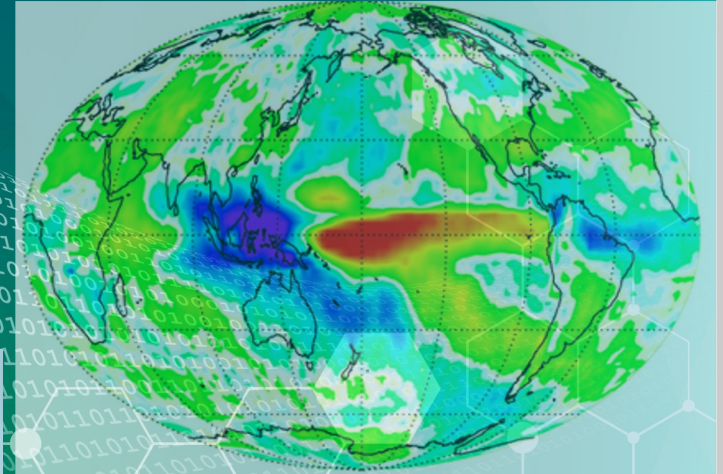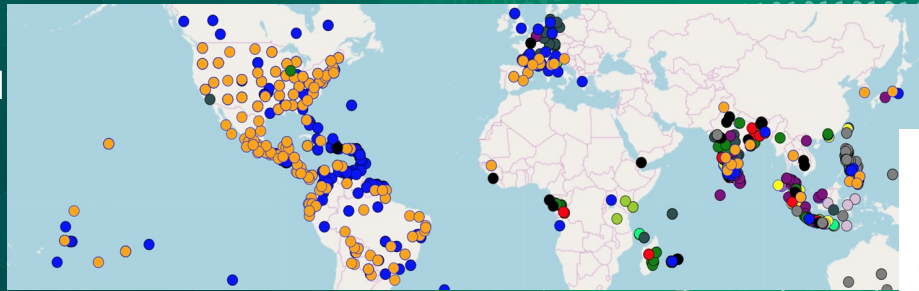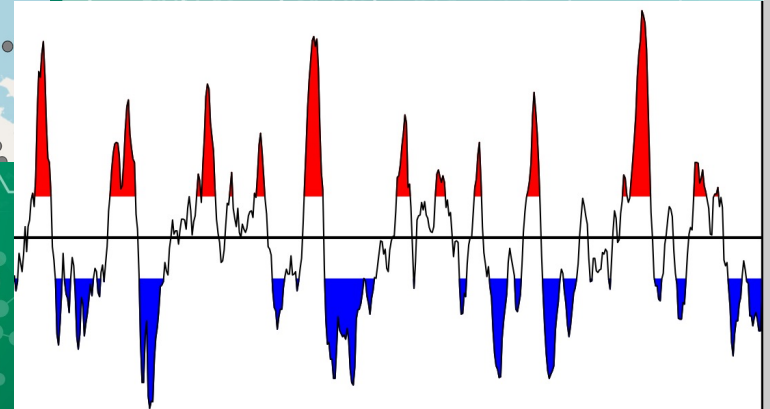# MEDINA: Machine Learning, Climate Variability and Disease Dynamics
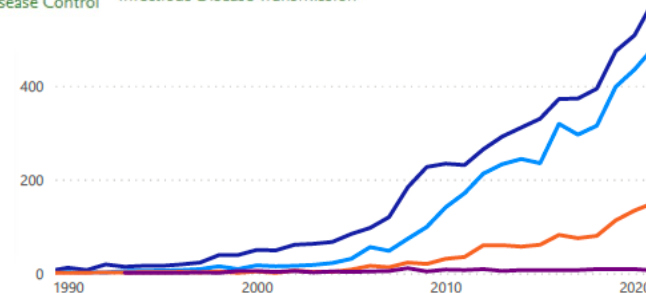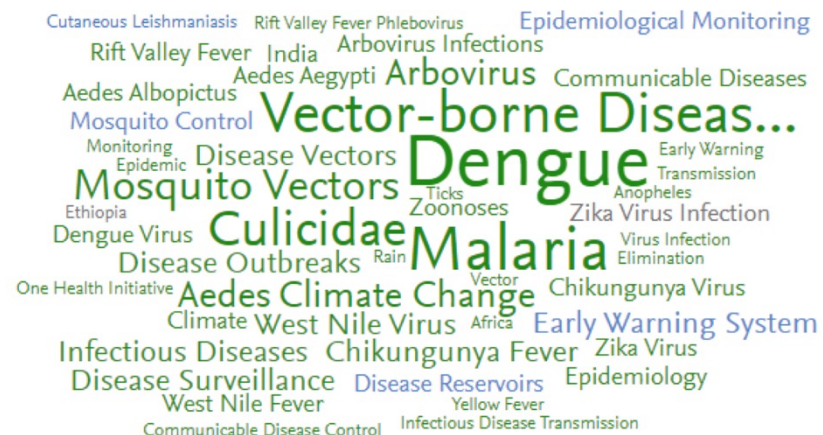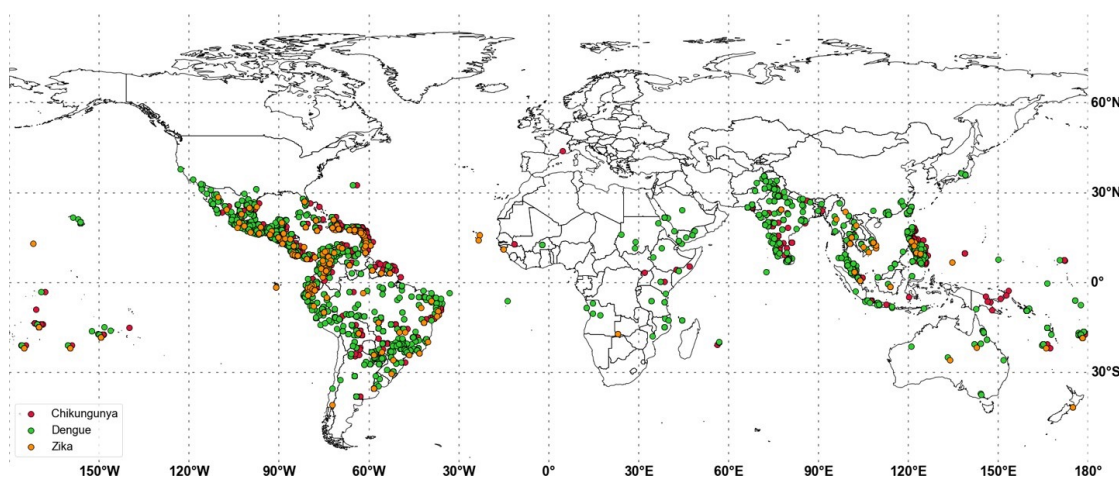
PI: Assaf Anyamba

Health and Air Quality Applications Program Review
Day 2: September 22, 2022, 12:45 p.m. – 12:50 p.m.
A.37 ROSES 2021

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U.S. DEPARTMENT OF
ENERGY

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Vectorborne Disease Challenge

❏ Threat US national security and global health security.

❏ Vectorborne and Zoonotic pathogens ~ 2/3 of the 57 top infectious disease threats to Department of Defense personnel and > than 17% of all global public infections + > 700 000 deaths per year.

❏ Defense and public health agencies - often behind the curve, responding to disease outbreaks rather than anticipating and controlling diseases before they become more widespread

Cutaneous Leishmaniasis Rift Valley Fever Phlebovirus Epidemiological Monitoring
Rift Valley Fever India Arbovirus Infections
Aedes Aegypti Arbovirus Communicable Diseases
Aedes Albopictus
Mosquito Control Vector-borne Diseas...
Monitoring Disease Vectors Dengue Early Warning
Epidemic Transmission
Mosquito Vectors Ticks Anopheles
Ethiopia Zoonoses Zika Virus Infection
Dengue Virus Culicidae Virus Infection
Disease Outbreaks Rain Malaria Elimination
One Health Initiative Aedes Climate Change Chikungunya Virus
Climate West Nile Virus Africa Early Warning System
Infectious Diseases Chikungunya Fever Zika Virus
Disease Surveillance Disease Reservoirs Epidemiology
West Nile Fever Yellow Fever
Communicable Disease Control Infectious Disease Transmission

NEED

❏ **Where** has VBD activity occurred
❏ Where is it occurring **now**
❏ Which regions are **currently at risk** for chikungunya
❏ Which regions are at **risk in the immediate future**

INFORM

❏ Surveillance
❏ Prevention, Control and Treatment
❏ Identification of "unknown" cases

Legend:
- Chikungunya
- Dengue
- Zika

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SCIENCE AND IMPLEMENTATION TEAMS

Assaf Anyamba (PI),

Inst.PI/Co-I: Kenneth J. Linthicum

Co-PI: Seth Gibson

LTC Kevin Taylor. *now USU

Inst.PI: Stephanie Schollaert Uz

Co-I: Ana Rivière Cinnamond

Co-I: Wassila M. Thiaw (NOAA-CPC)

Co-I: Claudia Pittiglio
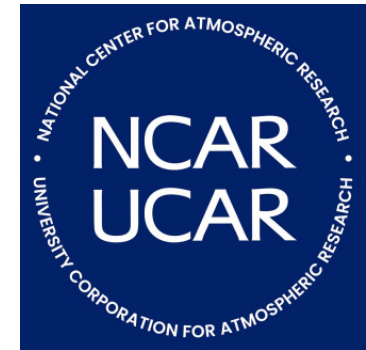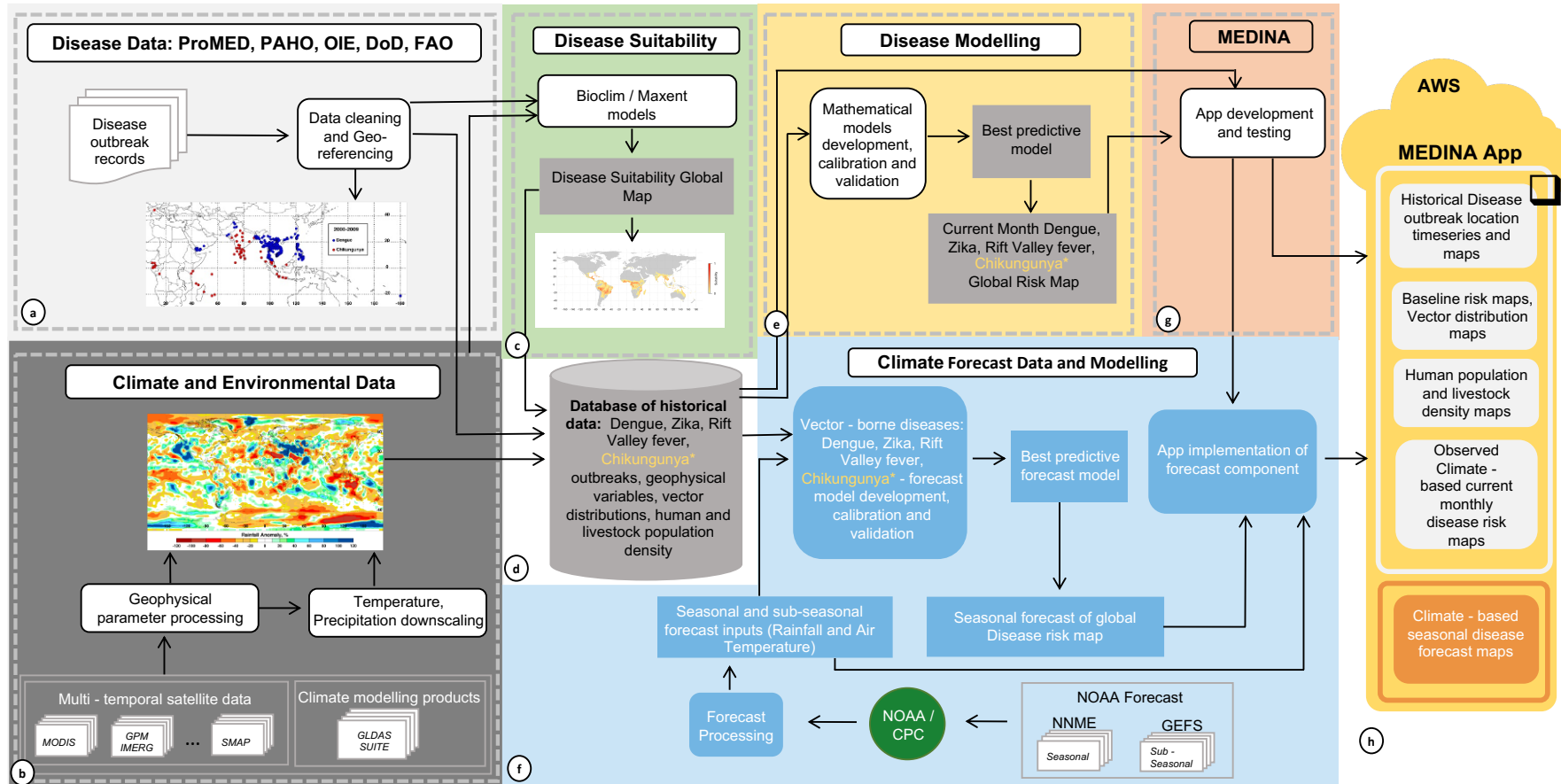
Assaf Anyamba
Heidi Tubbs
Bhaskar Bishnoi

Seth Gibson

Wassila M. Thiaw

Endalkachew Bekele

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STRATEGY

- ❑ Defense Health Agency's Febrile and **Vector-borne Infections (FVBI) Focus area** and are included on the **Global Ranked List of Infectious Disease Threats** (2015)
- ❑ Mediated by Climate Variability

1. Dengue
2. Zika Chikungunya
3. Rift Valley fever
4. Hantaviruses

Category A or **C** Bioterrorism Agents

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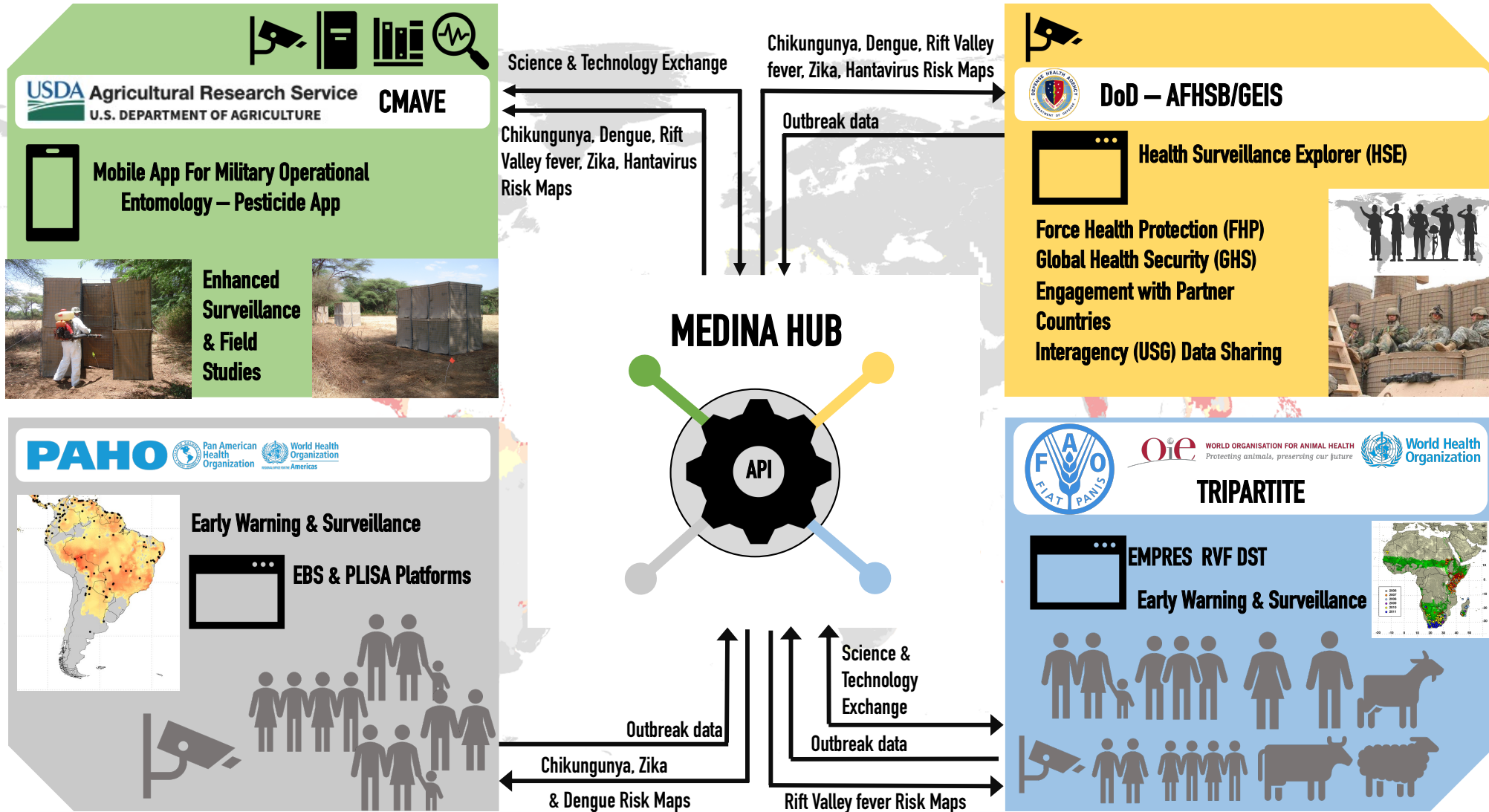
DECISION NETWORK

MEDINA Decision Support System Network (MDSSN) illustrating data and product flows to support various decision-making elements for various project partners as well as science and technology exchange

PROJECT SCHEDULE & ARLs

Task Description	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task A. Data processing: disease data, climate and environmental and ancillary data												
Disease data processing												
Milestone: Disease data (up to present) ready for use in analysis (other tasks)												
Ancillary Data												
Milestone: Human population, Livestock Population and SRTM Elevation												
Climate Data Processing and NMME Forecasts												
Milestone: Climate data (up to present) ready for use in analysis (other tasks)												
Task B: Disease Suitability and Modeling												
Dengue, Zika suitability and ML Evaluation												
Rift Valley fever, Hantavirus suitability and ML Evaluation												
Task C. MEDINA App development and Deployment												
Curation and Development												
Deployment to AWS and Component Updates												
Development of Interoperability with Pesticide App, API's for RVF DST, HSE, PLISA												
Task D: Application Readiness Levels (ARL)												
Chikungunya	8	8	8	8	8	8	8	8	8	8	8	8
Dengue	2	2	2	3	4	4	5	6	7	7	8	8
Zika		2	2	2	3	4	4	5	6	7	7	8
Rift Valley fever			4	4	5	5	6	6	7	7	8	8
Hantavirus			2	3	4	5	5	6	7	7	8	8

ARL KEY

ARL	STATUS
8/4/2	CURRENT
8	END GOAL

❑Technical risks/challenges: Terra, Aqua orbital drift and impact on data quality, availability and continuity (NDVI, LST)

❑Could impact project schedule and/or intended milestones

❑Mitigation: explore using Visible Infrared Imaging Radiometer Suite (VIIRS) products from Suomi NPP and NOAA-20 satellite missions

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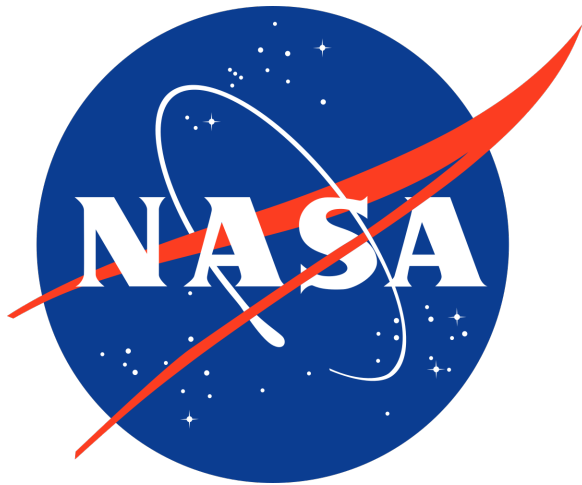Open slide master to edit

VISION : MEDINA
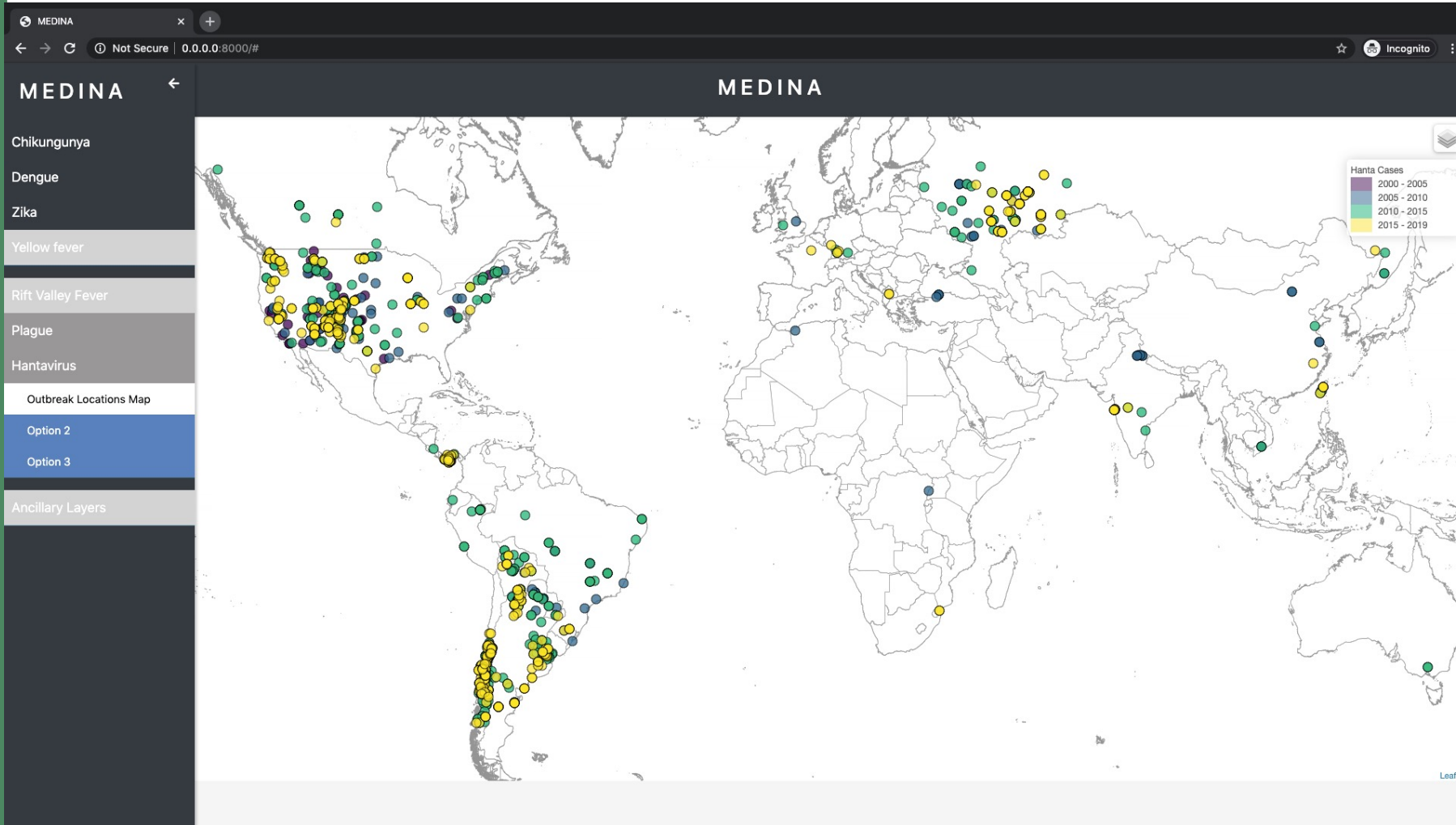
Unified Dashboard

- ❑ Persistent VBD Threats
- ❑ Current and Forecast Risk Maps
- ❑ Baseline Risk Maps
- ❑ Case timelines
- ❑ Vector Distributions
- ❑ Operationally Relevant
- ❑ Upgradeable

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Thank You !

EARTH SCIENCE APPLIED SCIENCES

NASA Applied Sciences Program – Health and Air Quality, Grant # 21-HAQ21-0027