

# Predictive assessment of transmission conditions of cholera in the environment and human population using earth observations

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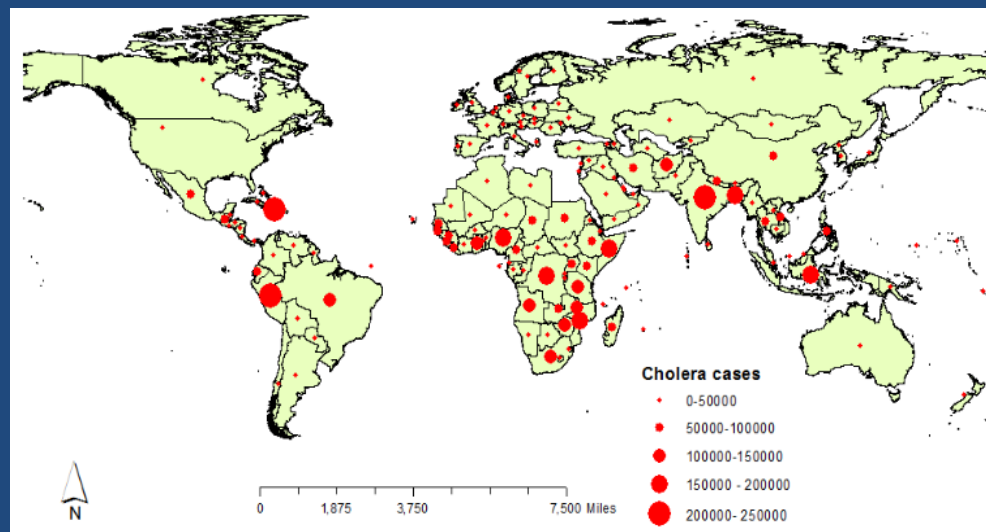
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# Goal of Research Project

We thematically envision “Cholera Ready Nations” where satellite based prediction (of risk of trigger and likelihood of transmission of cholera in the human population) will provide sustainable and resilient readiness to prevent outbreak of disease, saving human lives and improving quality of life.

## Objectives

- Systematically validate the epidemic and endemic cholera hypothesis for trigger component of cholera in Africa
- Develop, calibrate, and validate predictive model for transmission component of cholera.



# Research Pathway

Relevant earth observations

## EPIDEMIC CHOLERA

MODIS/VIIRS [LST, Land cover]  
TRMM/GPM [Precipitation]  
SRTM [DEM]

## ENDEMIC CHOLERA

MODIS/VIIRS [Chlorophyll, SST,  
Organic matter, Land Cover]  
AVHRR [SST]  
TRMM/GPM [Precipitation]  
SRTM [DEM]  
TOPEX/JASON [SSH]  
Aquarius [Salinity]

*SST: Sea Surface Temperature; SSH: Sea Surface Height; LST: Land Surface Temperature; MODIS: Moderate Resolution Imaging Spectroradiometer; TRMM: Tropical Rainfall Measuring Mission; GPM: Global Precipitation Mission; AVHRR: Advanced Very High Resolution Radiometer; DEM: Digital Elevation Model; SRTM: Shuttle Radar Topography Mission*

Use of earth observations to advance science of cholera (Section 2.1)

Validation of trigger hypothesis for Epidemic mode of cholera (Task 1)

Validation of trigger hypothesis for Endemic mode of cholera (Task 2)

Cholera Transmission Model (CTM) (Task 3)

Anticipated Results (Section 3)

Risk maps showing probabilities of occurrence of inland cholera infection

Risk maps showing probabilities of occurrence of cholera infection along coasts

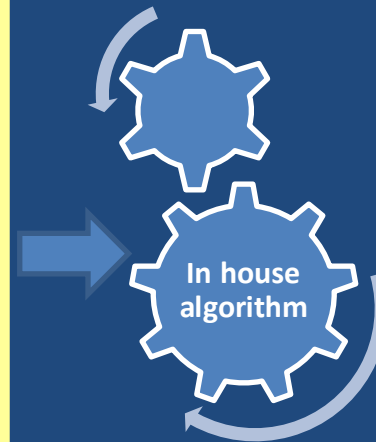
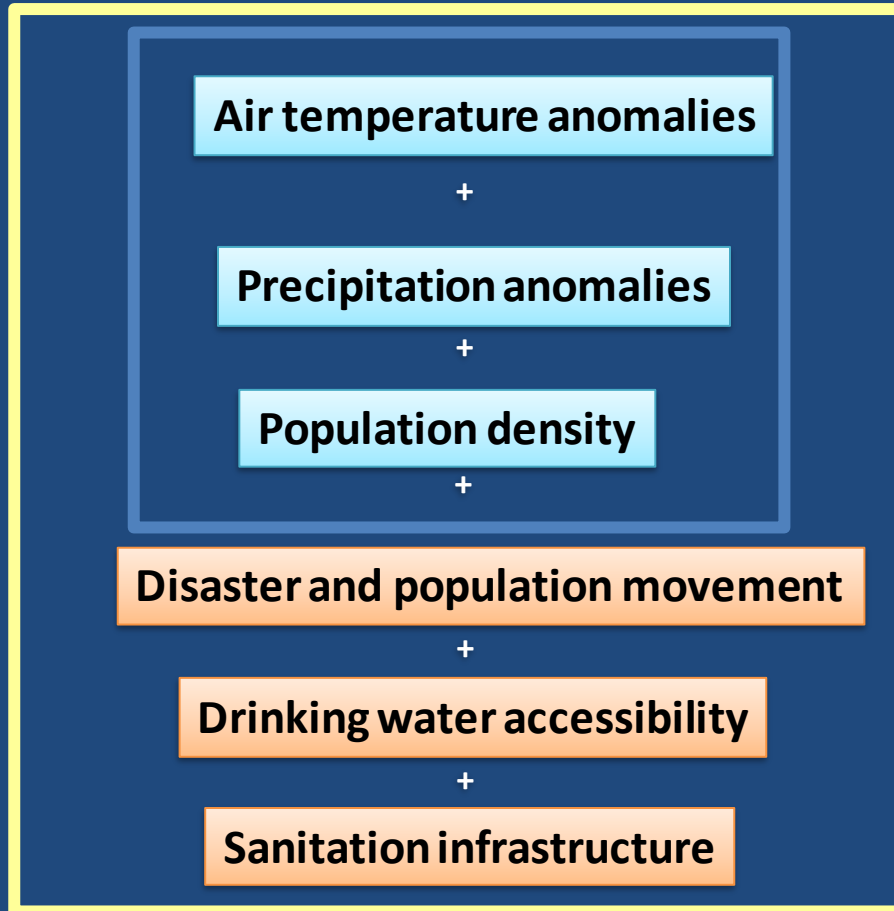
Ensemble scenarios on how cholera infection may spread in human population

Capacity building initiatives (Section 2.2)

- Communication plan with African partners identified by GEO Secretariat to identify core working group for cholera (Task 4)
- Determine feasibility of encourage use of earth observations and testing algorithms by partner foundations (Task 5)
- Workshop on African Cholera Initiative, social media and dissemination kit to advance Agenda 2030 plan (Task 6)

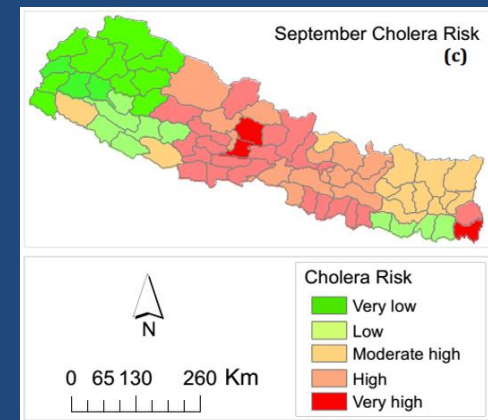
# Epidemic algorithm: Hydrology + Microbiology + Sociology

## Regional Cholera Prediction System (CAS-version 5)



$W_{i,j}$   
 $i$  = variable of interest  
 $j$  = risk level

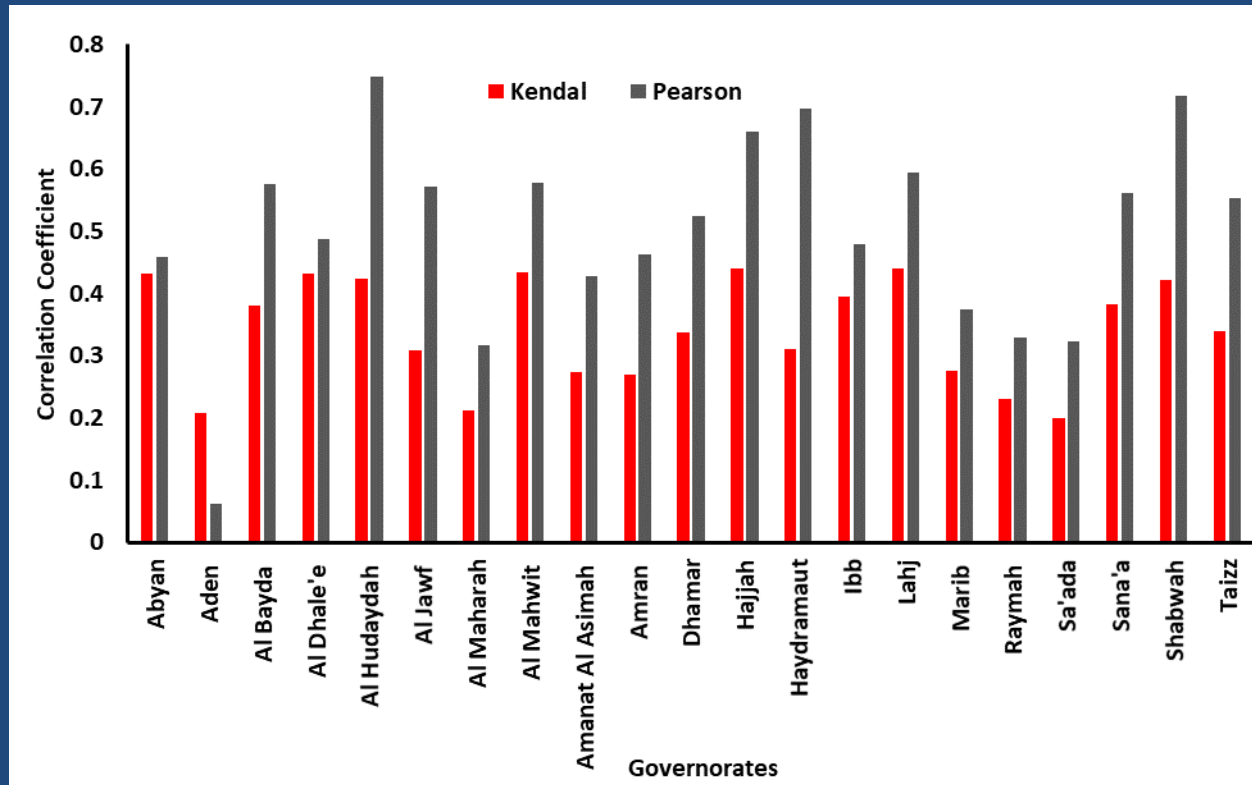
**Cholera Risk Map**



Hydrology+Microbiology

Hydrology+Microbiology+Sociology

# Validation of cholera model for trigger and transmission in Yemen



- Additional countries covered: India, Ethiopia, Mozambique, Sudan and Algeria.

# Vibrio Prediction Hub

GeoHealth & Hydrology Lab at the University of Florida



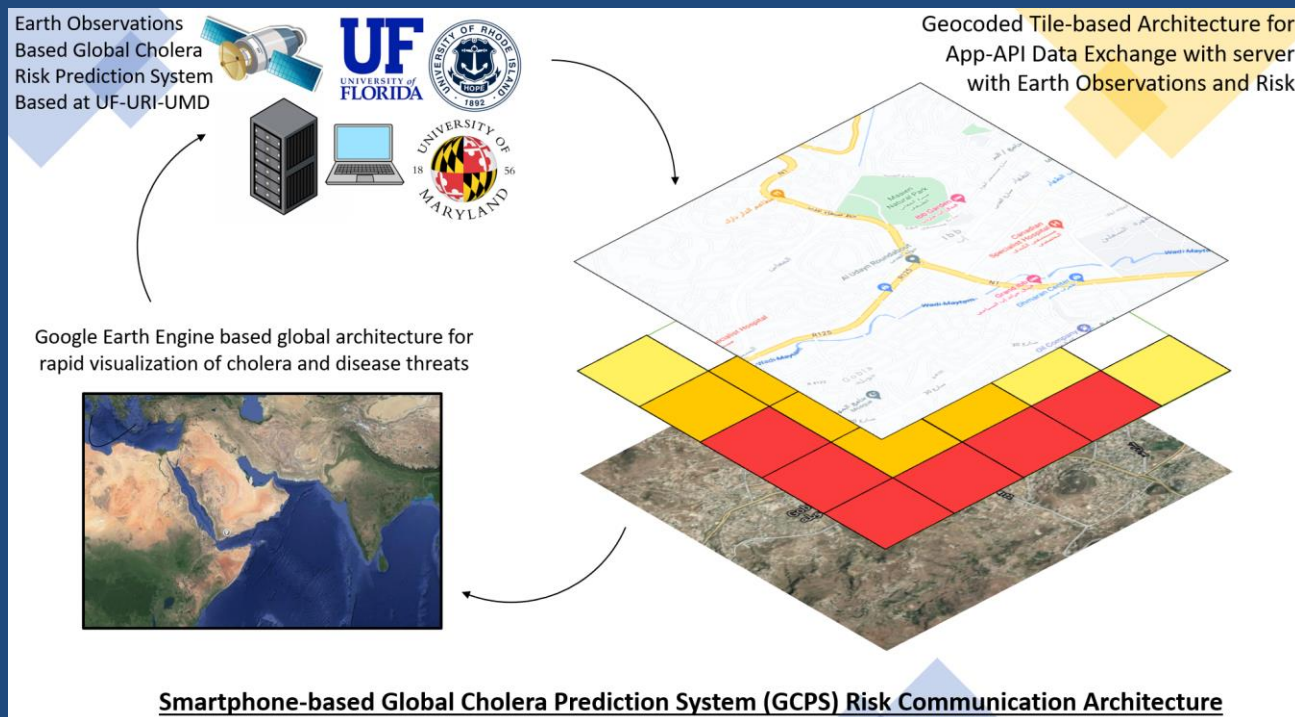
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A decision-making initiative for protecting human health and enhancing the resilience of coastal communities under current and changing environments

# Cholera Prediction App Development

- Partnerships developed: University of Rhode Island, University of Maryland and University of Florida to develop prototypes for one of the first apps to use earth observations for prediction of water-borne infectious diseases.
- Currently, web hub at UF is being prepared for data ingestion for apps.



# Regional Cholera Prediction System (RCPS)

On demand country level cholera prediction has been tested and a product manual has been developed. (snapshot below)

**This product is not yet out for public consumption.**

Regional Cholera Prediction System – Contact the University of Florida to obtain help, using any of the details shown below:

- By phone: 352-294-6898
- By email: [choleraprediction\\_users@lists.ufl.edu](mailto:choleraprediction_users@lists.ufl.edu)

Please specify your issue, or in the case of Regional Cholera Prediction System Inaccuracies, specify which elements of the forecast that you believe to be inaccurate, in the email subject line

UF listserv will send you an email to confirm your email.



# Continuing tasks

- Societal equity and equality at regional scales.
- Earth observations based anticipatory actions decision making framework.
- Ensemble model infrastructure for transmission of cholera on regional scales.

# ARL information

Starting ARL: 3

Current ARL: 8 (~8.5)

Target ARL: 9

# Overall timeline for research objective and activities at end user organization

Timeline of proposed activities and key milestones												
Activity	Year 1				Year 2				Year 3			
		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Kick off meeting (Skype)	C											
Task 1: Epidemic cholera		C	C	C	C	C						
Task 2: Endemic cholera				C	C	C	C		IP	IP	IP	
Task 3: CTM							C	C	IP	IP	IP	
Task 4: Core group formation	C	C	C	C	C	C	IP					
Task 5: Training/ dissemination plan with foundations					C	C	IP					
<b>Task 6: Workshop</b>								x <sup>1</sup>	*	*	*	*
PI meeting	Third week of every month											
Meetings with stakeholders (OCHA, DfID)				C				C				*

x<sup>1</sup> : planning; \*: status unknown due to COVID19  
 UF; Q1, Q2, Q3, Q4 represent quarter in a given year.

**Thank you**