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Data Descriptor

Weekly Dengue Incidence Linked to Meteorological Variables at City, Regional, and Multi-Setting Scales

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Abstract

Dengue is a leading vector-borne disease in tropical regions, and its seasonal dynamics are shaped by rainfall, temperature, and atmospheric moisture. Despite growing research on climate–dengue relationships, resources that align weekly dengue surveillance with meteorological observations across several spatial scales remain limited. We present an integrated dataset comprising 11,120 week-level records at three scales: Quezon City, 17 Philippine administrative regions, and eight dengue-endemic settings. The city component includes NASA GPM IMERG rainfall, ERA5-Land temperature, relative humidity, surface pressure and derived specific-humidity measures, together with available PAGASA reference series. The regional component pairs Department of Health dengue counts with CHIRPS v2 rainfall data sourced from HDX, and ECMWF ERA5-Land temperature and derived specific humidity. The multi-setting component combines OpenDengue case series with IMERG and ERA5-Land rainfall, ERA5-Land temperature and specific humidity, and MERRA-2 temperature and specific humidity. A fifteen-stage validation workflow examined structure, coverage, physical domains, data-quality flags, external and cross-product agreement, year-specific stability, cross-scale representativeness, and lagged dengue–environment associations. In Quezon City, IMERG rainfall showed moderate agreement with the available PAGASA rainfall series, while ERA5-Land temperature and humidity variables showed stronger concordance with PAGASA observations. Cross-product rainfall agreement varied across settings, showing how product choice and spatial support influence environmental summaries. The dataset provides a harmonized resource for exploratory climate–dengue analysis, comparative environmental assessment, and methodological development.

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1. Summary

Dengue is a leading vector-borne disease in tropical and subtropical regions. The World Health Organization (WHO) reported that global incidence has risen over recent decades, with billions of people now living in areas conducive to transmission [1–3]. The principal vectors, *Aedes aegypti* and *Aedes albopictus*, thrive in environments where rainfall patterns create and sustain larval habitats, making rainfall one of the primary drivers of transmission risk [4]. Within Southeast Asia, the Philippines bears a disproportionate burden as a hyperendemic setting that exports dengue internationally [5–7], routinely recording some of the highest case volumes nationally in the region [2]. Although timely outbreak detection is essential for containment and resource deployment, most modeling studies of climatic predictors of dengue require technical capacity beyond the operational resources of public health systems. This friction pushes practitioners toward arbitrary thresholds, with outbreak definitions varying by jurisdiction [8].

The environmental predictors selected for this dataset have been extensively evaluated due to their established associations with the dynamics of vector-borne transmission [9,10]. Rainfall remains a central environmental covariate because it directly affects the availability and persistence of aquatic Aedes habitats. While temperature and humidity also influence mosquito development, survival, biting activity, and viral incubation, their effects can interact with rainfall over time [11]. The dataset therefore includes temperature, relative humidity, surface pressure, and specific humidity where these variables were available from the source products. Retaining these measurements at weekly resolution permits rainfall–dengue analyses while also supporting multivariable and lagged environmental assessments.

Although dengue case data have been compiled into structured repositories, few, if any, link case records with concurrent climate measurements [12,13]. Global reporting through WHO channels typically operates at an annual national or jurisdiction-level resolution, which is too coarse for sub-seasonal modeling [3]. OpenDengue [12] offers the broadest multi-country coverage of standardized case series to date. However, it does not bundle environmental covariates, leaving researchers to independently locate, process, and temporally align meteorological inputs. This gap is most acute in countries such as the Philippines, where dengue surveillance data must be manually extracted from weekly reports or formally requested from health authorities. National totals are additionally compromised by reporting delays and gaps that preclude use at finer scales [14]. The result is a persistent shortage of standardized, multi-resolution datasets suited to comparing detection methods across settings.

Parallel barriers exist for climate data. Across much of the Global South, meteorological data remain inaccessible for research and/or civilian use, subject to bureaucratic delays, institutional fees, or restrictions on redistribution [15,16]. Research institutions in these regions also have fewer resources and frequently operate with fewer funding opportunities compared to the Global North, further limiting data acquisition. Even when available, these climate series are susceptible to technical inaccuracies and are constrained by sparse historical reference data. While satellite-derived products have lowered entry barriers, many public health systems still lack the technical capacity required to extract, interpret, and operationalize these inputs [15–17]. These constraints collectively impede methodological developments linking climate science and public health. And in the context of the ongoing worsening effects of climate change, this data disparity leaves a widening gap between regions in their capacity for evidence-based adaptation and mitigation.

To help address this, we present a dataset pairing dengue surveillance records with weekly meteorological variables at three progressively broader spatial levels: a single high-density city (Quezon City), all 17 Philippine administrative regions, and eight dengue-

endemic settings. The resource spans up to 16 years of weekly observations and includes rainfall, temperature, humidity-related measures, and surface pressure according to source availability. Barangay- and regional-level spatial files for Quezon City and the Philippines are included for geographic analysis. Combining the three scales in one release lowers the preprocessing burden for comparative climate–dengue research while preserving source-specific variable names and quality flags. The dataset provides a documented input resource for exploratory epidemiology, comparative environmental analysis, and method development [18].

2. Data Description

The complete dataset is publicly available at a Github and Zenodo repository (see Data Availability section) and released in Microsoft Excel (.xlsx) and geopackage (.gpkg) formats.

2.1. Primary Dataset

The primary Microsoft Excel workbook (Dengue_Environmental Vars_Dataset.xlsx) contains 11,120 week-level data records, together with a Dataset Summary sheet and a Data Dictionary sheet. The three analytical sheets contain 832 Quezon City records, 7072 regional records, and 3216 multi-setting records. The current workbook has 24 columns in QC Data, 9 in Regional Data, and 15 in Multi-Setting Data because the environmental variables and their quality flags are retained alongside the dengue and rainfall fields. Variable-level definitions, source information, units, and coverage notes are provided in the Data Dictionary and summarized in Table 1.

Table 1. Surveillance and environmental variables included in Dengue_Environmental Vars_Dataset.xlsx.

Variable Group	QC Data	Regional Data	Multi-Setting Data	Primary Source or Note
Dengue cases	DC_QC	DC_DOH	DC_OPENDENGUE	QCESD/PIDSR; DOH; OpenDengue
Rainfall	RF_NASA; RF_PAGASA	RF_HDX	RF_NASA; RF_ERA5-Land	IMERG; PAGASA; CHIRPS/HDX; ERA5-Land
Temperature	Temp_ERA5-Land; TempMax_ERA5-Land; TempMin_ERA5-Land; Temp_PAGASA	Temp_ERA5-Land	Temp_ERA5-Land; Temp_MERRA2; TempMax_MERRA2; TempMin_MERRA2	ERA5-Land; PAGASA; MERRA-2
Relative humidity	RH_ERA5-Land; RHMax_ERA5-Land; RHMin_ERA5-Land; RH_PAGASA	Not supplied	Not supplied	ERA5-Land and PAGASA in QC
Specific humidity	SH_ERA5-Land; SH_PAGASA	SH_ERA5-Land	SH_ERA5-Land; SH_MERRA2	ERA5-Land; PAGASA-derived; MERRA-2
Surface pressure	Pressure_ERA5-Land	Not supplied	Not supplied	ERA5-Land QC series
Quality flags	COVID; rainfall support; plausibility; pressure/SH gap	Decadal approximation; plausibility	Rainfall support; terminal gap; MERRA-2 SH coverage	Data Dictionary

Table 2 presents representative example records from the QC data sheet, showing dengue case counts alongside selected environmental variables and their associated quality flags.

Table 2. Example records from the QC data sheet showing dengue and selected environmental variables.

YR	WN	DC_QC	RF_NASA	Temp_ERA5-Land	RH_ERA5-Land	SH_ERA5-Land
2010	1	15	5.719	25.471	77.429	15.753
2010	2	35	16.375	24.843	75.571	14.811
2010	3	38	8.327	24.486	76.857	14.696
2010	4	22	9.109	24.571	73.571	14.113

2.2. Spatially Aggregated Case Data

Dengue case counts were aggregated at barangay and regional levels for spatial visualization. For Quezon City, monthly dengue case counts were aggregated by barangay across the full temporal coverage (2010–2025). For the regional-level analysis, monthly case counts were aggregated across the 17 administrative regions for two periods: 2016–2019 (pre-pandemic) and 2022–2025 (post-pandemic).

These aggregated files are available in the repository for geographic visualization and exploratory spatial analysis. The associated geopackage ("DC_Regional-Brgy.gpkg") contains polygon features representing barangay and regional boundaries, with attributes for dengue case counts and summary statistics (e.g., mean values over the study period). The geopackage includes the following field values spread across two separate shapefiles.

The first shapefile named "QC_Brgy.shp" contains the following fields:

ADM4_PCODE: Area-specific code based on the PSGC of the PSA [19].
BRGY: Name of barangay in Quezon City.
DC_YEAR: Number of reported dengue cases by year, per barangay.
DC_MEAN: Average number of cases per barangay from 2010 to 2025.

The second shapefile named "PH_Regions-DC.shp" contains the following fields:

ADM1_PCODE: Area-specific code based on the PSGC of the PSA [19].
Region: Name of the administrative region.
DC_YEAR: Number of reported dengue cases by year, per region.
DC_MEAN: Average number of dengue cases per region from 2016 to 2019 and 2022 to 2025.

Corresponding yearly case totals in comma-separated value format, together with representative data extracts and choropleth maps of mean case counts, are provided in Appendix A.

3. Methods

3.1. Primary Dataset

3.1.1. QC Data

Weekly dengue case counts for Quezon City over 2010–2025 (832 weekly records) were obtained from the Quezon City Epidemiology and Surveillance Division (QCESD) through the Philippine Integrated Disease Surveillance and Response system [20]. Daily rainfall was sourced from NASA GPM IMERG Final Run v07 at 0.1° × 0.1° spatial resolution [21,22] using the grid cell nearest the Quezon City centroid. The QC sheet also contains mean, daily-maximum, and daily-minimum temperature; mean, daily-maximum, and daily-minimum relative humidity; and surface pressure sourced from ECMWF ERA5-Land at 0.1° × 0.1° spatial resolution via the Open-Meteo Historical Weather API [23,24]. Available PAGASA series were used as external references for rainfall and station meteorology. RF_PAGASA covers 260 weeks, while PAGASA temperature and relative humidity series cover 352 weeks.

3.1.2. Regional Data

Regional dengue incidence for the 17 Philippine administrative regions was obtained from the Department of Health through Freedom of Information request 2026-031, released

30 January 2026 [25]. Regional rainfall was obtained from the Philippines Subnational Rainfall dataset hosted on HDX [26], which provides area-weighted CHIRPS v2 precipitation at a decadal resolution. Weekly ERA5-Land temperature and specific humidity were included for each region [27]. The regional component therefore contains three meteorological series: RF_HDX, Temp_ERA5-Land, and SH_ERA5-Land. For cross-product validation, the aggregated Philippine RF_HDX series was compared with independently generated setting-level IMERG and ERA5-Land rainfall series.

3.1.3. Multi-Setting Data

Multi-setting dengue data were obtained from OpenDengue, which harmonizes public surveillance series from multiple reporting systems [12]. Eight dengue-endemic settings with weekly case data from 2016 onward were included: Brazil, Colombia, Mexico, Peru, the Philippines, Singapore, Sri Lanka, and Taiwan [28,29]. The environmental component includes NASA GPM IMERG and ERA5-Land rainfall; ERA5-Land temperature and specific humidity; and NASA MERRA-2 temperature and specific humidity at a 3 h temporal and 0.5° × 0.625° spatial resolution [22,27,30]. For gridded setting-level products, values were summarized over the land polygon using area weighting and then aligned to the weekly index.

3.1.4. Data Processing and Harmonization

Raw climate data at daily and 3-hourly resolutions were summarized into daily and weekly blocks for consistent alignment with the surveillance series. To ensure robust temporal aggregation of humidity levels, relative humidity from both ERA5-Land and PAGASA was converted to specific humidity, following Bolton's 1980 refinement of the Magnus-Tetens formulation [31,32]. The processed data were then imported and harmonized in R using the tidyverse and readxl packages [33]. The workbook uses a 52-block within-year weekly index, with WN stored as an integer from 1 to 52. This convention follows the Dataset Summary and the observed workbook structure and is used consistently in the validation report. Daily rainfall totals were summed within weekly blocks, while temperature, humidity, and surface pressure variables were summarized as weekly means; daily high and low columns represent the weekly mean of daily maxima or minima. CHIRPS decadal totals were proportionally allocated across constituent days before weekly summation. Missing environmental values were not imputed. Anomalous MERRA-2 specific-humidity values were removed before aggregation, and weeks with low valid-day coverage are identified by a dedicated flag. Rainfall is expressed in millimeters per week, temperature in degrees Celsius, relative humidity in percent, surface pressure in hectopascals, and specific humidity in grams per kilogram.

3.2. Environmental Data Extraction and Spatial Aggregation

Environmental variables were kept at the original spatial resolution of their source products. For Quezon City, IMERG and the ERA5-Land variables use a single grid-cell or point extraction near the city centroid. At the regional scale, CHIRPS/HDX and ERA5-Land values represent regional aggregates. To extract environmental summaries for each land-based setting, exact administrative land polygons (shapefiles) were utilized for the high-resolution IMERG and ERA5-Land products (0.1° × 0.1°). The coarser spatial resolution of the MERRA-2 series (0.5° × 0.625°) introduced potential boundary artifacts and the exclusion of grid cells along irregular borders. To address these spatial constraints, bounding box polygons were derived from each setting's maximum and minimum coordinate points. Coordinate boundaries for each setting were tightly defined around the setting's primary landmass to minimize the inclusion of open ocean grid cells. This approach ensured that the

extraction area sufficiently encapsulated the cells representative of each setting. All products utilized setting-wide area-weighted summaries. Product source and spatial support are recorded explicitly in the variable names, metadata, and quality flags.

3.3. Temporal Disaggregation of CHIRPS Regional Data

Regional rainfall (RF_HDX) was obtained as 10-day CHIRPS v2 totals through HDX. To align these totals with the weekly surveillance index, each decade was divided equally across its constituent days, and the resulting daily allocations were summed into weekly blocks. This temporal disaggregation assumes uniform rainfall within each decade, and all Regional Data rows carry FLAG_DEKADAL_APPROX = 1. The resulting RF_HDX series preserves the source decadal totals while aligning rainfall with the weekly surveillance data. Its agreement with independently generated weekly rainfall products is evaluated in the Section 4.

3.4. Cross-Source and External Validation Framework

Validation distinguished external-reference comparisons from cross-product concordance. In Quezon City, available PAGASA rainfall, temperature, and relative-humidity observations were compared with the corresponding IMERG or ERA5-Land series. SH_PAGASA was derived using PAGASA temperature and relative humidity together with ERA5-Land pressure. At the multi-setting scale, IMERG rainfall was compared with ERA5-Land rainfall, and ERA5-Land temperature and specific humidity were compared with MERRA-2. At the Philippine scale, the unweighted mean of the 17 regional CHIRPS/HDX rainfall series was compared with setting-level IMERG and ERA5-Land rainfall. Agreement was quantified using Pearson correlation, Spearman correlation, mean bias, mean absolute error, root mean square error, Lin's concordance correlation coefficient, Nash–Sutcliffe efficiency, Kling–Gupta efficiency, Bland–Altman limits, and linear-regression R-squared where applicable. Year-specific and leave-one-year-out analyses summarized how source agreement varied across the observed years.

3.5. Use of Artificial Intelligence

Generative artificial intelligence was used during manuscript revision through ChatGPT 5.5 (OpenAI) for language editing, structural review, and methodological cross-checking. Google Gemini was also utilized for technical troubleshooting of codes used in extracting data via Google Earth Engine. Neither tool was used to generate or alter source data or to execute the reported statistical analyses. All revised text, analytical outputs, interpretations, citations, and submission decisions were reviewed by the authors, who retain responsibility for the final manuscript.

4. Technical Validation

Technical validation was conducted with a version-controlled R workflow and consolidated in environmental_validation_report.xlsx. The fifteen-stage workflow covers: environmental-variable inventory and metadata checks (Stage 1); structure, year coverage, and weekly completeness (Stage 2); environmental-variable coverage and MERRA-2 humidity coverage (Stage 3); duplicate and temporal-key checks (Stage 4); physical and epidemiological value domains (Stage 5); ordering, derived-variable consistency, and pressure-gap checks (Stage 6); flag-domain and flag-rule verification (Stage 7); dengue plausibility screening (Stage 8); Quezon City cross-source comparisons (Stage 9); multi-setting cross-product comparisons (Stage 10); year-specific agreement (Stage 11); leave-one-year-out stability checks (Stage 12); cross-scale representativeness checks (Stage 13); lagged dengue–environment associations (Stage 14); and best-lag, source-pair, and manifest checks

(Stage 15). Together, these stages provide separate checks of structural integrity, environmental coverage, product agreement, temporal stability, spatial representativeness, and epidemiological coherence.

4.1. Dataset Structure and Row Reconciliation

The QC dataset contains 832 year-week records spanning 2010–2025, the Regional dataset contains 7072 records across 17 Philippine regions, and the Multi-Setting dataset contains 3216 records across eight settings. Under the workbook's 52-block convention, QC Data has 16 geography-years and exactly 832 expected records, while Regional Data has 136 observed geography-years and exactly 7072 expected records. Multi-Setting Data has 62 observed setting-years, corresponding to 3224 expected records at 52 weeks per setting-year; 3216 are present, leaving eight structurally absent week rows. Total observed records across the three analytical sheets total 11,120. These figures are summarized in Table 3.

Table 3. Dataset structure and row reconciliation under the 52-block weekly convention.

Dataset	Rows	Columns	Observed Geography-Years	Expected Rows at 52 Weeks	Missing Week Rows	Geographic Units
QC Data	832	24	16	832	0	1 city
Regional Data	7072	9	136	7072	0	17 regions
Multi-Setting Data	3216	15	62	3224	8	8 settings
Total	11,120	—	—	—	—	—

Note: Column counts reflect all surveillance, environmental, and flag variables in the released workbook. Expected rows are calculated as 52 weekly blocks for each observed geography-year.

4.2. Cell-Level Completeness

Completeness was evaluated separately for core surveillance fields and for optional or source-limited environmental variables. The primary dengue and principal gridded meteorological fields are complete within observed rows for their stated components, but environmental reference and derived fields have variable-specific coverage. In QC Data, RF_NASA, temperature, and relative humidity fields are complete across all 832 rows; Pressure_ERA5-Land and SH_ERA5-Land are available for 819 rows (98.4%), RF_PAGASA for 260 rows (31.3%), and the PAGASA temperature and humidity series for 352 rows (42.3%). Regional RF_HDX, Temp_ERA5-Land, and SH_ERA5-Land have complete coverage across all 7072 rows. In Multi-Setting Data, the principal IMERG, ERA5-Land, and MERRA-2 temperature variables are complete across 3216 rows, while SH_MERRA2 is observed in 3007 rows (93.5%) because corrupted source values were excluded before aggregation. Table 4 summarizes these coverage patterns.

4.3. Structural Year Coverage

Structural year coverage was evaluated against each geography's observed span. QC Data has uninterrupted annual coverage from 2010 to 2025. All 17 Philippine regions contain records for 2016–2019 and 2022–2025, with 2020 and 2021 absent across the regional component. Multi-setting coverage is heterogeneous: Brazil, Mexico, and Peru span 2016–2023 with 2020 absent; Colombia spans 2016–2023 with 2019 and 2020 absent; the Philippines spans 2016–2023 with 2021 absent; Singapore spans 2016–2025 without a missing year; and Sri Lanka and Taiwan span 2016–2024 without a missing year within those stated spans.

Table 4. Environmental-variable coverage in the released workbook.

Component	Environmental Variables	Coverage	Coverage Note
QC gridded/reanalysis	RF_NASA; Temp_ERA5-Land; TempMax/Min_ERA5-Land; RH_ERA5-Land; RHMax/Min_ERA5-Land	100%	Single 0.1° × 0.1° ERA5-Land and IMERG grid cell nearest to QC administrative centroid (14.65° N, 121.05° E); applies to all 832 Quezon City week-level records
QC source-limited fields	Pressure_ERA5-Land and SH_ERA5-Land: 819/832; RF_PAGASA: 260/832; PAGASA temp/RH-derived fields: 352/832	98.4%; 31.3%; 42.3%	ERA5-Land fields (Pressure, SH): same QC centroid cell (14.65° N, 121.05° E), partial weeks only. RF_PAGASA and derived fields: single PAGASA synoptic station point observation within Quezon City; gaps reflect the on-hand station record availability, not temporal gaps
Regional	RF_HDX; Temp_ERA5-Land; SH_ERA5-Land	100% of 7072 rows	RF_HDX disaggregated from CHIRPS v2 0.05° decadal totals; ERA5-Land fields at 0.1° area-weighted over each regional extent
Multi-Setting	RF_NASA; RF_ERA5-Land; Temp_ERA5-Land; SH_ERA5-Land; MERRA-2 temperature fields	100% of 3216 rows	Setting-wide land-polygon area-weighted means for each dengue-endemic setting; RF_NASA and ERA5-Land fields at 0.1° × 0.1°; Bounding box polygon was used for the area-weighted mean for MERRA-2 temperature fields at 0.5° × 0.625°
Multi-Setting SH_MERRA2	SH_MERRA2	3007/3216 (93.5%)	Bounding box polygon for the area-weighted mean of MERRA-2 specific humidity fields at 0.5° × 0.625°

4.4. Structural Week Completeness

Weekly completeness was assessed against the workbook's 52-block convention. QC Data is complete for all 16 years, and every observed region-year in Regional Data contains 52 weekly records. Eight structurally absent rows occur in Multi-Setting Data: Philippines 2022 weeks 51–52, Philippines 2023 weeks 46–50, and Sri Lanka 2023 week 52. Philippines 2023 weeks 51–52 are present in the workbook but carry FLAG_TERMINAL_GAP = 1 because they occur at the terminal reporting boundary. Structural absence and boundary flagging are therefore reported separately. These structurally absent rows are listed in Table 5.

4.5. Duplicate Record Validation

Duplicate-key detection used Year + Week for QC Data, Region + Year + Week for Regional Data, and Setting + Year + Week for Multi-Setting Data. No duplicate composite keys were detected.

Table 5. Structurally absent weekly rows under the 52-block convention.

Dataset	Setting	Year	Missing Week(s)	Interpretation
Multi-Setting Data	Philippines	2022	51–52	Structurally absent rows
Multi-Setting Data	Philippines	2023	46–50	Structurally absent rows; weeks 51–52 are present but terminally flagged
Multi-Setting Data	Sri Lanka	2023	52	Structurally absent row

4.6. Value-Domain Validation

Environmental and dengue values were screened against broad physical and data-domain rules. Dengue counts were non-negative. Rainfall, temperature, relative humidity, pressure, and specific humidity values remaining after source cleaning fell within the validation bounds defined in the workflow. The bounds were used to screen for impossible or clearly erroneous values. Derived-variable ordering and internal relationships were also checked where applicable.

4.7. Schema and Type Verification

Column presence, data types, weekly-index bounds, and metadata consistency were checked before analysis. WN is stored as an integer from 1 to 52 in all analytical sheets. Validation of structural completeness therefore follows the Dataset Summary's 52-block convention. The environmental validation audit also identified metadata items that should be synchronized in the release package, including use of SETTING in the Multi-Setting Data sheet, inclusion of RF_PAGASA in the variable dictionary, and consistent wording for the weekly-index convention.

4.8. Temporal Validity and Epidemiological Plausibility Checks

Year and week values were checked against the declared temporal coverage, and no out-of-range weekly indices were identified under the 1–52 convention. Week-over-week dengue changes exceeding 500% were used as an epidemiological plausibility screen. The comparison logic prevents multi-year structural gaps from generating artificial jumps. The recalculated screen identified no QC rows, six Regional rows, and twelve Multi-Setting rows that exceeded the threshold. These observations were retained for source review. The released row-level FLAG_PLAUSIBILITY field is retained in QC Data and Regional Data, consistent with the current workbook schema.

4.9. Cross-Scale Descriptive Summaries

Descriptive summaries were generated for dengue incidence and the available environmental variables by year, geography, and weekly block. These outputs permit direct review of seasonal rainfall, temperature, humidity, pressure, and specific-humidity patterns alongside dengue counts. The lagged association analyses described below use the same within-year weekly alignment and do not bridge structural gaps between calendar years.

4.10. Data Quality Flags

Data quality fields were checked for valid binary domains and for consistency with rules that can be independently recomputed from the weekly workbook. Table 6 summarizes the flag set and its interpretation.

Seven data-quality flag types are used across the three analytical sheets:

- FLAG_COVID = 1 for QC Data records in 2020–2021, identifying a period in which dengue transmission and surveillance were affected by the COVID-19 pandemic.
- FLAG_DEKADAL_APPROX = 1 for every Regional Data row because RF_HDX is reconstructed from decadal CHIRPS totals by proportional temporal allocation.
- FLAG_SINGLE_CELL_RF = 1 is the rainfall spatial-support flag retained in QC Data and Multi-Setting Data. In QC Data, it denotes the single IMERG centroid grid cell; in Multi-Setting Data, it denotes the setting-wide area-weighted rainfall summary.
- FLAG_TERMINAL_GAP = 1 identifies Multi-Setting rows that are present at the terminal boundary of reporting but may be incomplete. In the current workbook, this flag is set for Philippines 2023 weeks 51–52.

- FLAG_PLAUSIBILITY = 1 in QC Data or Regional Data when the recalculated week-over-week dengue change exceeds the 500% advisory threshold under the year-gap guard.
- FLAG_PRESSURE_SH_GAP = 1 for QC weeks from 2025 week 40 onward, where the ERA5-Land surface-pressure feed ends and Pressure_ERA5-Land and SH_ERA5-Land are left missing rather than estimated.
- FLAG_MERRA2_SH_LOW_COVERAGE = 1 in Multi-Setting Data when fewer than four of seven source days contributed a valid MERRA-2 specific-humidity value. Weeks with no valid source day have SH_MERRA2 and the flag recorded as missing. The flag occurs most frequently in Singapore and Taiwan.

Table 6. Data quality flags and validation status.

Flag	QC Data	Regional Data	Multi-Setting Data
FLAG_COVID	2020–2021 rows	Not applicable	Not applicable
FLAG_DEKADAL_APPROX	Not applicable	All rows	Not applicable
FLAG_SINGLE_CELL_RF	All rows: QC centroid support	Not applicable	All rows: setting-wide rainfall support
FLAG_TERMINAL_GAP	Not applicable	Not applicable	Philippines 2023 weeks 51–52
FLAG_PLAUSIBILITY	Recomputed; no QC threshold exceedance	Recomputed; 6 threshold exceedances	Not carried as a row-level field in current sheet
FLAG_PRESSURE_SH_GAP	13 rows from 2025-W40 onward	Not applicable	Not applicable
FLAG_MERRA2_SH_LOW_COVERAGE	Not applicable	Not applicable	279 low-coverage rows; 209 SH_MERRA2 values missing

The validation distinguishes a structural or metadata rule, which can be confirmed from workbook organization, from a rule that requires unavailable daily source information for full independent recalculation.

4.11. Regional Cross-Product Rainfall Concordance

Regional CHIRPS/HDX rainfall was assessed at an aggregated Philippine scale against independently generated weekly rainfall products. Across 305 overlapping weeks in the primary analytic period, the unweighted mean of the 17 regional RF_HDX series correlated with the Philippines IMERG setting mean at Pearson r = 0.804 and Spearman rho = 0.813, with mean bias of 0.828 mm/week, MAE of 13.976 mm/week, RMSE of 18.670 mm/week, and CCC of 0.793. Against the Philippines ERA5-Land rainfall series, the corresponding values were Pearson r = 0.796, Spearman rho = 0.793, mean bias of −4.952 mm/week, MAE of 13.922 mm/week, RMSE of 18.011 mm/week, and CCC of 0.782. These comparisons demonstrate broad temporal concordance between the aggregated CHIRPS/HDX series and the two independent rainfall products. These results are summarized in Table 7.

Table 7. Regional CHIRPS/HDX rainfall concordance with independent setting-level rainfall products.

Comparison	N Weeks	Pearson r	Spearman Rho	Bias A − B (mm/wk)	MAE	RMSE	CCC
Mean 17 regional CHIRPS/HDX vs. Philippines IMERG	305	0.804	0.813	0.828	13.976	18.670	0.793
Mean 17 regional CHIRPS/HDX vs. Philippines ERA5-Land rainfall	305	0.796	0.793	−4.952	13.922	18.011	0.782

4.12. Quezon City External-Reference Meteorological Agreement

The available PAGASA series provides the external observational reference in the workbook. Across all overlapping weeks, IMERG rainfall showed moderate agreement with RF_PAGASA (N = 260, Pearson r = 0.639, Spearman rho = 0.624, CCC = 0.594). Agreement was stronger for ERA5-Land temperature (N = 352, r = 0.852, CCC = 0.717) and relative humidity (N = 352, r = 0.911, CCC = 0.825). Specific humidity showed the highest concordance (r = 0.954; CCC = 0.947, respectively). Table 8 reports the full error and agreement metrics.

Table 8. Quezon City cross-source environmental agreement with available PAGASA reference series.

Comparison	N	Pearson r	Spearman Rho	Bias A − B	MAE	RMSE	CCC
IMERG rainfall vs. PAGASA rainfall	260	0.639	0.624	2.469 mm/wk	38.526	64.036	0.594
ERA5-Land temperature vs. PAGASA temperature	352	0.852	0.849	−0.806 C	0.958	1.103	0.717
ERA5-Land relative humidity vs. PAGASA RH	352	0.911	0.918	3.672%	4.539	5.279	0.825
ERA5-Land specific humidity vs. PAGASA-derived	352	0.954	0.903	−0.031 g/kg	0.490	0.622	0.947

Note: Comparisons use the weeks available in both source series. SH_PAGASA is calculated from PAGASA temperature and relative humidity together with ERA5-Land pressure.

4.13. Multi-Setting Cross-Product Environmental Validation

Independent gridded-product comparisons were evaluated within each setting over the primary analytic years. IMERG versus ERA5-Land rainfall agreement was heterogeneous: setting-specific Pearson correlations ranged from 0.027 to 0.937, with a median of 0.669, while CCC ranged from 0.018 to 0.936. Agreement was strongest in Brazil and Mexico and weak in Peru and Sri Lanka. ERA5-Land versus MERRA-2 temperature was more consistent, with Pearson r from 0.823 to 0.998 and a median of 0.952, although level differences remained in several settings. Specific humidity also varied by setting; after restricting MERRA-2 to weeks with adequate source-day coverage, Pearson r ranged from 0.036 to 0.977 with a median of 0.795. Table 9 summarizes the setting-level cross-product and retrospective stability results for rainfall, temperature, and specific humidity.

Table 9. Multi-setting cross-product agreement and retrospective temporal-stability summary.

Variable	Product Pair	Median Pearson r (Range)	Median CCC (Range)	Median LOYO R-Squared (Range)
Rainfall	IMERG vs. ERA5-Land	0.669 (0.027 to 0.937)	0.644 (0.018 to 0.936)	0.404 (−0.017 to 0.866)
Temperature	ERA5-Land vs. MERRA-2	0.952 (0.823 to 0.998)	0.754 (0.343 to 0.987)	0.880 (0.631 to 0.996)
Specific humidity	ERA5-Land vs. MERRA-2, adequate-day weeks	0.795 (0.036 to 0.977)	0.429 (0.022 to 0.916)	0.620 (−0.079 to 0.954)

Note: Reported values summarize setting-specific cross-product agreement and leave-one-year-out stability for rainfall, temperature, and specific humidity.

4.14. Temporal Stability and Leave-One-Year-Out Checks

Year-specific comparisons and leave-one-year-out (LOYO) calibration checks were used to characterize source agreement across observed years. In Quezon City, the median LOYO R-squared was 0.396 for IMERG versus PAGASA rainfall, 0.666 for temperature, 0.817 for relative humidity, and 0.922 for specific humidity. Across the eight multi-setting series, the median of setting-specific LOYO R-squared values was 0.404 for rainfall, 0.880 for

temperature, and 0.620 for specific humidity. The setting-specific LOYO R-squared ranges were −0.017 to 0.866 for rainfall, 0.631 to 0.996 for temperature, and −0.079 to 0.954 for specific humidity. Temperature showed the most stable cross-product relationship, while rainfall and specific humidity showed wider between-setting variation.

4.15. Cross-Scale Spatial Representativeness Diagnostics

Spatial representativeness was evaluated by comparing the same environmental source at different spatial supports during the primary analytic years. For rainfall, the Quezon City IMERG point series and the Philippines IMERG setting mean overlapped for 305 weeks and showed Pearson r = 0.653, Spearman rho = 0.727, mean bias = 3.863 mm/week, MAE = 26.810 mm/week, RMSE = 42.325 mm/week, and CCC = 0.557. For ERA5-Land temperature, the Quezon City point series and the Philippines setting mean showed Pearson r = 0.781, Spearman rho = 0.743, mean bias = 2.168 °C, MAE = 2.168 °C, RMSE = 2.338 °C, and CCC = 0.250. For ERA5-Land specific humidity, the corresponding values were Pearson r = 0.938, Spearman rho = 0.902, mean bias = 0.612 g/kg, MAE = 0.849 g/kg, RMSE = 1.004 g/kg, and CCC = 0.764. At broader spatial support, the unweighted mean of the 17 regional ERA5-Land series closely tracked the Philippines setting mean for temperature (Pearson r = 0.998, CCC = 0.976) and specific humidity (Pearson r = 1.000 after rounding, CCC = 0.997). These comparisons characterize differences associated with spatial support, from a city-centroid extraction to regional and setting-wide aggregates. These diagnostics are reported in Table 10.

4.16. Lagged Dengue–Environment Plausibility Checks

Lagged environmental associations were examined from 0 to 8 weeks as descriptive epidemiological plausibility checks. In the primary Quezon City years, the strongest rank correlations occurred at a 6-week lag for both IMERG and PAGASA rainfall, a 4-week lag for ERA5-Land and PAGASA relative humidity, and an 8-week lag for ERA5-Land and PAGASA specific humidity. Across the 17 Philippine regions, the median best lag was 4 weeks for RF_HDX, 7 weeks for SH_ERA5-Land, and 8 weeks for Temp_ERA5-Land, with substantial between-region variation in correlation strength. Multi-setting best lags and association strengths also varied across variables and settings. Source-pair lag checks showed similar best-lag timing for paired rainfall and humidity products in several settings, with variation across settings. The observed lag profiles provide a descriptive basis for retaining multiple environmental variables in subsequent analyses.

Table 10. Cross-scale environmental representativeness diagnostics from the primary analytic years.

Comparison	N	Pearson r	Spearman Rho	Bias A − B	MAE	RMSE/CCC
QC IMERG point vs. Philippines IMERG mean	305	0.653	0.727	3.863 mm/wk	26.810 mm/wk	42.325/0.557
QC ERA5-Land temperature vs. Philippines ERA5-Land mean	305	0.781	0.743	2.168 °C	2.168 °C	2.338/0.250
QC ERA5-Land specific humidity vs. Philippines ERA5-Land mean	305	0.938	0.902	0.612 g/kg	0.849 g/kg	1.004/0.764
Mean 17 regional ERA5-Land temperatures vs. Philippines ERA5-Land mean	305	0.998	0.997	0.175 °C	0.175 °C	0.186/0.976
Mean 17 regional ERA5-Land SH vs. Philippines ERA5-Land mean	305	1.000	0.999	0.082 g/kg	0.082 g/kg	0.086/0.997

Note: Values are rounded from S13_CrossScale in environmental_validation_report.xlsx. The final column reports RMSE followed by Lin's concordance correlation coefficient (CCC).

4.17. COVID-19 Cross-Scale Data Coverage Summary

The COVID-19 period affects the three components differently. QC Data retains 2020–2021 and marks those records with FLAG_COVID. Regional Data has no rows for 2020–2021. Multi-Setting Data has setting-specific year gaps that differ by source coverage. Table 11 summarizes these patterns across the pandemic period, including surveillance and environmental coverage.

Table 11. COVID-19 cross-scale data availability summary.

Component	2020 Status	2021 Status	Analytical Note
QC Data	Included; FLAG_COVID = 1	Included; FLAG_COVID = 1	Pandemic-period records identified by FLAG_COVID
Regional Data	Absent	Absent	No rows for either year across all 17 regions
Multi-Setting Data	Setting-specific; absent in Brazil, Colombia, Mexico, Peru	Setting-specific; absent in Philippines	Coverage follows source-specific OpenDengue availability

5. User Notes

The dataset provides harmonized weekly dengue counts together with rainfall (mm/week), temperature (Celsius), relative humidity (%/week), specific humidity (g/kg), and pressure (hPa) according to scale and source availability. It supports descriptive epidemiology, environmental-lag exploration, sensitivity analyses across meteorological products, and development of statistical workflows that preserve source and spatial-support information.

All weekly meteorological variables available in the supplied source files have been retained in the revised workbook, including temperature, relative humidity, pressure, and specific humidity in addition to rainfall. Land cover, population density, human mobility, and mosquito-abundance indicators remain linkable external covariates for studies that require broader ecological or mechanistic analysis.

Source names, spatial support, temporal processing, variable-specific coverage, and row-level quality flags are retained in the workbook so users can select and combine environmental variables consistently with their analytical design.

The geopackage is distributed as two compressed files; standard extraction tools (e.g., 7-Zip or WinRAR) are required for access. All files, metadata, and code are openly available in the repository.

5.1. Limitations and Future Validation

Regional dengue surveillance data are absent for 2020–2021, while QC records for those years are retained and flagged. Multi-setting year coverage is source-specific, and eight within-span weekly rows are structurally absent under the 52-block convention: Philippines 2022 weeks 51–52, Philippines 2023 weeks 46–50, and Sri Lanka 2023 week 52. Philippines 2023 weeks 51–52 are present but terminally flagged. These discontinuities should be handled explicitly in longitudinal analyses rather than treated as zero-incidence periods.

The atmospheric variables have scale- and product-specific limitations. Regional RF_HDX is reconstructed from decadal CHIRPS totals by uniform within-decade allocation, which can smooth short rainfall events and shift rainfall between adjacent weekly blocks. Quezon City gridded variables used centroid coordinates as a basis for extraction, while multi-setting rainfall, temperature, and humidity are area-weighted means that compress within-setting heterogeneity. The regional rainfall comparison is conducted after aggregation to the Philippine scale and does not replace region-specific gauge-network validation. The PAGASA reference series strengthens external comparison in Quezon City, but the

supplied source file does not identify the exact station. SH_PAGASA is partly dependent on ERA5-Land because ERA5-Land pressure is used in its derivation. MERRA-2 specific humidity has substantial source-day loss in Singapore and lesser loss in Taiwan and the Philippines, and affected weeks are retained with explicit coverage flags. These features should be considered when using the environmental variables as local exposure measures or when comparing products across spatial scales.

The current validation establishes structural integrity, environmental coverage, cross-source agreement, retrospective temporal stability, cross-scale representativeness, and descriptive lag plausibility within the observed data. Prospective temporal validation, comparison with additional ground-station networks, subnational validation within large and climatically heterogeneous settings, and assessment under future climate conditions remain priorities for subsequent work. Transferability to new settings should likewise be evaluated within the intended analytical or forecasting framework. No forecast modeling is applied within this dataset; it is intended to serve as a baseline resource for future studies seeking to explore dengue–climate dynamics at the Quezon City, Philippine regional, and multi-setting levels. Area-weighted meteorological data effectively compress within-setting climatic variations at fine spatial and temporal resolutions, which may limit the applicability of this dataset for sub-national assessments. The multi-setting component is instead designed to facilitate inter-setting comparison and structured analyses of dengue–climate characteristics across geographically and epidemiologically diverse contexts.

5.2. File Format and Access

Datasets are distributed in .xlsx format with Dataset Summary, Data Dictionary, QC Data, Regional Data, and Multi-Setting Data sheets importable into R 4.4+, Python 3.10+ using pandas 2.x, Stata 17+, and IBM SPSS Statistics 28+. The GitHub repository contains the dataset, a README.md, the validation script (Dengue_Environmental Vars_Validation.R), flagged CSVs, and validation tables. The geopackage is split into two compressed files due to repository size limits; standard extraction tools (7-Zip, WinRAR) are required.

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Institutional Review Board Statement: This study was approved by the University of the Philippines Research Ethics Committee (REC Protocol No: 2024-0004-F-FMDS, 3 October 2024).

Informed Consent Statement: Not applicable. The dataset uses only unidentified, individual case records with no personal identifiers attached.

Data Availability Statement: The complete dataset (Dengue_Environmental Vars_Dataset.xlsx, spatial files, validation outputs, and supplementary files) is available at Zenodo (https://doi.org/10.5281/zenodo.21978184) and mirrored at GitHub (https://github.com/UPRI-NOAH/dengue-rainfall-dataset) (accessed on 17 August 2026). The environmental variables derive from NASA GPM IMERG, ECMWF ERA5-Land, NASA MERRA-2, CHIRPS/HDX, and the available PAGASA reference series. Source-specific licensing and redistribution terms should be retained in the repository metadata. The released workbook preserves source names and quality flags so that downstream users can distinguish external observations, reanalysis variables, cross-product rainfall fields, derived humidity measures,

and temporally reconstructed CHIRPS rainfall. Data harmonization and technical-validation code is available through the project repository. The current environmental validation workflow produces environmental_validation_report.xlsx and implements the fifteen-stage checks described in Section 4, including structural validation, environmental coverage, cross-source agreement, year-specific and leave-one-year-out stability, cross-scale representativeness, lagged dengue–environment associations, and the final validation manifest.

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Abbreviations

The following abbreviations are used in this manuscript:

CHIRPS	Climate Hazards Group InfraRed Precipitation with Station data
CORD	Center for Climate and Health Global Research on Disasters
COVID-19	Coronavirus Disease 2019
DOH	Department of Health
ECMWF	European Centre for Medium-Range Weather Forecasts
ERA5-Land	ECMWF Reanalysis v5
FOI	Freedom of Information
GES DISC	Goddard Earth Sciences Data and Information Services Center
GPM	Global Precipitation Measurement
HDX	Humanitarian Data Exchange
IMERG	Integrated Multi-satellitE Retrievals for GPM
ISO	International Organization for Standardization
MERRA-2	Modern-Era Retrospective Analysis for Research and Applications, Version 2
NASA	National Aeronautics and Space Administration
NCR	National Capital Region
NIH	National Institutes of Health
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
ODC-ODbL	Open Data Commons Open Database Licence
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAHO	Pan American Health Organization
PIDSR	Philippine Integrated Disease Surveillance and Response
PSA	Philippine Statistics Authority
PSGC	Philippine Standard Geographic Code
QCESD	Quezon City Epidemiology and Surveillance Division
REC	Research Ethics Committee
WHO	World Health Organization

Appendix A. Additional Data Records

A separate comma-separated value (CSV) file for the yearly cases in Quezon City per Barangay is also included in the repository (see Data Availability section), with a total of 142 records. Table A1 shows a representative extract of QuezonCity-DC_YEARLY.csv.

Table A1. Example of data items for QuezonCity-DC_YEARLY.csv.

ADM4_PCODE	BRGY	DC_2010	DC_2011
PH1307404001	Alicia	34	28
PH1307404002	Amihan	4	16
PH1307404003	Apolonio Samson	64	86
PH1307404004	Aurora	10	17
PH1307404005	Baesa	105	154

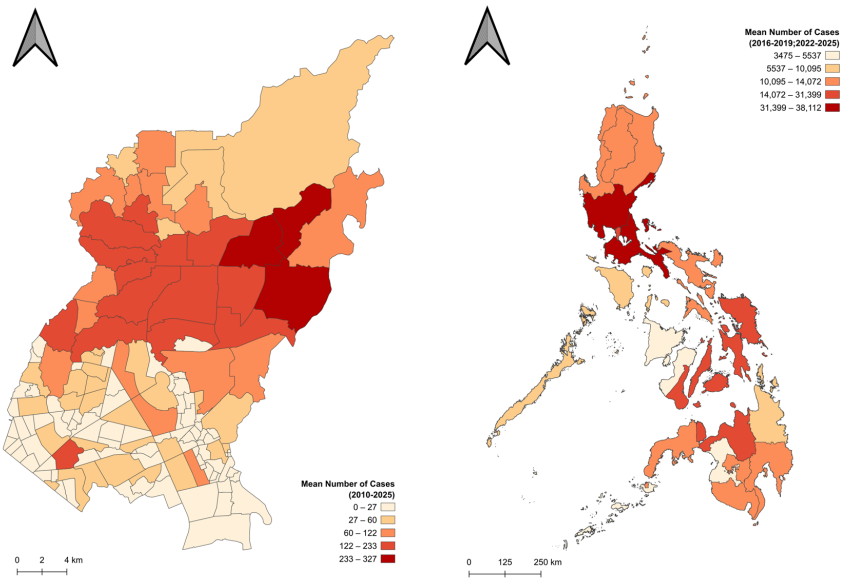
Table A2 shows a corresponding extract of PH_Regions-DC.csv for regional-level dengue cases.

Table A2. Example of data items for PH_Regions-DC.csv.

ADM1_PCODE	Region	DC_2016	DC_2017
PH01	Region I (Ilocos Region)	8281	8284
PH02	Region II (Cagayan Valley)	3891	5327
PH03	Region III (Central Luzon)	20989	24935
PH04	Region IV-A (Calabarzon)	24282	22403

Appendix B. Spatial Data Overview

Monthly dengue case counts in Quezon City were aggregated by barangay over the full study period (2010–2025) and across the 17 administrative regions for 2016–2019 and 2022–2025. Choropleth maps were generated in QGIS by shading each polygon by cumulative monthly case count. The aggregated data are included in the released dataset.



(**a**) (**b**)

Figure A1. Corresponding city and regional-level mean dengue cases for the Philippines: (**a**) Mean dengue cases per barangay in Quezon City across the 2010–2025 study period, covering 16 calendar years. Barangays in the eastern and central areas of Quezon City show consistently higher mean case counts over the study period, with the highest recorded means concentrated in a contiguous band of densely populated districts. (**b**) Mean annual dengue case totals across the eight observed regional years, 2016–2019 and 2022–2025. The regional panel shows the highest mean annual case totals in NCR and adjacent Luzon regions, including Regions III and IV-A. Regional differences in mean case totals reflect a combination of dengue burden, population size, urbanization, and surveillance coverage across regions [34,35].

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