

algorithms[10] for each entity. The resulting key dictionary includes over 214,000 unique administrative entities with specific geometries, and over 1.5 million total records of administrative entities, including name variations based on common errors or language variations from Portuguese, Spanish, French, Italian and others.

Following the construction of the key dictionary, we proceeded to harmonize and match the data for all entities available in previously identified national and transnational initiatives that consolidate information on climate pledges, plans and emissions including dataset from the CDP, the GCoM, C40, China Carbon Neutrality Tracker and others (see Online Table 2). The harmonization process included two complementary workflows, the first one focused on nominal and spatial matching using the key dictionary as the reference, and the second one that harmonized each subnational entity's specific climate information (i.e., participation in transnational climate initiatives, emission reduction targets, self-reported emission data, climate plan information).

The first process involved an automated nominal and geographical matching, which combined two machine-aided approaches: first, matching based on common name variations or language-specific spellings of each entity; and second, a phonetic-based matching using the closest phonetic match of an entity's name compared to a set of ten phonetic representations produced by multiple algorithms (Caverphone, cologne, lein, metaphone, mra_encode, nysiis, onca, phonex, rogerroot, soundex, and statcan) implemented by Howard, II (2020). A significant improvement over the previous version of ClimActor[6] is the use of official names for all entities to prevent mismatches when multiple entities share the same name within a country. For example, Copenhagen (DNK) is considered both a city and a municipality, each with distinct climate commitments, population, GDP and emissions profile.For the automated matching stage, we used GHSL population data as a secondary validation check when self-reported figures were available, with a maximum allowable difference of 20%. If the discrepancy exceeded this threshold, the record was excluded from automatic name-based matching but could still be resolved through phonetic matching or in the subsequent manual review. These population checks not only account for differences in reporting years or demographic shifts but also help distinguish between entities with the same name that correspond to different administrative areas. This geo-matching procedure resulted in a dictionary linking each entity across all databases to its corresponding administrative unit and geometry, identified by a unique key variable, climactor_id. In total, this process produced slightly over 38,000 records of entities participating in one or more of the identified climate initiatives or networks, each matched to a standardized administrative boundary. Figure 2 illustrates the spatial distribution of these entities, with particularly high participation observed in Europe.

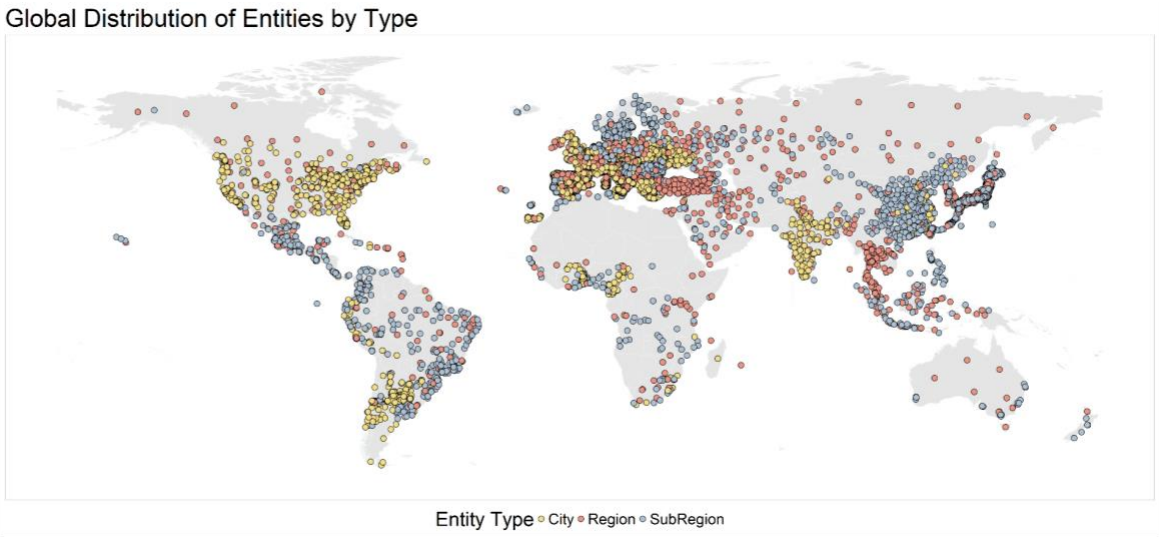

Figure 2. Global spatial coverage of subnational entities included in the ClimActor 2.0 database.

Next, after entities were matched with their spatial boundary, the second step focused on detailed cleaning and harmonization of climate information from each source, implemented through custom scripts and targeted string manipulation. Unlike the previous stage, this process relied less on automation and more on expert knowledge of the underlying databases and reporting guidelines of the organizations collecting the climate information. For example, CDP datasets for cities and regions were harmonized by referencing the CDP Questionnaire Guidance for cities and regions,[11] which specifies the relevant questions for emissions, targets and plans. This step resulted in the construction of four core datasets for each data source, covering aggregated emissions, sectoral emissions, climate target-setting, and climate plans, along with auxiliary datasets containing contextual data, actor information, and participation in networks and initiatives.

The final stage involved the integration of all datasets into a combined database for each type of climate data: aggregated emissions, sectoral emissions, mitigation targets, and climate plans. Here we integrated all datasets using the unique key variable (climactor_id) to group all climate information from the same administrative entity. Given the overlap among reporting initiatives such as CDP and GCoM, we identified duplicate records for emissions and targets by comparing coverage, scope and commitment characteristics. For emissions data, we also applied quality controls to flag unlikely or implausible values that may indicate reporting errors, such as per capita emissions below 0.2 tons per person or higher 40 tons per person, as well time-series anomalies (following Hsu et al, 2022).[12] While all records are retained in the database to allow users flexibility in selecting data for their specific analyses, these checks facilitate deduplication and the use of unique values for emissions and targets, even when reported through multiple national or transnational initiatives.

Input Data

The input data used for the construction of ClimActor can be classified as two types: a) administrative and geometry data, and b) climate-related data. Administrative and geometry data were sourced primarily from GDAM 4.1. For 36 countries, we complemented or replaced these data with officially sourced or

crowdsourced data[13] due to missingness or outdated geometries, particularly for lower level administrative entities that have undergone recent administrative boundary changes, such as Italy or Greece. From the full set of available administrative entities, we selected only those corresponding to subnational governments, on the basis that climate pledges and related decisions are made by recognized authorities. Administrative subdivisions without governing authority, such as planning zones or census units, were excluded from the key dictionary.

The climate-plan, mitigation targets, or emissions-related information is sourced directly from a curated list of repositories or national and transnational organizations that collect and disclose climate information from multiple sources and through different means. The list of data sources is not meant to be exhaustive, and future users can easily integrate additional climate data from updated versions of the curated database or entirely new data sources. While ClimActor's primary objective is to compile self-reported information, it also aims to address gaps in coverage, particularly in regions that have been traditionally overlooked outside of Europe and North America. We also incorporated national datasets on subnational climate efforts in Japan and China, which track the actions of their subnational entities through national reporting mechanisms rather than solely relying on voluntary disclosure platforms that are primarily English-based, such as GDP or GCoM. Future ClimActor versions will aim to further identify these types of non-English language datasets to increase geographical coverage.

Detailed records of the sources used for the administrative and geometry data, and climate-related data are available in Online Table 1 and Table 1 respectively.

Data Source	Description
Carbon Disclosure Project 2023 City-wide Emissions (CDP)[14]	Data is self-reported data on city-wide emissions disclosed by cities in 2023, drawn from section 2.1 in Cities 2023 questionnaire (743 entities)
Carbon Disclosure Project 2023 Full Cities Dataset (CDP)[15]	All data is self reported by cities via 2023 Cities Questionnaire. Collected through CDP-ICLEI Track (1019 entities)
EU Covenant of Mayors for Climate & Energy (2024)[16]	Open to all local authorities democratically constituted with/by elected representatives, linked to EU's climate and energy policy framework (7563 entities)
US Climate Mayors (2024)[17]	Network of nearly 350 mayors who demonstrate climate leadership through meaningful actions in their communities. (341 entities)
Global Covenant of Mayors for Climate & Energy (GCoM)[18]	Coalition of cities and local governments committed to reducing greenhouse gas emissions and increasing resilience to climate change (13374 entities)
Global Convent of Mayors Joint Research Centre (GCoM JRC)[19]	Comprehensive and harnessed collection of action plans and monitoring reports from MyCovenant platform in the context of the GCoM initiative after a scrutiny by JRC (1552 entities)
U.S. Climate Alliance (2024)[20]	Coalition of 23 governors securing America's net-zero future by advancing state-led, high-impact climate action (23 entities)

Carbon Disclosure Project 2023 Full States and Regions Dataset (CDP)[11]	2023 data for states and regions. All data included in the dataset is self reported by states and regions through the 2023 States and Regions Questionnaire. (109 entities)
Global Climate Action Portal (GCAP)[21]	Online platform where actors from around the globe - countries, regions, cities, companies, investors and other organizations - can register their commitments to act on climate change (12,019 entities)
Japanese Prefecture Targets, Japan Ministry of Environment (2024)[22]	Ministry of the Environment conducts yearly on the status of implementation of the Act on Promotion of Global Warming Countermeasures in Local Governments. (1793 entities)
China Carbon Neutrality Tracker, Institute for Global Decarbonization Progress (2024)[23]	China Carbon Neutrality Tracker tracks China's up-to-date national and sub-national carbon neutrality actions (322 entities)
Net Zero Tracker (2024)[24]	Dataset tracking net zero targets and actions across all nations and the world's largest regions, cities, and companies (1892 entities)
C40 Cities for Climate Leadership Group (2024)[25]	Database of 98 member cities' efforts towards confronting climate change. (98 entities)

Table 1. Climate databases used for construction of ClimActor 2.0 database.

Data limitations

Our database is not without limitations. First, self-reported data carry inherent limitations, as human error in reporting can lead to gaps, inaccuracies, or even internal contradictions within the same source database. While we tried to overcome some of these limitations with quality checks and duplicate identification (See Methods), some errors inevitably still persist (e.g., such as reported emissions data due to an entity's own miscalculation). The second limitation is the geographical imbalance in participation across transnational networks and disclosure initiatives, with a disproportionately high number of entities from Europe. This disparity reflects, in part, the maturity of initiatives that originated in Europe and its strong emphasis on disclosure, such as in the GlobalCovenant of Mayors for Climate and Energy - EU Secretariat (EUCoM) that requires member governments to publish climate action plans and report emission inventories.[26] While we tried to include additional national datasets from other regions to better represent subnational climate action originating in the Global South, our dataset still reflects this imbalance. Finally, language barriers limit our capacity to further incorporate countries and regions where English is not the primary language or when access to information is limited due to regional or national constraints, such as regional blocks or limited access to non-citizens to country-specific data.

Data Records

ClimActor v2.0 includes 6 main datasets: i) a key dictionary for subnational entities; ii) an actor database that includes all entities identified in the selected databases; iii) an emissions database that includes data on aggregated emissions for all sectors, GHGs, and scopes reported; iv) reported data on sector-specific emissions; v) climate action plans that include information about climate plan characteristics; and vi) climate target information, including descriptive information on an entity's mitigation target. The datasets are available on the Data-Driven EnviroLab's Dataverse,[27] as well as on Github (www.github.com/datadrivenenvirolab/ClimActor), alongside the updated functions for their use included

in an R package. An overview of the most relevant indicators is available in Table 1 and more detailed in Online-only Table 3.

Dataset: Key Dictionary	
right	Official entity name including name and entity type
entity_type	ClimActor classification for subnational entities including: Regional, Sub-regional and City
ent_type_eng	Country specific subnational classification
lat_long	Centroid of associated geometry of entity.
Dataset: Actor	
mame	Name of entity in original dataset
entity_type	Entity type according to original data source
datasource_id	Unique code of data source
orig_id	Unique identifier of original data source
climactor_id	Unique ClimActor identifier for entities that provide the information
Dataset: Aggregated Emissions and Emissions Breakdown	
climactor_id	Unique ClimActor identifier for entities that provide the information
inv_year	Year of emissions (YYYY)
total_emissions	Integer value of emissions in units (recorded in inv_unit)
inv_unit	Unit of total_emissions. Currently supported:'tCO2e': tonnes of CO2 equivalent
inv_scopes	Relevant scope numbers (1, 2, or 3) combined by “+”. Ex. “1+2”

inv_sectors	All sectors included in the inventory. Possible options include: AFOLU, Buildings, Energy, IPPU, Transportation, Waste, Other
ghgs_included	Type of unique greenhouse gases included in the emissions data: CO2 only, CO2 + other gases, or a combination of the gases included in the emissions (ex. CO2+CH4)
Dataset: Targets	
climactor_id	Unique ClimActor identifier for entities that provide the information
target_type	The type of target as explicitly stated by the entity: Examples include:“Relative emission reduction”, “Absolute emission reduction”, “Net zero target” or similar
target_year	Year of completion (YYYY). Targets may have year values in the past for historical targets
target_unit	Unit of the target value. Current units supported are: - 'tCO2e': tonnes of CO2 equivalent - 'percent': percentage reduction
target_value	Value of the target. This is delimited in units by target_unit
target_sectors	All sectors included in the plan. Possible options include: AFOLU, Buildings, Energy, IPPU, Transportation, Waste, Other
Dataset: Plan	
climactor_id	Unique ClimActor identifier for entities that provide the information
plan_type	Thematic coverage of the plan including: ‘Mitigation’, ’Adaptation’, ’Integrated’, ’Energy’, or ’Other’
plan_adoption_year	Year of plan adoption

Table 2. Description of selected variables within each of ClimActor 2.0’s four core datasets.

Data Overview

The ClimActor 2.0 dataset provides harmonized, spatially-explicit information on subnational climate action worldwide, covering emission records, climate action plans, mitigation targets, and

network/initiative participation for more than 15,000 entities worldwide. By linking each entity to its geospatial administrative boundary and decision-making authority, the dataset enables both global comparisons and integration with other geospatial and socioeconomic or policy-relevant datasets. Figures 3-6 provide an illustration of the overall coverage of the data available in ClimActor 2.0. Figure 3 presents the number of annual emissions records reported per entity. While many entities disclose only a few years of data, others provide time series extending 10 or 15 years or more, which provides opportunities for longitudinal analysis of subnational emission trajectories. Figure 4 maps the global distribution of climate plans by type, distinguishing between mitigation, adaptation, energy and integrated plans. Europe shows the highest density of reporting entities, but there is also subnational coverage across Latin America, East Asia, and the Middle East. Figure 5 presents the evolution of climate target types adopted by subnational entities over time, highlighting the growing prevalence of net-zero targets as long-term goals. Earlier commitments were more likely to emphasize absolute or relative emission reductions, whereas in more recent years net-zero targets have emerged as a dominant long-term goal for subnational governments. Finally, Figure 6 highlights variation in the detail of self-reported emissions data across regions. Entities in Europe and North America are more likely to report comprehensive greenhouse gas inventories, while those in regions such as Sub-Saharan Africa or South Asia often provide only carbon dioxide emissions data or insufficient information to distinguish. These disparities reflect both the progress made and the remaining challenges in achieving consistent, high-quality subnational climate reporting worldwide.

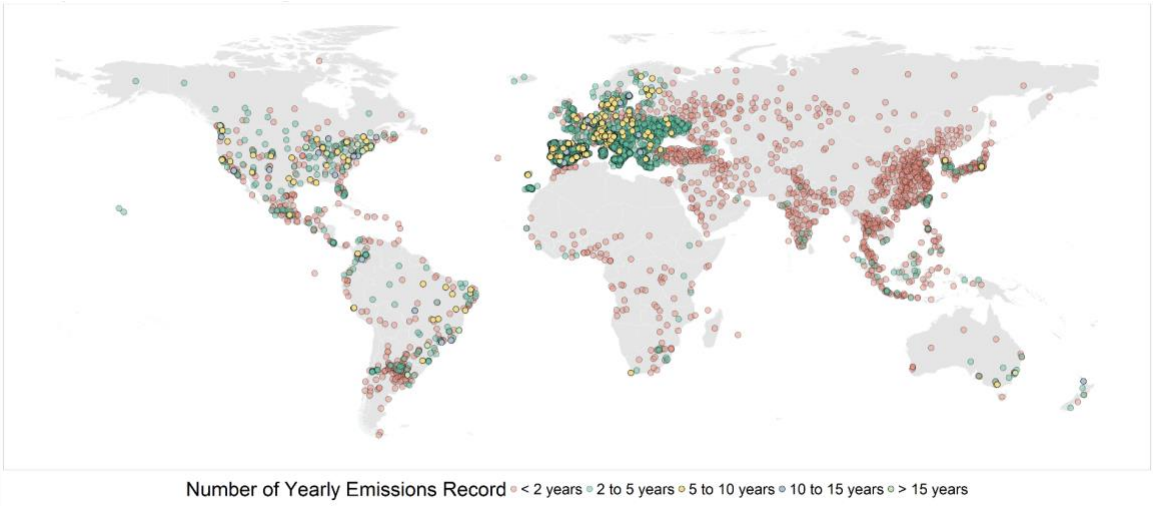

Figure 3. Number of annual emissions records per entity in the ClimActor dataset.

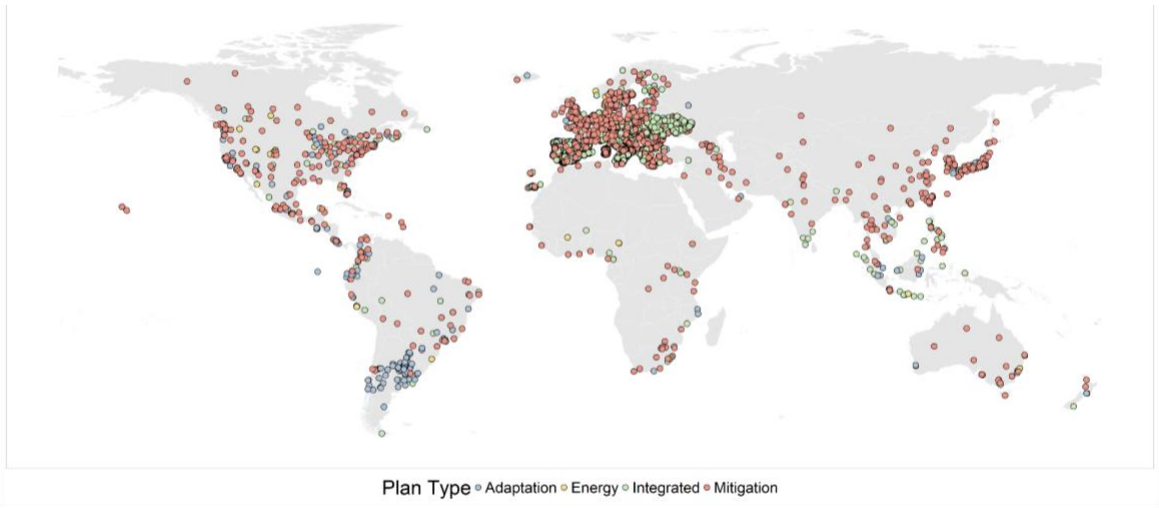

Figure 4. Global distribution of climate plans by type: adaptation, energy, mitigation, or an integrated plan that includes a combination of aims.

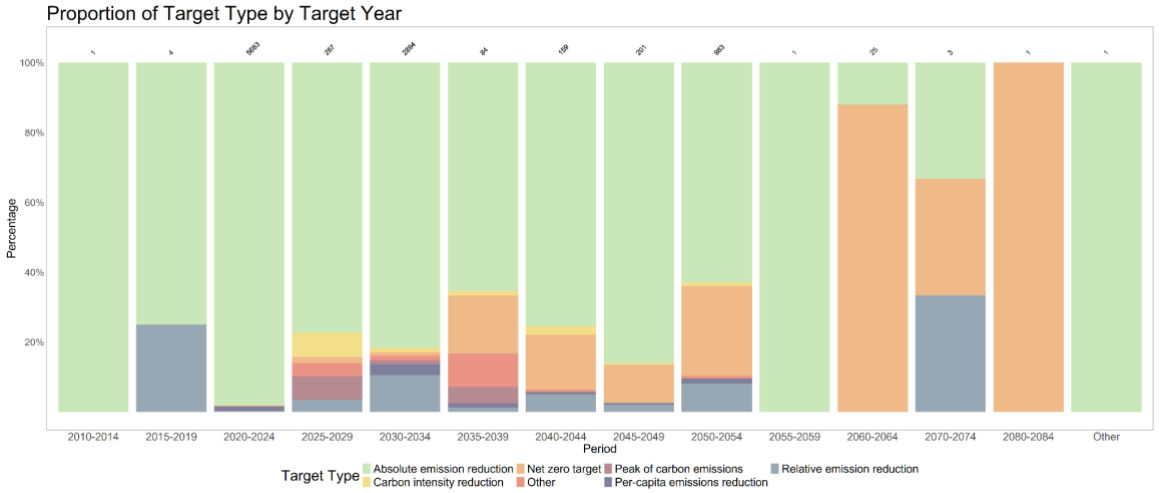

Figure 5. Types of mitigation targets and their approximate timeframe from subnational entities' climate action plans and reported data.

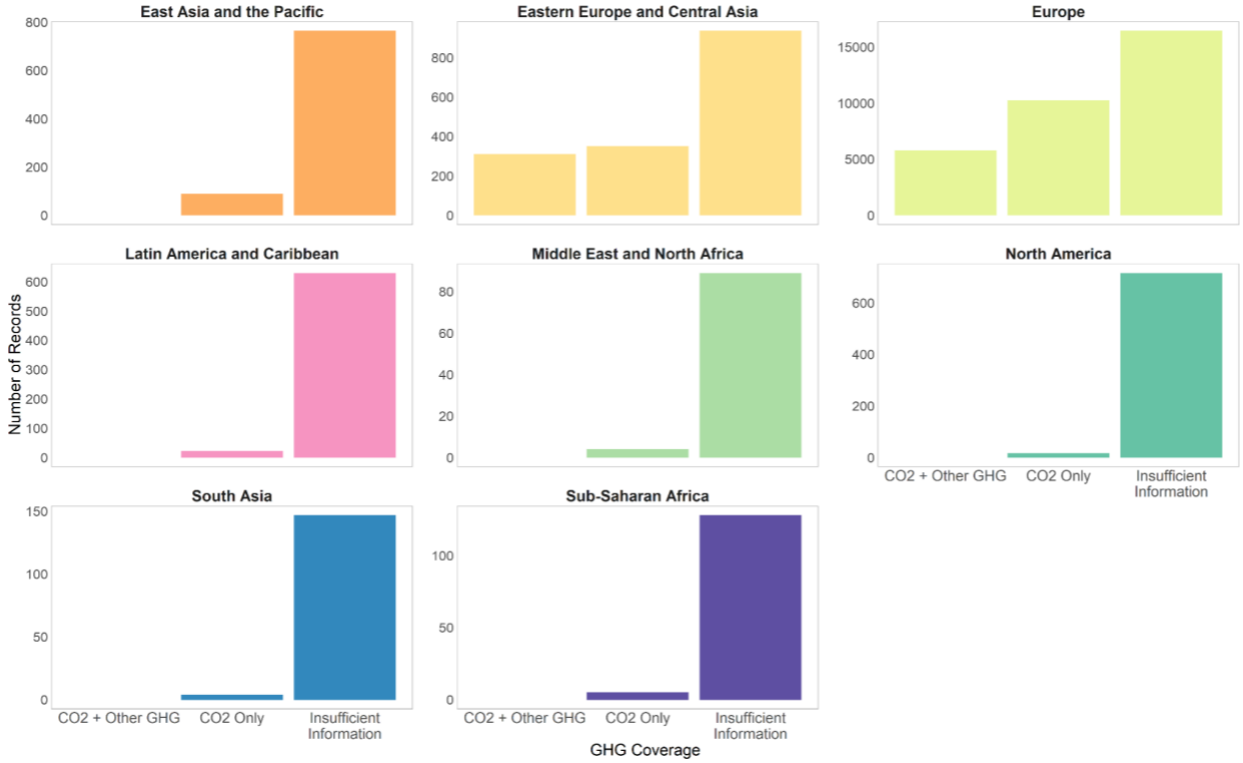

Figure 6. Greenhouse gas emissions coverage information for entities by geographic region.

Technical Validation

Because ClimActor harmonizes information reported by other climate initiatives, direct external validation of the underlying climate data is not feasible. Instead, our validation efforts focused on assessing the accuracy of the entity matching process, which links climate commitments to the correct administrative authority and spatial geometry (Figure 7). Across the 11 datasets integrated, we achieved a matching success rate of over 85%, with particularly high accuracy for national-level datasets such as those from China and Japan.

Unmatched entities occur primarily in datasets such as GCoM and EUCoM, where municipal boundary reforms have altered or eliminated certain jurisdictions after their initial participation. For example, in Greece, municipal reorganizations in 2011 and 2019 merged several previously independent entities, creating discrepancies between historical membership lists and current administrative structures. These challenges reflect genuine changes in administrative geography rather than failures of the matching procedure.

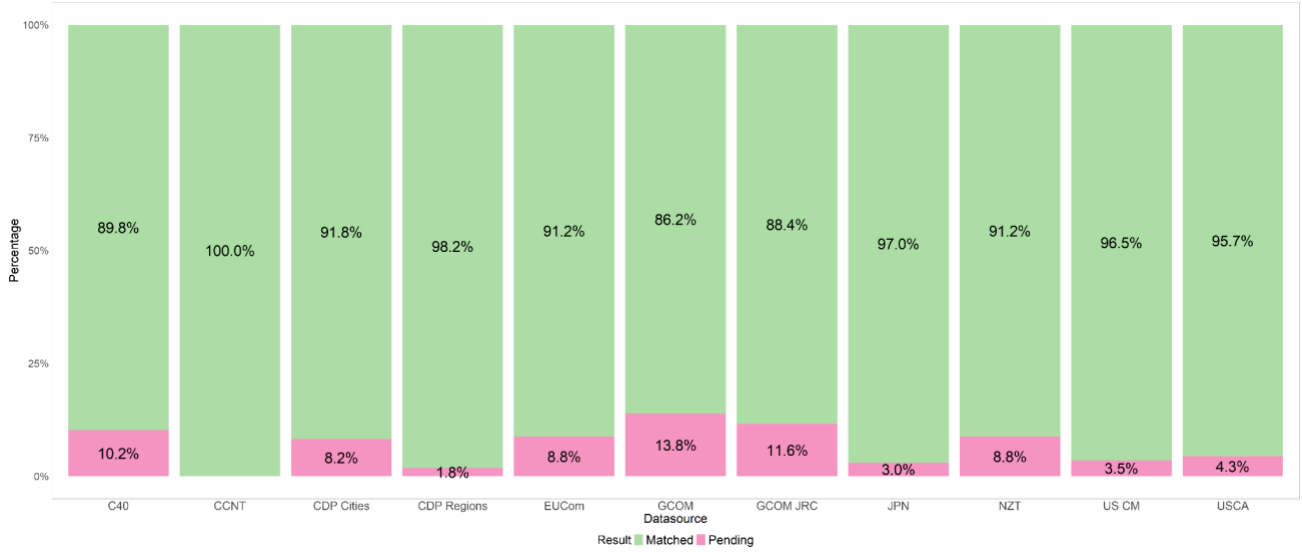

Figure 7. Entity matching results percentage for each climate-related dataset.

Usage Notes

We updated the existing ClimActor R package with new functions and databases to assist researchers in utilizing our database alongside other datasets. Key improvements include enhanced naming conventions for administrative entities, which reduce ambiguity by specifying, for example, 'State of New York' or 'City of Lima' instead of just 'New York' or 'Lima', which could refer to multiple administrative levels. In addition we have expanded machine-aided matching functions and refined the phonetic matching tools to operate effectively with the updated entity names.

Code Availability

Data and code for the ClimActor R package functions are publicly available on GitHub: https://github.com/ datadrivenenvirolab/ClimActor.

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Author Contributions

D.M, and K.B organized the data collection process and established the methods. D.M., K.B., E.B. and A.M. collected data and executed the method. D.M., K.B., E.B. and A.M. contributed to the manuscript. A.H. conceptualized and supervised the study. All coauthors reviewed, edited, and approved the manuscript.

Competing Interests

The authors declare no competing interests.

References

1. UNFCCC. *Paris Agreement, United Nations Framework Convention on Climate Change. 21st Conference of the Parties* 16 https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf (2015) doi:FCCC/CP/2015/L.9.

2. Hoffmann, M. J. *Climate Governance at the Crossroads: Experimenting with a Global Response after Kyoto*. (Oxford University Press, Oxford ; New York, 2011).

3. Bulkeley, H. & Betsill, M. M. Revisiting the urban politics of climate change. *Environ. Polit.* **22**, 136–154 (2013).

4. Hsu, A., Moffat, A. S., Weinfurter, A. J. & Schwartz, J. D. Towards a new climate diplomacy. *Nat. Clim. Change* **5**, 501–503 (2015).

5. Kuramochi, T. *et al.* Beyond national climate action: the impact of region, city, and business commitments on global greenhouse gas emissions. *Clim. Policy* **20**, 275–291 (2020).

6. Hsu, A. *et al.* ClimActor, harmonized transnational data on climate network participation by city and regional governments. *Sci. Data* **7**, 374–374 (2020).

7. GADM. GADM data. (2025).

8. Schiavina, M., Freire, S. & MacManus, K. GHS-POP R2023A - GHS population grid multitemporal (1975-2030). European Commission, Joint Research Centre (JRC) https://doi.org/10.2905/2FF68A52-5B5B-4A22-8F40-C41DA8332CFE (2023).

9. Kummu, M., Kosonen, M. & Masoumzadeh Sayyar, S. Downscaled gridded global dataset for gross domestic product (GDP) per capita PPP over 1990–2022. *Sci. Data* **12**, 178 (2025).

10. Howard, II, J. P. Phonetic Spelling Algorithm Implementations for *R*. *J. Stat. Softw.* **95**, (2020).

11. CDP. 2023 Full States and Regions Dataset. (2024).

12. Hsu, A., Wang, X., Tan, J., Toh, W. & Goyal, N. Predicting European cities' climate mitigation performance using machine learning. *Nat. Commun.* **13**, 7487 (2022).

13. OSM. OpenStreetMaps. https://www.openstreetmap.org/ (2025).

14. CDP. 2023 City-wide Emissions. (2024).

15. CDP. 2023 Full Cities Dataset. (2024).

16. EUCoM. EU Covenant of Mayors Signatories. https://eu-mayors.ec.europa.eu/en/signatories (2024).

17. Climate Mayors. Climate Mayors Member Cities. https://climatemayors.org/member-cities/ (2024).

18. GCoM. Global Covenant of Mayors for Climate & Energy - Our Cities. https://www.globalcovenantofmayors.org/our-cities/ (2024).

19. Baldi, M., Rios, C. F. de L., Melica, G., Treville, A. & Bertoldi, P. GCoM - MyCovenant, 5th Release - January 2024. (2023).

20. U.S. Climate Alliance. U.S. Climate Alliance Members. https://usclimatealliance.org/members/ (2024).

21. UNFCCC. Global Climate Action Portal. https://climateaction.unfccc.int/ (2024).

22. Ministry of Environment (JPN). Local Government Decarbonization Efforts Status Map. (2024).

23. Institute for Global Decarbonization Progress. China Carbon Neutrality Tracker (CCNT). https://ccnt.igdp.cn/en/action-database (2024).

24. Lang, J. *et al.* Net Zero Tracker. (2024).

25. C40. C40 Cities. https://www.c40.org/cities/ (2024).

26. Hsu, A. *et al.* Performance determinants show European cities are delivering on climate mitigation. *Nat. Clim. Change* **10**, 1015–1022 (2020).

27. Manya-Gutierrez, D., Burley Farr, K., Brown, E., Martin, A. & Hsu, A. Climactor 2.0: A spatialized database of subnational climate pledges and emissions data. UNC Dataverse https://doi.org/10.15139/S3/GGWVVQ (2025).

Online-Only Tables

	Total number of administrative entities	Administrative Levels	Source
Global Administrative Dataset	ADM1 = 2871 ADM2 = 33168 ADM3 = 113175 ADM4 = 52844 Total = 202058	4 (Varies by country)	GADM
Canada	ADM1 = 13 ADM2 = 293 ADM3 = 5161 Total = 5467	3	Statistics Canada (National Statistical Office)
China	ADM1 = 34 ADM2 = 347 ADM3 = 2845 Total = 3226	3	Cheng (2025)
Finland	ADM1 = 20 ADM2 = 310 Total = 330	2	Finnish land surveying agency
Ghana	ADM1 = 16 ADM2 = 261 Total = 277	2	Ghana Statistical Service Microdata Catalogue
United Kingdom	ADM1 = 4 ADM2 = 9 ADM3 = 218 Total = 231	3	ADM1: Office of National Statistics England ADM2: Office of National Statistics Northern Ireland ADM2: University of Edinburgh Datashare ADM3: Office of National Statistics
India -	ADM1 = 36 ADM2 = 733 ADM4 = 139 Total = 908	3 (skips ADM_3)	OSM
Indonesia	ADM1 = 38 ADM2 = 517 ADM3 = 6893 Total = 7448	3	Batas-administrasi-indonesia On GitHub
Iran	ADM1 = 31 ADM2 = 429 Total = 460	2	UN OCHA Humanitarian Data Exchange
Iraq	ADM1 = 18 ADM2 = 101 ADM3 = 294	3	UN OCHA Humanitarian Data Exchange

	Total = 323		
Japan	ADM1 = 47 ADM2 = 1746 Total = 1793	2	ESRI
Kazakhstan	ADM1 = 20 ADM2 = 218 Total = 238	2	UN OCHA Humanitarian Data Exchange
Lithuania	ADM1 = 10 ADM2 = 60 Total = 70	2	European Commission, INSPIRE Geoportal
Malaysia	ADM1 = 16 ADM2 = 160 Total = 176	2	UN OCHA Humanitarian Data Exchange
Morocco	ADM1 = 12 ADM2 = 75 Total = 87	2	UN OCHA Humanitarian Data Exchange
Mozambique	ADM1 = 11 ADM2 = 159 ADM3 = 411 Total = 581	3	UN OCHA Humanitarian Data Exchange
Myanmar	ADM1 = 15 ADM2 = 6 ADM3 = 80 ADM4 = 330 Total = 431	4	Michael Bauer Research
Russia	ADM1 = 85 ADM2 = 2607 Total = 2692	2	Geoportal of the Geodata Center of the National Research University Higher School of Economics
Saudi Arabia	ADM1 = 13 ADM2 = 148 Total = 161	2	GDAM
Sweden	ADM1 = 21 ADM2 = 290 Total = 311	2	National Land Survey of Sweden
Turkey	ADM1 = 81 ADM2 = 972 Total = 1053	2	Republic of Turkey Ministry of National Defense General Directorate of Mapping
United States	ADM1 = 51 ADM2 = 3136 ADM3 = 19476 Total = 22663	ADM1 and 2 from GDAM, ADM 3 from US Census places dataset	United States Census Bureau
Venezuela	ADM1 = 25 ADM2 = 335 ADM3 = 1134	3	UN OCHA Humanitarian Data Exchange

	Total = 1494		
Italy	ADM1 = 20 ADM2 = 107 ADM3 = 7899 Total = 8026	3	Italian National Institute of Statistics
Greece	ADM1 = 8 ADM2 = 13 ADM3 = 74 ADM4 = 332 Total = 427	4	Data from Hellenic Statistical Authority
Latvia	ADM1 = 43 ADM2 = 592 ADM3 = 1378 Total = 2013	3	ESRI's SIA Envirotech group
Argentina	ADM1 = 24 ADM2 = 527 ADM3 = 2084 Total = 2635	3	Datos Argentina
Romania	ADM1 = 42 ADM2 = 3186 Total = 3228	2	Romanian National Agency for Cadastre and Land Registration
Hungary	ADM1 = 20 ADM2 = 175 ADM3 = 3176 Total = 3371	3	European Commission, INSPIRE Geoportal
Spain	ADM1 = 20 ADM2 = 53 ADM3 = 8220 Total = 8293	3	Spanish National Institute of Geography
Czech Republic	ADM1 = 14 ADM2 = 206 ADM3 = 393 ADM4 = 6258 ADM5 = 131 Total = 7002	5	Czech Land Surveying and Cadastral Office
France	ADM1 = 18 ADM2 = 101 ADM3 = 1266 ADM4 = 34875 ADM5 = 45 Total = 36305	5	Republic of France Geoservices Portal
Moldova	ADM1 = 37 ADM2 = 989 Total = 1026	2	OSM (validated against Moldova's Agency for Geodesy, Cartography, and Cadastre)
Ukraine	ADM1 = 27	4	UN OCHA Humanitarian

	ADM2 = 139 ADM3 = 1768 ADM4 = 459 Total = 2393		Data Exchange
Togo	ADM1 = 5 ADM2 = 39 ADM3 = 117 Total = 161	3	Open Data Geoportal of the Republic of Togo
Cameroon	ADM1 = 10 ADM2 = 58 ADM3 = 11 ADM4 = 360 Total = 439	4	Republic of Cameroon Ministry of Forests and Wildlife
Belarus	ADM1 = 7 ADM2 = 118 ADM3 = 1302 Total = 1427	3 (Validated against Belarus's Federal Cadastral Agency)	OSM (2025)

Online Table 1. *Sources of Administrative and Spatial data*

Variable	Description
Actor	
Climactor_id	Actor ID
Entity_type	City, subregion, region, or associations
Name	Default name to use for the actor
Iso	iso-3 for the actor
Orig_id	Original actor ID that came with the datasource, if available
datasource_id	ID of the DataSource the actor came from.
Contextuals: Territory	
climactor_id	Actor ID the territory represents
area	Area in km^2
lat	Latitude of centroid or major landmark multiplied by 10000: - ex. 407494 => latitude 40.7494
lng	Longitude of centroid or major landmark multiplied by 10000: - ex. -739674 => longitude -73.9674
admin_bound	geoJSON of the territory boundary
datasource_id	ID of the DataSource the territory information came from
created	When the row was added to the table
last_updated	When the row was last changed
Contextuals: Population	
climactor_id	Actor ID the territory represents
population	Population in units; - ex. 1000 => 1000 people
population_year	Year of measurement, (YYYY)
datasource_id	ID of the DataSource the territory information came from
created	When the row was added to the table

last_updated	When the row was last changed
Contextuals: GDP	
climactor_id	Actor ID for the economy in question
gdp	GDP
gdp_units	Unit GDP is provided in, including currency if given - ex. Billion USD, GBP
gdp_year	Year of measurement, YYYY
datasource_id	ID of the DataSource the economic information came from
created	When the row was added to the table
last_updated	When this row was last changed
Emissions: EmissionsAgg	
climactor_id	Responsible party for the emissions
inv_year	Year of emissions, YYYY
total_emissions	Integer value of emissions in units (recorded in inv_unit)
inv_unit	Unit of total_emissions. Currently supported: - 'tCO2e': tonnes of CO2 equivalent
inv_scopes	String, including relevant scope numbers combined by "+", similar to formatting for GHG. Scope represented by integers 1, 2, or 3. - Ex. 1+2 - Should match the unique scopes appearing under "scope" in the EmissionsBreakdown
inv_sectors	String, all sectors included in the inventory, combined with "+" similar to process for sectors and scopes: - Possible Options: AFOLU, Buildings, Energy, IPPU, Transportation, Waste, Other - Note: AFOLU = Agriculture, Forestry, and Other Land Use, IPPU = Industrial processes and product use - Should match the unique sectors appearing under "sector" in the EmissionsBreakdown - If creating this from an emissions breakdown, make sure to sort to get the combined list in alphabetical order
ghgs_included	String, type of unique greenhouse gases included in the breakdown - Can be CO2 only, CO2 + other gases, or a

	combination of the gases included in the emissions - ex. CO2+CH4
inv_emissfactor_source	Emission factor source, if available - Emissions factors used to calculate the amount of emissions produced from activity recorded. See IPCC's Emission Factor Database for examples of emissions factors used to calculate emissions from activity recorded
inv_boundary	Administrative and/or geographical boundaries included in the activity and emissions recorded. For subnational actors, this corresponds to whether emissions cover CommunityWide emissions or only emissions from MunicipalOperations; for companies and facilities, this corresponds to the set of business units/functions covered by the emissions - Possible Values: Same, Smaller, Larger
inv_boundary_desc	Includes any details from the data provider to describe the administrative and/or geographic boundary of the emissions inventory. Required if inv_boundary is designated as smaller or larger
inv_gwp_source	Source of GWP. If available, different time horizons are used to calculate the global warming potentials of non-CO2 greenhouse gases. Can be gwp20, gwp100, or gwp500
inv_method	methodology used to estimate inventory
inv_url	URL link to emissions inventory if available
inv_comments	any comments or description associated with aggregate emissions
datasource_id	ID of the DataSource this emissions information came from
created	When the row was added to the table
last_updated	When the row was last changed
Emissions: EmissionsBreakdown	
climactor_id	Responsible party for the emissions
inv_year	Year of emissions, YYYY
emissions_value	emissions value for given breakdown, in units (recorded in inv_unit)
inv_unit	Unit of emissions_value. Currently supported: - 'tCO2e': tonnes of CO2 equivalent
scope	String, including relevant scope numbers combined by "+", similar to formatting for GHGs. Scope represented by integers 1, 2, or 3. - ex. 1+2

sector	The sector for the emissions - Possible Options: AFOLU, Buildings, Energy, IPPU, Transportation, Waste, Other - Note: AFOLU = Agriculture, Forestry, and Other Land Use, IPPU = Industrial processes and product use - Assign Other if it is not possible to categorize in one of the above options - If multiple, combined with "+" similar to process for sectors and scopes
subsector	Due to different reporting frameworks, include as closely as possible to the original language provided by the data source
ghgs_included	String, Type of unique greenhouse gases included in the breakdown, can be CO2 only, CO2 + other gases, or a combination of the gases included in the emissions - ex. CO2+CH4
comment	any additional comments or description associated with breakdown, as provided by the data source
datasource_id	ID of the DataSource the emission information came from
created	When the row was added to the table
least_updated	When the row was last changed.
Targets	
climactor_id	The Actor responsible for the target
target_type	The type of target; used in exact-match comparisons by software. An open vocabulary, but the following values are widely used: - "Peak of carbon emissions": A goal to reach a peak of carbon emissions, after which emissions will begin going down. Peak value is given as the target value - "Relative emission reduction": A reduction in emissions versus baseline year. Percentage is the typical unit - "Absolute emission reduction": An absolute reduction in emissions. Despite the name, both tonnes of CO2 equivalent and percentage versus baseline value are used - "Carbon intensity reduction": reducing the amount of CO2 equivalent produced relative to economic output, such as GDP or revenue. Typically measured in percent - "Net zero target": cutting greenhouse gas emissions to as close to zero as possible, with any remaining emissions re-absorbed from the atmosphere, including by oceans and forests (UN, 2023). Targets similar to net zero targets, such as carbon neutrality targets, zero emission targets, zero carbon targets, are all included in 'Net zero targets', but the scope is labeled in target_GHG variable.

target_year	Year of completion, YYYY. Targets may have year values in the past for historical targets
target_unit	Unit of the target value. Current units supported are: - 'tCO2e': tonnes of CO2 equivalent - 'percent': percentage reduction
target_value	Value of the target. This is delimited in units by target_unit
target_boundary	Administrative and/or geographical boundaries included in the activity and emissions recorded. For subnational actors, this corresponds to whether emissions cover CommunityWide emissions or only emissions from MunicipalOperations; for companies and facilities, this corresponds to the set of business units/functions covered by the emissions - Possible Options: Same, Smaller, Larger
target_boundary_desc	Includes any details from the data provider to describe the target boundary. Required if target_boundary is designated as smaller or larger
target_scopes	String, including relevant scope numbers combined by "+", similar to formatting for GHGs. Scope represented by integers 1, 2, or 3. - Ex. 1+2
target_gases	String, type of unique greenhouse gases included in the breakdown, can be CO2 only, CO2 + other gases, or a combination of the gases included in the emissions (E.g., CO2+CH4)
target_sectors	Sector that the target applies to - Possible Options: AFOLU, Buildings, Energy, IPPU, Transportation, Waste, Other - Note: AFOLU = Agriculture, Forestry, and Other Land Use, IPPU = Industrial processes and product use - Assign Other if it is not possible to categorize in one of the above options - If multiple, combined with "+" similar to process for sectors and scopes
baseline_year	Year of comparison, YYYY. If the baseline year and target year are identical, the target is against "business as usual" or "BAU", that is, what would or could happen if no mitigation effort was attempted
baseline_value	Value of comparison. Units are the same as target_unit
baseline_unit	Unit of the baseline value
target_url	URL of a human-readable document on the target
target_summary	Short English summary of the target

target_comments	Comments or description of the emissions covered (gases, scopes, sectors) provided by the data source
datasource_id	ID of the DataSource the sector information came from
created	When the row was added to the table. Not necessarily publication date; see the DataSource for that metadata
last_updated	When the row was last changed. Not necessarily publication date; see the DataSource for that metadata.
Plan	
climactor_id	The Actor responsible for the plan
plan_type	Notated as either 'Mitigation', 'Adaptation', 'Integrated', 'Energy', or 'Other'
plan_name	Name of the plan
plan_adoption_year	Year of plan adoption
plan_end_year	If available, the last year that the plan covers
plan_boundary	Administrative and/or geographic boundary covered by the plan in relation to the actor. Options: 'Same', 'Smaller', 'Larger'
plan_boundary_desc	Includes details from the data provider to describe the plan boundary. Required if plan_boundary is designated as smaller or larger
plan_url	Publicly accessible link to plan if available
plan_comments	Comments or descriptions related to the plan, as provided by the data source
datasource_id	ID of the DataSource the plan information came from
DataSource	
datasource_id	Unique identifier for the data source: - publisher id: <series identifier>:<publication year> - ex. CDP:Regions:2024
publisher_id	Identifier for the Publisher of the data source - ex. "CDP"
series_id	Identifier for the specific publication series - ex. "Regions", for CDP Regions
publication_date	Date of publication of the upstream document or dataset - This can be long before the data was imported to OpenClimate. - ex. "01-01-2024"
publication_year	4-digit year of publication only

URL	URL of the upstream data source - Preferably the document that describes or links to the data set, not the artifact itself
created	When the row was added to the table.
last_updated	When the row was last changed.

Online Table 2. *Description of files and variables*