



# **WATER USAGE EFFICIENCY (WUE) IN AFRICAN DATA CENTERS**

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# ANALYSIS-READY DATASET

## Before aggregation

timestamp	city	temperature	precipitation	wind_speed	humidity	country	wetbulb_temperature	climate_region
string · date	string · classes	float64	float64	float64	int64	string · classes	float64	string · classes
2022-08-20 00:00:00	Algiers	23.6	0	7.6	61	Algeria	65.097651	Mediterranean
2022-08-20 01:00:00	Algiers	22.3	0	6.8	60	Algeria	62.740671	Mediterranean
2022-08-20 02:00:00	Algiers	21.7	0	6.1	58	Algeria	61.283347	Mediterranean
2022-08-20 03:00:00	Algiers	21.2	0	5.4	57	Algeria	60.239583	Mediterranean
2022-08-20 04:00:00	Algiers	21	0	5.6	57	Algeria	59.920088	Mediterranean
2022-08-20 05:00:00	Algiers	20.7	0	5.9	57	Algeria	59.440646	Mediterranean
2022-08-20 06:00:00	Algiers	20.4	0	6.1	58	Algeria	59.197425	Mediterranean
2022-08-20 07:00:00	Algiers	21.3	0	6.2	54	Algeria	59.666776	Mediterranean
2022-08-20 08:00:00	Algiers	24.2	0	6.4	50	Algeria	63.161803	Mediterranean
2022-08-20 09:00:00	Algiers	25.2	0	6.5	46	Algeria	63.570149	Mediterranean

- Very large dataset:  $\approx 3\text{M}$  observations (hourly data  $\times$  many cities  $\times$  multiple countries)
- High spatial granularity (city-level) not aligned with our research question
- Highly disaggregated energy source data

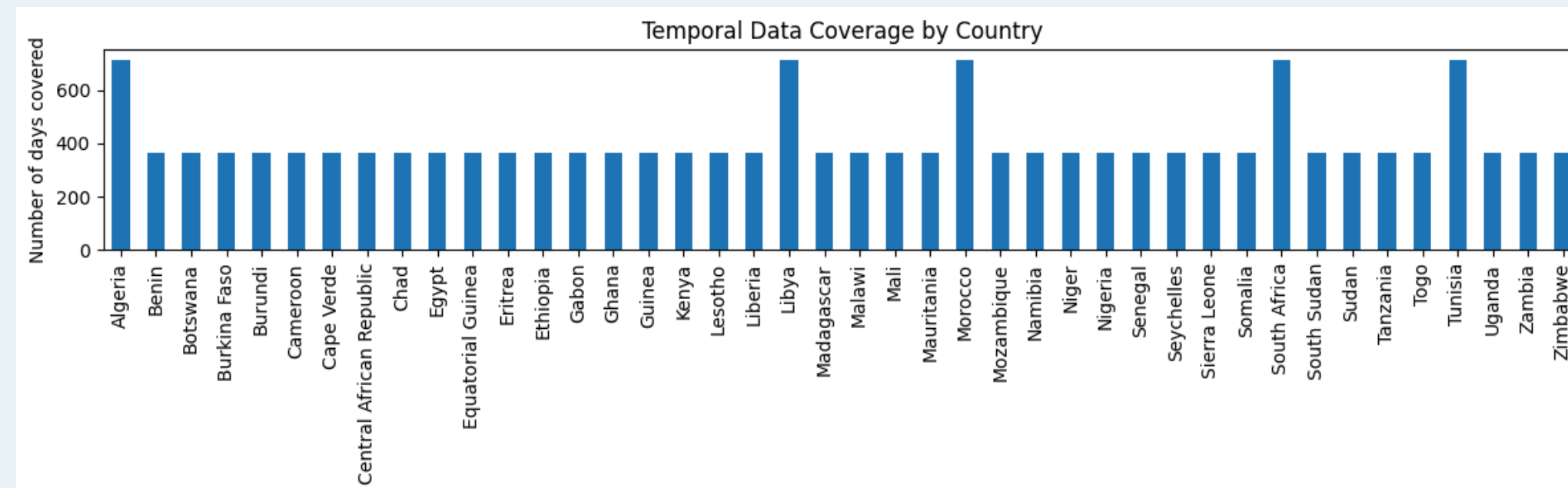
## After aggregation

- Country-level, hourly dataset
- Cities aggregated  $\rightarrow$  countries
- Focused variables: climate (temperature, humidity, wet-bulb), WUE, energy context
- Dataset size significantly reduced while preserving focused variables

country	climate_region	date	hour	avg_temperature	avg_humidity	avg_wetbulb_temperature	avg_wind_speed	avg_precipitation	avg_wue_fixed	avg_wue_indirect	avg_total_renewables_twh
string	string	date	int64	float64	float64	float64	float64	float64	float64	float64	float64
Algeria	Mediterranean	2022-08-20	0	22.02	64.3	63.175698	6.04	0	1.641379	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	1	21.42	64.7	62.305006	5.32	0	1.635311	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	2	20.84	65	61.430778	4.58	0	1.628322	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	3	20.29	65.4	60.639498	3.06	0	1.621868	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	4	19.92	66	60.170544	4.11	0	1.617717	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	5	19.75	66.8	60.07275	4.4	0	1.616492	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	6	19.22	67.7	59.397945	4.67	0	1.610999	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	7	20.2	61.4	59.593583	5.24	0	1.612671	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	8	22.04	55.1	62.290711	5.81	0	1.634286	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	9	24.95	48.9	63.907056	6.38	0	1.645884	1.413949	5,957.884724
Algeria	Mediterranean	2022-08-20	10	27.21	44.2	65.939271	8.54	0	1.659209	1.413949	5,957.884724

# FIRST CHECKS IMPLEMENTED

- **Dataset size (rows × columns):** 382.968 observations × 14 variables
- **Data types validation:** all variables correctly parsed
- **Missing values:** no missing values across variables
- **Geographic coverage:** 42 African countries
- **Temporal coverage:** 4 countries have nearly 2 years of observations, while the remaining countries have approximately 1 year (important for later averaging and comparisons)



# WHAT'S NEXT...

- **Variable-level understanding:**

- Means and ranges of:
  - WUE main metric
  - Climate and energy variables
- Outlier checks

- **Temporal sanity checks**

- Examine hourly averages of WUE and key climate variables
- Identify expected diurnal patterns in cooling demand
- Check for anomalies, discontinuities, or data artifacts

# TODAY

- Compute means and ranges of the main WUE metric
- Examine climate and energy variable distributions
- Identify outliers and implausible values
- Start temporal sanity checks