Global Heat Resilience Service: Project Concept

This document is submitted to the 19th Plenary for information.

Group on Earth Observations (GEO) is convening partners to develop a service that will provide every urban area in the world with intelligence on the health risks from exposure to extreme heat. These insights will help cities develop plans to adapt to heat and reduce the impact on citizens' health and local economies. This service is envisioned as a joint contribution of GEO and World Meteorological Organisation (WMO) to Early Warnings for All (EW4All) Initiative, which calls for every person on Earth to be protected by an early warning system by 2027. In the Executive Action Plan of the initiative, launched at the 2022 United Nations (UN) Climate Change Conference (COP27), the UN Secretary-General specifically mentioned heatwaves as an example of climate hazards that we must invest. Two co-leads of the EW4All Initiative, WMO and the UN Office for Disaster Risk Reductions, invited GEO to take part in the initiative as a support implementing partner, and GEO has been engaged in especially in the areas of innovation. In this context, the development and implementation of the Global Heat Resilience Service is going to be the key activity.

1 PROBLEM STATEMENT

1.1 The impact of heat on health and society

Hot days and extreme heat events are becoming more intense and more frequent. Cities are particularly affected, due to an urban heat island effect that can increase temperatures by up to 20 degrees Celsius.

The impacts on health are significant. Extreme heat is already the deadliest weather event, responsible for an estimated 500,000 excess deaths each year. With rising temperatures and rapid urbanization, this figure is expected to rise significantly. The elderly, young children, pregnant women, and people with chronic health conditions are particularly vulnerable. Heat also impacts air quality, disease transmission, workplace injury and mental health, and can interrupt essential services such as energy, water, and transport.

Economies also suffer. The global economy's estimated cost from heat stress through lost working hours is estimated to be $2.4 trillion by 2030.[i] Poorer communities are worst affected. Two thirds of global exposure to extreme heat occurs in urban areas in the global south where rapid urbanization and climatic changes are more pronounced[ii], but there are fewer resources to mitigate and adapt to climate risks. Economic losses from heat are four times higher in low-income counties than in the world's wealthiest regions.[iii] Within cities, low-income neighbourhoods may experience greater heat exposure due to overcrowding, lower construction standards and a lack of green spaces.[iv]

1.2 Why do we need a Global Heat Resilience Service?

Death and illness can be prevented with tailored strategies and plans, such as investing in green spaces in vulnerable areas, and by improving early warning systems, as supported by the EW4All Initiative.

However, most cities don't have comprehensive heat resilience strategies or effective early warning systems because they don't have the urban data needed for risk assessment and management. Some cities do have heat vulnerability data, but these are often the result of one-off, costly exercises. Even in richer countries, it's challenging for cities to collect and analyze data on the full range of variables - weather, climate, infrastructure, health, socio-economic and coping capacities - then translate that data into evidence that can inform strategies and other actions.

It will be more cost-effective to prepare cities for extreme heat now than to deal with the impacts later. Global adaptation initiatives like the Marrakech Partnership and the Sharm-El-Sheikh Adaptation Agenda provide an articulation of what adaptation outcomes are desirable and link to funding commitments, including in respect to human settlement systems. But currently only around 7-8% of global urban climate financing needs are being met, with far less still flowing to urban areas in the global south[1]. A key barrier to accessing this climate finance is a lack of appropriate data and information with which to develop feasible plans and projects to mitigate risks.

The Global Heat Resilience Service aims to fill these gaps. Using the latest digital tools and leveraging the power of cloud computing and Artificial Intelligence, the service will help cities to understand when and where extreme heat events will occur, who will be most vulnerable, and what actions can be taken to manage risks.

1.3 Why GEO?

As a global partnership dedicated to facilitating equitable access to quality Earth observations, GEO is uniquely positioned to mobilize its extensive network and convene governments, scientists and researchers, data owners, technology companies, civil society organizations, philanthropic foundations and other stakeholders, to leverage the power of Earth observation data and tools to improve risk knowledge relating to extreme heat, facilitating true global cooperation and supporting local action towards building climate resilience. Earth observations in this context provide a unique opportunity to further understanding of phenomena at the nexus of climate-health-urbanisation.

The Global Heat Resilience Service concept was developed taking into account the strategic direction of the GEO partnership in line with the GEO Post-2025 Strategy under consideration by the Executive Committee (ExCom) and the GEO community. The service also reflects the aims and objectives of GEO's Resilient Cities and Human Settlements engagement priority and will build on the wealth of existing GEO Work Programme activities relating to climate change, health, and urbanization.

[1] Climate Policy Initiative, "The State of Cities Climate Financing 2021," 2021.

The project concept was first presented to the ExCom on 4 November 2022, and was subsequently discussed by the GEO Programme Board at its 25th meeting from 6-7 February 2023, at ExCom 60 from 22-23 March 2023, the GEO Symposium on June 12th and again at the GEO Programme Board at its 26th meeting from 15-16 June 2023.

2 PROJECT DESCRIPTION

2.1 Vision

The Global Heat Resilience Service will provide every urban area in the world with intelligence on the health risks from exposure to extreme heat. These insights will help cities develop plans to adapt to heat and reduce the impact on citizens' health and local economies.

2.2 Objectives, outcomes and impacts

The overarching goal of the project is **to enhance the use of high-quality, city-specific data, information and insight on heat-related risks to inform improved public health, economic resilience and sustainable urban development, in all cities, globally**.

The **Global Heat Resilience Service** would provide cities, other urban settlements, and their communities, timely and spatially relevant information for understanding the scale and nature of local exposure to extreme heat events, the drivers of urban heat, as well as social vulnerabilities of local populations and potential health-related impacts.

Insight generated through the service allows decision-makers in cities to better understand and coordinate prevention and preparedness for managing risk from extreme heat. The service will help cities build resilience to heat by better preparing for increasing temperatures and extreme heat events, and through implementing appropriate policies, plans and programmes, and investments ultimately prevent health and other negative socio-economic impacts of extreme heat. The following outcomes have been proposed:

- **Outcome 1**: To enhance access and capacity of decision-makers to interpret relevant data, information and insight to understand risks from extreme heat in cities;
- **Outcome 2:** To enhance understanding, decision-making capacity, and partnerships to address local extreme heat risks;
- **Outcome 3:** To support cities and their communities to raise awareness of / communicate local extreme heat risks.

The project sits at the nexus between climate-health-urbanisation and as such responds to the goals and targets set out in Sustainable Development Goals: 3 (Good Health & Well-being); 11 (Sustainable Cities & Communities); 13 (Climate Action); and 17 (Partnerships for Goals).

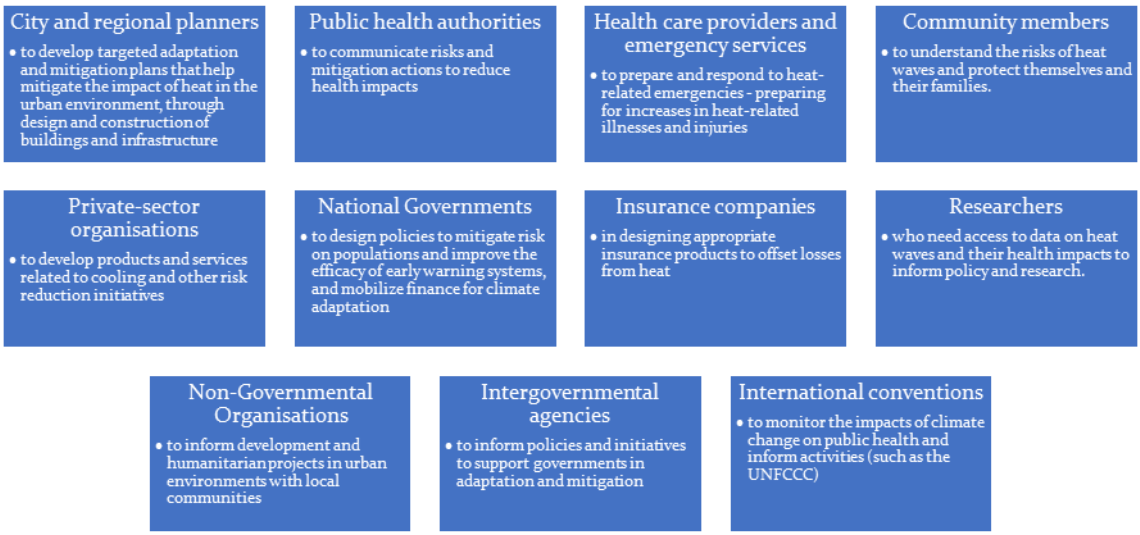
2.3 Project design approach

The service will be co-designed with cities and their networks to ensure the service responds effectively to the needs, resource and capacity constraints of cities and

urban settlements – particularly those in lower and lower-middle income countries.

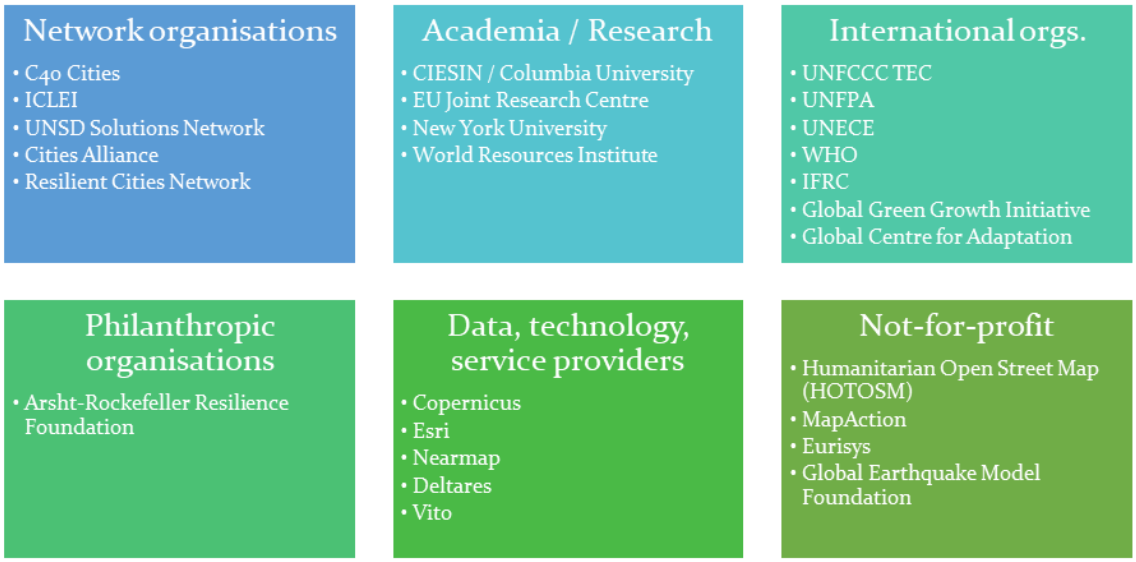
A multitude of actors will benefit from the service, either directly or indirectly. Primary actors are those with a mandate and capabilities to create heat resilient cities and will co-design the service. These include: mayoral offices, urban planners, climate resilience officers, construction companies, infrastructure and housing agencies, health and social service providers, disaster/emergency management, researchers, and civil society actors. Use-cases will be scoped and developed in detail to guide project design. See Figure 1.

Figure 1: Anticipated user and use-cases



The initial project concept has been developed by the Group on Earth Observations (GEO) and the World Meteorological Organization (WMO). Inspiration has been drawn from the work of the Global Heat Health Information Network and the National Heat Health Information System (NIHHIS) managed by the National Oceanic and Atmospheric Organisation in the US (NOAA). Other partners are being engaged as the initiative is defined and includes policy makers – in particular city and urban local governments and their networks - researchers, data providers, technology companies, civil society organizations, international agencies, and philanthropic foundations. Initial discussions have taken place with the following organisations who have shown interest and enthusiasm, and helped shaped the project concept (see Figure 2 below).

Figure 2: Type of partners that are likely to be required for project design and implementation.



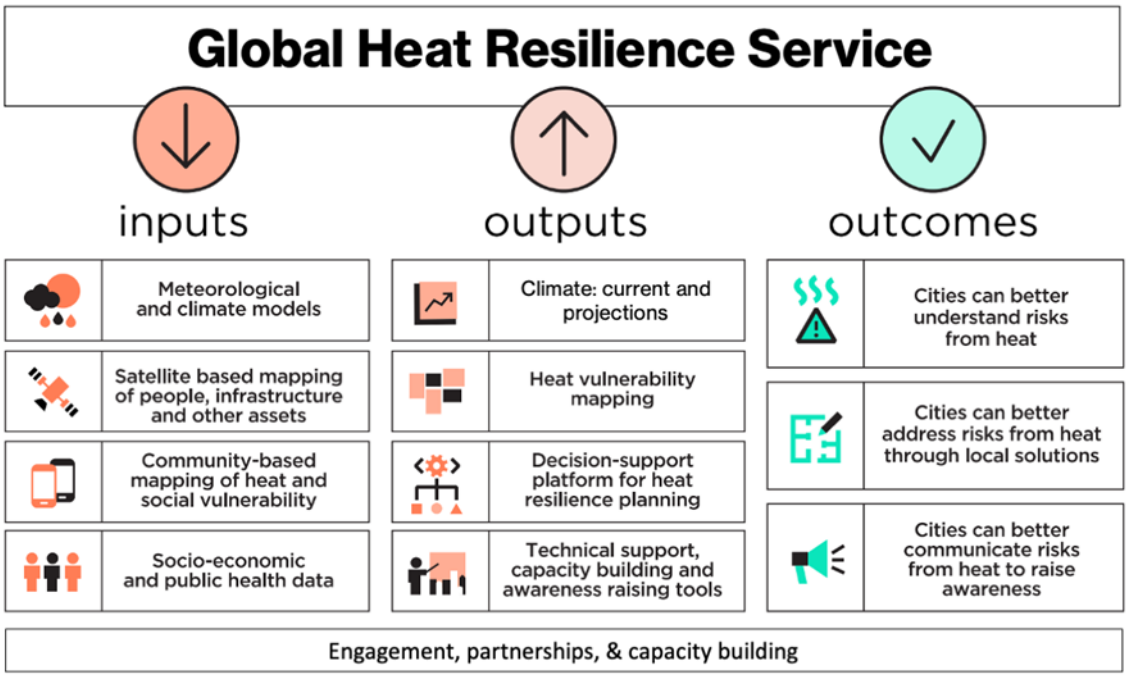
2.4 Anticipated project workstreams (inputs/outputs)

The Global Heat Resilience Service will draw on the best scientific knowledge and respond to the (policy) needs of cities and other urban settlements in relation to the impacts of extreme heat. The service will enhance cities' understanding of extreme heat as a hazard through measurement and analysis of seasonal and climate variables as well as urban vulnerability to extreme heat as defined by the location of residents and workers, the physical characteristics of the urban environment, and scale and nature of socio-economic sensitivity to extreme heat. The service will combine bottom-up local data and knowledge of heat-related vulnerabilities with top-down, Earth observations of climatic, physical and environmental characteristics that determine health outcomes.

The service will generate knowledge and insight through a decision-support platform and supporting tools that allows cities to identify entry points for planning, policy, awareness raising, interventions and investments to prevent and mitigate health-risks associated with extreme heat in urban areas. (see Figure 3 below).

The project's design approach anticipates working with a number of partner cities in an initial pilot phase to test approaches and methodologies to understanding risks from heat. Approaches and tools will then be refined iteratively to ensure they are appropriate for a range of use-cases. At this stage an anticipated number of workstreams have been identified which would be revisited and refined during the design phase.

Figure 3: Illustrative design of the Global Heat Resilience Service



2.4.1 Output 1 – Develop heat-health relevant climate analysis for urban areas

The urban climate component will develop and institutionalize a sustainable, actionable and authoritative **climate analysis for cities**. Climate analysis and trends will be assembled at a suitable spatial scale and will incorporate global indicators of extreme temperature and heatwave intensity indices drawing on those defined in the Handbook of Heatwave Indicators and Indices currently being developed by WMO. The outputs would be used as inputs to heat vulnerability mapping being undertaken in Component 2. This component will also look towards developing the support cities need to interpret climate analysis already available through National and Regional Climate Centres. Downscaling of these analyses and trends will be delivered as city-level products.

2.4.2 Output 2 – Heat Vulnerability mapping

This component would provide a global baseline of urban heat-exposure and tools to capture and assess local and indigenous knowledge in relation to heat. It will combine: the top-down mapping of exposure to heat as a hazard in cities using remote sensing techniques, existing statistical and socio-economic data; and bottom-up, community-led, heat and social vulnerability mapping. This component would provide a global baseline of urban heat-exposure and tools to capture and assess local and indigenous knowledge in relation to heat. Heat vulnerability maps could be produced at an appropriate spatial scale to characterise the health risks from heat within a city i.e., at neighbourhood level, 100 metre or lower resolution. The output would draw on high resolution data, artificial intelligence/ machine learning techniques to combine and augment to fill critical data gaps.

Under this output, the Global Heat Resilience Service will **foster youth and community engagement** innovative mapping, technology, and communication challenges in a number of pilot cities.

2.4.3 Output 3 – Decision-support platform

An open decision-support platform will be co-designed to provide an accessible and flexible interface for generating insight to understand and manage local health-related risks from extreme heat. The platform would host the climate analysis, heat vulnerability mapping above for current and future conditions, plus a range of decision support tools for cities to plan for different scenarios, addressing climatic and non-climatic factors such as population growth and urbanization. In addition, the platform would provide tools to help cities understand the potential policy, social, technical, grey and green infrastructure measures to manage risks; and tools to help communicate and raise awareness of risks from extreme heat.

2.4.4 Output 4 – Capacity development and awareness raising on health-related impacts from extreme heat

Output 4 will provide support and capacity development to ensure cities are able to get the most out of the service and inform future improvements.

This will be achieved through the co-development, with inter alia, partners, local communities, of case-studies and training activities, as well as translational products to raise awareness of heat-health risks and decision-making opportunities; including how to translate evidence into policies, plans and projects. Existing capacity development and communication tools from across the GEO Work Programme will be incorporated where relevant. Through the participation of cities and their communities, this output will see the co-development of tools and materials to help cities communicate and raise awareness of urban heat and health-related risks and the potential for EO-derived data, tools, and approaches to managing those risks.

2.5 Phases / Timeline

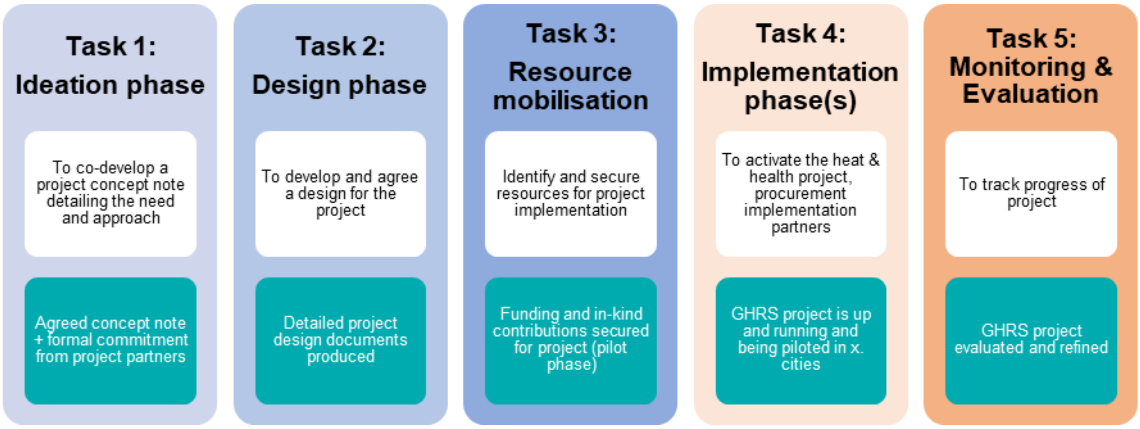
A number of key phases have been identified in project design and implementation – see timeline in Figure 4 below. The project is anticipated to be developed over 5+ years, with the first 12-18 months being allocated for project design.

To date, during the ideation phase (2022-23) experts from the World Meteorological Organisation's Climate-Health team, and relevant partners from across the GEO Work Programme, the Global Heat Health Information Network (GHHIN), and friends of GEO from both science and policy-based organisations have shaped the project concept note. This has been presented at a number of in person and on-line events including: GHHIN Heat Health Warning Systems Roundtable (online, February 2023); GEO Symposium (Geneva, June 2023); ICLEI Overheated Cities: Urban Resilience planning for extreme heat (webinar, July 2023); UN-GGIM Committee of Experts side-event (New York, July 2023).

The design phase of the project would commence in Q1 of 2024 through a series of technical meetings and workshop to further develop proposals, project plans, and how the concept would be implemented. Later stages of the design phase may include pilot testing

methodologies and approaches in a number of heat exposed cities. Resource mobilisation (Task 3) and Monitoring & Evaluation (Task 5) would run concurrently with project design, with implementation taking place towards the end of 2024 / early 2025.

Figure 4: Indicative phases of the project



3 PROJECT GOVERNANCE / ORGANIZATIONAL CAPACITY

In order to ensure the GHRS projects align with GEO and its partners strategic objectives and deliver value to project stakeholders, a suitable governance framework will be established. Effective governance helps mitigate project risks, promotes transparency, and enhances communication among project teams, sponsors, and stakeholders. The governance framework would be detailed during the design phase being responsive to project and partner requirements.

4 BUDGET

A budget has been developed for the project design phase which include a range of technical, engagement and communications activities. The design phase would necessarily involve convening various stakeholders at a serious of technical workshops, as well as planned field-missions to a small number of cities. The design phase will produce detailed project documentation – technical methodology, scope of works, work plans, detailed budgets, partnership and governance arrangements, a theory of change (impact pathway), and detailed consideration of project risks for advancing the project and guiding resource mobilization for project implementation. See Table 1 below.

Table 1: Design phase budget

	Budget description	**Total (CHF)**	**Justification**
Design Phase			
1.1	Detailed project design –	280,000	Inputs from a range of technical experts needed to provide a clear roadmap for project implementation. The project design documentation will also guide resource mobilisation activities, identifying potential risks and mitigation measures to drive project success. Documentation will include: technical design; Theory of Change/ monitoring & evaluation framework; budgeting; governance arrangements; and detailed risk register. Includes 2 x convening meetings held in Geneva.
1.2	Develop an engagement and communications strategy	100,000	Developing an engagement and communications strategy targeting stakeholders, potential partner cities, and the broader community, ensuring that all parties understand the project's objectives and their roles. This strategy will also include the design and management of a city partner selection process. The selection process itself will help demonstrate transparency, fairness and promoting trust among all involved parties.
1.3	Pilot phase	400,000	Pilot testing is crucial in the user-centric design of the service as it will ensures the project's viability (methods, tools and approaches), allows for iterative improvements to design, builds relationships with initial partner cities, and can help demonstrate the project's value and impact. The pilot phase would include field testing in up to 6 cities.
Total		**780,000**	

[i] *ILO (2019) Working on a Warmer Planet: The Impact of Heat Stress on Labour Productivity and Decent Work*

[ii] *Cascade Tuholske et al., "Global Urban Population Exposure to Extreme Heat," Proceedings of the National Academy of Sciences 118, no. 41 (October 12, 2021): e2024792118, https://doi.org/10.1073/pnas.2024792118.*

[iii] *Christopher W. Callahan and Justin S. Mankin, "National Attribution of Historical Climate Damages," Climatic Change 172, no. 3 (July 12, 2022): 40, https://doi.org/10.1007/s10584-022-03387-y.*

[iv] *T. Chakraborty et al., "Disproportionately Higher Exposure to Urban Heat in Lower-Income Neighborhoods: A Multi-City Perspective," Environmental Research Letters 14, no. 10 (September 2019): 105003, https://doi.org/10.1088/1748-9326/ab3b99*