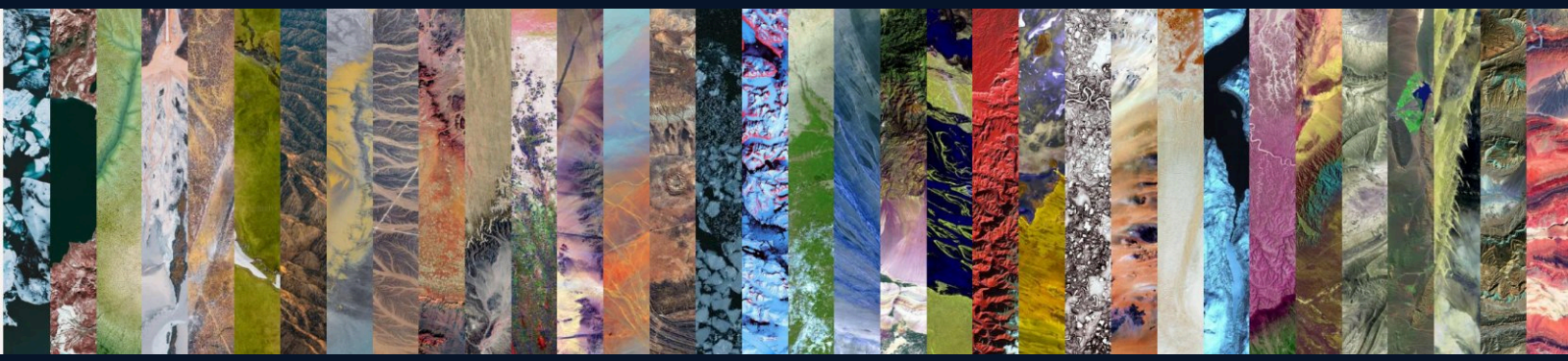


IN PARTNERSHIP WITH C40 CITIES

Preparing Cities for a *Warmer* Future

How data from Berkeley Earth's Climate Model Synthesis helped C40 Cities turn global climate models into actionable projections for city planning, investment, and adaptation.

~100
C40 CITIES

2050
PROJECTION HORIZON

20–30%
AVG. CDD INCREASE

117→217
MT CO_2 FROM COOLING

6×
AFRICAN COOLING DEMAND

OVERVIEW

The future of urban heat looks different everywhere.

Preparing for it starts with the same thing: local data.

Lagos

NIGERIA

50–100%
Projected CDD increase by 2050

~36%
Current AC ownership (CMCC)

A city of over 20 million people and one of the fastest-growing urban economies in the world. Despite steep projected increases in cooling demand, AC ownership remains low. Cities that plan early with accurate local data can build smarter energy systems, attract climate-aligned investment, and ensure a targeted response to protect the most vulnerable communities.

London

UNITED KINGDOM

50–100%
Projected CDD increase by 2050

~46%
Current AC ownership (CMCC)

A global financial center whose built environment was designed for a temperate climate that is shifting rapidly. European C40 cities face some of the steepest relative increases in Cooling Degree Days. Higher AC ownership means different investment priorities: retrofits, grid modernization, and green infrastructure rather than first-time deployment.

These two cities illustrate how the same warming trend creates fundamentally different challenges depending on existing infrastructure, economic context, and access to cooling. Both require precise, localized climate projections to inform investment and policy. Understanding these inequalities in heat exposure and resilience is essential for governments developing targeted adaptation strategies.

In October 2025, **C40 Cities** published a study projecting how cooling demand will evolve across nearly 100 of the world's largest cities through 2050. This analysis was built using inputs from **Berkeley Earth's Climate Model Synthesis**, which provided bias-corrected, city-level temperature projections that account for urban heat island effects, alongside socioeconomic modeling from the **Euro-Mediterranean Center on Climate Change (CMCC)** (Falchetta et al. 2024). Standard global climate models do not capture this level of local detail. Synthesis does.

> Cooling-related emissions across C40 cities could nearly double from 117 million tons in 2020 to 217 million tons by 2050. Understanding where and how this growth will occur is the first step toward managing it.

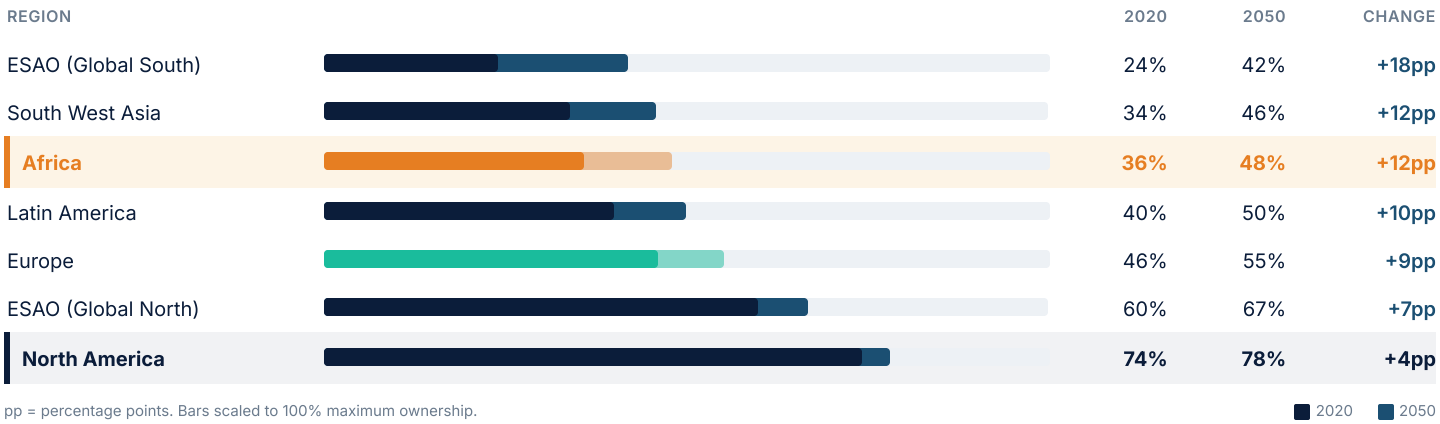
The findings from the C40 Cities study demonstrate the need for access to localized climate projections built at the resolution where decisions are actually made. Berkeley Earth's Synthesis platform delivers warming projections and derived metrics at the resolution of human experience, helping shape urban decision-making, infrastructure investment, and adaptation strategy for a post-1.5°C world.

How Cooling Demand Will Reshape Urban Energy Systems

City-level modeling reveals where investment in cooling infrastructure, energy supply, and targeted decarbonization can have the greatest impact.

The Cooling Access Gap: AC Ownership by Region, 2020 vs. 2050

Projected share of households with air conditioning, average climate scenario. Source: CMCC / Falchetta et al. 2024, scaled to C40 cities.



pp = percentage points. Bars scaled to 100% maximum ownership.

2020 2050

Climate change is only one driver. When population growth, rising incomes, and increasing AC adoption are factored in (CMCC / Falchetta et al. 2024), the scale of the opportunity for energy infrastructure, sustainable cooling technology, and climate-smart urban planning becomes clear.

up to 6×
demand increase

In African C40 cities, total cooling electricity demand could reach **up to six times current levels** by 2050 — driven by projected warming **combined with** population growth, rising incomes, and accelerating AC adoption (CMCC, avg. scenario 368%, range 149–503%). In South West Asian cities, demand could reach **five times** current levels. These projections represent one of the largest infrastructure investment opportunities of the coming decades.

The Access Gap: Risk and Opportunity

The distribution of cooling access today is both an equity challenge and a market signal: the regions with the fastest-growing demand have the most room for efficient, sustainable solutions. Granular data on heat-exposure inequality helps governments target their response.

North American C40 cities

74% AC ownership today, rising to 78% by 2050 (CMCC). Mature cooling markets where the opportunity lies in efficiency upgrades, grid modernization, and peak demand management.

African C40 cities

36% AC ownership today, rising to 48% by 2050 (CMCC). An emerging market for sustainable cooling solutions, leapfrog technologies, and climate-resilient building design.

195 → 350 TWh

Total cooling electricity demand across C40 cities and their supporting energy grids could grow from 195 TWh to up to 350 TWh by 2050. Planning for this growth now determines whether it strains or strengthens urban systems.

590–1,365 $MtCO_2e$/year globally by 2050

Rising cooling needs worldwide could generate up to 1,365 Mt CO_2e per year by 2050 (Falchetta et al. 2024, as cited in C40 study). Scenario-specific projections can target decarbonization where it matters most.

Synthesis: The Data That Made This Possible

How Berkeley Earth's observational data infrastructure delivered the city-level precision this analysis required.

The Limitations of Global Climate Models

Global climate models are effective at projecting large-scale trends. But cities don't plan at the continental scale. The C40 analysis required daily, city-level temperature projections across five emissions scenarios. Standard CMIP6 models cannot deliver this resolution, and other downscaled projections often present methodological challenges that make consistent, like-to-like comparisons difficult.

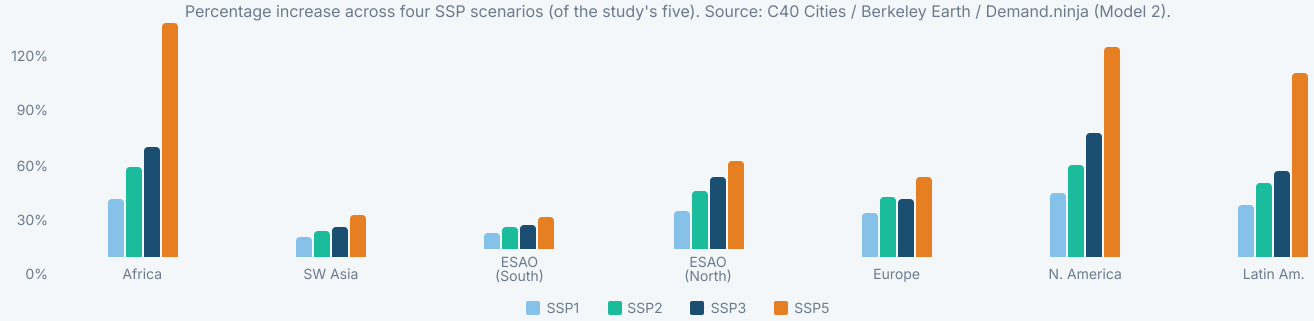
Data at the Resolution of Human Experience

Cities are measurably hotter than surrounding areas due to building density, paved surfaces, and waste heat, an effect often averaged out in global climate models. Thanks to Berkeley Earth's proprietary observational record, Synthesis can bias-correct and downscale the full ensemble of CMIP6 model outputs to the city level, providing a high-fidelity result that better represents urban heat island effects often overlooked in other products.

The C40 study ran two models in parallel: one driven by socioeconomic factors (CMCC) and one driven by climate projections (Berkeley Earth / Demand.ninja). Having both approaches allowed the researchers to validate results against each other and disentangle the effects of warming from demographic and economic change.

Cooling Degree Day Increases in C40 Cities by Region, 2020–2050

Percentage increase across four SSP scenarios (of the study's five). Source: C40 Cities / Berkeley Earth / Demand.ninja (Model 2).



Cooling demand grows fastest where you might least expect it. Even North American C40 cities — where **74%** of households already have air conditioning — face climate-driven demand growth on par with Africa's. Warming doesn't only add new AC users; it increases demand on existing systems.

Source: C40 Cities, Summary Methodology, October 2025, p. 5. Data: Berkeley Earth / Demand.ninja (Model 2).

What This Means for Lagos and London

Lagos

NIGERIA

368%

Projected cooling demand growth to 2050
(avg. scenario, with socioeconomic factors, CMCC)

When climate projections are combined with demographic and economic trends, Lagos faces one of the steepest demand curves globally. Granular data on heat exposure inequality helps governments prioritize investment for the communities most at risk.

London

UNITED KINGDOM

46%

Projected cooling demand growth to 2050
(avg. scenario, European C40 cities, CMCC)

London's growth is driven primarily by climate change rather than demographic shifts. City-level projections that capture urban heat effects enable targeted retrofits and locally calibrated heat action plans.

From Observation to Decision: Berkeley Earth's Integrated Data Pipeline

Fifteen years of building the world's most comprehensive temperature record.
Now extended into the projections that cities need.

Berkeley Earth was founded in 2010 to build the most rigorous, transparent, and comprehensive record of the Earth's surface temperature. That record now integrates over 1.6 billion observations from more than 50,000 weather stations and 450 million ocean measurements. It is peer-reviewed, openly available, and relied upon by researchers, journalists, and institutions worldwide.

2010
Founded to build an independent global temperature record

2013
First peer-reviewed global land surface temperature analysis (BEST)

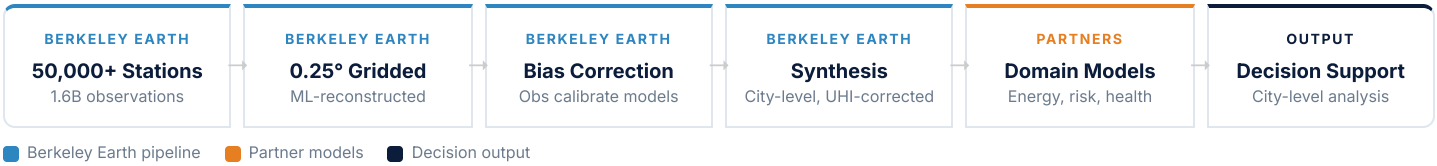
2023
BEST-HR: highest-resolution instrumental dataset at 0.25° with full global coverage

2025
Synthesis: high-resolution warming projections for 8,000+ global cities

Next
Expanding coverage, variables, and partnerships

The Integrated Pipeline

The same organization that built the world's most comprehensive observational record also built the projections layer on top of it. This ensures consistency from raw observations to city-level projections, eliminating gaps that arise when combining products from multiple providers.



What Synthesis Enables

Urban resilience
Heat action plans, green infrastructure, and building codes informed by local projections.

Climate risk
Physical risk quantification at the facility level for insurers, banks, and asset managers.

Public health
Heat-related outcome modeling and early warning systems calibrated to local thresholds.

Energy planning
Peak demand forecasting, generation sizing, and cooling-driven load growth analysis.

Explore Synthesis

The climate projections that powered the C40 analysis are available now. We welcome the opportunity to discuss how Synthesis can support your work.

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C40 Cities, "Evolution of the Cooling Demand Under Different Climate Scenarios in C40 Cities," October 2025.
Falchetta et al., "Inequalities in global residential cooling energy use to 2050," Nature Communications 15, 7874 (2024).
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