UF Herbert Wertheim College of Engineering
UNIVERSITY of FLORIDA

POWERING THE NEW ENGINEER TO TRANSFORM THE FUTURE

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

Antar Jutla-PI
University of Florida

Rita Colwell Co-I
University of Maryland

AfriGEOSS-GEO Secretariat
DfID, UK-Africa operations
UK Met Office
OCHA
UNICEF
WMO
WHO
Red Cross
State Department-Africa

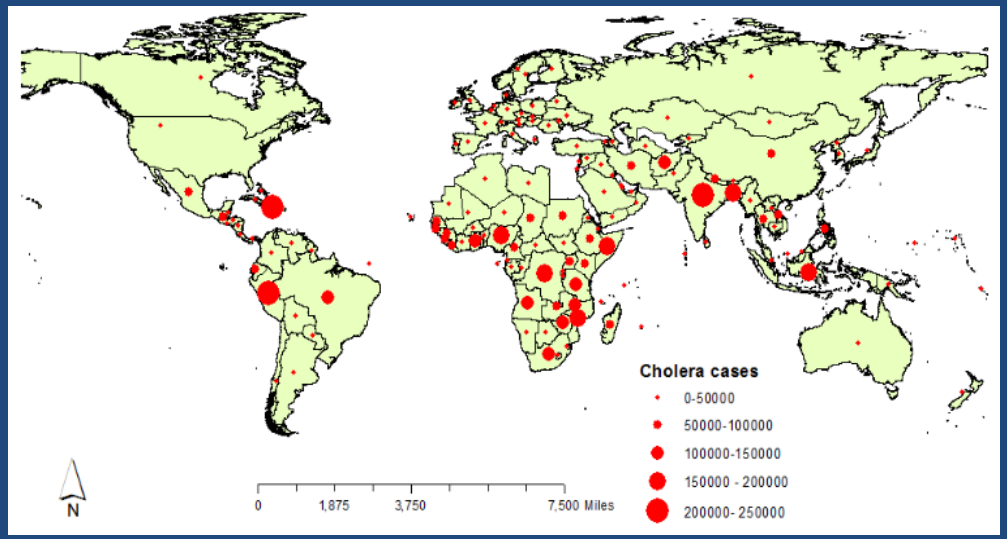
UF Herbert Wertheim College of Engineering
UNIVERSITY of FLORIDA

Goal of Research Project

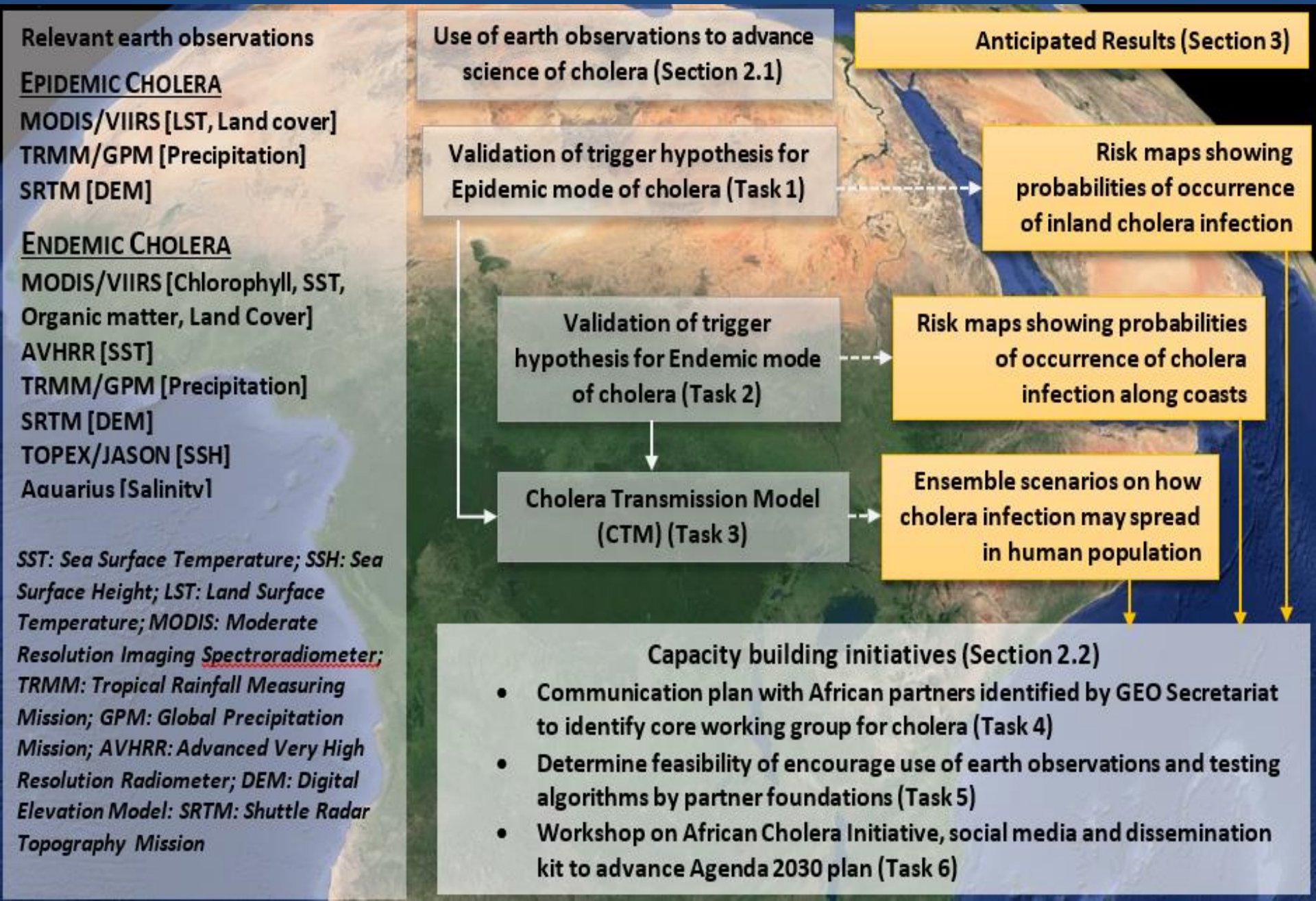
We thematically envision "Cholera Ready Nations" where satellite based prediction (of risk of trigger and likelihood of transmission of cholera in the human population) will provide sustainable and resilient readiness to prevent outbreak of disease, saving human lives and improving quality of life.

Objectives

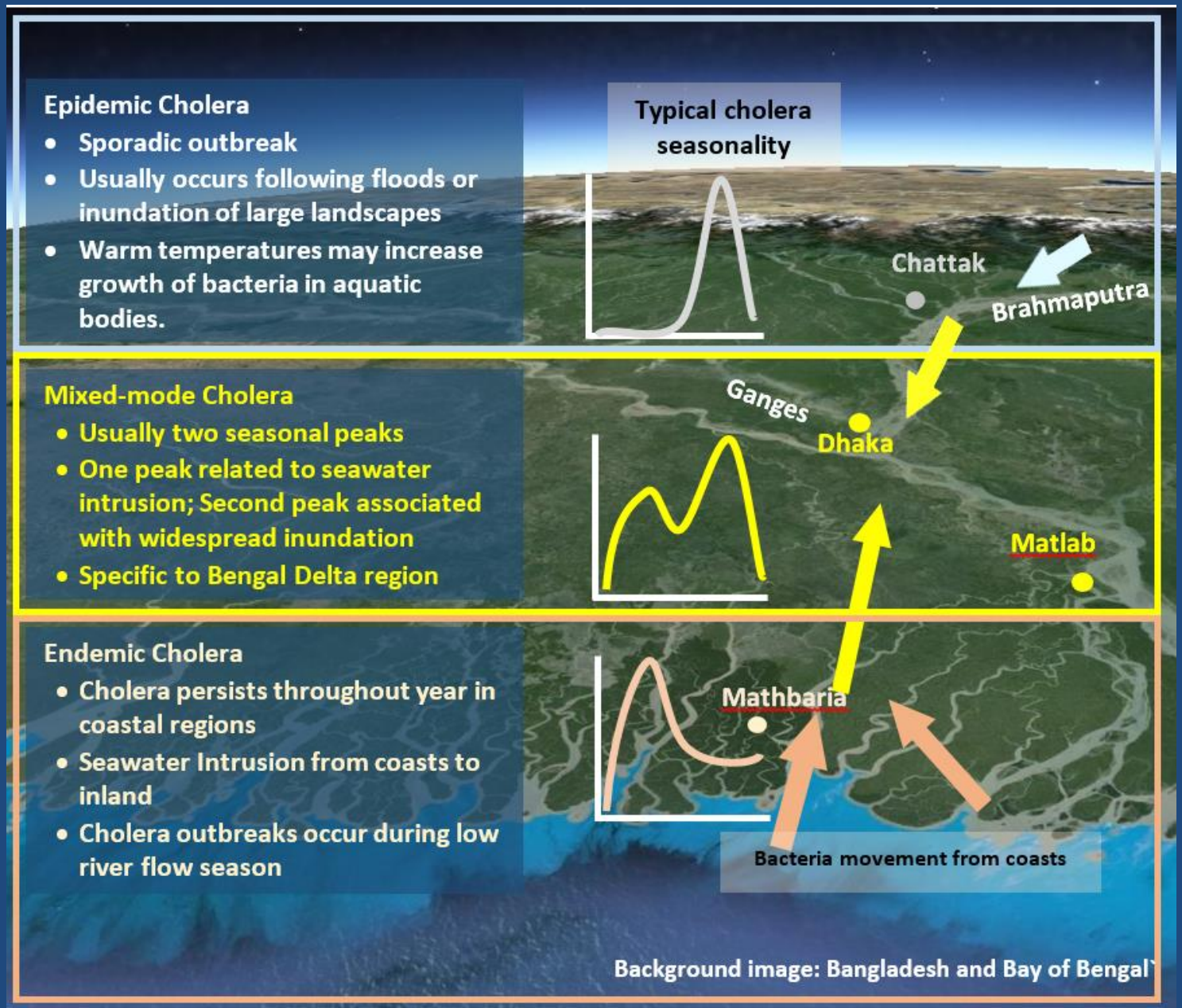
- Systematically validate the epidemic and endemic cholera hypothesis for trigger component of cholera in Africa
- Develop, calibrate, and validate predictive model for transmission component of cholera.



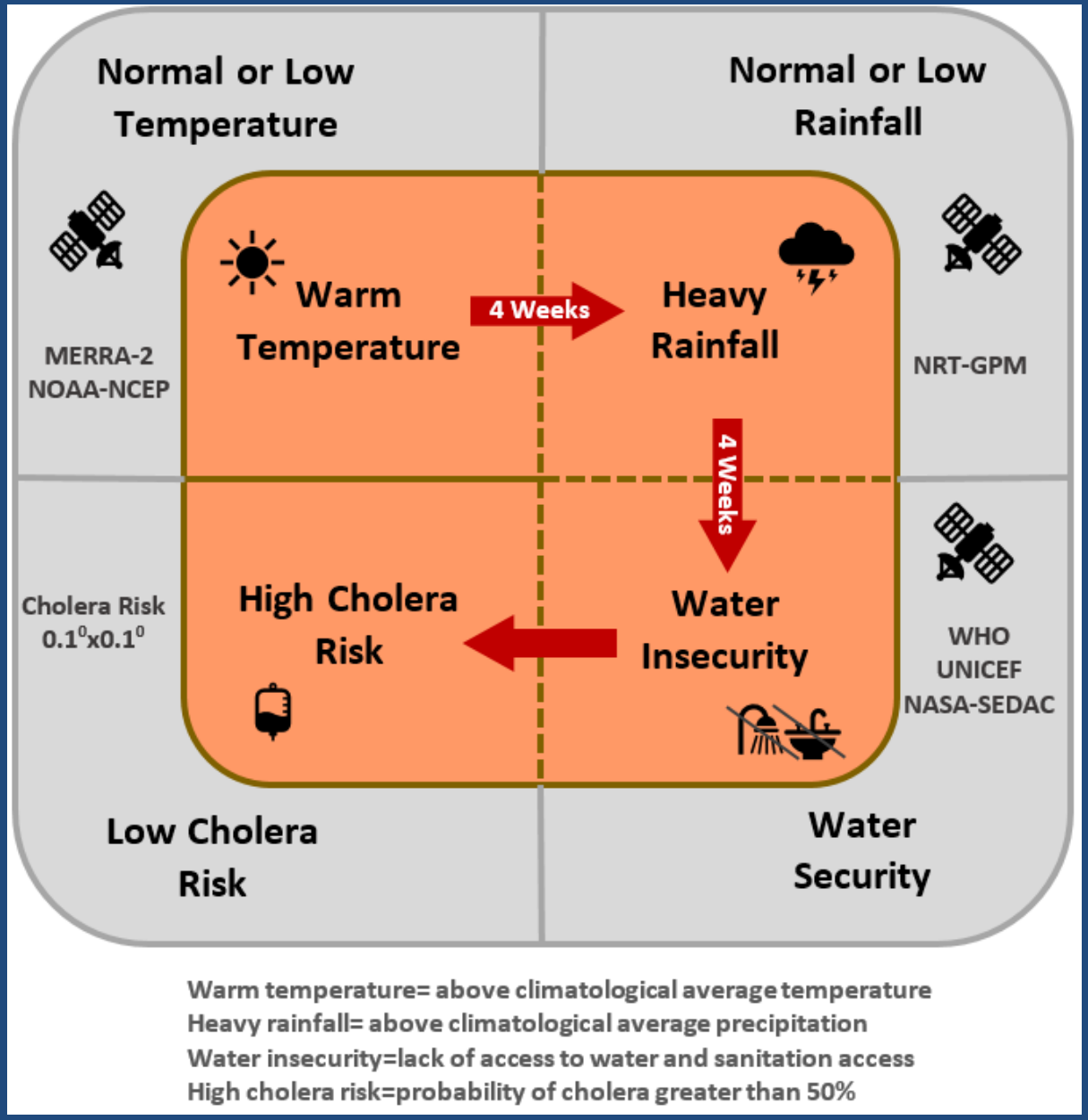
Research Pathway



Knowledge transfer from previous project



Epidemic cholera model



Epidemic algorithm: Hydrology + Microbiology + Sociology
CHOLERA ALERT SYSTEM (CAS-version 4)

Air temperature anomalies

+

Precipitation anomalies

+

Population density

+

Disaster and population movement

+

Drinking water accessibility

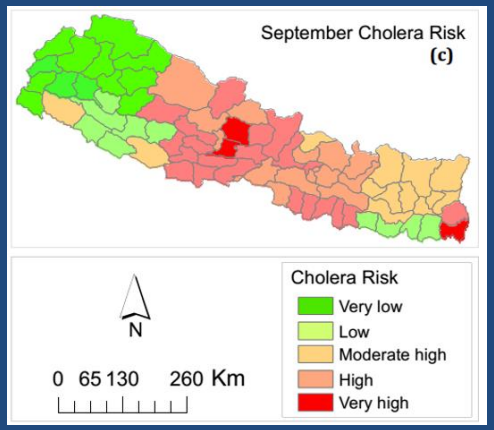
+

Sanitation infrastructure

In house algorithm

Cholera Risk Map

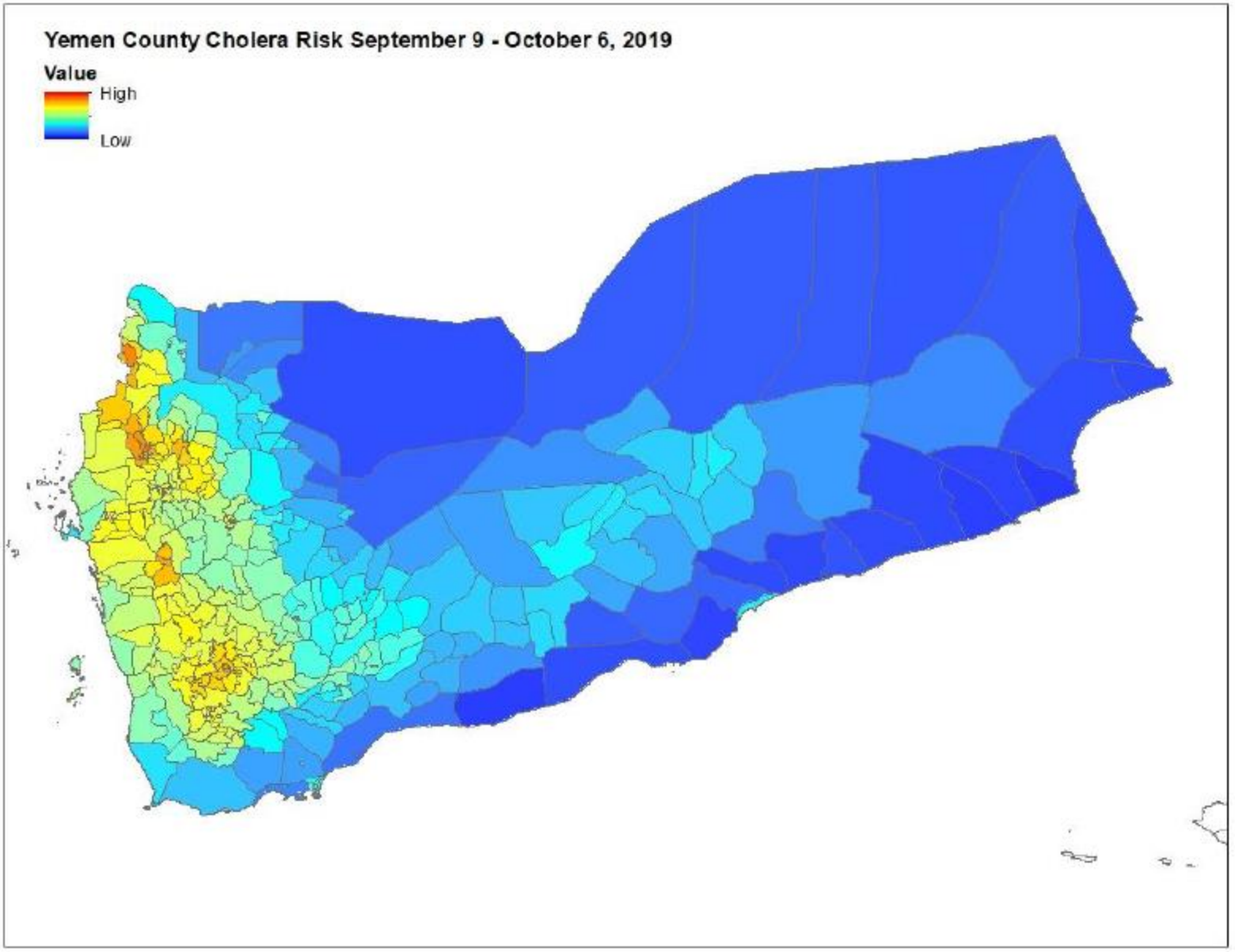
$W_{i,j}$
i= variable of interest
j=risk level



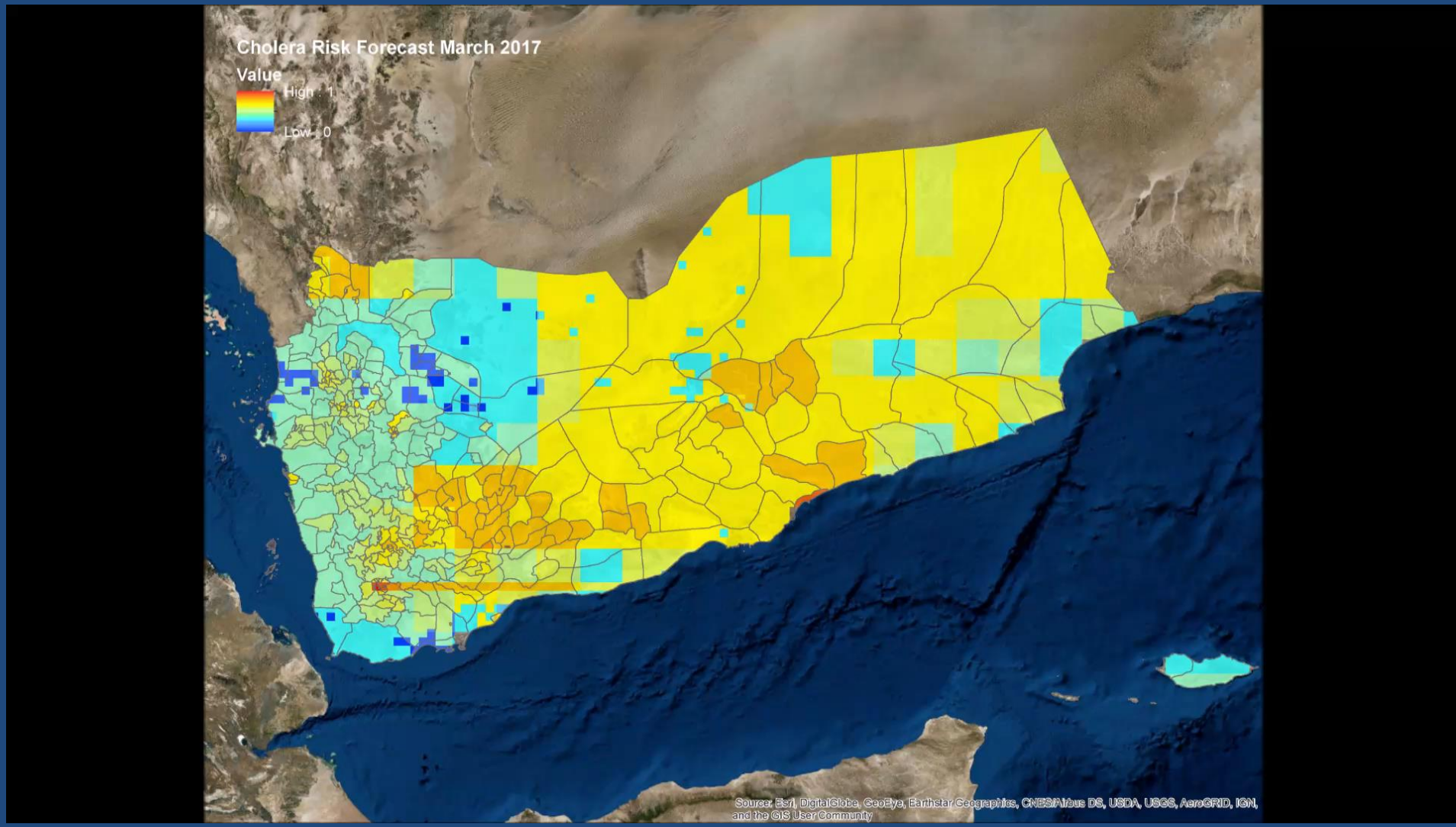
Hydrology+Microbiology

Hydrology+Microbiology+Sociology

Cholera outlook for Yemen September 9 – October 6, 2019



OBJECTID	NAME	MEAN
1	Al Buraiqeh	0.214002
2	Al Mansura	0.510318
3	Al Mualla	0.564102
4	Ash Shaikh Outhman	0.528846
5	Attawahi	0.485207
6	Craiter	0.491124
7	Dar Sad	0.506493
8	Khur Maksar	0.483516
9	Ahwar	0.2561
10	Al Mahfad	0.334128
11	Al Wade'a	0.305409
12	Jayshan	0.251778
13	Khanfir	0.27903
14	Lawdar	0.375147
15	Mudiyah	0.328232
16	Rasad	0.567069
17	Sarar	0.411538
18	Sibah	0.467964
19	Zingibar	0.416545
20	Al A'rsh	0.462967
21	Al Bayda City	0.615384
22	Al Bayda	0.444793


Cholera Risk Forecast March 2017
Value
High : 1
Low : 0
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Antar,

April 2019

What are the possibilities/limitations of running your cholera risk model for Mozambique, given the current situation and increasing concerns re cholera risk?

Thanks,

REPÚBLICA DE MOÇAMBIQUE

MINISTÉRIO DA SAÚDE

Gabinete de Comunicação e Relações Públicas

Comunicado de Imprensa

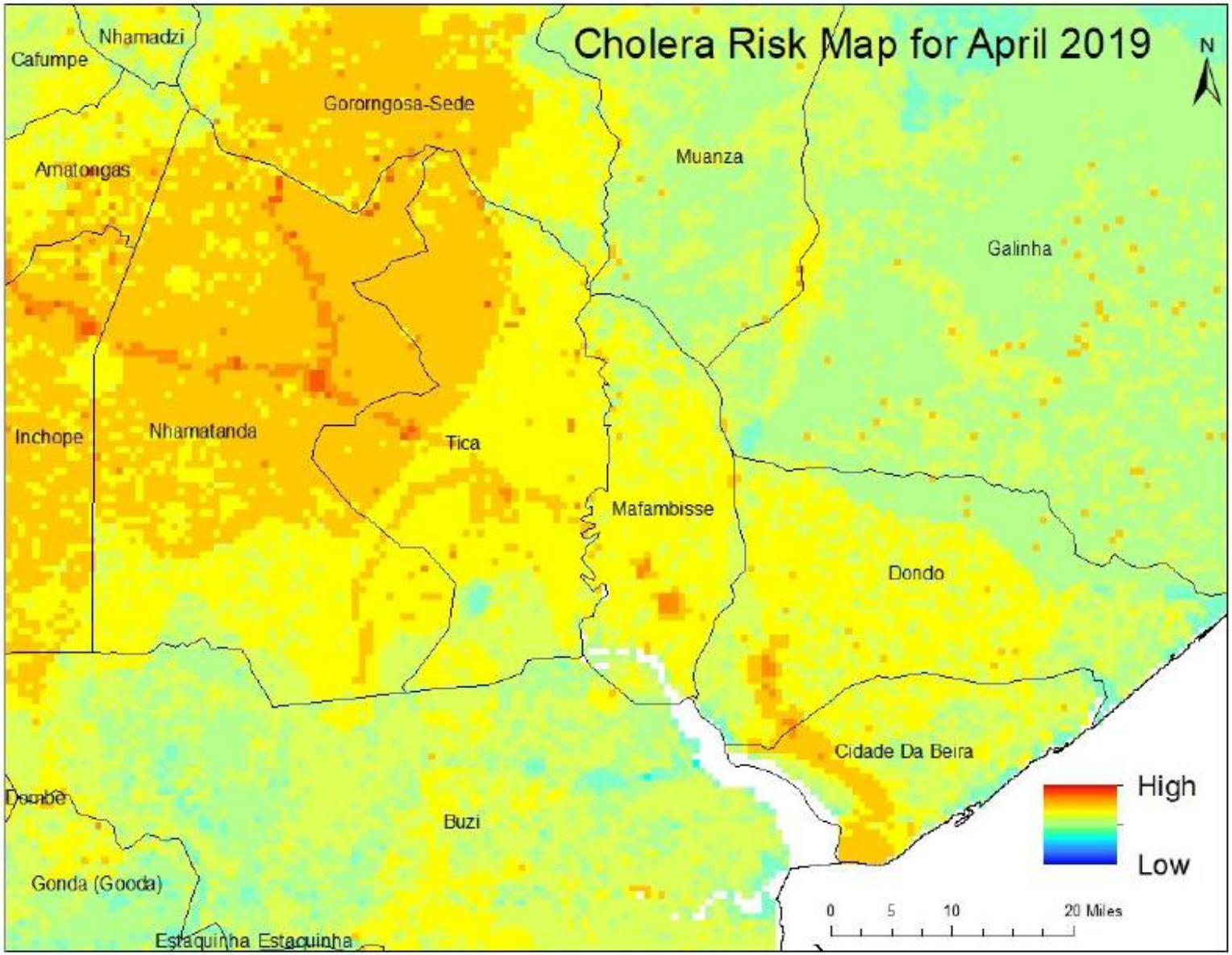
Assunto: **Actualização dos Dados de Saúde face aos efeitos do Ciclone IDAI na Província de Sofala**

No âmbito da actualização da informação sobre a situação sanitária na Província de Sofala face aos efeitos do ciclone IDAI, o Ministério da Saúde vem por meio desta tornar público a informação correspondente às 7H00 do dia 31 de Março às 7H00 do dia 01 de Abril de 2019.

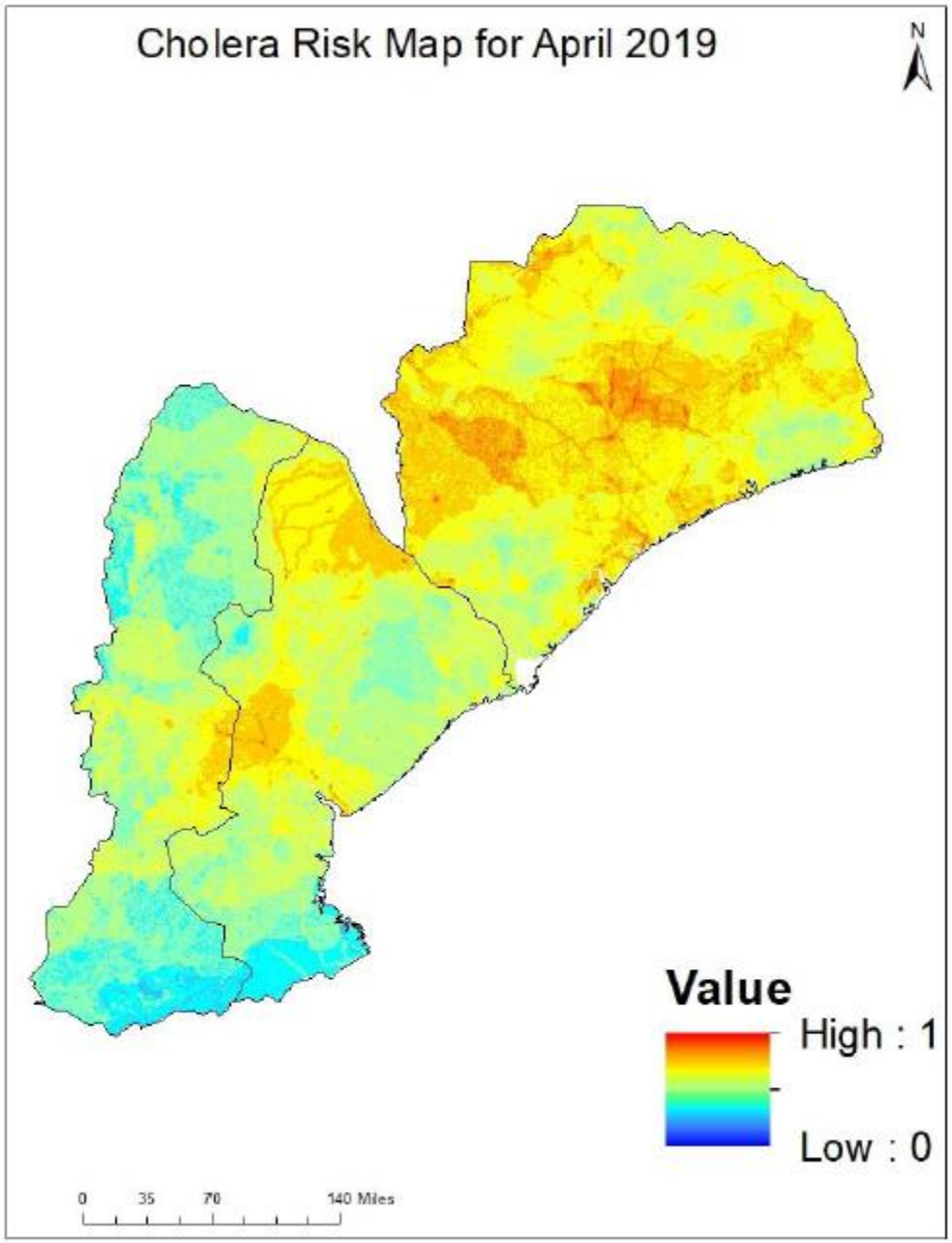
Unidades Sanitárias da Cidade da Beira

Doença	Casos	Óbitos
Malária	63	0
Febre	165	0
Diarreia	182	0
Cólera	247	1

Cholera outlook for three districts of Beira, Dondo and Nhamatanda, April 2019* (see note below)



Cholera outlook for the provinces of Sofala, Zambezia and Manica, April 2019* (see note below)



Mechanistic algorithms: Hydrology-Environment-Microbiology-Epidemiology: A new generation of mathematical models

$$\frac{dS}{dt} = \eta(S + E + I + R) - [\sigma R + (\mu + \alpha)S]$$

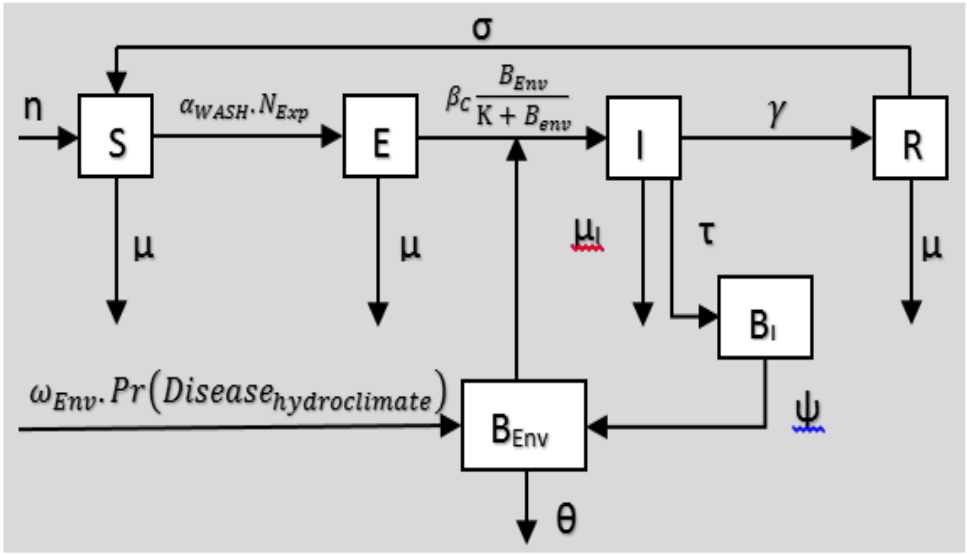
$$\frac{dE}{dt} = \alpha_{WASH}.N_{Exp}.S - \left(\mu + \beta_{fit}.\frac{B_{Env}}{K + B_{env}}\right)E$$

$$\frac{dI}{dt} = \beta_c.\frac{B_{Env}}{K + B_{env}}E - (\mu_I + \tau + \gamma)I$$

$$\frac{dR}{dt} = \gamma I - (\mu + \sigma)R$$

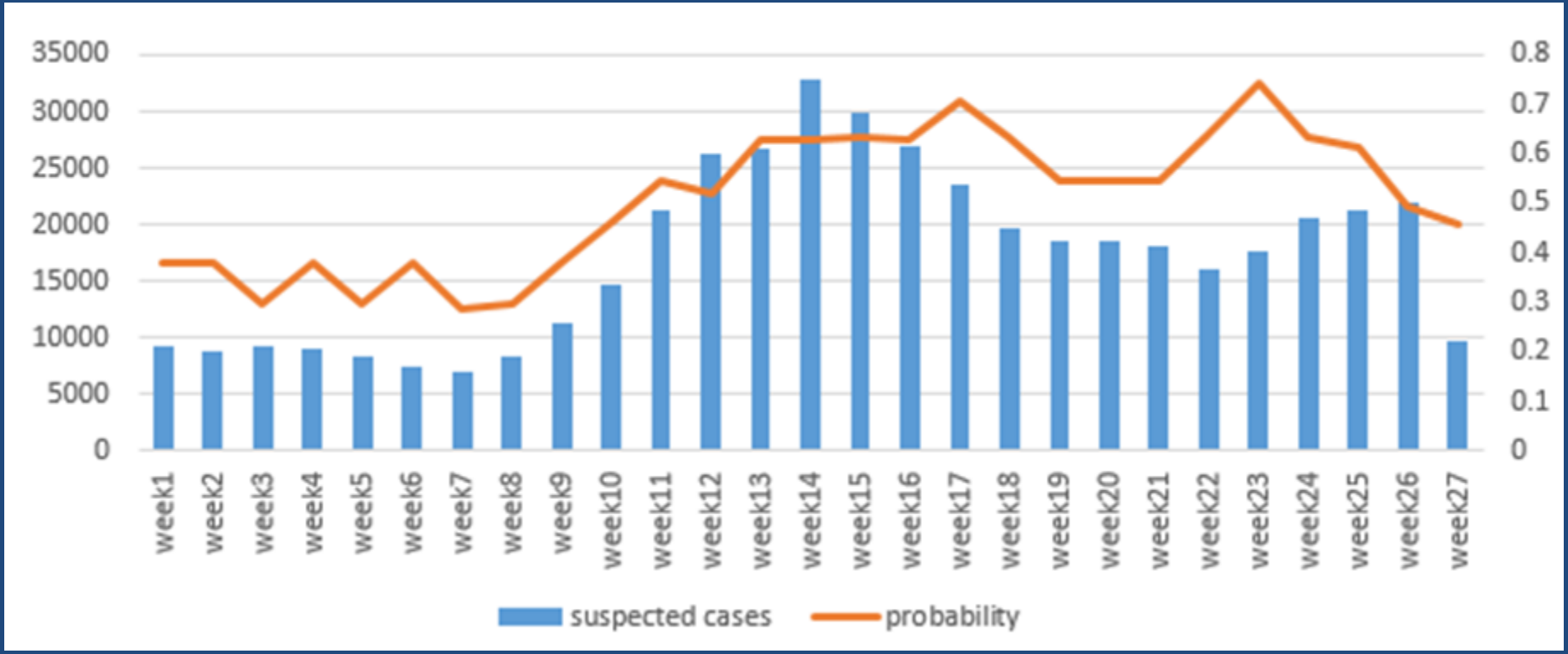
$$\frac{dB_I}{dt} = \tau I - \psi B_I$$

$$\frac{dB_{Env}}{dt} = \psi B_I + \left(\omega_{Env} \times Pr\left(Disease_{hydroclimate}\right) - \theta\right)B_{Env};\quad Pr\left(Disease_{hydroclimate}\right) = \frac{e^{a+bx_n}}{1 + e^{a+bx_n}}$$



Jutla et al., 2016: Plos-One

Trigger -> Transmission



ARL information

Starting ARL: 3

Current ARL: Approaching 5

Target ARL: 8

Overall timeline for research objective and activities at end user organization

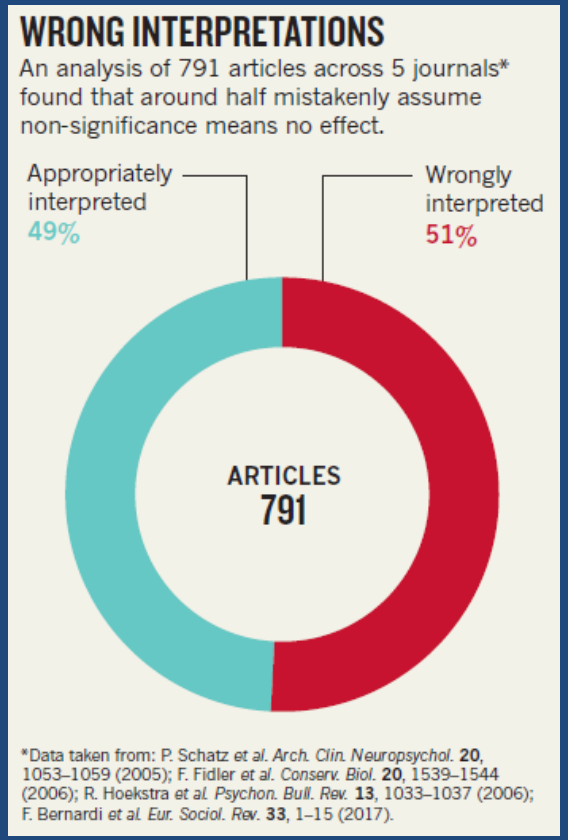
Timeline of proposed activities and key milestones												
	Year 1				Year 2				Year 3			
Activity		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Kick off meeting (Skype)	C											
Task 1: Epidemic cholera		C	C	IP	IP	IP						
Task 2: Endemic cholera				IP	IP	IP	X					
Task 3: CTM							X	X	X	X	X	
Task 4: Core group formation	C	C	X	X	X	X						
Task 5: Training/ dissemination plan with foundations					C	IP	X					
Task 6: Workshop								x^1	x^1	x^1	x^1	x^2
PI meeting	Third week of every month											
Veolia/Health Initiatives Foundation/Kirschbaum/ Thiaw/ Jutla/Colwell meeting				C				X				X

#initiate discussion with GEO Secretariat; x^1 : planning; x^2 : workshop at UMD or UF; Q1, Q2, Q3, Q4 represent quarter in a given year.

MENU
nature
International journal of science
20 MARCH 2019
Subscribe
Search
Login

Retire statistical significance

Valentin Amrhein, Sander Greenland, Blake McShane and more than 800 signatories
call for an end to hyped claims and the dismissal of possibly crucial effects.



Thank you