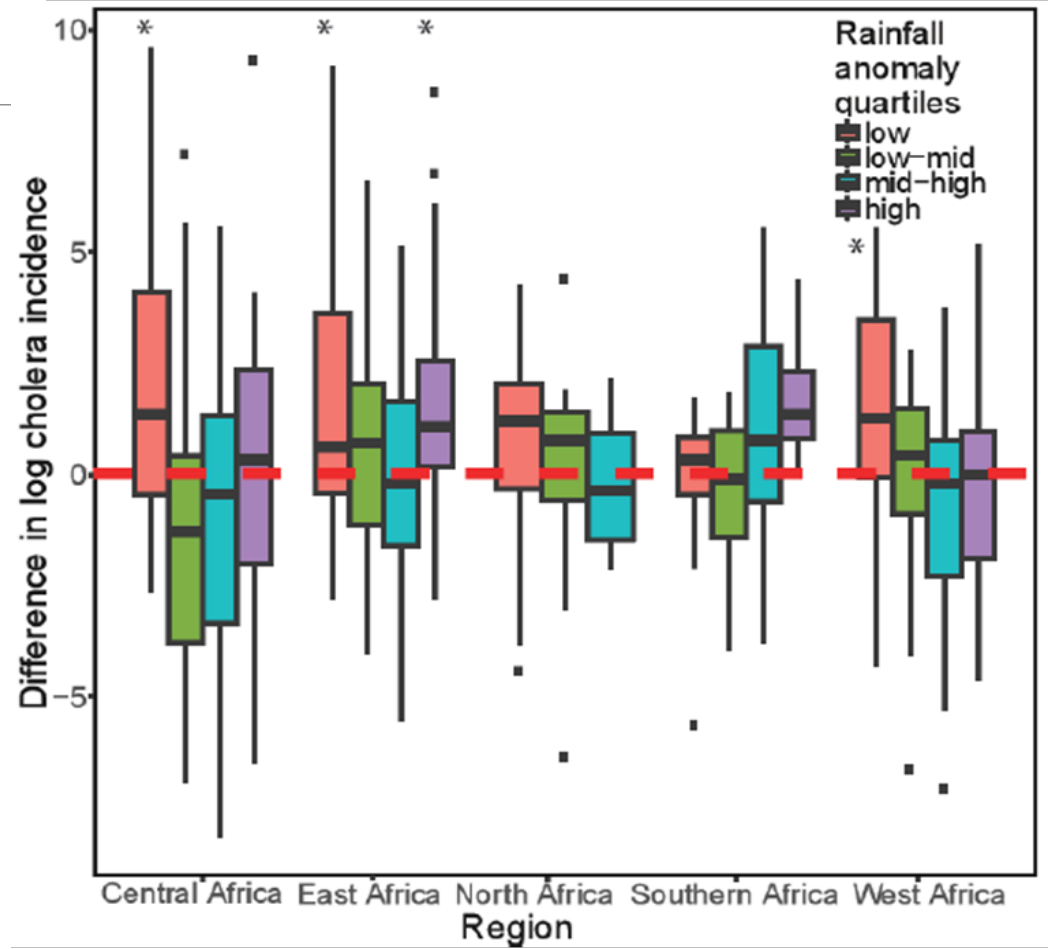
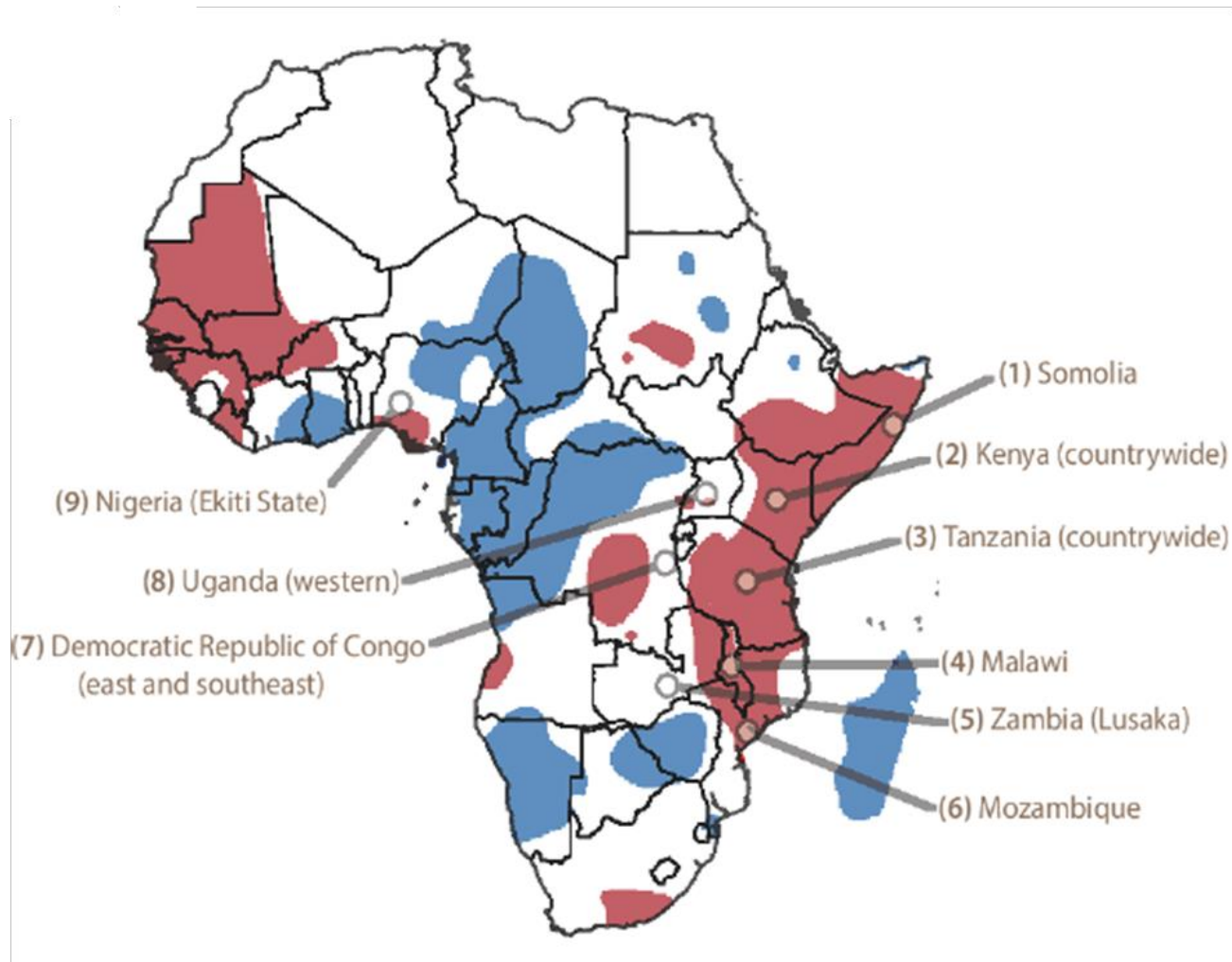


The African Cholera Risk Early Warning System (ACREWS)

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Alarming spike in cholera as famine grips East Africa



The Disasters Emergency Committee says it is worried by the rapid increase in the number of waterborne diseases as famine begins to grip



22nd March 2017 by Paul Cardwell

0 Comments

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The Disasters Emergency Committee (DEC) has warned of an alarming surge in the transmission of waterborne diseases such as cholera across East Africa.

Prolonged drought, conflict and food and water shortages have left 16 million people on the brink of starvation and resulted in a spike in the number of cases of Acute Watery Diarrhoea (AWD) – a key symptom of cholera.

The DEC, which is made up of 13 of the UK's biggest aid charities, launched its East Africa Crisis Appeal last week and has since raised £26 million to fund work on the ground.

In Somalia alone, the UN recorded almost 12,700 cases of AWD and cholera in the first three months of 2017.

In South Sudan, the World Health Organisation has recorded 5,640 cases. One in five are children under five.

GLOBAL HEALTH

Cholera Is Spreading in Mozambique, and It's Far From the Only Health Threat

About two million people are displaced, cholera has broken out, and malaria is expected. But doses of cholera vaccine have arrived, and the humanitarian crisis may yet be contained, aid agencies say.

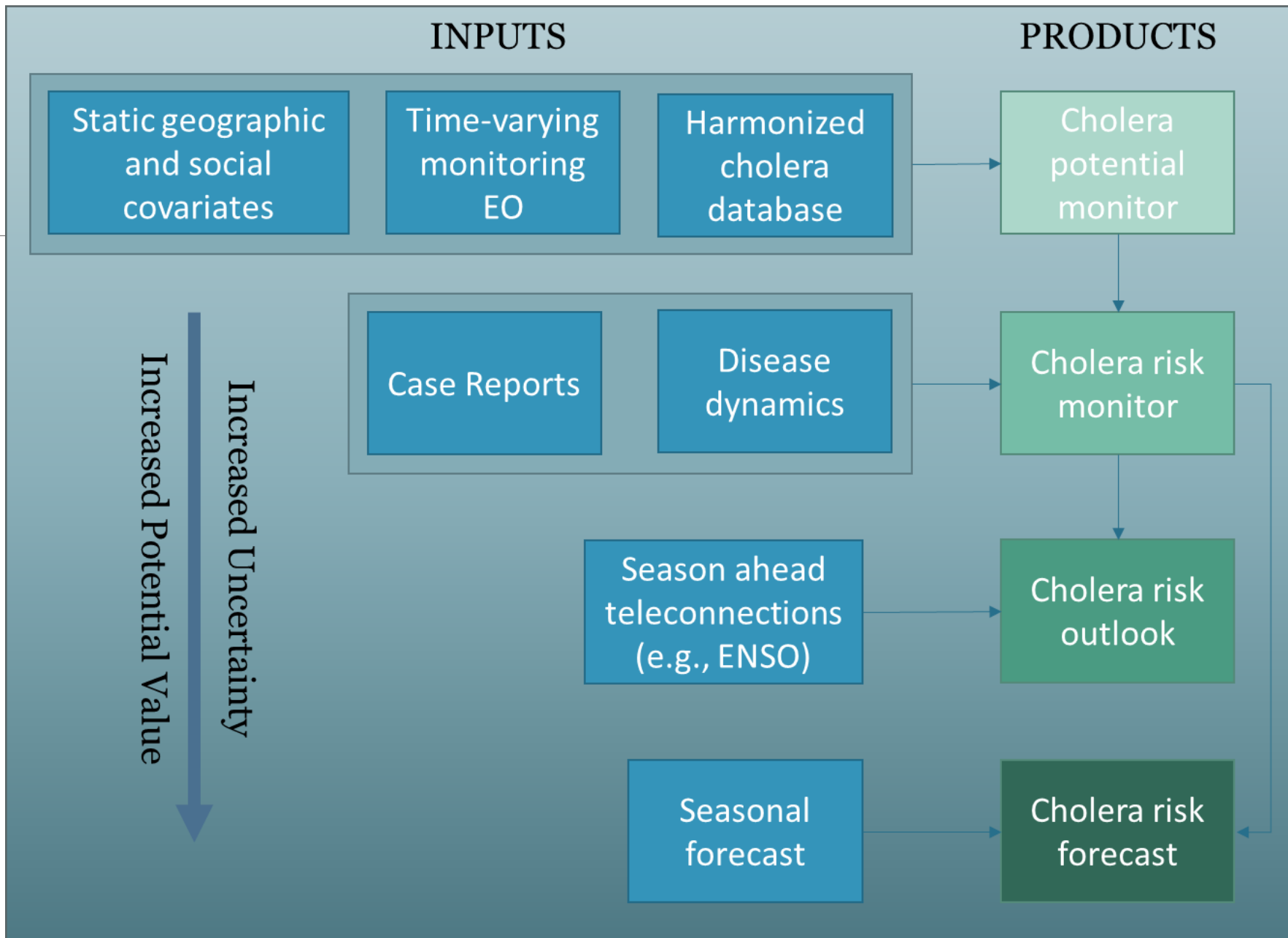


A doctor examined a girl with cholera on Saturday at a treatment center in Beira, Mozambique. Tsvangirayi Mukwazhi/Associated Press

Project Goal

Develop and operationalize an **Earth Observation-informed African Cholera Risk Early Warning System (ACREWS)** to support rapid response interventions

End users: UN Taskforce on Cholera Control, Save the Children, MSF



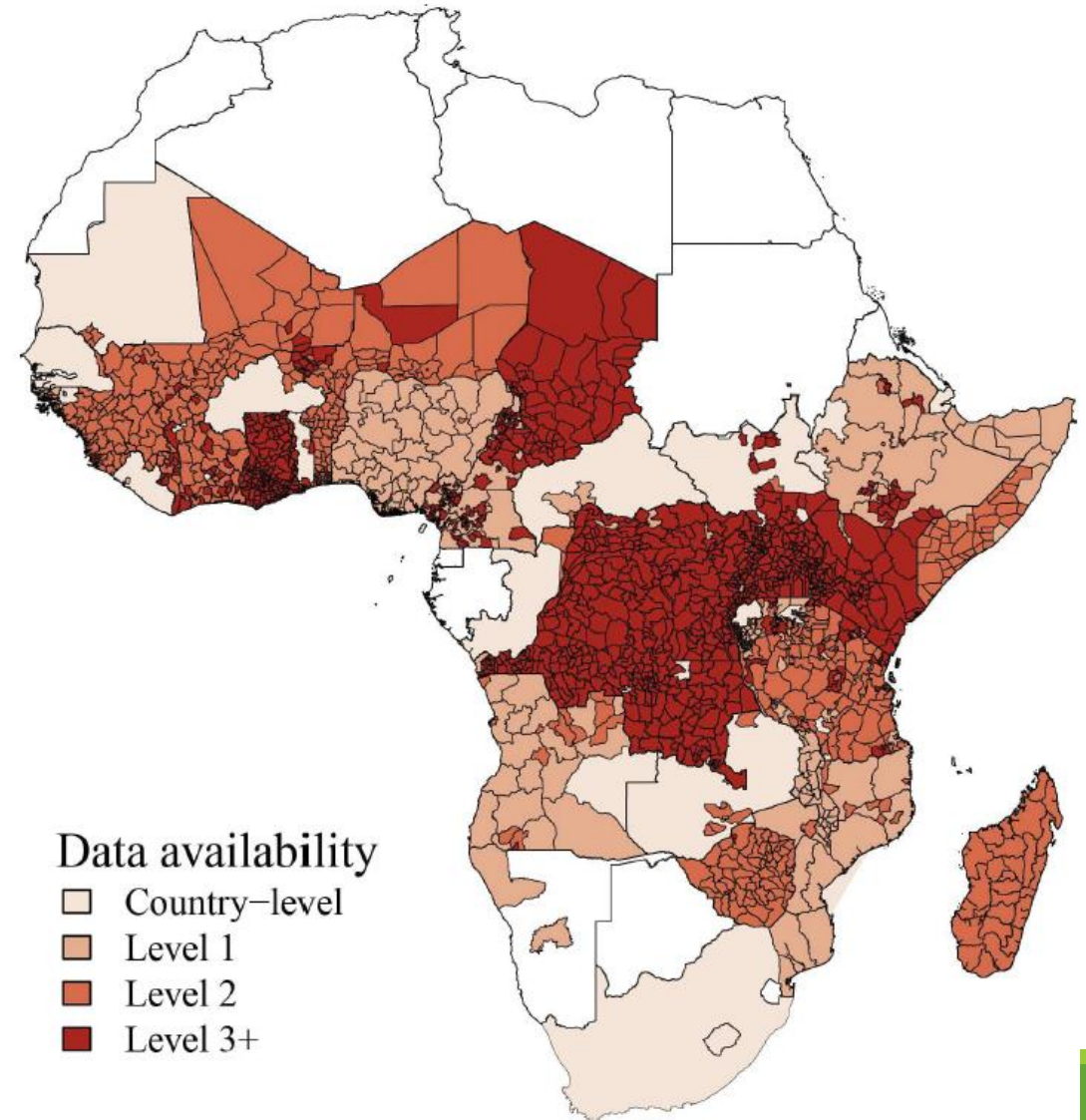
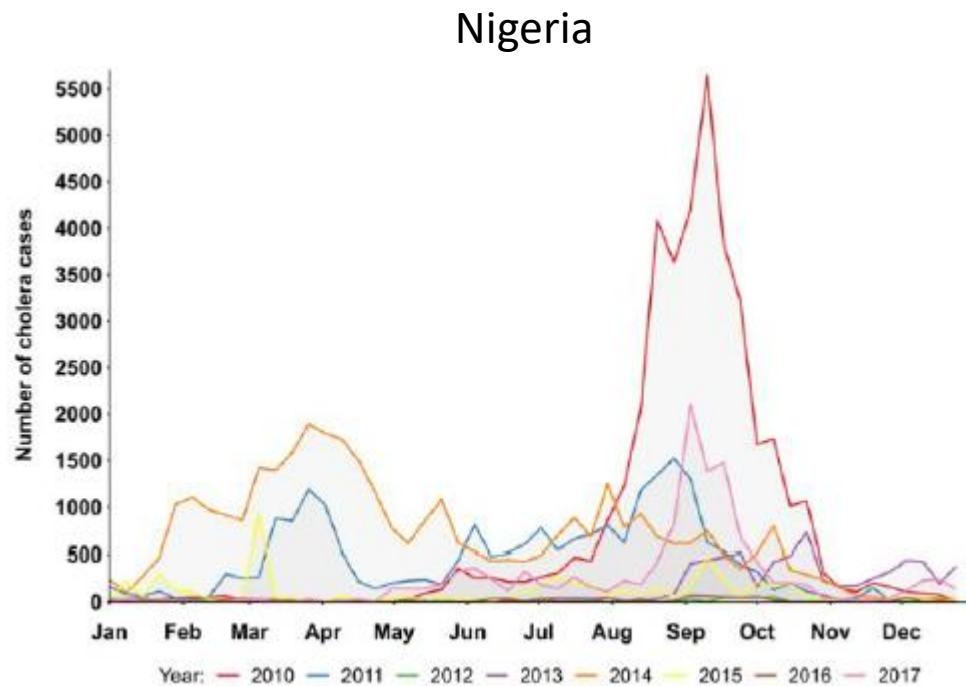
Objectives

1. Deliver a database of spatial and temporal variability in cholera burden across the continent.
2. Align our cholera database with a matching EO database of potential cholera predictors.
3. Collaboratively design a baseline system that generates weekly maps of environmental cholera potential based on historical correlations between ENSO, rainfall, and local cholera response.
4. Enhance the system to monitor actual cholera risk using EO-informed predictive models that account for the roles of population susceptibility, spatial correlation, and introduction probability
5. Apply two seasonal prediction techniques to extend the ACREWS time horizon: an ENSO analog-based cholera risk outlook and a dynamically-based cholera risk forecast.
6. Operationalize the system for decision support through partnership with the GTFCC.

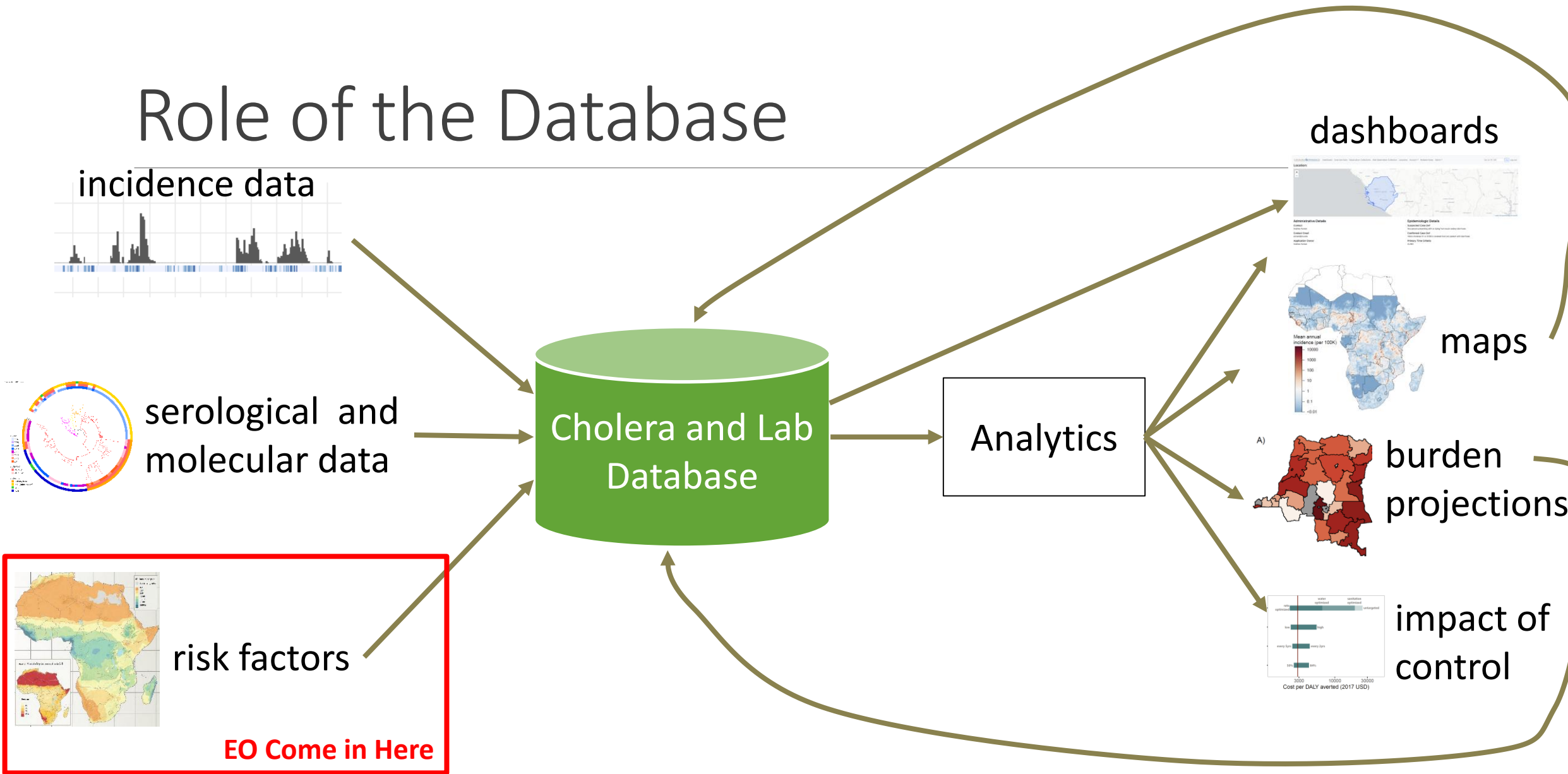
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1. Database of spatial and temporal cholera variability



Role of the Database



2. Earth Observation database

Satellite-derived rainfall: **GPM/TRMM** and **CHIRPS**

Satellite-derived surface temperature and near-surface air temperature:
MODIS/VIIRS and **CHIRTS**

Surface water extent and quality: **MODIS/VIIRS**; **Aquarius/SMAP** for salinity

Vegetation status: **MODIS/VIIRS**

Soil moisture and water flow from a **Land Data Assimilation System (LDAS)**

Subseasonal to Seasonal hydrological forecast: **NMME forecasts + LDAS**

ACREWS LDAS

MERRA-2 + CHIRPSv2

Noah-MP LSM

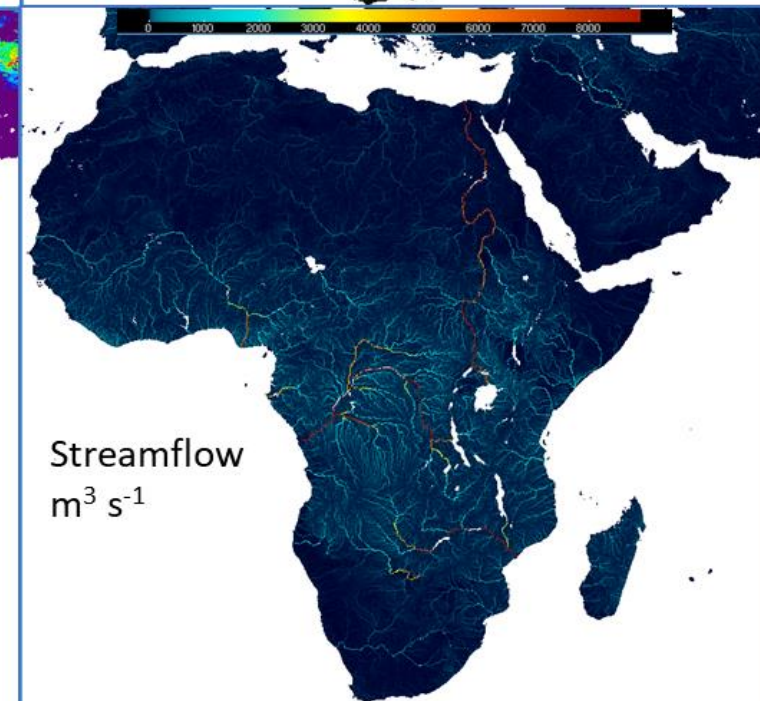
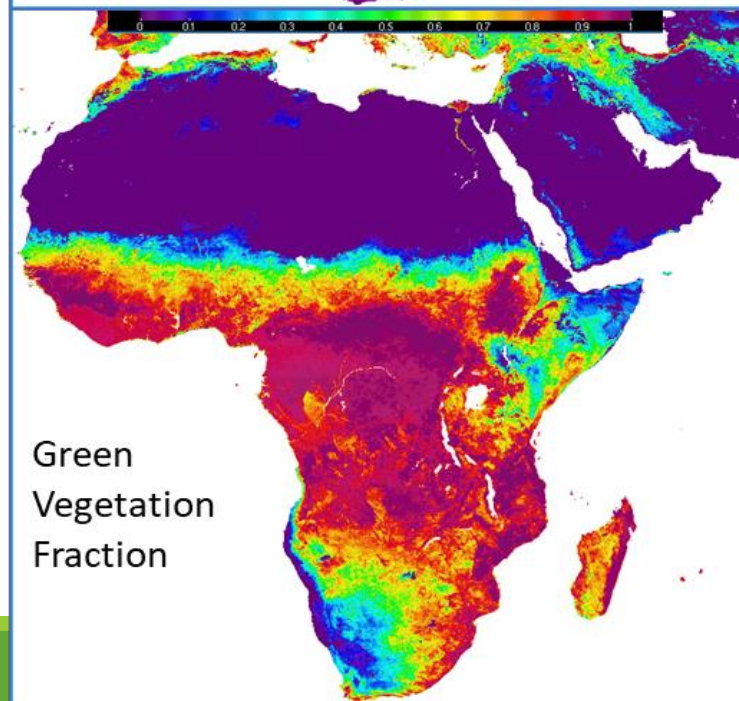
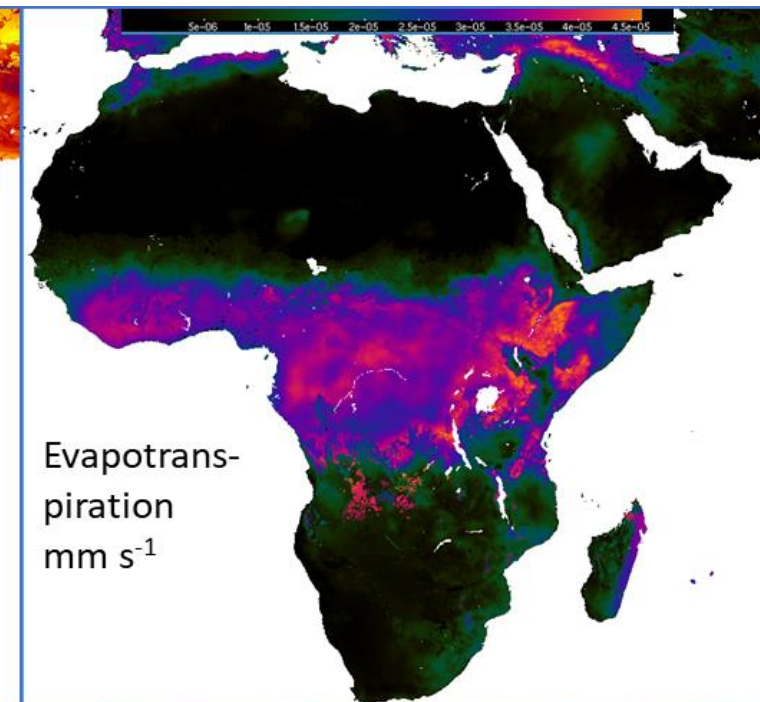
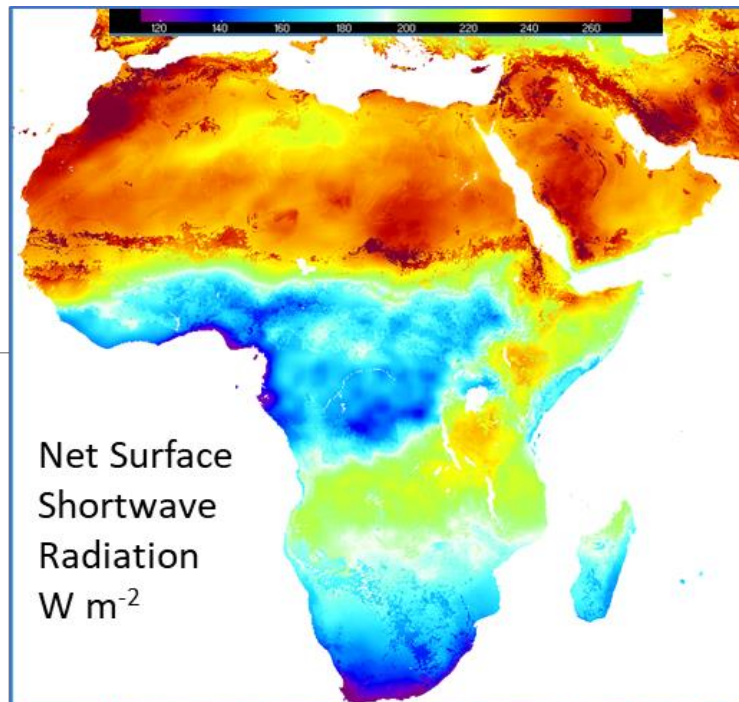
HyMAP hydrological model

MODIS vegetation and land cover

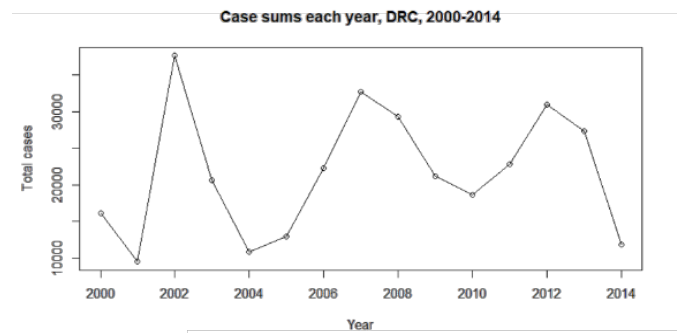
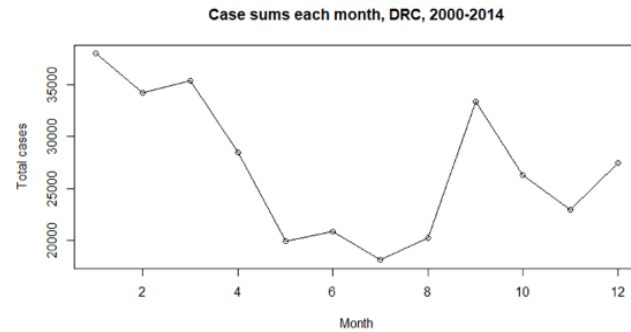
Evaluation data:

- SSEBop ET
- SMAP and ESACCI Soil Moisture
- River gauge records

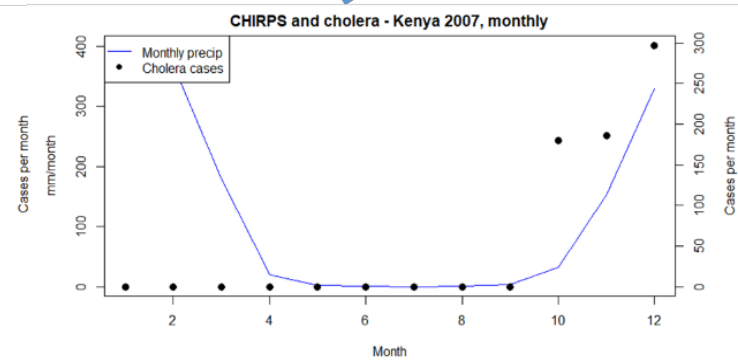
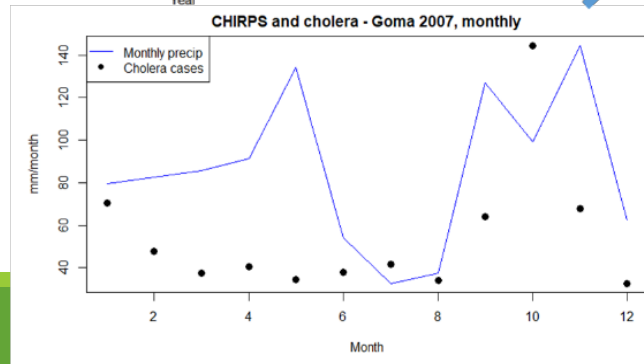
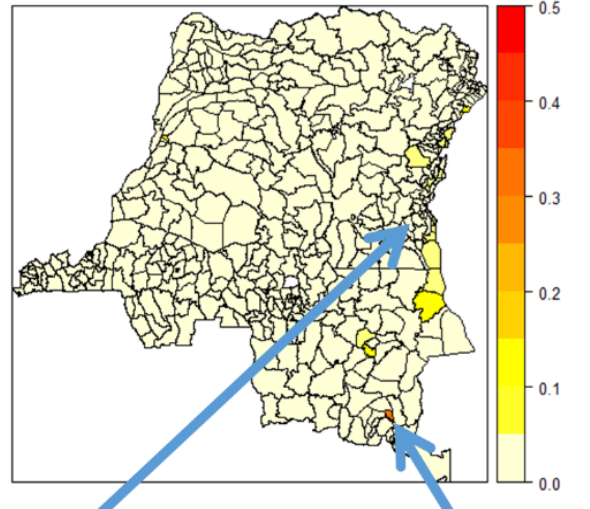
Simulations for 1981-2018 are being integrated to the cholera database



The aligned database



Total cases/district population, DRC, 2000-2014



3. Weekly maps of environmental cholera potential

Based primarily on **established relationships** between environment and cholera risk.

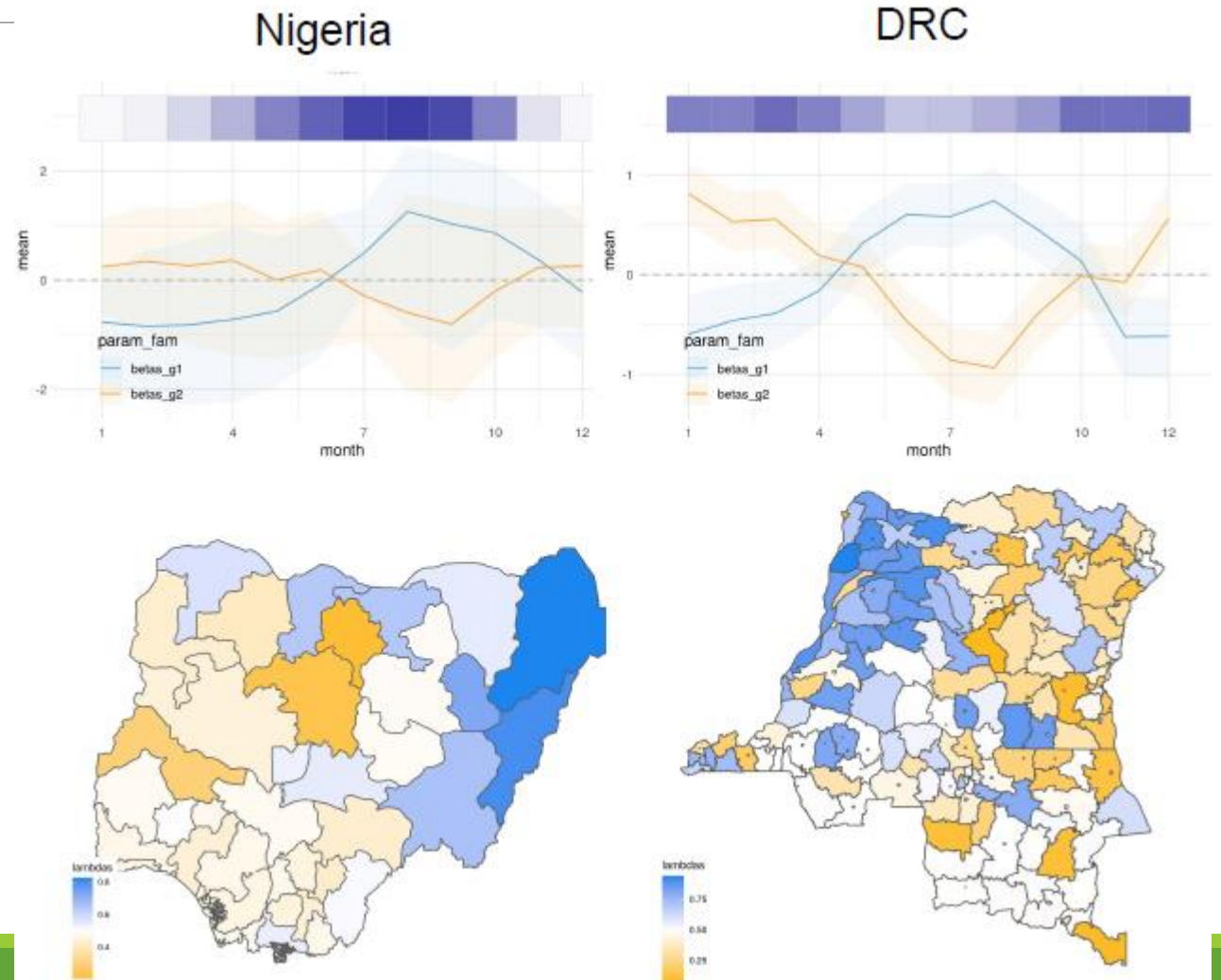
These relationships will **vary geographically and by season.**

Goal is a **20km gridded resolution monitoring product**, updated monthly or more frequently

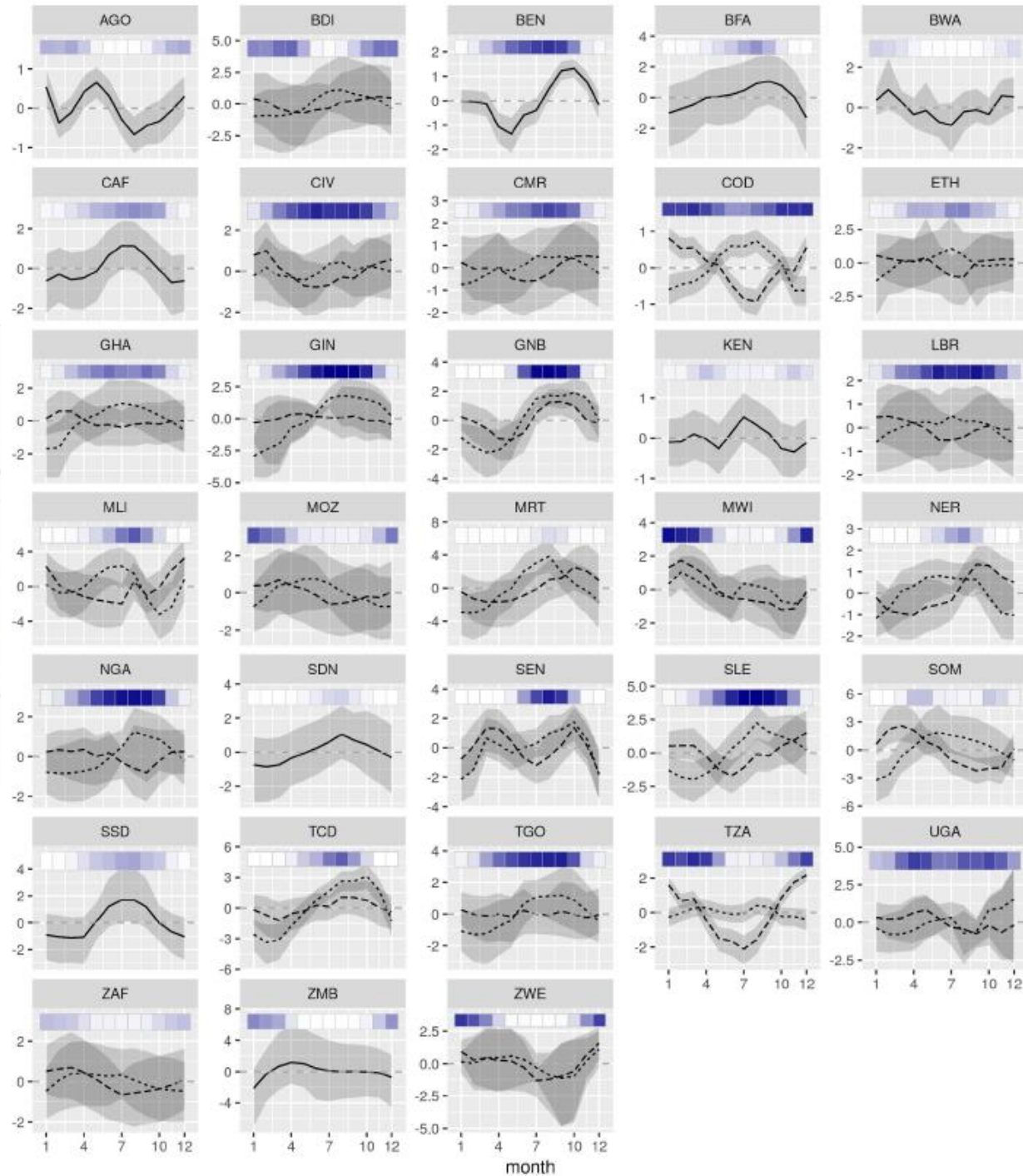
Capturing seasonality

$$Y_{i,m,y} \sim \text{Binomial}(n_{i,m,y}, p_{i,m,y})$$

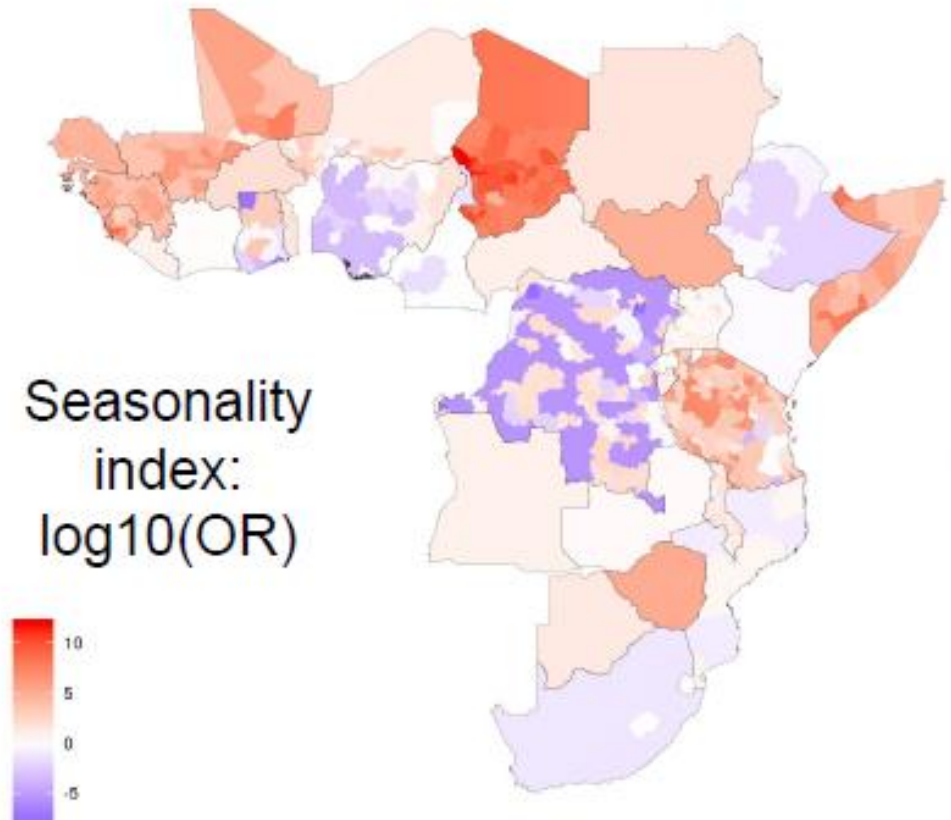
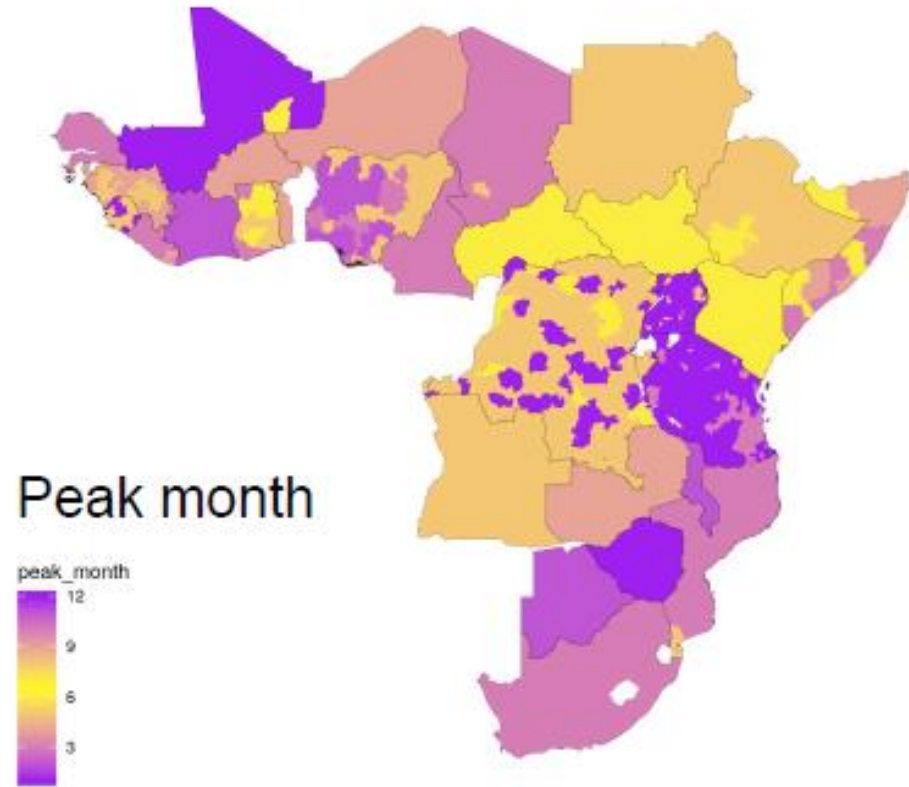
$$\text{logit}(p_{i,m,y}) = \beta_m + \eta_y + \theta_i + \phi_i$$



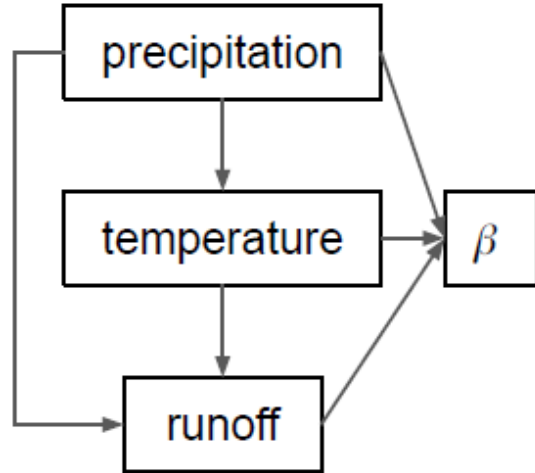
Monthly random effect (logodds scale)



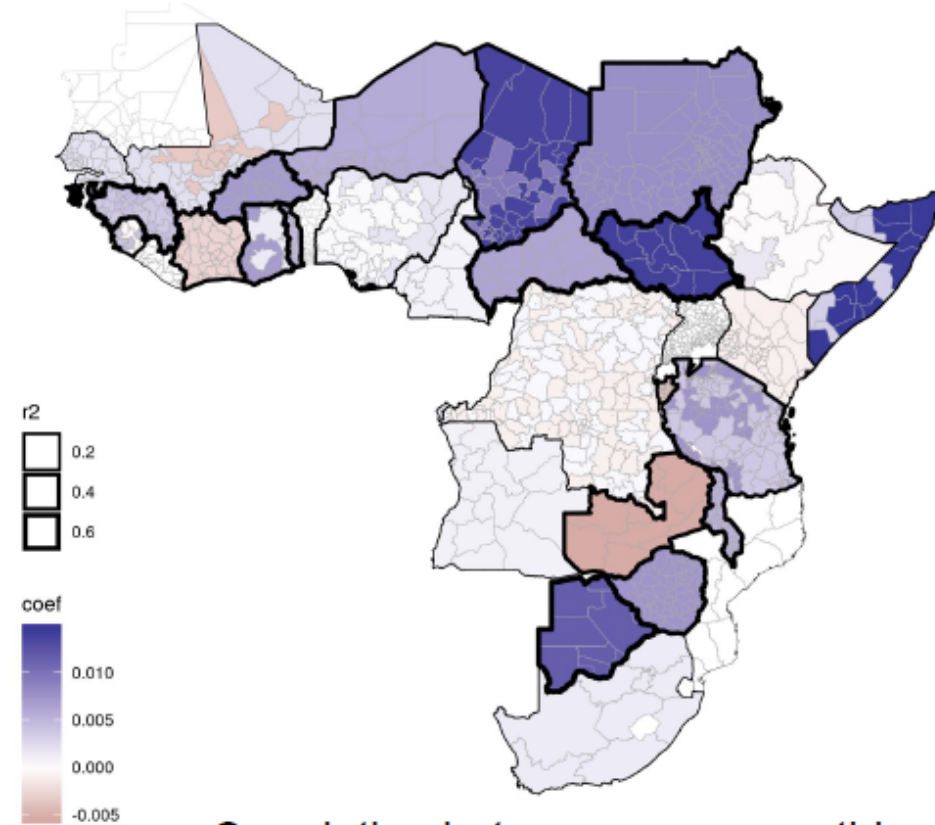
Large-scale patterns



Seasonality and climatology



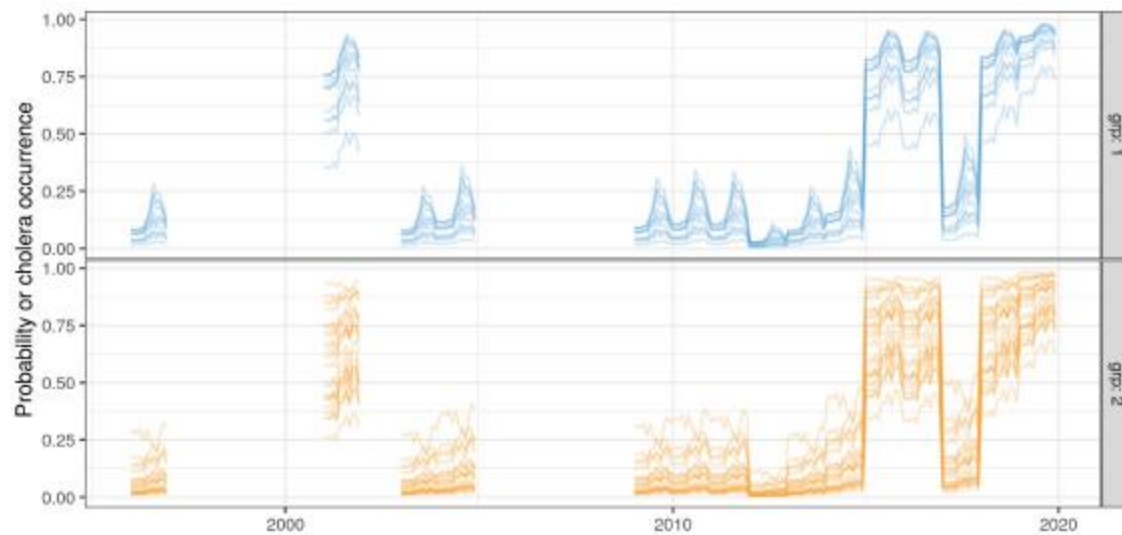
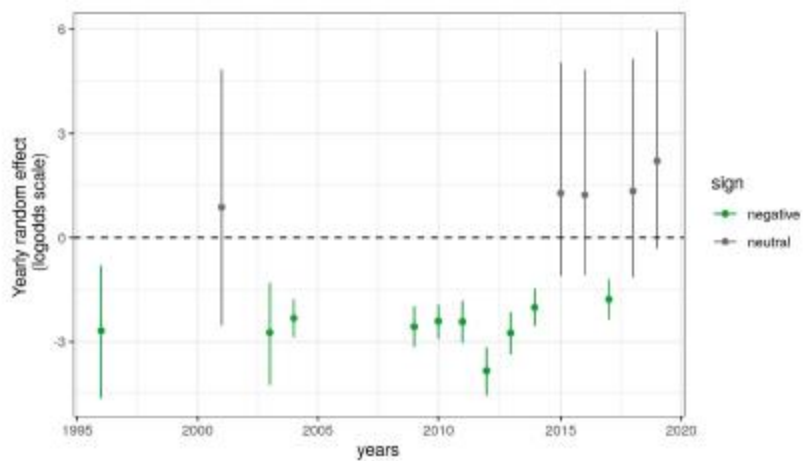
Can seasonality groups be explained by differences in local climatology or due to sensitivity to similar conditions? Preliminary results suggest differences between countries.



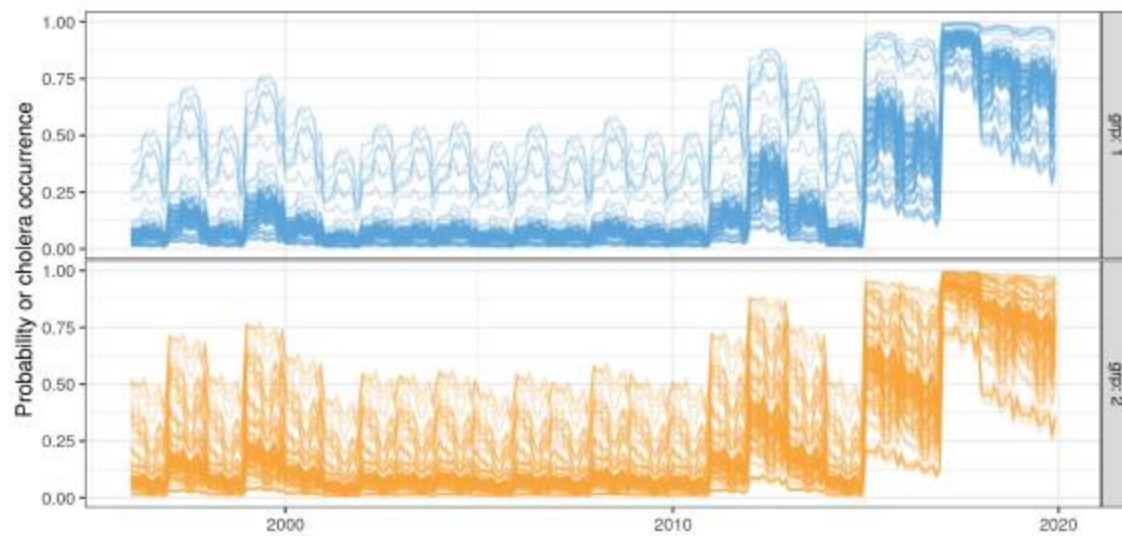
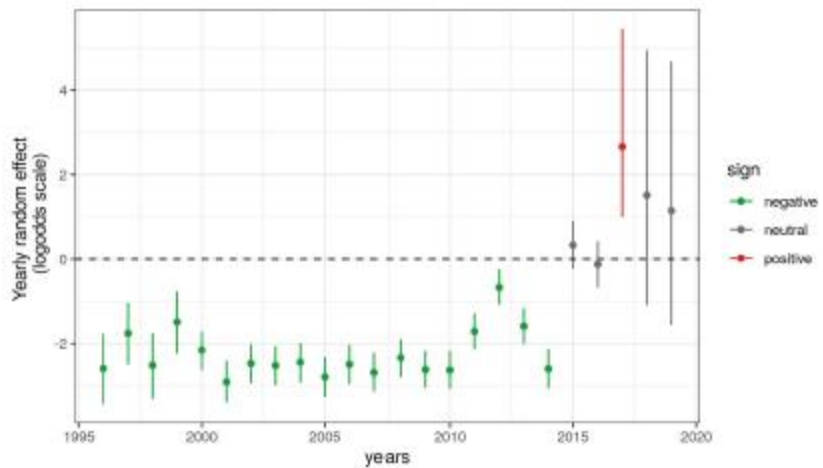
Correlation between mean monthly precipitation and seasonality.

Interannual Variability

Nigeria



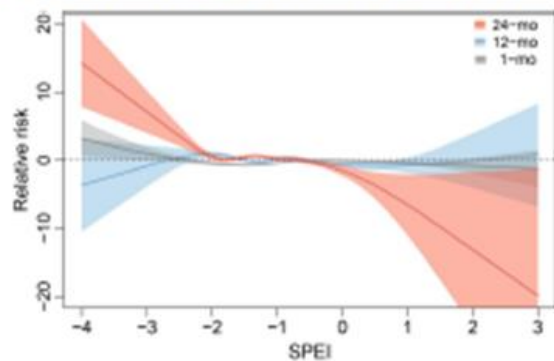
DRC



Drought

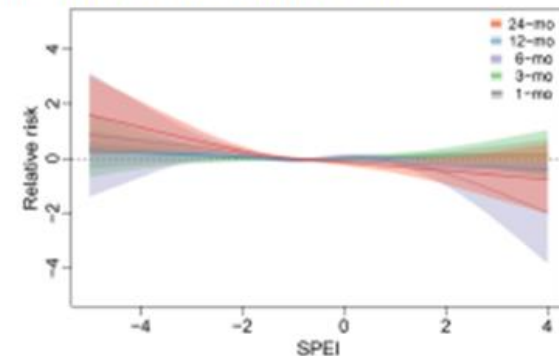
Arid areas

The association with long-term drought conditions (24-mo) was particularly strong in the driest regions of Africa (arid index > 0.6).

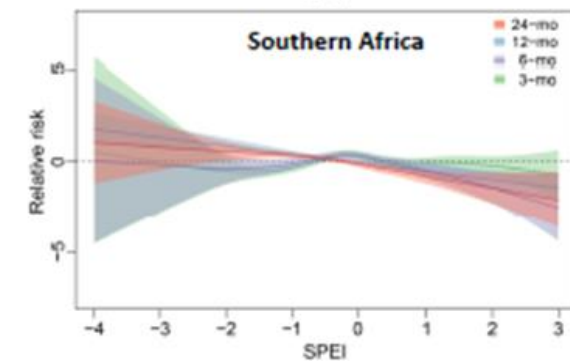
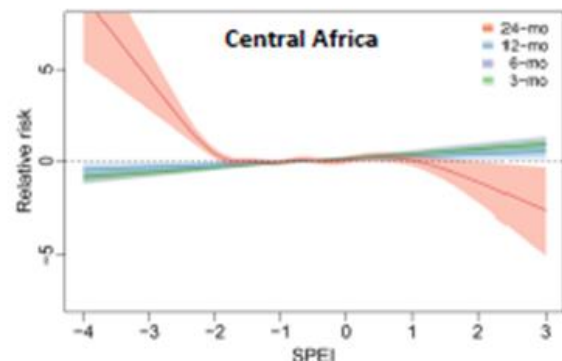
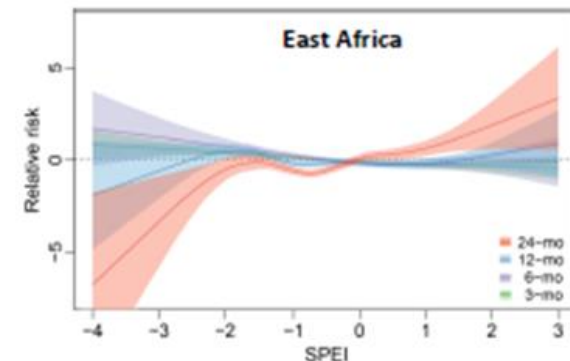
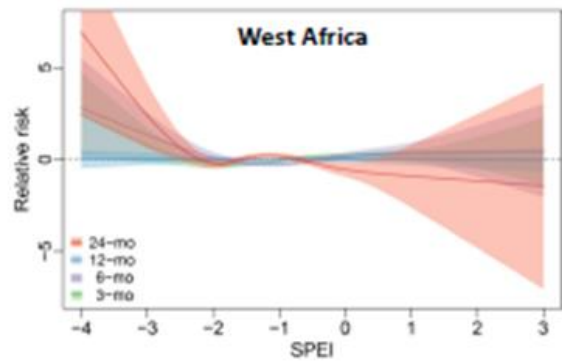


Conditions at start of outbreak

Cholera was positively associated with drought conditions during the first month of an outbreak.



Regional Results



Next Steps

Finalize the cholera risk and potential **monitoring** tools

Integrate **water quality** EO

Test strategies for communicating risk **outlooks**

Risks:

This project team has been deeply involved in COVID-19 response, which has put us behind schedule

The pandemic has also slowed communication with some partners

ARL

Current: ARL 4

Expectation: ARL 6 this PY

Goal: ARL 8, will likely require an NCE

Thank You

