CoP Small Work Group:
Prediction and Prevention of Heat-related Health Risks across Time Scales

BEN ZAITCHIK & CASCADE TUHOLSKE, CO-CHAIRS
Primary Goal

To reduce morbidity and mortality associated with extreme heat events and rising temperatures through reliable, decision-relevant integrated information systems, that include early warning, targeted to reduce heat impacts on vulnerable populations.

This effort will focus on identifying, applying and documenting Earth observation (EO) needs to reduce heat-related health risks.

The goal is to build a globally relevant capacity to use EO to understand, predict, and reduce health risks from heat across time scales.
2022 Activities

Ongoing informal seminar series: research presentations from Xiaojiang Li, Ashish Sharma, and Zach Guido

Heat research showcase for the GEO-Health CoP

Focused discussions on EO heat products and urban heat monitoring

Exchange of experience and funding announcements. The Heat Small Working Group had several members succeed in heat-related proposals to NASA, DOE, and NSF, among others

Continued brainstorming for collaborative Work Group activities, but no direct actions to date
Plans for 2023

Option 1: continue with the current model. The Work Group offers a useful forum for research talks and scientific exchange

Option 2: focus on one or more research topics and seek funding to pursue a collaborative project

Option 3: select one or more topics of shared interest and write a perspectives piece or other publishable output that draws on the Work Group’s collective experience
INFECTIONOUS DISEASES GROUP

Antar Jutla, Chair
1: Establish database on earth observation use in understanding modalities of infectious diseases
2: Discussions on format of meetings
3: Volunteering for position document on earth observations and pathogens of clinical importance.
4: Health for all: Health and Environmental Equity through earth observation

For point 1:
- Students from various labs can work on it, but this is a huge undertaking and may need resources for updating this system. The database is critical but will require depth and breadth for consistency and coverage of infectious pathogens and associated diseases.
- A post-doc at NASA or NOAA can help and see if such resources can be developed.
- Recruitment of students from various labs
- Database should have query functions such as studies for hypothesis, or application or mixed ones.
- Broader questions need to be defined in terms of who will be the audience to use this data.

For point 2:
- A quarterly meeting format is acceptable at this stage. Schedule meeting after preliminary outputs (actionable) from Point 1

For point 3:
- A need for a review article that can summarize history of EO in predicting various infectious pathogens (or develop proxies for emergence of pathogens).
  - GeoHealth Climate change special section

For point 4:
- No discussion yet- will address in 2023.
**Work in Progress**

- Experimental resources on where expertise exist. Mapping, monitoring and following up with people, resources
  - Contacting appropriate volunteers for this task
    - Request all who are interested to complete the spreadsheet shared earlier
  - Link to map
    - [https://remote-sensing-infectious-diseases-ufl.hub.arcgis.com/](https://remote-sensing-infectious-diseases-ufl.hub.arcgis.com/)
  - Link to database
    - [https://uflorida-my.sharepoint.com/:x:/g/personal/ajutla_ufl_edu/ETeOGJNB0j5ItQrBqV-oxlIBFxV_YoMdCMnd2qOABRrIYq?e=qUFa2m](https://uflorida-my.sharepoint.com/:x:/g/personal/ajutla_ufl_edu/ETeOGJNB0j5ItQrBqV-oxlIBFxV_YoMdCMnd2qOABRrIYq?e=qUFa2m)

- Showcasing our work for COP- products and services developed, limitations and further improvements.
  - Work in progress
Earth Observations and Infectious Diseases
Antar Jutla & Members of GEO Infectious Disease Small Group
University of Florida, Gainesville, FL

Abstract

Improve prediction and prevention systems for environmentally-sensitive infectious diseases to help reduce risks for human health by application of Earth Observations (EO) to enhance decision-relevant risk monitoring, with particular focus on underserved communities.

1) Develop a generalization framework for incorporating climatic and environmental data for enhancing predictive and decision-making mapping capacity to serve as the EO backbone for water-air- and vector-borne diseases; and
2) Develop platform for the monitoring and prediction of emerging pathogens and toxins risk in marine and coastal environments coupled with critical EO-derived coastal and inland water quality parameters.

Examples of application of EO

- **Cholera**
  - Jutla et al., 2021

- **Rift Valley Fever**
  - Anyamba et al., 2009

- **West Nile Virus**
  - Hess et al., 2018

- **Zika**
  - October
  - Zika outbreak in 2015 in Brazil.
  - (R1, R2...are regions of risk)

Discussion points

- Identification of critical EO and prediction requirements for health, specifically for evolutionary aspects of pathogens.
- What data, surveillance systems and tools are currently being used?
- What data and surveillance systems and tools are required to be able to measure risk of disease outbreak in future?
- Enhance integrated modeling of disease risk or prediction of environmental drivers of disease and other health outcomes.
- Understand links between environmental and climate change, food quality and nutrition, and health.
- Predict when, how, and where diseases will emerge and identify the populations most at risk and most vulnerable
- Earth observation and health equity justice
- Communication across aisle (other disciplines)
CoP Small Work Group: Air Quality, Wildfires, Respiratory Health

• Eric Klos & Pawan Gupta, Co-Chairs
Purpose

• To collectively advance the science of modeling satellite and sensor measurement data for monitoring, forecasting, and assessment of air quality, wildfire-related pollutants, and aeroallergens to quantify the levels of exposure associated with health risk for various population groups and the public at large.
Past Activities

• Coalesced around a Community Feasibility Study
  • Wildfires affect communities (health services, schools, community centers, event organizers, and individuals) in many ways
  • Satellite and surface data models can help provide useful information for informed decision making at many levels
  • Often datasets and tools are designed using top-down approach (i.e. someone has idea, data and execution power)
  • During a wildfire – what actual useful information does a particular health service, community, or patient population need and how NASA can help provide that?
  • As a group, we can do a needs assessment exercise and propose a solution to NASA applied science program
Future Plans

• Last Meeting in Spring 2022
• Seeking New Co-Chairs for 2023
• Gather Volunteers for Community Feasibility Study
  • Identify region/county which frequently is affected by Wildfires
  • Assess existing resources and how are they being used
  • Reach out to potential local collaborators (AQ agencies, schools, community groups, citizen scientists, emergency services, health providers, etc.)
  • Organize listening session – online
  • Develop surveys to formally collect information
  • Perform need assessments
  • Identify NASA datasets, tools and develop a prototype study
Health Care Facility Infrastructure progress and actions for 2023

Andreas N. Skouloudis
iSteep.org
Goals for this Area (Dec 6, 2022):

1. Integrate images Earth Observations (open and commercial sources) in order to develop an informational resource that assesses the vulnerability of health care facilities,

2. Develop methods to assess the adequacy of these facilities under regional acute catastrophes or during escalating chronic pandemics.

3. To assess their infrastructures risks to local environmental stressors (during seasonal loads and local population needs).

4. This has implications of their functional status both real-time operations and for long-term health adaptation planning.
1. Progress on the automation challenge: how to extract the HCF …

Demand for object recognition in multispectral satellite imagery.

Full earth visual coverage of RGB and panchromatic accuracy of >25 cm per pixel.

Examined for object recognition with FastFCN, DeepLabv3, UNET, and MACU.

The machine learning process with better performance, especially in a low-information intensity environment. … and no trivial GPU or CPU capacity.

- https://github.com/topics/deeplab-v3-plus
- Multi-scale skip connected and asymmetric-convolution-based U-Net https://github.com/lironui/MACU-Net

Excessive Loads

Geolocation of Mortality hot spots
3. Manually examine events and their risks

When the operational capabilities of HCF are becoming important (and their infrastructure critical):

- Earthquakes, floods, atmospheric events (e.g. Kentucky, Berkshire) landslides (Ischia) are regular natural extremes with significant effects on population.
- Man-made caused toxic releases and radioactive accidents are rare, but with large population exposures.
- Epidemics (and the ongoing pandemic) are causing escalating demands for hospitalizations that can raise acute needs beyond the normal capabilities.
Projected Future (2040s) Climate Risks for HCF

Projections of future climate risk: Binita KC et. al (2020)
Food Security and Safety Work Group

Dorian Janney, Chair
Past Activities

We focused on three big questions:

1. How are EO being integrated with food systems data to provide actionable information on food security in regions with extreme food insecurity?

2. What is the impact of increasing heat on agricultural and ranching production in the western United States?

3. What is the impact of algae blooms and toxins on water quality, shellfish and aquaculture on the eastern coast of the United States?

For each question, we brainstormed on the following:

- Potential stakeholders and decision-makers

- What data are they currently relying on?

- What is the current state of the research?

- What are the gaps in the research and in the available data?
Present Activities

We are now shifting our focus to investigate the impact of climate change on food security and safety from a One Health perspective.

As a working group, we will brainstorm on similar questions as for the three big questions we looked at previously. We will begin by identifying the impacts and potential impacts of climate change on food security and safety, and focus in on the interactions of humans, animals, and the environment.

We have also taken a look at the impact of the war in Ukraine on food security and safety as an exercise in the real-world applications of EOS and other data to better understand the impact as well as operational responses.

See more here: [http://bit.ly/3ibSSCg](http://bit.ly/3ibSSCg)