Climate Services for Health, a critical part of Wellcome's vision to support science to solve the urgent health challenges facing everyone

Madeleine C Thomson

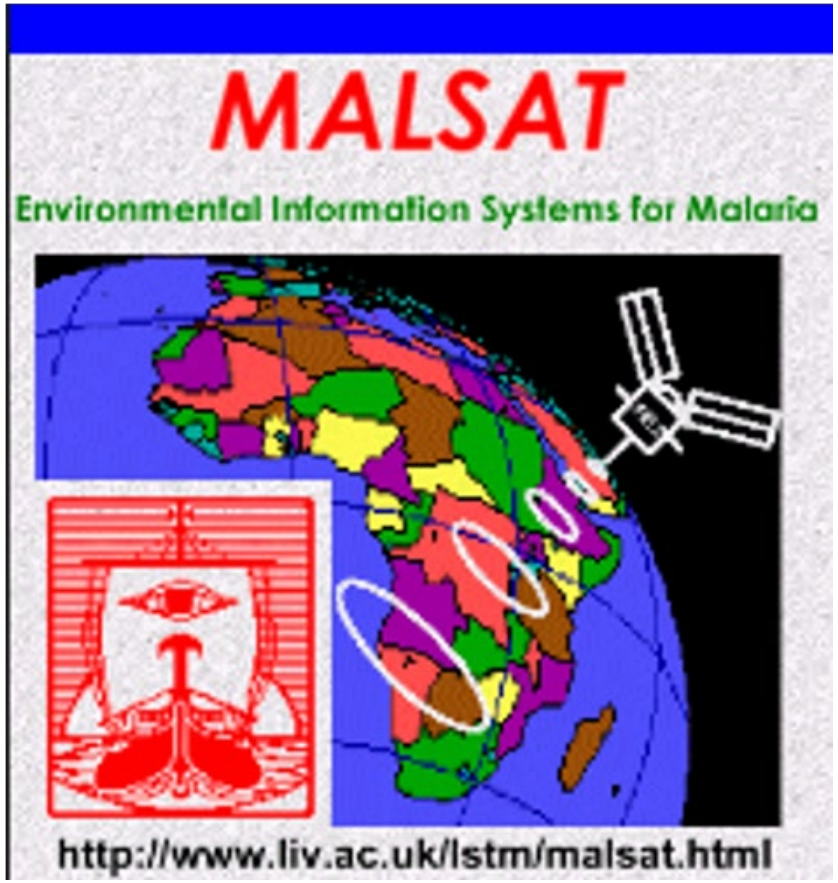
Head, Climate Impacts and Adaptation

ECMWF 03/06/2026

Using ECMWF's Forecasts Event (UEF2026)

Programme

Liverpool School of Tropical Medicine 1993-2002



- Research on use of satellite data for malaria early warning following 1992 Ministerial Conference on Malaria in Amsterdam

As requested by the Executive Board in January 1990, the Ministerial Conference on Malaria was held from 26 to 27 October 1992 in Amsterdam, the host being the Government of the Netherlands. There were 450 participants including 225 delegates from 100 countries - 90 of the 95 malaria endemic countries were represented, 44 by their minister of health. The Conference, which adopted the World Declaration for the Control of Malaria, was the culmination of three interregional meetings on malaria control held during the past year.

Followed by the Millennium Development Goals in 2000

Demeter project 2000-2003

Madeleine Thomson

Head Climate Impacts & Adaptation Wellcome
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Climate and Health

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TITLE	CITED BY	YEAR
Development of a European multimodel ensemble system for seasonal-to-interannual prediction (DEMETER) TN Palmer, A Alessandri, U Andersen, P Cantelaube, M Davey, ... Bulletin of the American Meteorological Society 85 (6), 853-872	1267	2004
Malaria early warnings based on seasonal climate forecasts from multi-model ensembles MC Thomson, FJ Doblas-Reyes, SJ Mason, R Hagedorn, SJ Connor, ... Nature 439 (7076), 576-579	653	2006
Mortality and morbidity from malaria in Gambian children after introduction of an impregnated bednet programme U D'Alessandro, B Olaleye, P Langerock, MK Aikins, MC Thomson, ... The Lancet 345 (8948), 479-483	579	1995
Use of rainfall and sea surface temperature monitoring for malaria early warning in Botswana MC Thomson, SJ Mason, T Phindela, SJ Connor	366	2005
Climate change and vectorborne diseases MC Thomson, LR Stanberry New England Journal of Medicine 387 (21), 1969-1978	306	2022

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Bulletin of the American Meteorological Society

Volume 85: Issue 6

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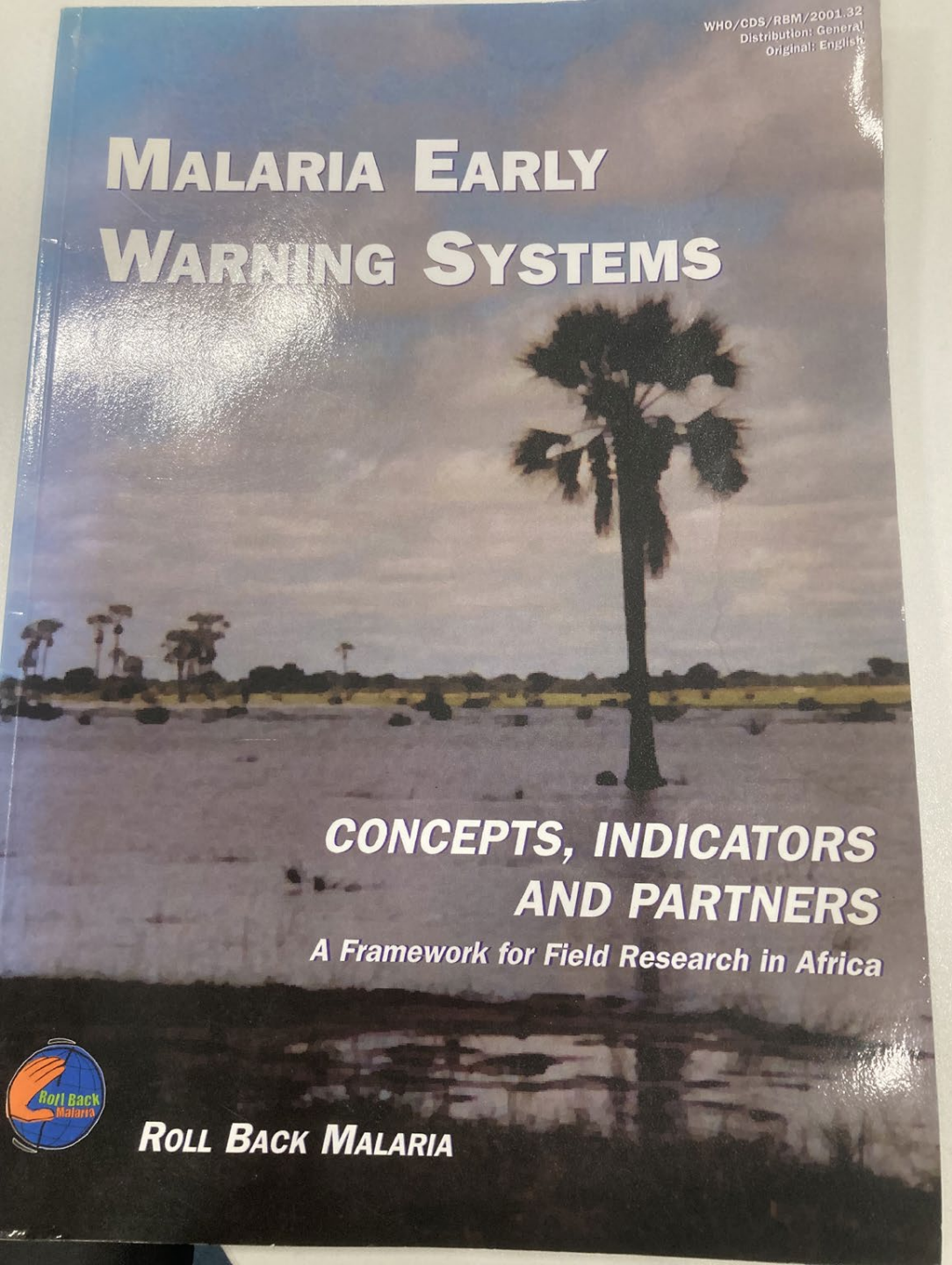
DEVELOPMENT OF A EUROPEAN MULTIMODEL ENSEMBLE SYSTEM FOR SEASONAL-TO-INTERANNUAL PREDICTION (DEMETER)

T. N. Palmer, A. Alessandri, U. Andersen, P. Cantelaube, M. Davey, P. Délécluse, M. Déqué, E. Díez, F. J. Doblas-Reyes, H. Feddersen, R. Graham, S. Gualdi, J.-F. Guérémy, R. Hagedorn, M. Hoshen, N. Keenlyside, M. Latif, A. Lazar, E. Maisonnave, V. Marletto, A. P. Morse, B. Orfila, P. Rogel, J.-M. Terres , and M. C. Thomson

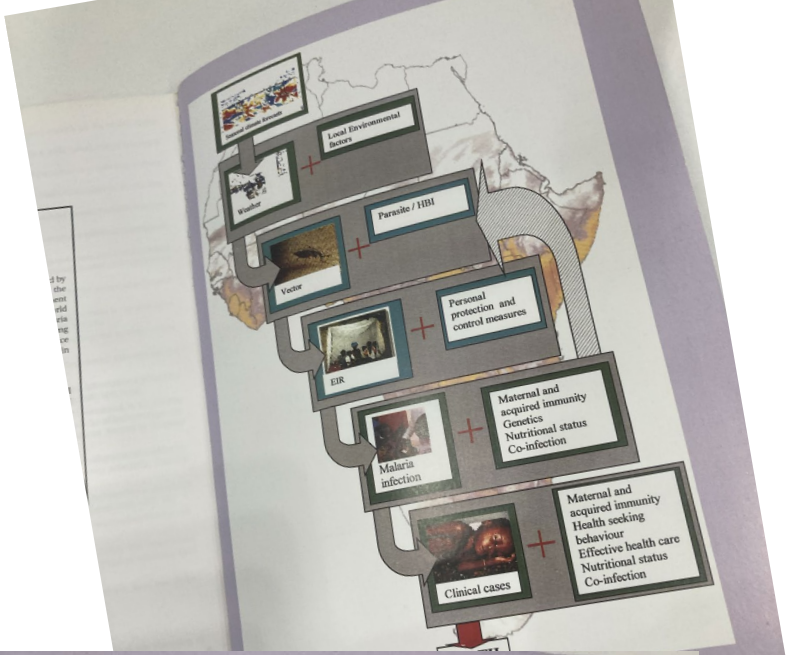
Online Publication: 01 Jun 2004

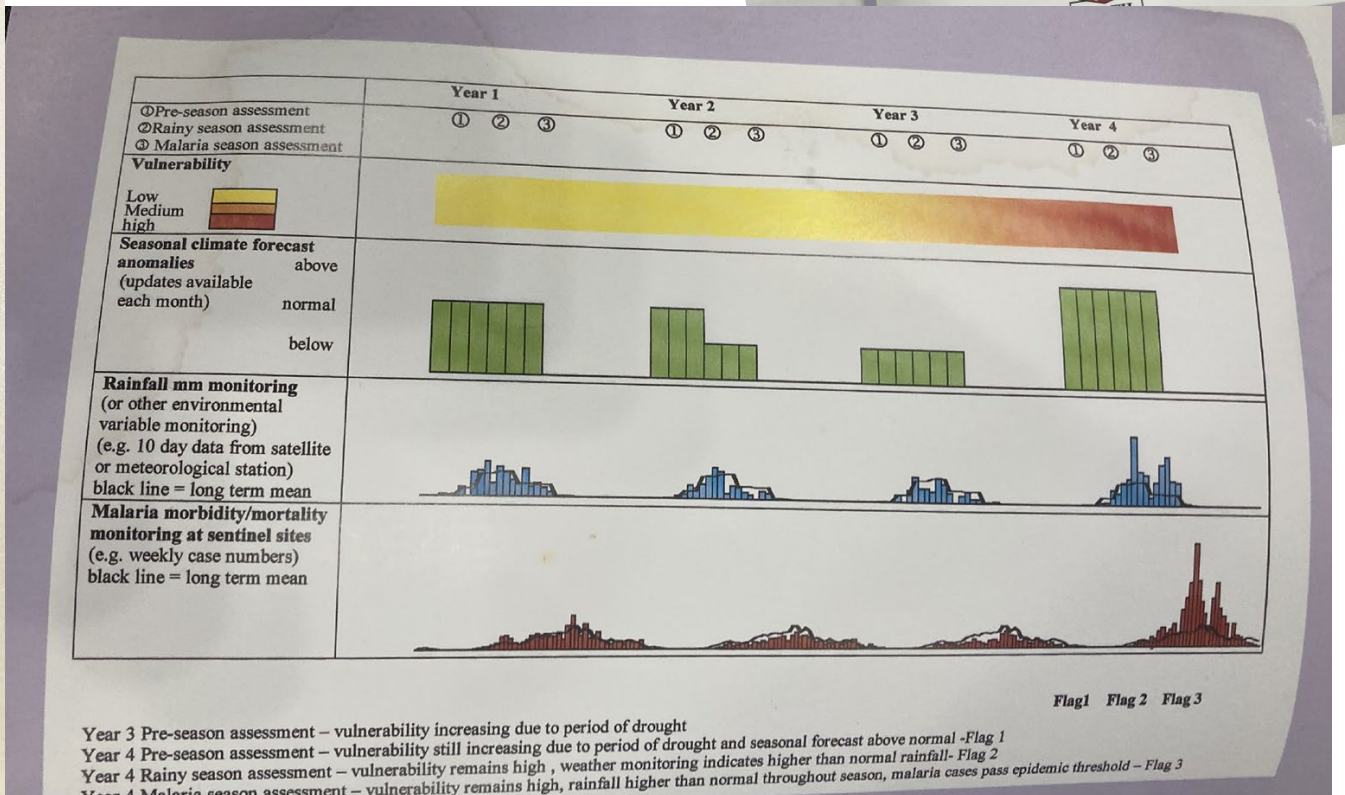
Print Publication: 01 Jun 2004

Tim Palmer and DEMETER team awarded the Norbert Gerbier Mumm International Award - **June 28, 2006**



Before the research was completed seasonal climate forecasting was introduced into the WHO framework for ”Malaria Early Warning Systems” in 2001





International Research Institute for Climate and Society 2002-2019

nature

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nature > letters > article

Letter | Published: 02 February 2006

Malaria early warnings based on seasonal climate forecasts from multi-model ensembles

M. C. Thomson, F. J. Doblas-Reyes, S. J. Mason, R. Hagedorn, S. J. Connor, T. Phindela, A. P. Morse & T. N. Palmer ✉

Nature **439**, 576–579 (2006) | Cite this article

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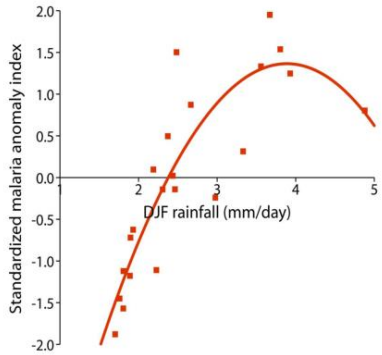
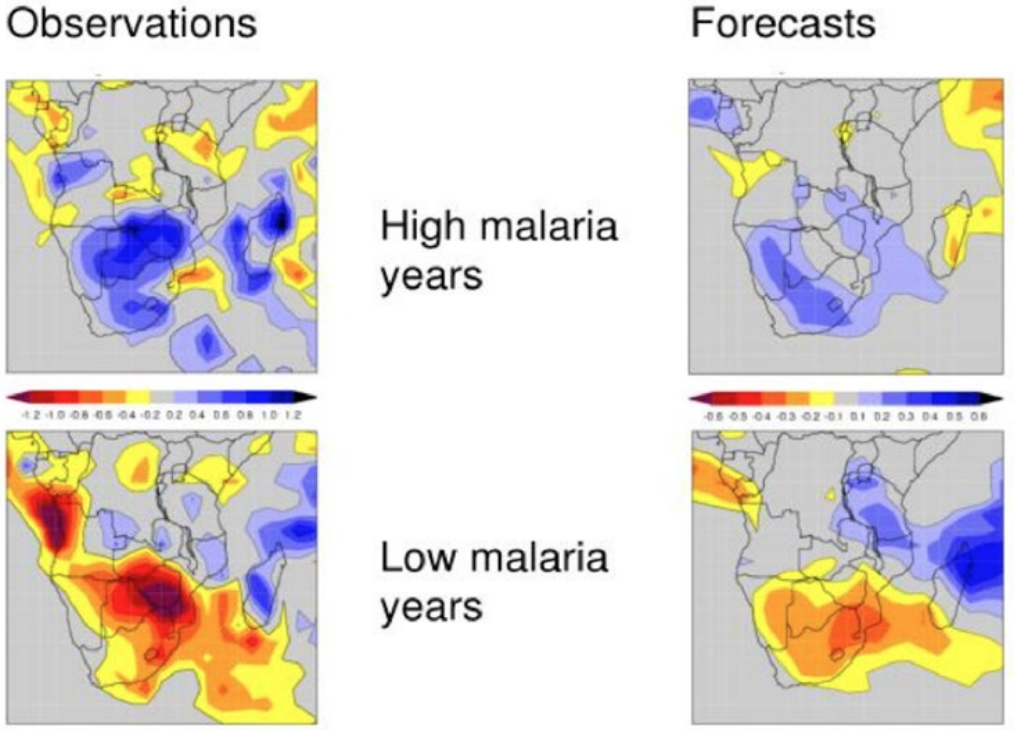
Relationship to Observed Rainfall



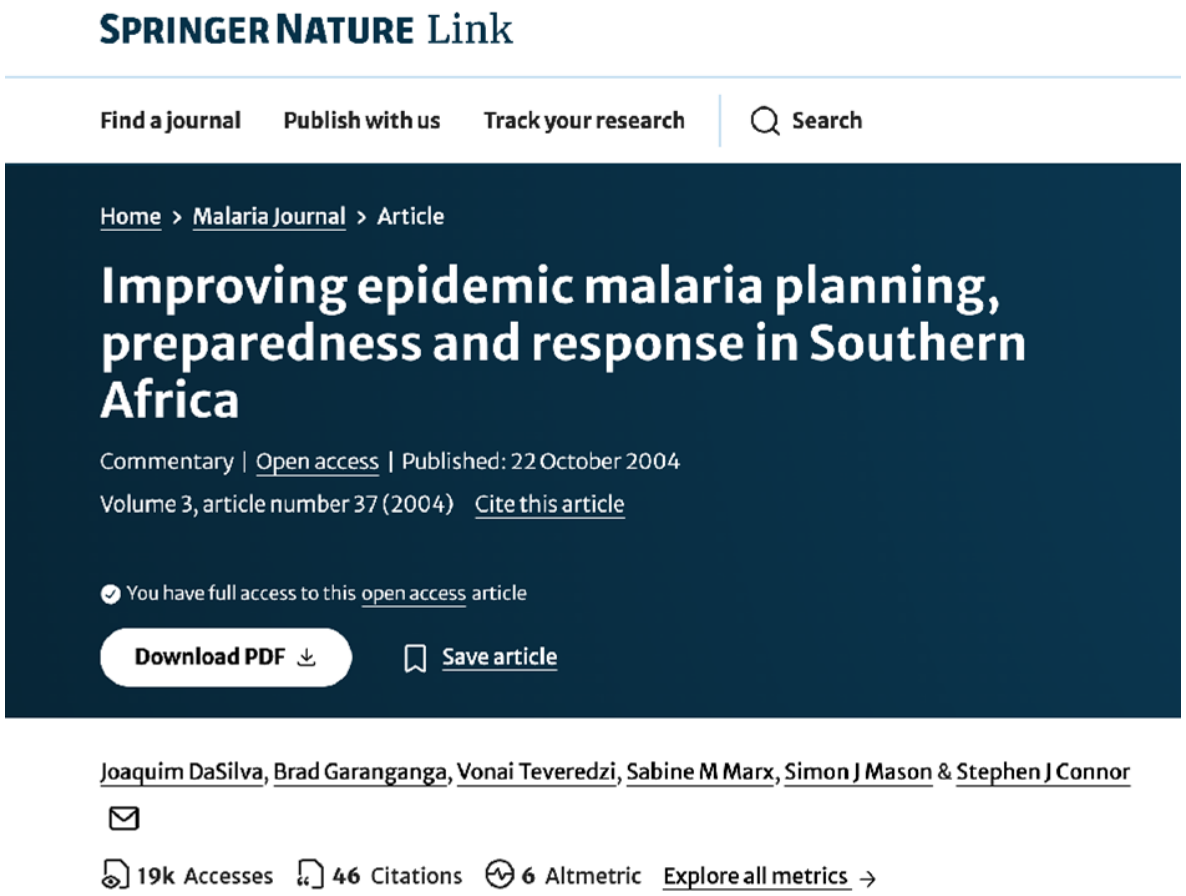
Malaria incidence in Botswana is strongly related to rainfall variability during the peak rainfall season December – February.

The relationship is non-linear: incidence peaks at about 4 mm per day.

DEMETER Forecasts



The MALOF



The WHO Southern Africa Inter - Country Programme for Malaria Control (SAMC) …… together with SADC's Drought Monitoring Centre (DMC) organized the 1st Southern African Regional Epidemic Outlook Forum, which was held in Harare, Zimbabwe, 26th – 29th September, 2004 and hosted by Zimbabwe's Ministry of Health and Child Welfare.

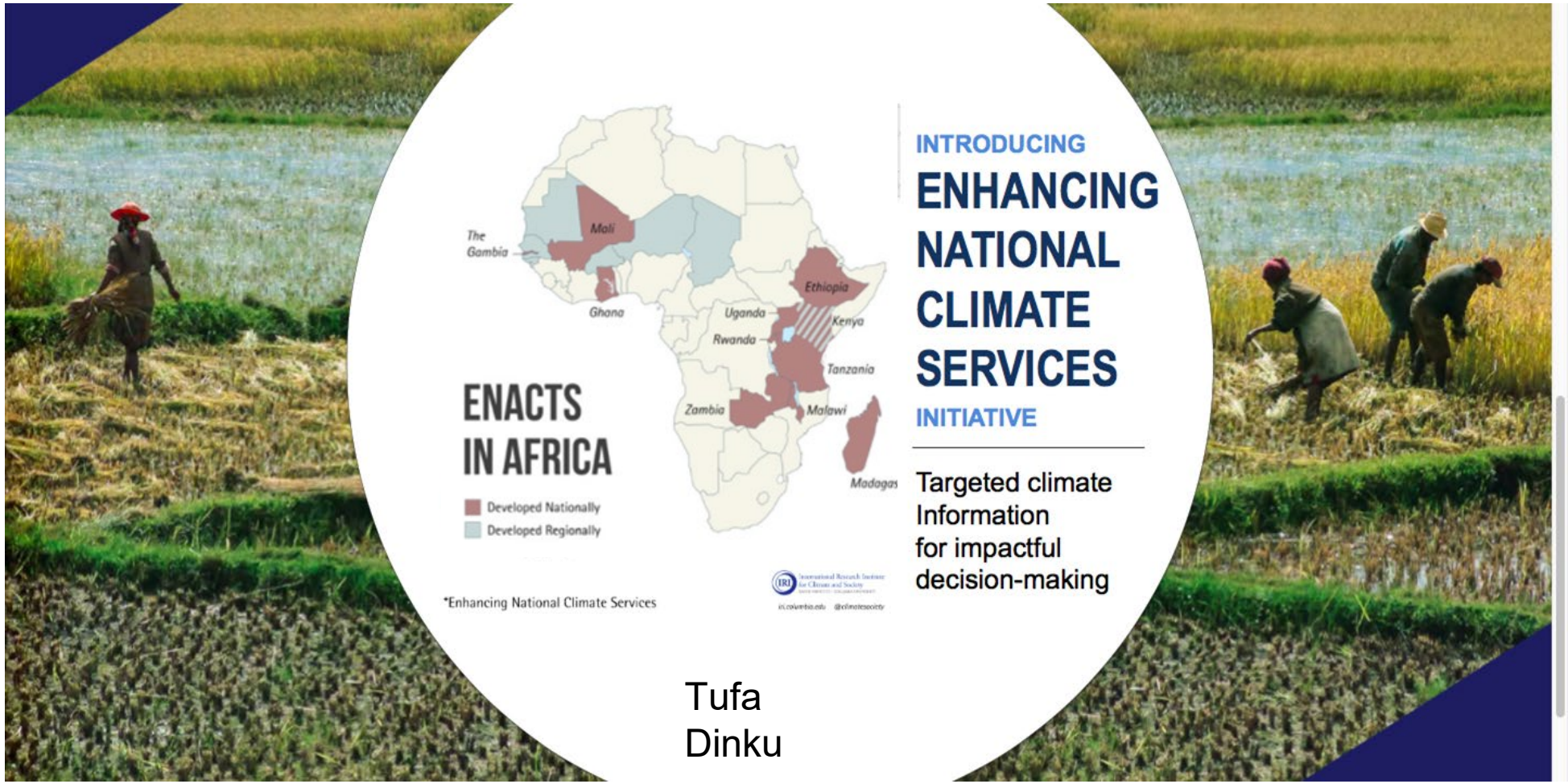
Representatives from malaria control services in nine Southern African countries participated in the meeting: Angola, Botswana, Madagascar, Mozambique, Namibia, Swaziland, Tanzania, Zambia, and Zimbabwe.

What did we learn?

- Enormous excitement about the scientific achievements of the DEMETER project
- Significant but largely uninformed demand expressed by the malaria community
- Limited quality time series of epidemiological information “malaria programme flying blind”
- Difficulties in accessing weather/climate monitoring information at appropriate spatial and temporal scale
- The spatial scale of seasonal forecast products was not suitable for district level control efforts
- What did we do?

ENACTS

2008-Present



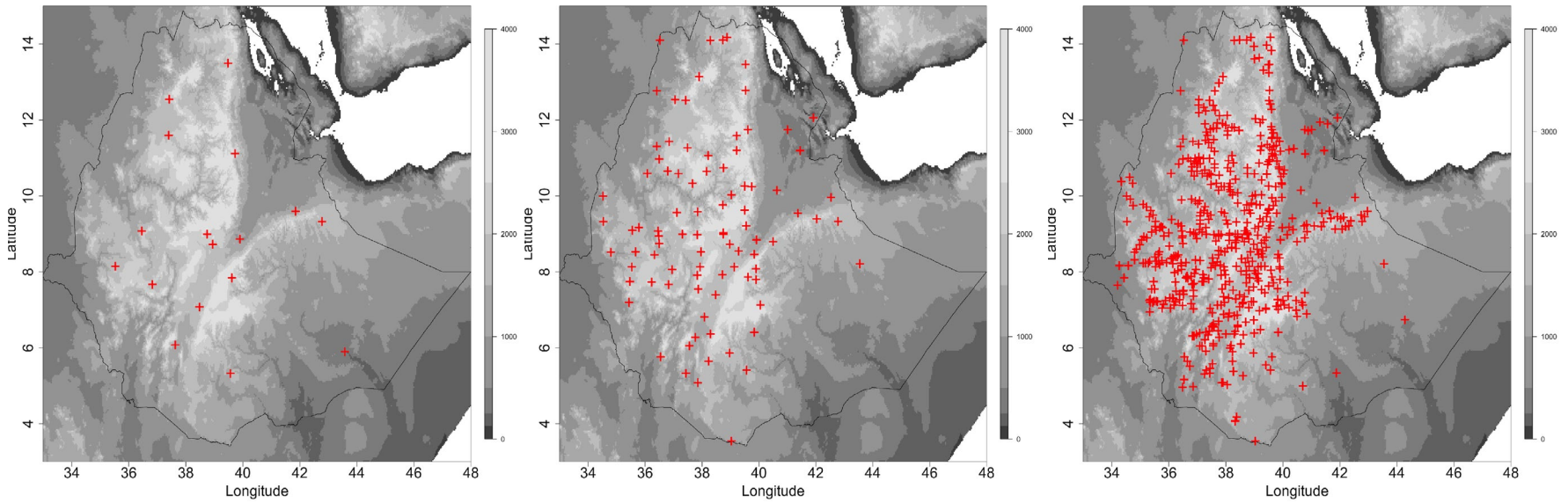
Tufa Dinku

ENACTS ADVANTAGE ETHIOPIA

GLOBAL PRODUCTS

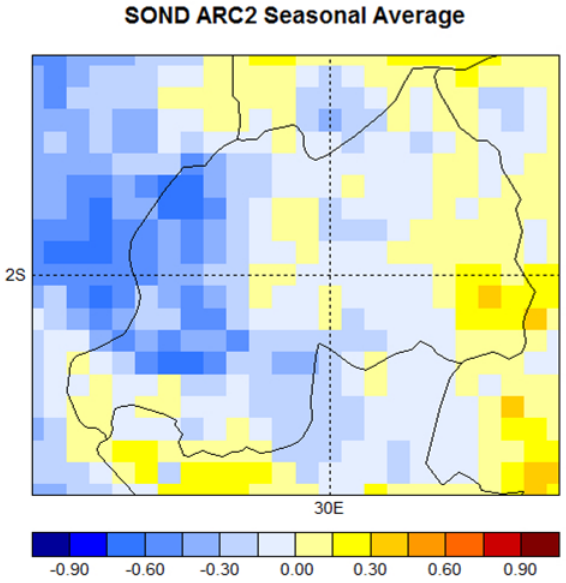
ENACTS Monitoring

ENACTS Climate Analysis

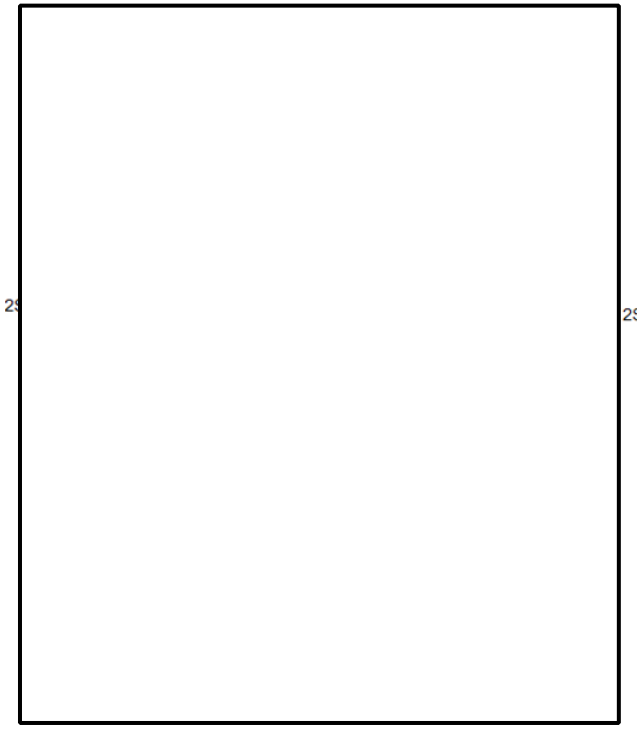


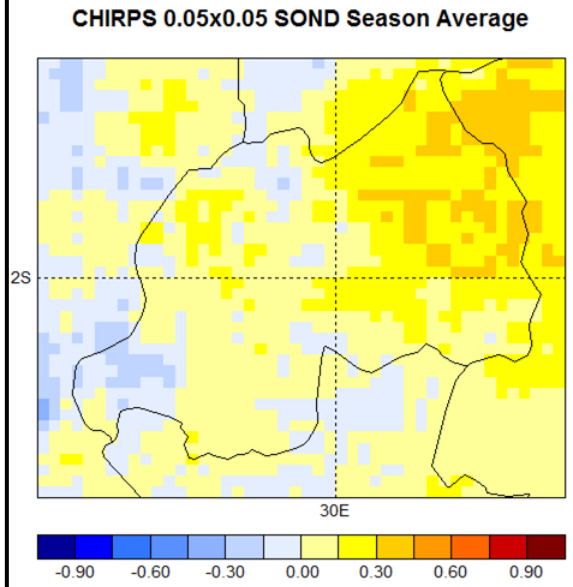
The skill of seasonal forecasts as estimated using different rainfall products

Pearson's correlation skill maps using GCM (CFS2) outputs for SOND Precipitation



ARC2





CHIRPS

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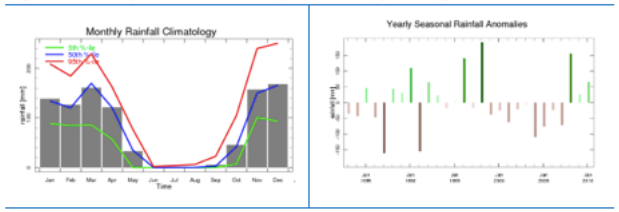
MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

National Guidelines for Malaria Surveillance and Response

July 2017

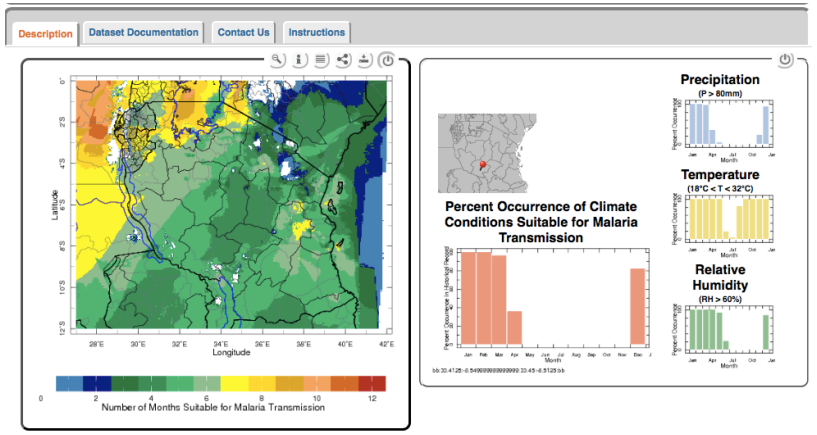
Figure 46: Monthly anomalies in January–March in Kigoma Region



Information and Knowledge (what the indicators mean)

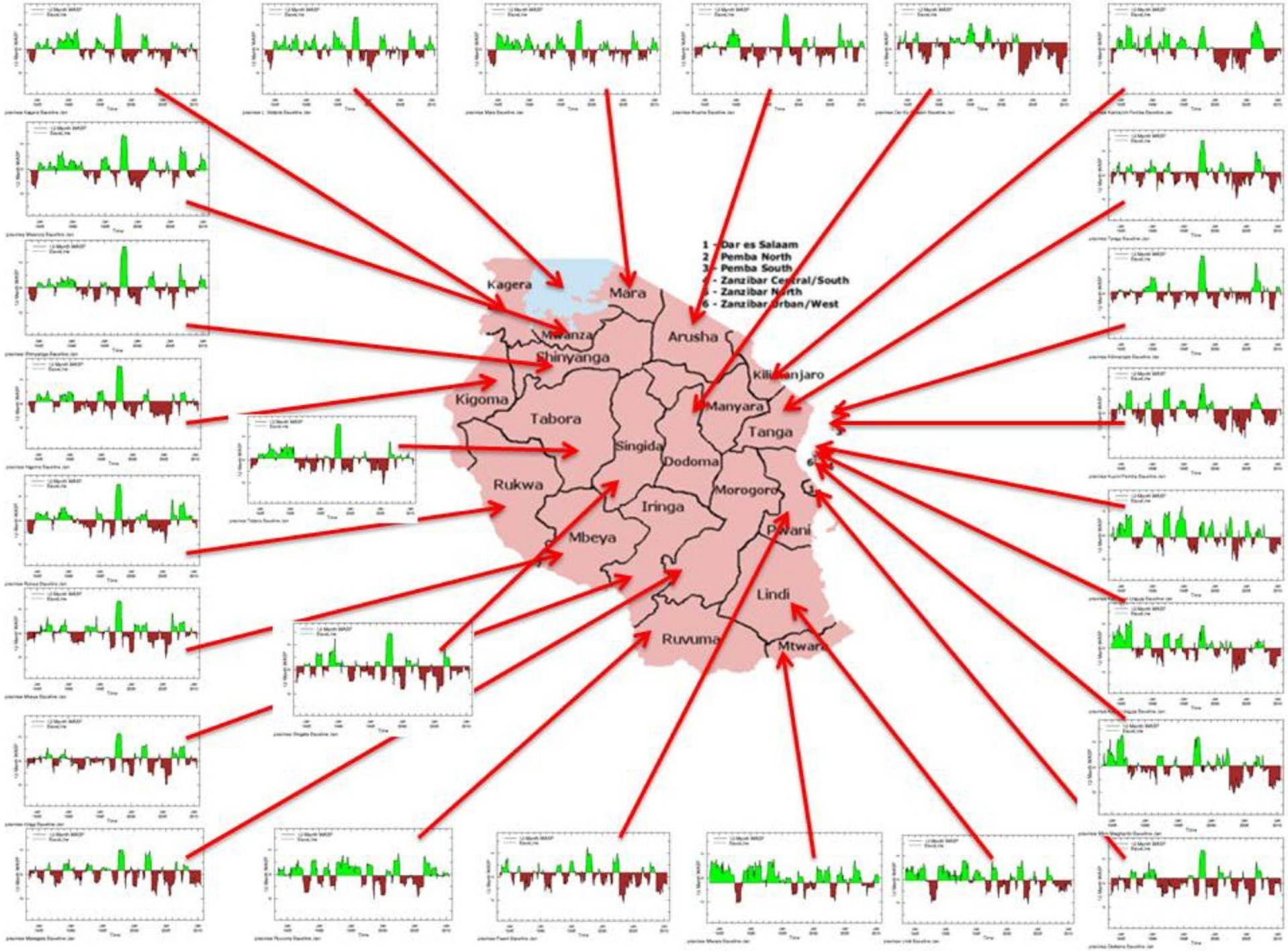
Seasonal climate tool can be used for a) visualizing the seasonal patterns of rainfall and temperature at the point, district, and regional scales; b) visualizing the impact of the spatial scale on the analysis of seasonal climate; c) visualizing the level of uncertainty in the seasonal climate; and d) providing information to support seasonal agriculture, livelihoods, and disease planning calendars. However, this tool cannot be used for predicting epidemics.

Response (what should be done based on the evidence)



Seasonal Climatic Suitability for Malaria Transmission

Launch Sept 11th, Dar Es Salaam

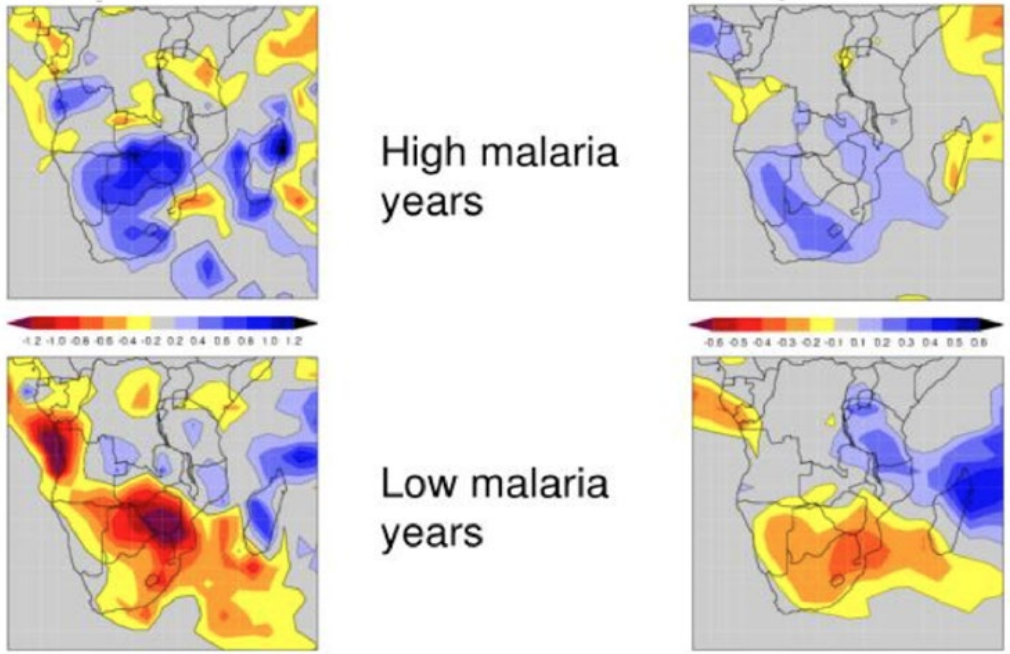

1 - Dar es Salaam
2 - Pemba North
3 - Pemba South
4 - Zanzibar Central/South
5 - Zanzibar North
6 - Zanzibar Urban/West
Kagera
Mara
Mwanza
Shinyanga
Arusha
Kilimanjaro
Kigoma
Tabora
Manyara
Tanga
Singida
Dodoma
Rukwa
Morogoro
Iringa
Pwani
Mbeya
Lindi
Ruvuma
Mtwara

Seasonal climate forecasts

DEMETER Forecasts

Observations

Forecasts



High malaria years

Low malaria years

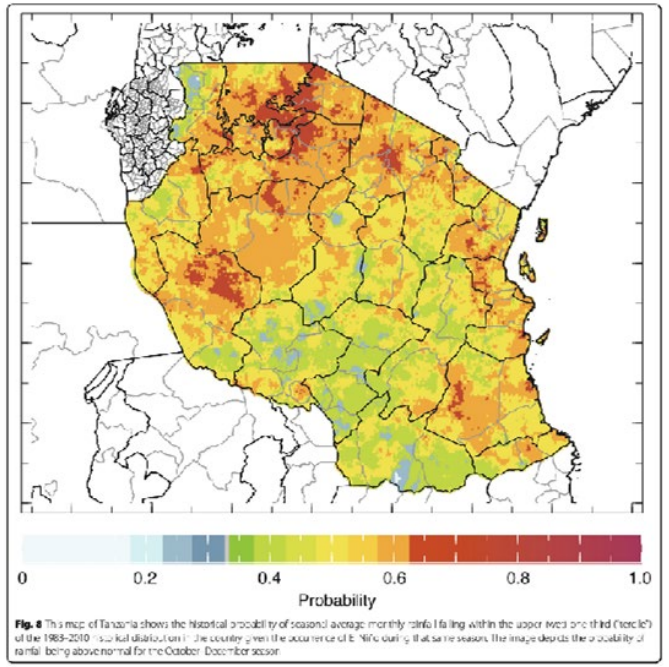
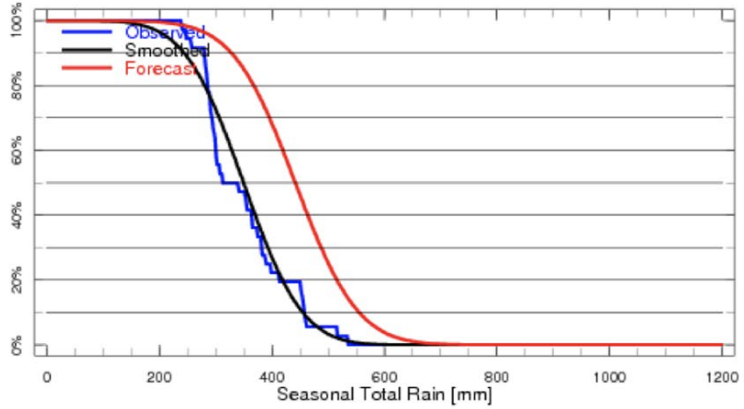


Fig. 6 This map of Tanzania shows the historical probability of seasonal average monthly rainfall falling within the upper (wet) one third (tercile) of the 1983–2010 historical distribution in the country given the occurrence of El Niño during that same season. The image depicts the probability of rainfall being above normal for the October–December season

Most Recent Precipitation Seasonal Forecast



Sep-Dec 2018 Forecast issued August 2018 at Kanyinya, NYARUGENGE, VILLE DE K

http://maproom.meteorwanda.gov.rw/maproom/

Getting the climate right for malaria control

The Center for Global Development, the American Society of Tropical Medicine and Hygiene, and the U.S. President's Malaria Initiative, in collaboration with the United Nations Foundation, Friends of the Global Fight, and Malaria No More, cordially invite you to our upcoming event:

Malaria Control: A Critical Investment for Saving Lives in Africa

Honorary Co-hosts

Sen. Chris Coons (Co-Chair of Malaria Caucus)
Sen. Roger Wicker (Co-Chair of Malaria Caucus)

Featuring

Tedros Adhanom Ghebreyesus, Director-General, World Health Organization (Invited)
Kesete Admasu, Roll Back Malaria Partnership CEO
Anne Schuchat, Principal Deputy Director Centers for Disease Control and Prevention
Irene Koek, Acting U.S. Global Malaria Coordinator
Bernard Nahlen, Deputy Coordinator, U.S. President's Malaria Initiative
Elizabeth Chizema, Director, National Malaria Elimination Centre, Zambia
Patrick Kachur, Chief of the Malaria Branch at the US Centers for Disease Control and Prevention
Regina Rabinovich, President of the American Society of Tropical Medicine and Hygiene
Jen Kates, Vice President and Director of Global Health & HIV Policy at the Kaiser Family Foundation
Amanda Glassman, Chief Operating Officer and Senior Fellow at the Center for Global Development

Date & Time

Wednesday, September 27
12:30 - 3:30 p.m.

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Location
Center for Global Development
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Washington, DC 20036

Not able to attend in person?

Am. J. Trop. Med. Hyg., 00(00), 2017, pp. 1–14
doi:10.4269/ajtmh.16-0696
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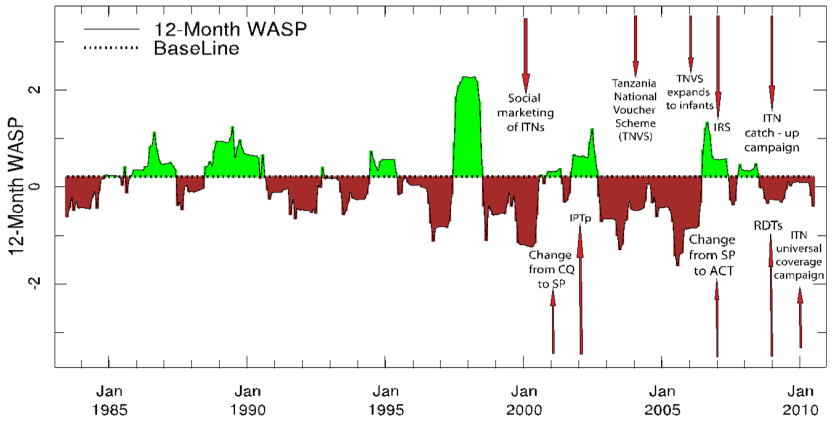
Using Rainfall and Temperature Data in the Evaluation of National Malaria Control Programs in Africa

Madeleine C. Thomson,[1,2*] Israel Ukawuba,[1] Christine L. Hershey,[3] Adam Bennett,[4] Pietro Ceccato,[1] Bradfield Lyon,[1] and Tufa Dinku[1]

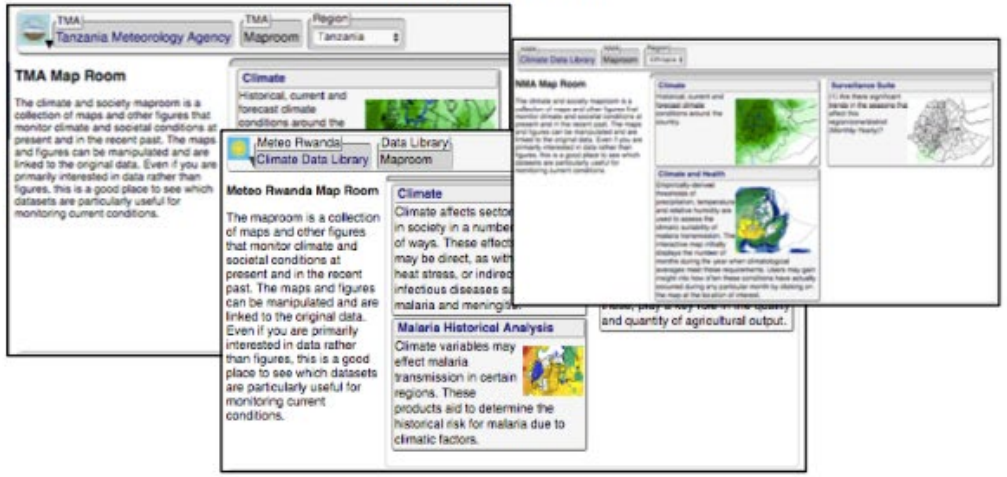
[1]*International Research Institute for Climate and Society, Palisades, New York;* [2]*Department of Environmental Health Sciences, Mailman School of Public Health, Columbia University, New York, New York;* [3]*President's Malaria Initiative, United States Agency for International Development, Washington, District of Columbia;* [4]*Malaria Elimination Initiative, Global Health Group, University of California, San Francisco, California*

Abstract. Since 2010, the Roll Back Malaria (RBM) Partnership, including National Malaria Control Programs, donor agencies (e.g., U.S. President's Malaria Initiative and Global Fund), and other stakeholders have been evaluating the impact of scaling up malaria control interventions on all-cause under-five mortality in several countries in sub-Saharan Africa. The evaluation framework assesses whether the deployed interventions have had an impact on malaria morbidity and mortality (Rowe and others, 2007) and requires consideration of potential nonintervention influencers of transmission, such as drought/floods or higher temperatures. Herein, we assess the likely effect of climate on the assessment of the impact malaria interventions in 10 priority countries/regions in eastern, western, and southern Africa for the U.S. President's Malaria Initiative. We used newly available quality controlled Enhanced National Climate Services rainfall and temperature products as well as global climate products to investigate likely impacts of climate on malaria evaluations and test the assumption that changing the baseline period can significantly impact on the influence of climate in the assessment of interventions. Based on current baseline periods used in national malaria impact assessments, we identify three countries/regions where current evaluations may overestimate the impact of interventions (Tanzania, Zanzibar, Uganda) and three countries where current malaria evaluations may underestimate the impact of interventions (Mali, Senegal and Ethiopia). In four countries (Rwanda, Malawi, Mozambique, and Angola) there was no strong difference in climate suitability for malaria in the pre- and post-intervention period. In part, this may be due to data quality issues and analysis issues.



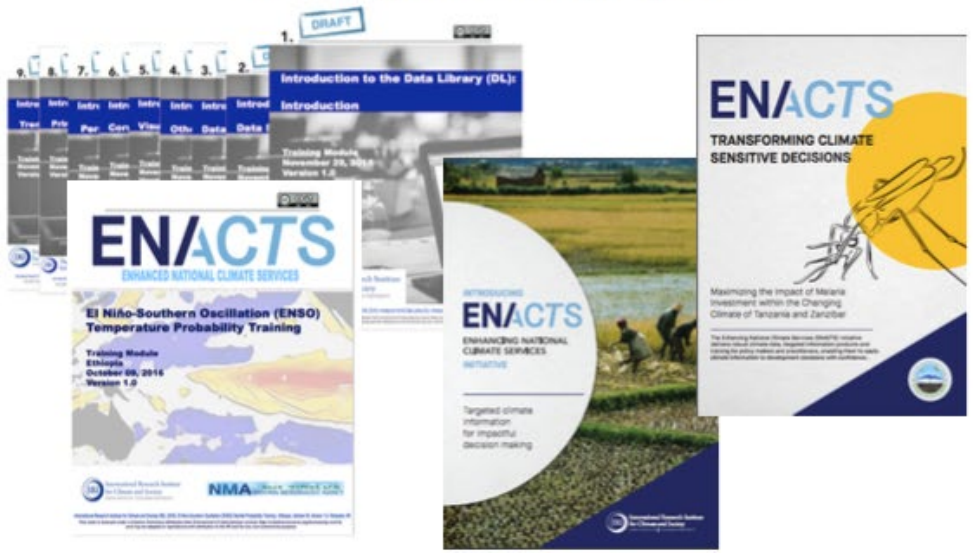
WISER-ENACTS Milestones (Year 1)

Implementation and Strengthening of Maprooms

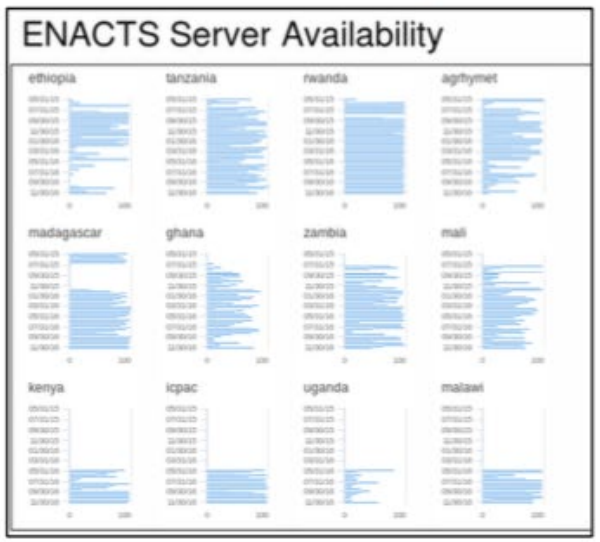


ENACTS Launches

Training Materials/Flyers



24/7 Tracking



What did we learn?

- Increasing interest from Donor community – NASA, NIH, DFID, USAID, WB, Wellcome
- Significant uptake by the National Meteorological Agencies
- Significant interest from the malaria community but still limited uptake capacity
- Major barriers to data sharing and governance
- Challenges around project nature of investments and lack of institutionalization
- What did we do?

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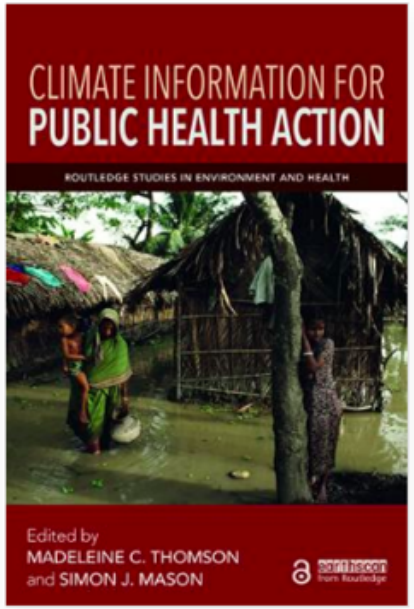

Climate Information for Public Health Action

1st Edition

Edited by **Madeleine C. Thomson**, **Simon J. Mason**

Routledge

244 pages | 37 B/W Illus.

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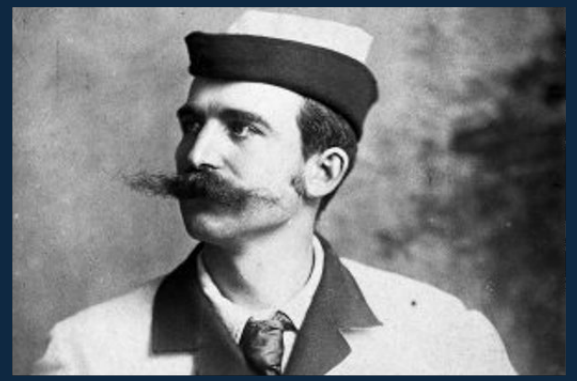
Description

Policy-makers are increasingly concerned about the impact of climate variability and change on the health of vulnerable populations. Variations and trends in climatic factors and extreme weather events impact many health outcomes, including malaria, heat stress and undernutrition.

Climate Information for Public Health Action is based on the premise thatclimate knowledge and information can help protect the public from climate-sensitive health risks. With a focus on infectious

Wellcome 2019-Present



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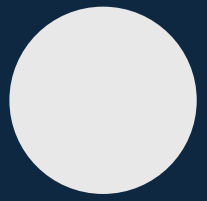
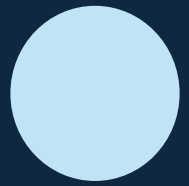
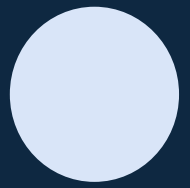
supporting science to solve the urgent health challenges facing everyone.



Enabling and investing in research



Influencing policy change



Engaging with people

Strategic programmes

Sanger Institute

Discovery Research

Data for Science and Health

Climate and Health

Infectious Disease

Mental Health

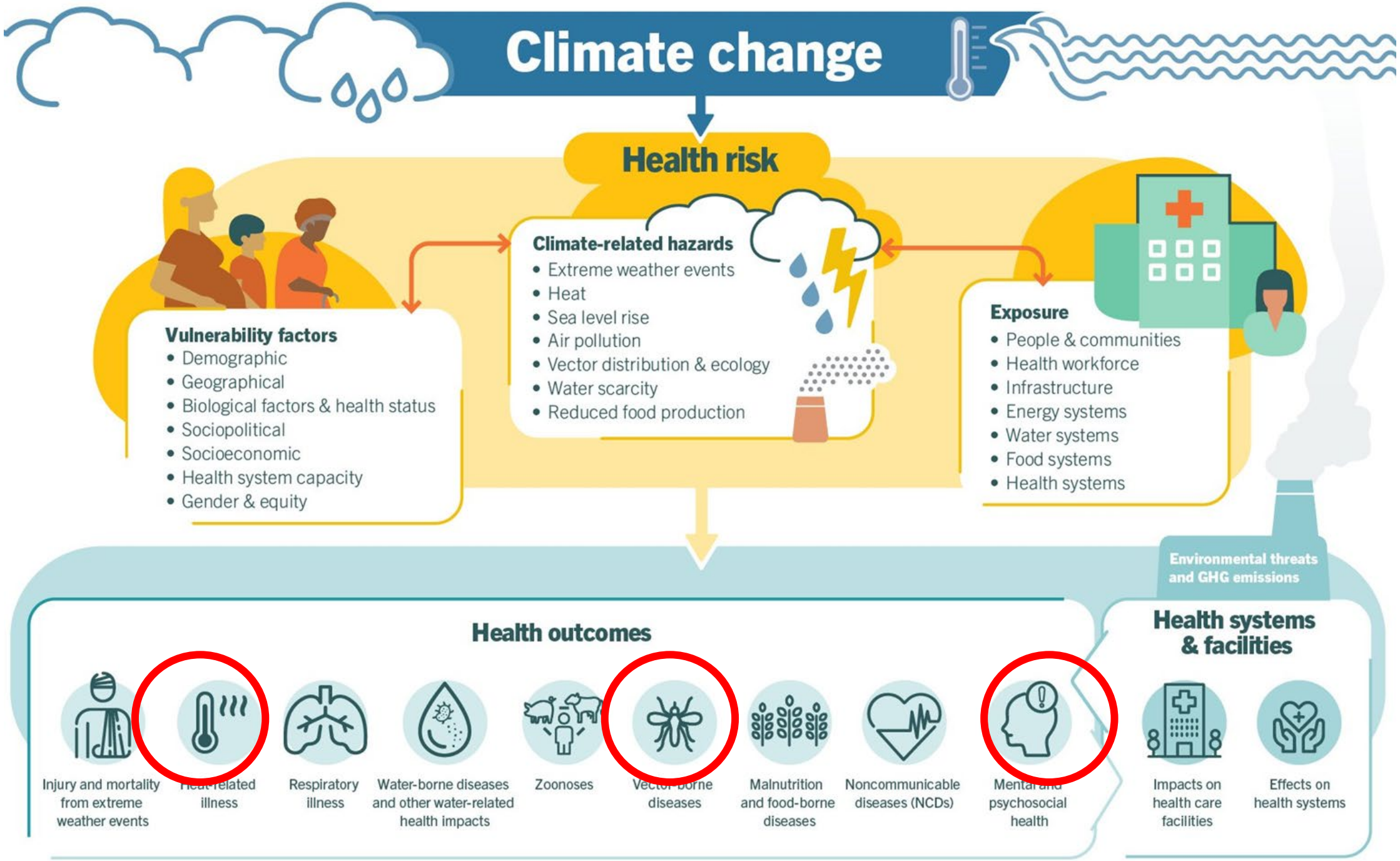
Climate and Health

Vision:

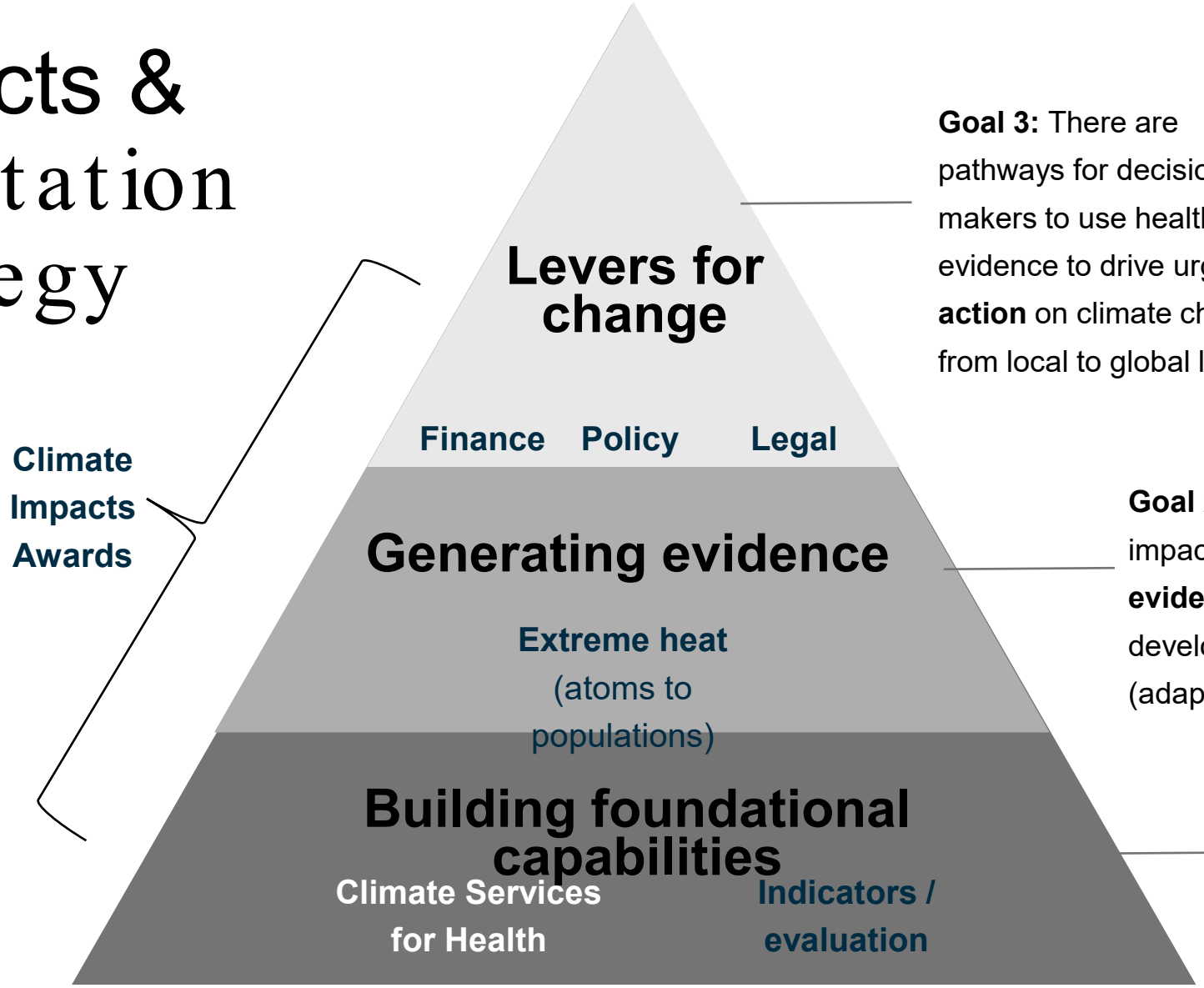
- A world where catastrophic climate breakdown is averted in a way that allows human health to flourish.

Mission until 2030:

- Putting health at the heart of climate action
  - help drive health centred mitigation action
  - help protect the most vulnerable from the impacts of climate change


Climate change
Health risk
Vulnerability factors
• Demographic
• Geographical
• Biological factors & health status
• Sociopolitical
• Socioeconomic
• Health system capacity
• Gender & equity
Climate-related hazards
• Extreme weather events
• Heat
• Sea level rise
• Air pollution
• Vector distribution & ecology
• Water scarcity
• Reduced food production
Exposure
• People & communities
• Health workforce
• Infrastructure
• Energy systems
• Water systems
• Food systems
• Health systems
Environmental threats and GHG emissions
Health outcomes
Injury and mortality from extreme weather events
Heat-related illness
Respiratory illness
Water-borne diseases and other water-related health impacts
Zoonoses
Vector-borne diseases
Malnutrition and food-borne diseases
Noncommunicable diseases (NCDs)
Mental and psychosocial health
Health systems & facilities
Impacts on health care facilities
Effects on health systems

Impacts & Adaptation strategy



Goal 3: There are pathways for decision-makers to use health evidence to drive urgent **action** on climate change from local to global levels

Goal 2: There is a robust and impact-oriented climate and health **evidence base** appropriate for developing context-specific (adaptation) solutions

Goal 1: There is a global transdisciplinary **ecosystem** of C&H stakeholders equipped with tools, methods and approaches required to respond to the risks to global health from climate change.

Discovery Research Meetings

Climate Services for Health is an important workstream as it supports many of our research and operational investments

Discovery Research Meetings

Improving the availability, access and use of ”fit for purpose” weather and climate data is critical for ensuring best available climate and health evidence

Table 1
Timescales of climate variability and associated data requirements for studying climate-health associations

Timescale of variability	Weather	Sub-seasonal	Seasonal	Inter-annual	Multi-decadal	Long-term trends
Time period over which variations occur	Hours to several days	1-4 weeks	1-12 months	1-10 years	10-30 years	>30 years
Frequency of health data required	Sub-daily to daily	Pentads-weekly	1-3 monthly	Annual, at the same time each year	Annual, at the same time each year	Annual, at the same time each year
Length of climate and health timeseries required for analysis	Depends on variability in weather and strength of signal in health data. Extreme weather events require longer time series to obtain adequate sample sizes.	Several years.	At least several years depending on strength of seasonal signal vs. interannual variability.	At least 10 years, more for causal modelling depending on strength of signal.	At least 30 years, more for causal modelling depending on strength of signal (usually unfeasible in practice).	At least 50-60 years to detect trends. Causal modelling of trends likely unfeasible given data availability.
Considerations	Diurnal weather variability means that exposure data (and potentially health data for highly variable outcomes) must be at the appropriate time of day. Associations may differ in different seasons, or during different phases of climate variability (e.g. during ENSO events or different phases of decadal oscillations).	Several years required to account for inter-annual variations.	Several years required to account for inter-annual variations. Causal modelling to explain seasonal variability in health data would require many years of sub-annual data but average seasonal cycles could be estimated with fewer years.	Seasonality means that the timing of data collected during the year matters: health data must be at the appropriate time of year to capture the impacts of climate, and successive years require observations at the same times of year.	Annual data needed to avoid confounding by inter-annual variability. Frequent measurements are also needed to discern when different phases begin and end. More years are required to detect decadal variations in regions with high interannual variability.	Annual data needed to avoid confounding by inter-annual variability. More years required to detect trends in regions with high interannual and decadal variability.

Table 2
Characteristic durations and spatial extents of weather and climate events

	Weather / climate event	Duration	Spatial extent
	Strong winds	Hours - days	Wide variation depending on the driving weather system / mechanism.
	Tornado	Hours, but they move quickly so can pass over any one location in a very short time.	Tens of m to 3 km
	Floods (riverine, flash, coastal)	Hours - days	Flash floods: < a few hundred m Riverine/coastal floods: < a few hundred m inland from coastline or river banks.
	High temperatures / heat waves	< 2 weeks	Absolute values vary on small scales according to land cover (urban areas are hotter) and elevation (high altitudes are cooler); temperature anomalies correlated over hundreds of km up to about 1500 km.
	Drought	Months to years	Hundreds to thousands of km
	Extreme winter conditions (cold, ice, snow, wind)	Days to months	Varies by parameter
	Heavy precipitation	Hours to days depending on the driving weather system.	Rain occurrence: a few hundred m to a few hundred km, depending on the driving weather system. Amount of rain/snow: much less spatially correlated.
	Tropical storms (cyclones & hurricanes cause strong winds, heavy rain and storm surge)	The whole system will last several days. Associated rain and wind are experienced for shorter periods depending on how quickly the storm moves once it makes landfall.	Weather varies dramatically over small distances within a tropical storm.

Explainer

Explained: how El Niño impacts health

According to the World Meteorological Organization (WMO), an El Niño event is expected to develop from mid-2026, reshaping global weather, influencing temperatures, rainfall, drought, and extreme weather patterns across the world.

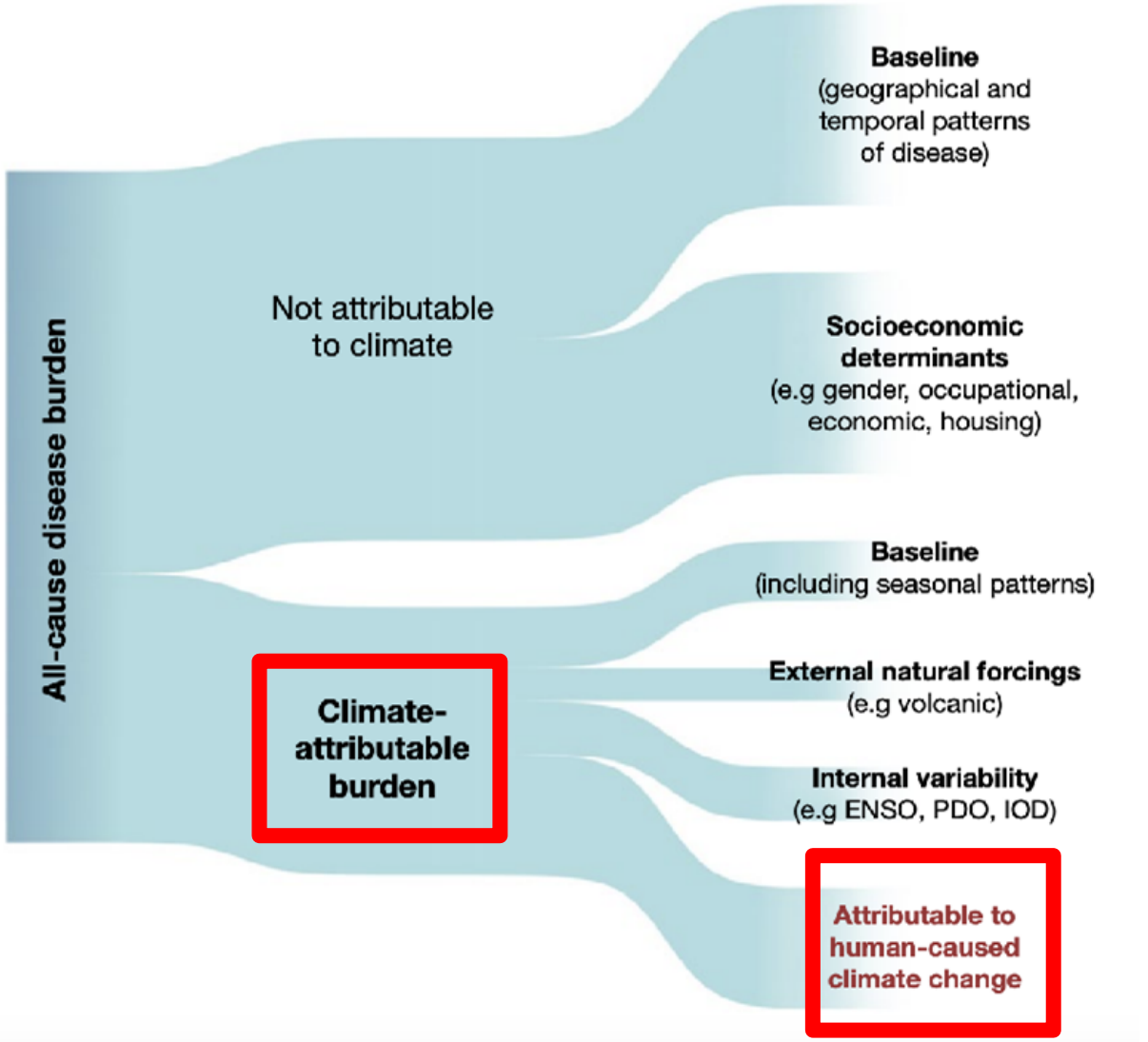
The last El Niño event that began in July 2023 was marked by record-breaking temperatures, with 2024 becoming the hottest year on record. Find out about the health effects of El Niño and why preparedness is critical to addressing its impact.

Read image details

Impact Attribution and Impact Assessment

Many of the tools and frameworks that were developed for the detection and attribution of human influence on the global climate system can also be used to understand the consequences for human health.

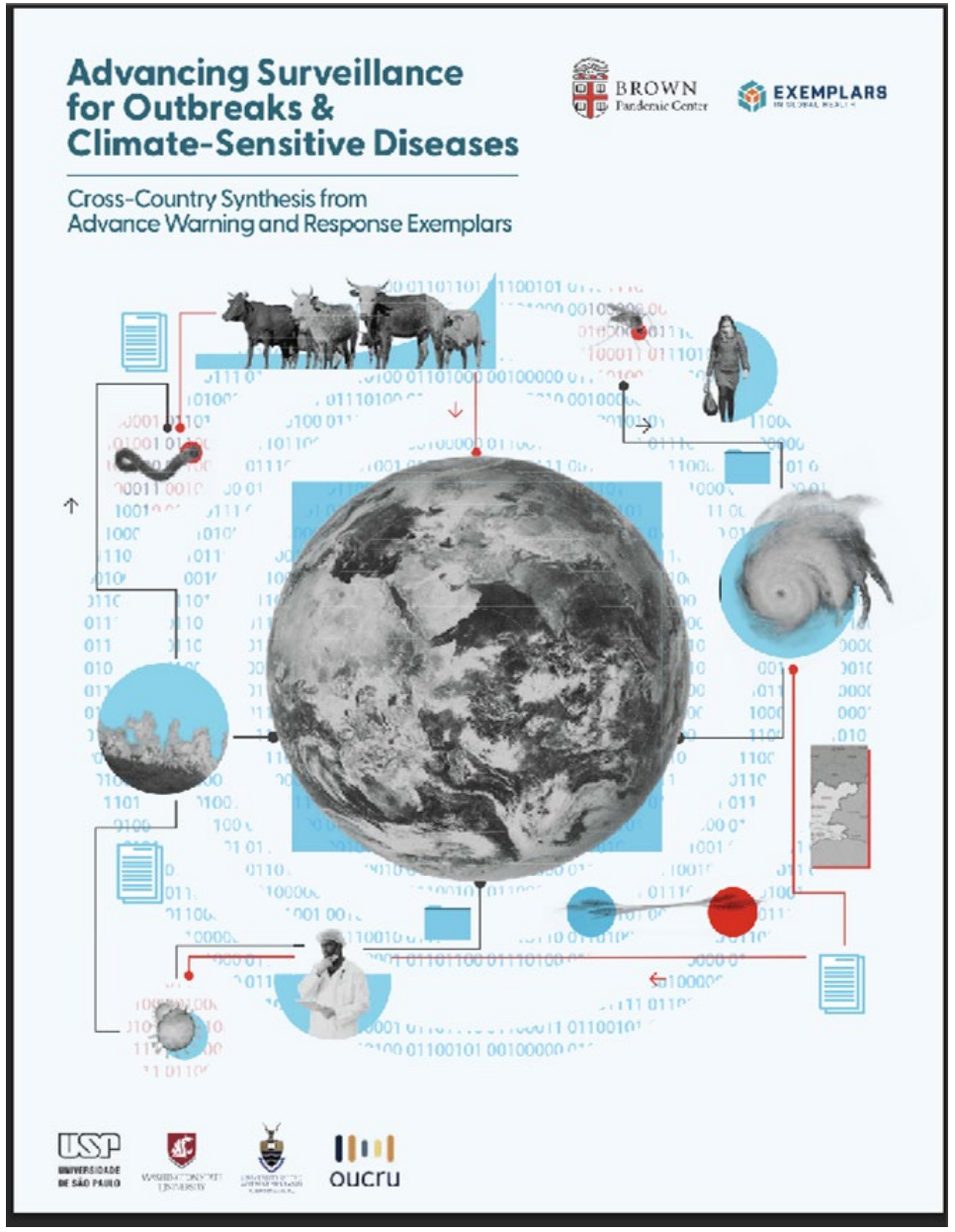
Figure 2.2
Drivers and sources of variation in all-cause disease burden



CJ Carlson, M Lukas-Sithole, DS Shumba, M North, C Lippi, R Gibb, T Carleton, M Chersich, T Lavelle, D Mitchell, M New, SJ Ryan, CH Trisos. Detection and attribution of climate change impacts on human health: a data science framework.

The Exemplars in Global Health (EGH) program studies "positive outlier" countries that successfully detect and respond to infectious disease outbreaks using constrained resources. EGH's research on Early Warning Systems (EWS) spotlights five best-practice themes utilized by successful nations to protect vulnerable populations: [1, 2, 3, 4, 5]

- **Advanced Warning & Response:** Systems capable of predicting outbreaks before they spread widely.
- **Financing & Sustainability:** Dedicated, long-term funding streams.
- **Evaluating Effectiveness:** Regular metrics and outcome assessments.
- **Data Sharing & Integration:** Seamless cross-agency and cross-border communication.
- **Governance & Decision -Making:** Clear, localized leadership and accountability. [1, 2, 3, 4]



9 July 2014

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WMO, WHO Establish Joint Office for Climate and Health

STORY HIGHLIGHTS

- The World Health Organization (WHO) and the World Meteorological Organization (WMO) have established a Joint Office for Climate and Health, under the auspices of the Global Framework for Climate Services (GFCS), to promote the development and use of climate services to improve public health.

Open calls to-date

Launch	Funding Call	Scope
Jan 2022	Digital Technology Development Awards (Climate-Sensitive Infectious Disease Modelling)	Global
Mar 2022	Heat adaptation: evaluating interventions to help manage the health effects of heat	LMIC PI/LMIC institution
May 2022	Biological Vulnerability to Extreme Heat in Maternal and Child Health	Global
July 2022	Advancing climate mitigation policy solutions with health co-benefits in G7 countries	G7 countries only
Feb 2023 **Feb 2024** **Feb 2025** **Feb 2026 (in process)**	Climate Impacts Awards: Unlocking urgent climate action by making the health effects of climate change visible	Global
Jan 2025	Uncovering mechanisms between heat and mental health	Global

Our grantees use climate data for a wide range of activities

- Assessing vulnerability, exposure, or risk
- Contextualising background and baselines
- Designing or evaluating adaptation strategies
- Early warning / decision support for operations or policy
- Validating field observations
- Designing or evaluating mitigation strategies

Only 25% consider they have the expertise to fully use the information appropriately

Data needs cover full range from local historical observations to real time monitoring to global climate change scenarios

What are we learning?

- Massive capacity gap still waiting to be filled – we will start with our grantee and provide support across the climate and health ecosystem
  - Health needs to be at the table when climate services are being developed
  - Health needs to be engaged with and learn from latest innovations in climate science and services
- Funder collaborations are key to supporting Climate and Health research and implementation activities – including Climate Services for Health New tools and initiatives, such as AI/Destination Earth, have the potential to be transformative.
- Prioritisation challenge – better modelling v. better use of information
- World has changed

We have come a long way – we still have someway to go.

WORLD HEALTH SUMMIT

WORLD METEOROLOGICAL ORGANIZATION | World Health Organization

JOINT OFFICE FOR CLIMATE AND HEALTH

wellcome

Engaging policy makers

Support to WHO & WMO

Climate Services for Health Panel at the World Health Summit 2024

Acknowledgements

Thank you

https://wellcome.org/what-we-do/climate-and-health