

# Cholera risk and climate observations: case study in coastal regions of the northern Indian Ocean

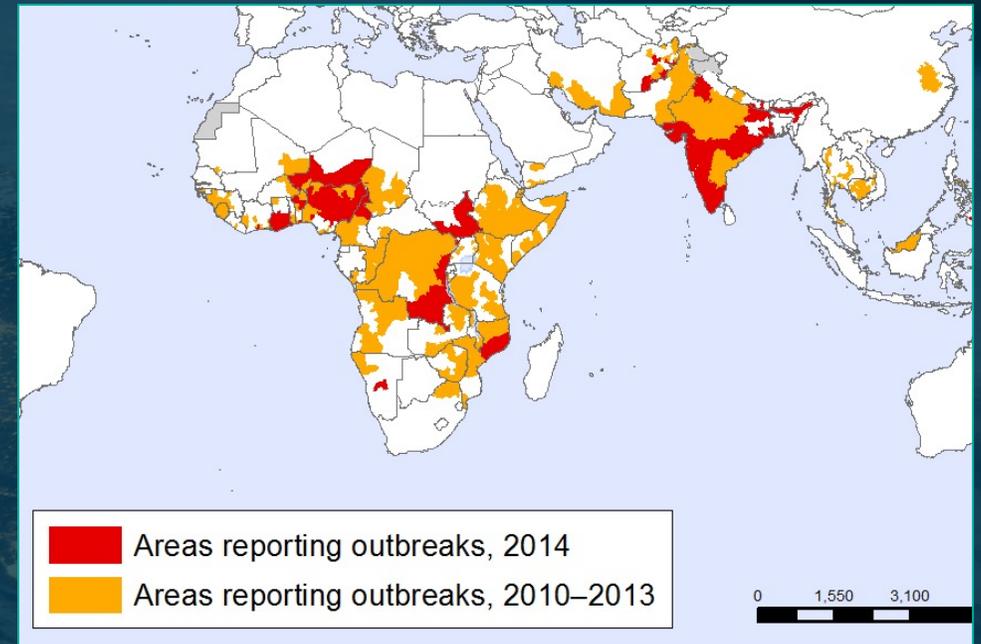
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11<sup>th</sup> ESA - CCI Colocation meeting  
08 October 2021

EO play a major role in helping coastal communities to adapt to climate change, e.g., by providing early-warning systems for sea-level rise and extreme weather events

In addition to these climate hazards, there are severe impact and threats linked to food security and human health



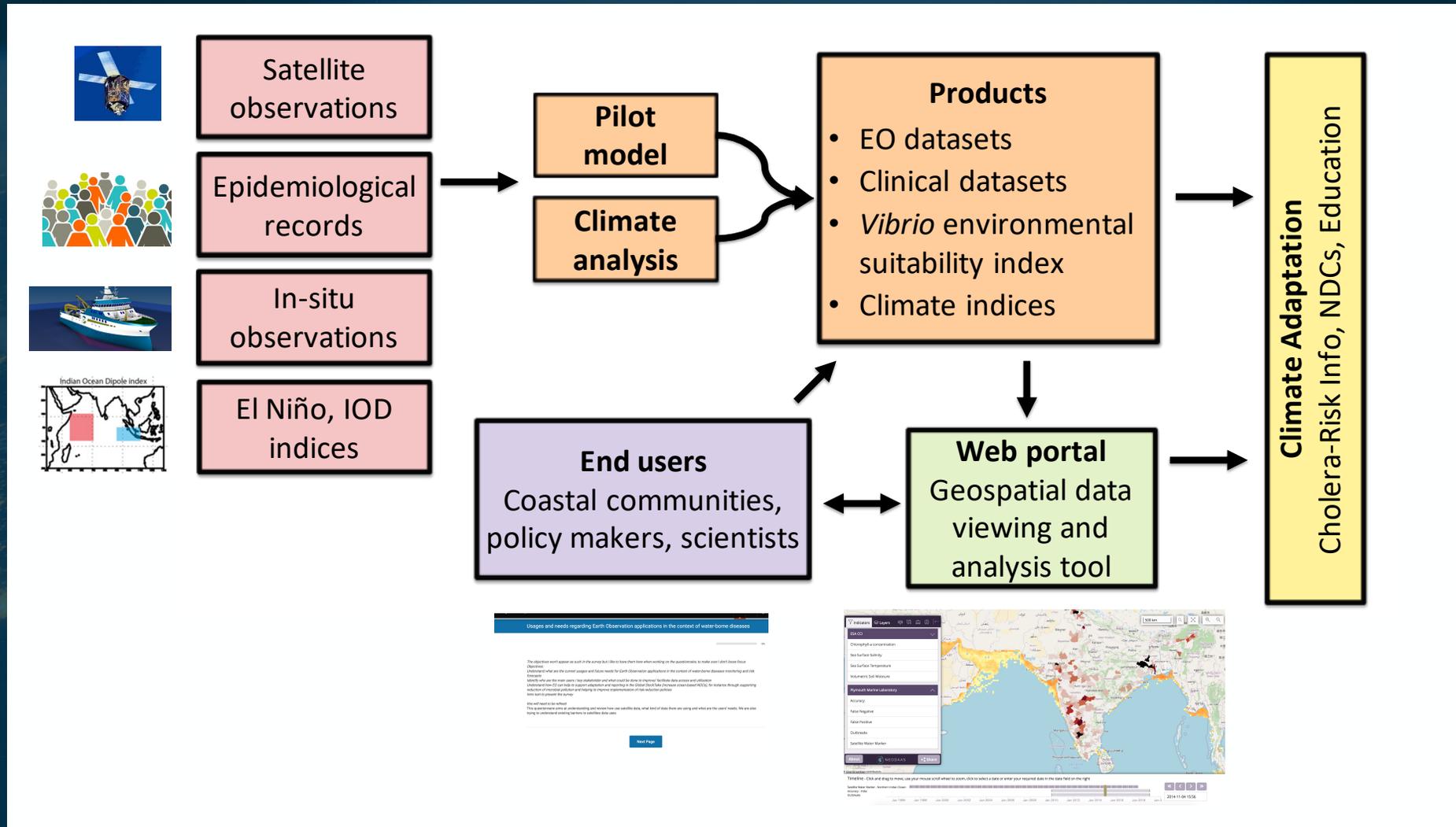
Source: World Health Organization

**Motivation:** In the last decade, 82 countries reported cholera cases worldwide. Yet, only 11% of these countries integrated disease-risk warnings under adaptation measures in their NDC for the Paris Agreement

# PODCAST-DEMO proof-of-concept



Bringing environmental, climate and health indicators to end-users

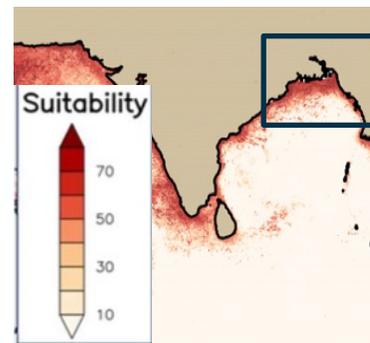


**Goal:** improve prediction lead time of Spring cholera risk in northern Bay of Bengal by identifying climate drivers of suitable oceanic conditions for *Vibrio cholerae*

Prediction Lead Time = 2 months (Jutla et al. 2013)

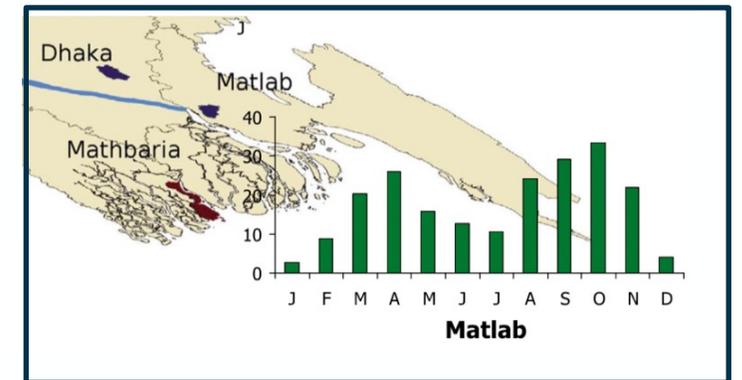
High Satellite Water  
Marker for *V. cholerae* -->  
in Bay of Bengal  
(fall)

High cholera risk in  
Bangladesh  
(spring yr+1)



Racault et al., 2019

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Akanda et al., 2009

# Climate precursors for Spring cholera outbreak

Prediction Lead Time = 5 months (present study)

Prediction Lead Time = 2 months (Jutla et al. 2013)

La Niña pattern  
(summer)

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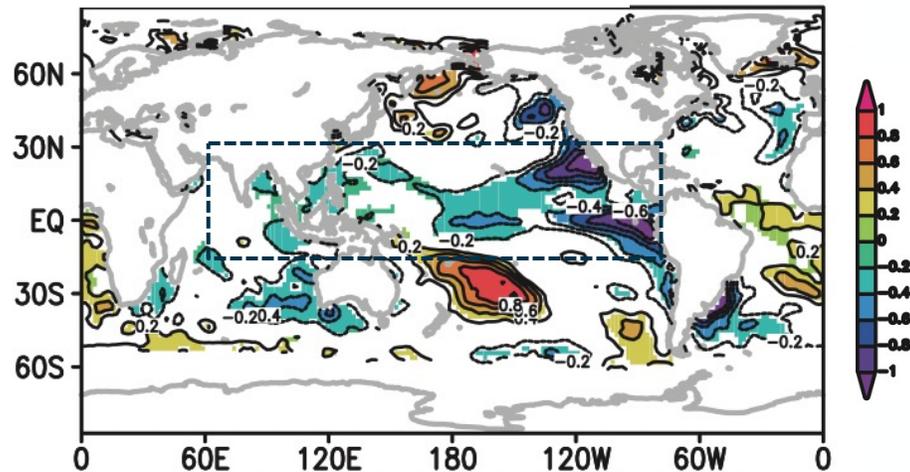
High rainfall in  
northern India  
(summer)

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High Satellite Water  
Marker for *V. cholerae*  
in Bay of Bengal  
(fall)

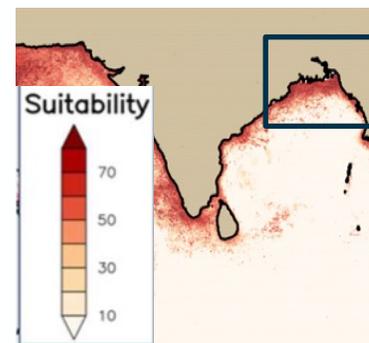
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High cholera risk in  
Bangladesh  
(spring yr+1)



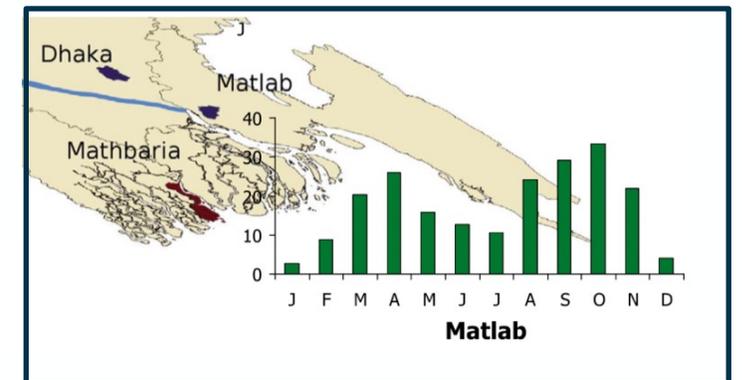
Ogata et al., 2021

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Racault et al., 2019

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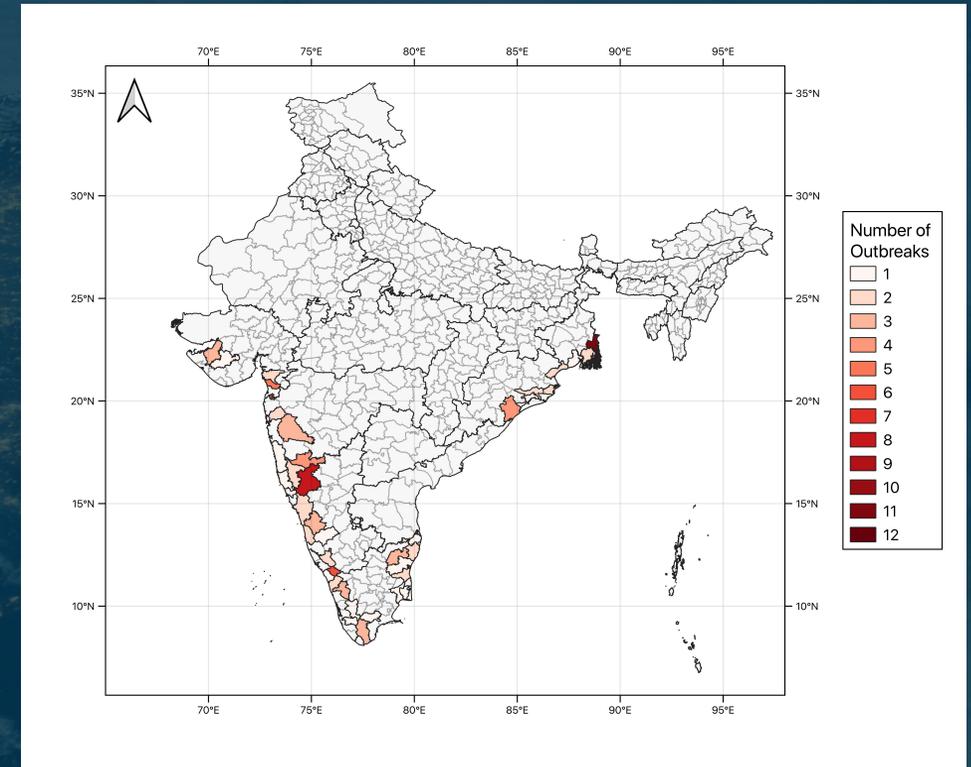


Akanda et al., 2009

**Goal:** develop cholera-risk model by using machine learning techniques to analyse in combination satellite ECV data and epidemiological clinical data

**Study site:** India coastal districts, monthly resolution, 2010-2018

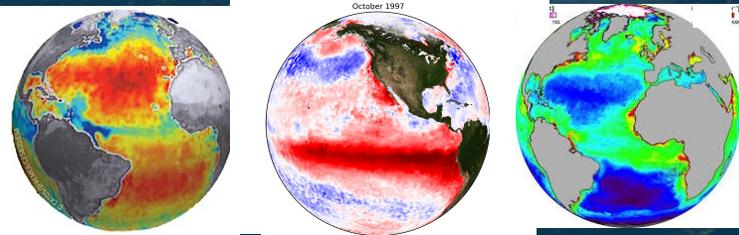
## Cholera outbreaks in coastal India



Campbell et al. (2020)

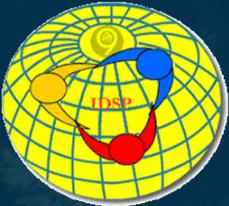
Successful new application of AI for cholera risk based on combined analyses of clinical data and ESA-CCI ECV datasets

## Space ECVs



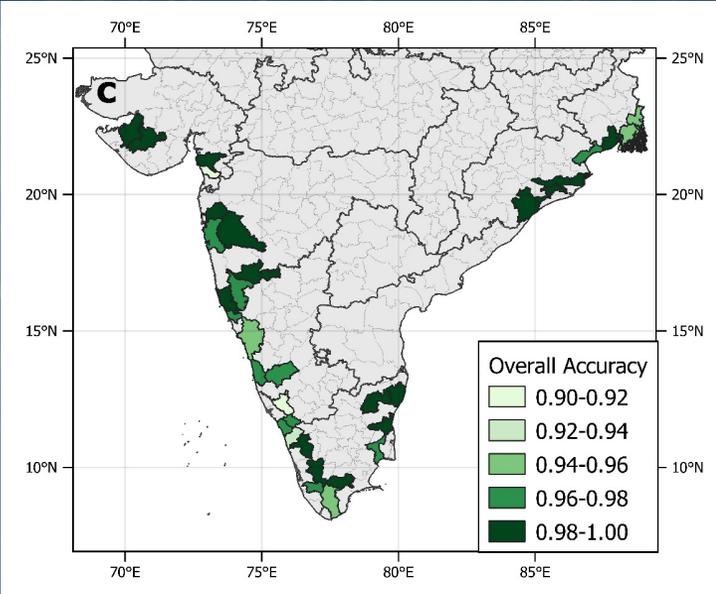
first use of sea surface salinity

## Clinical data



IDSP Cholera Outbreaks

Random Forest model



Campbell et al., 2020

→ 89.5% of outbreaks correctly identified across all coastal Indian districts reporting cholera outbreaks during 2010-2018

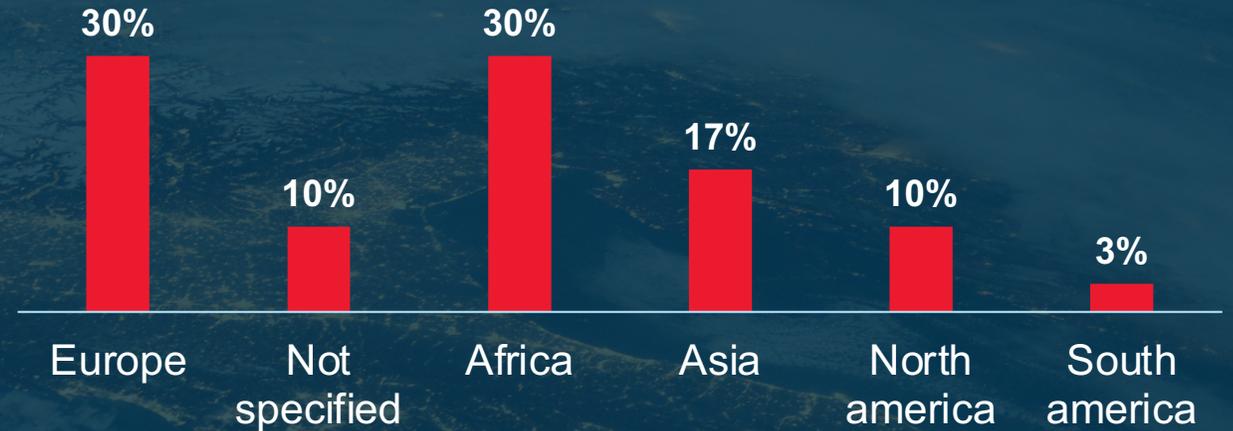
# Snapshot of the online survey results

## Goals of the survey:

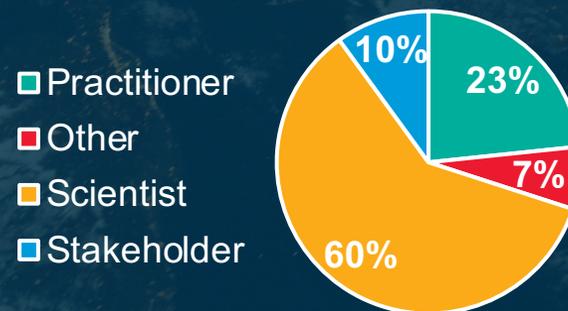
1. Identify main users and stakeholders
2. Assess availability and current usage of cholera-risk information
3. Understand potential opportunities and future needs of EO applications for cholera-risk information

Survey live from 5<sup>th</sup> Aug until 20<sup>th</sup> Sep  
Total > 30 respondents

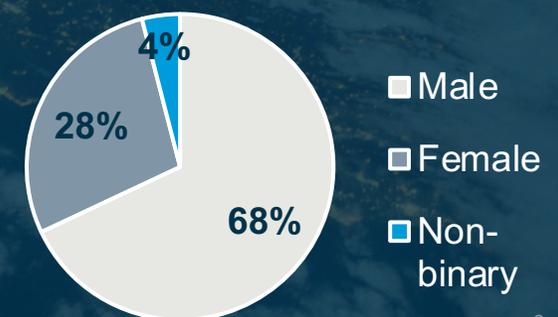
## RESPONDENTS GEOGRAPHIC DISTRIBUTION



## RESPONDENTS OCCUPATION



## GENDER REPRESENTATION



# Snapshot of the online survey results

## GEOGRAPHICAL COVERAGE NEEDS

(in %)

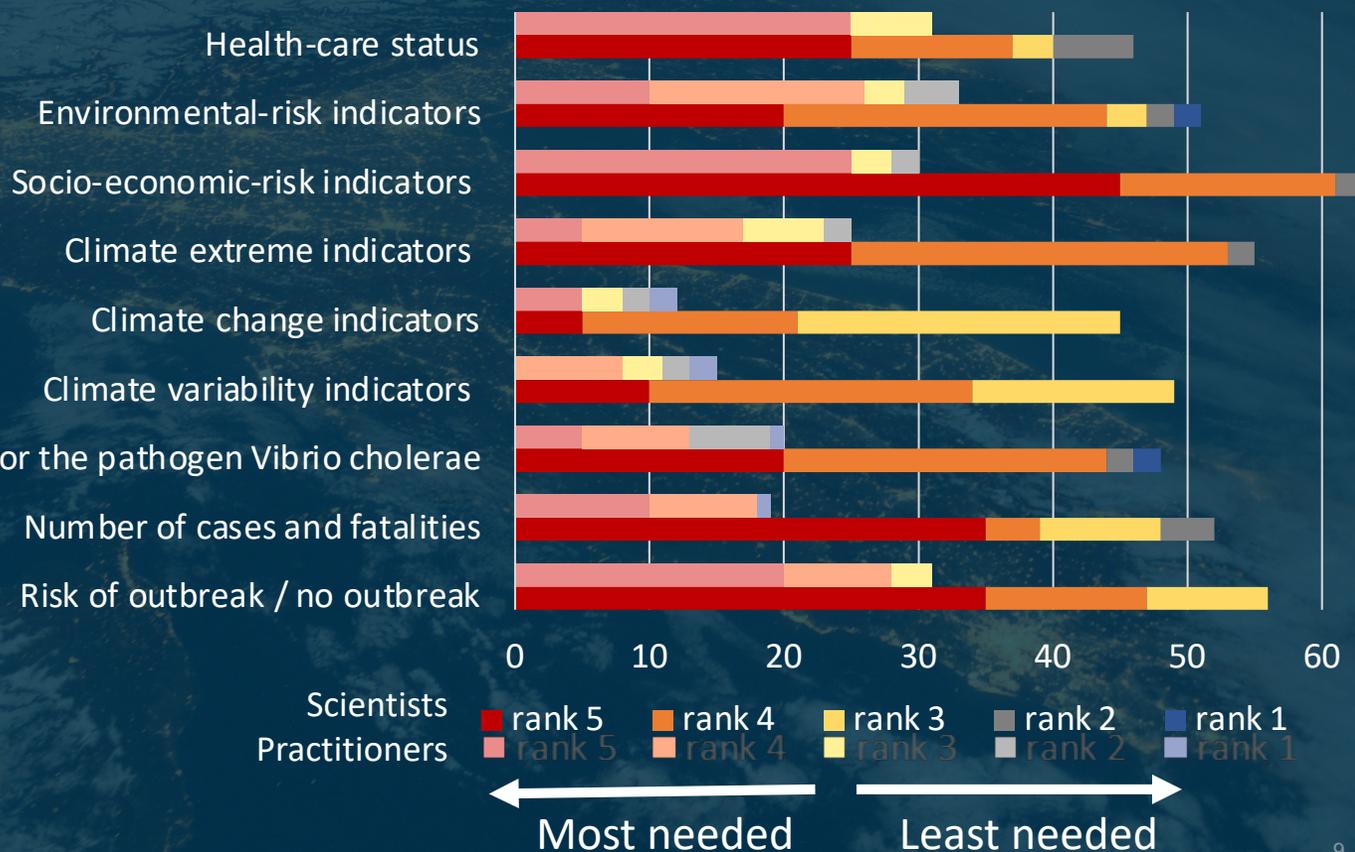


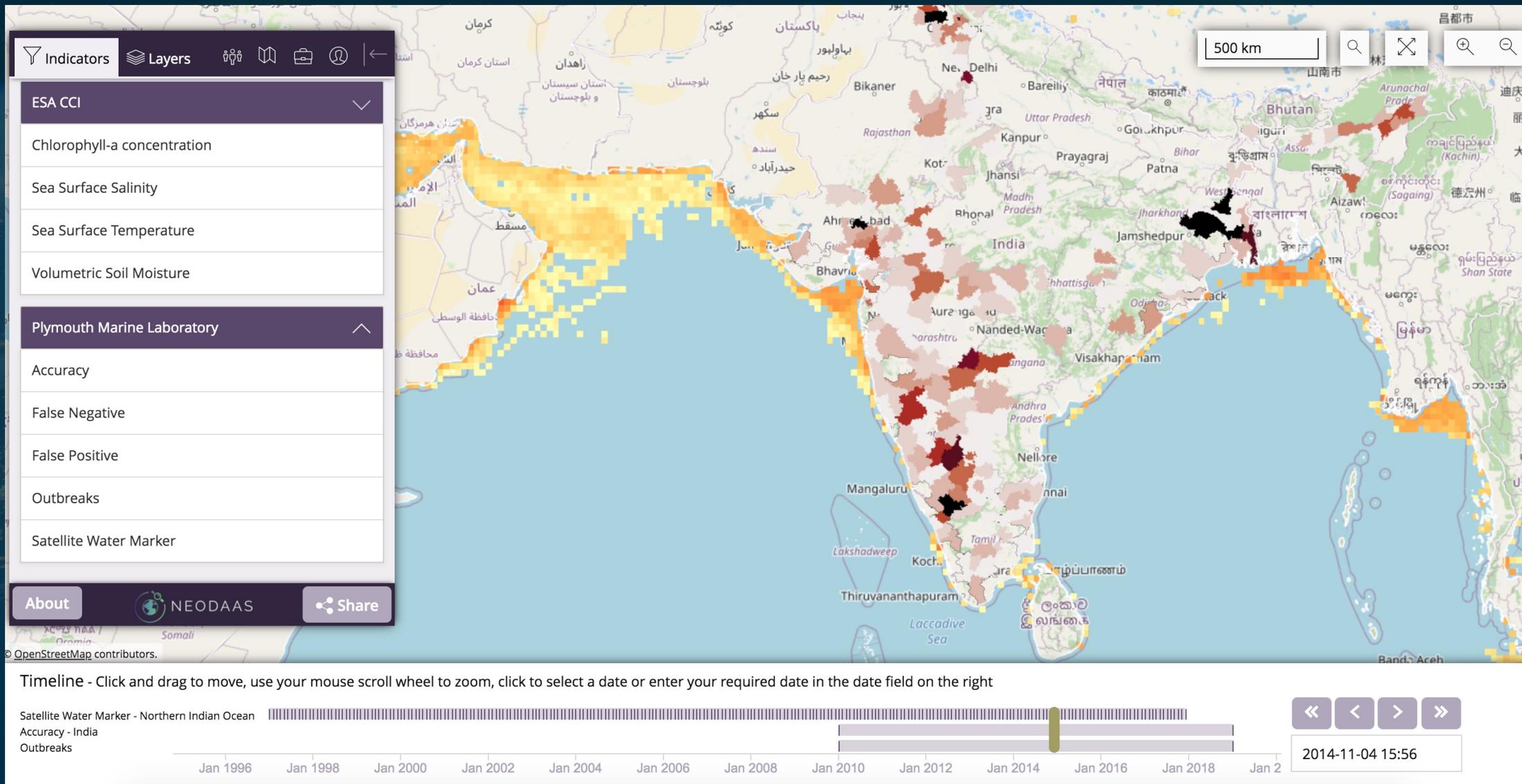
## TEMPORAL UPDATE NEEDS

(in %)



## SCORING OF DISEASE RISK INDICATORS





# Key outcomes and next steps

- Identified **key climate data records** for cholera risk information:  
2 papers published, 1 user consultation survey, 1 web portal proof-of-concept
- **Survey** showed **strong interest to learn more** through:  
web portal (69%), workshop (54%), training (35% of respondents)
- **Essential** to include **socio-economic data** and **consider extreme events**
- Explore potential for **transfer of models to other regions**
- **Development of new collaborations** with ESA Climate Office, YGT Amy Campbell, and Future Earth Health KAN team and FE Coasts and UN Coordination of Humanitarian Affairs
- **Present** virtual demo of cholera risk model at COP26

Thank you