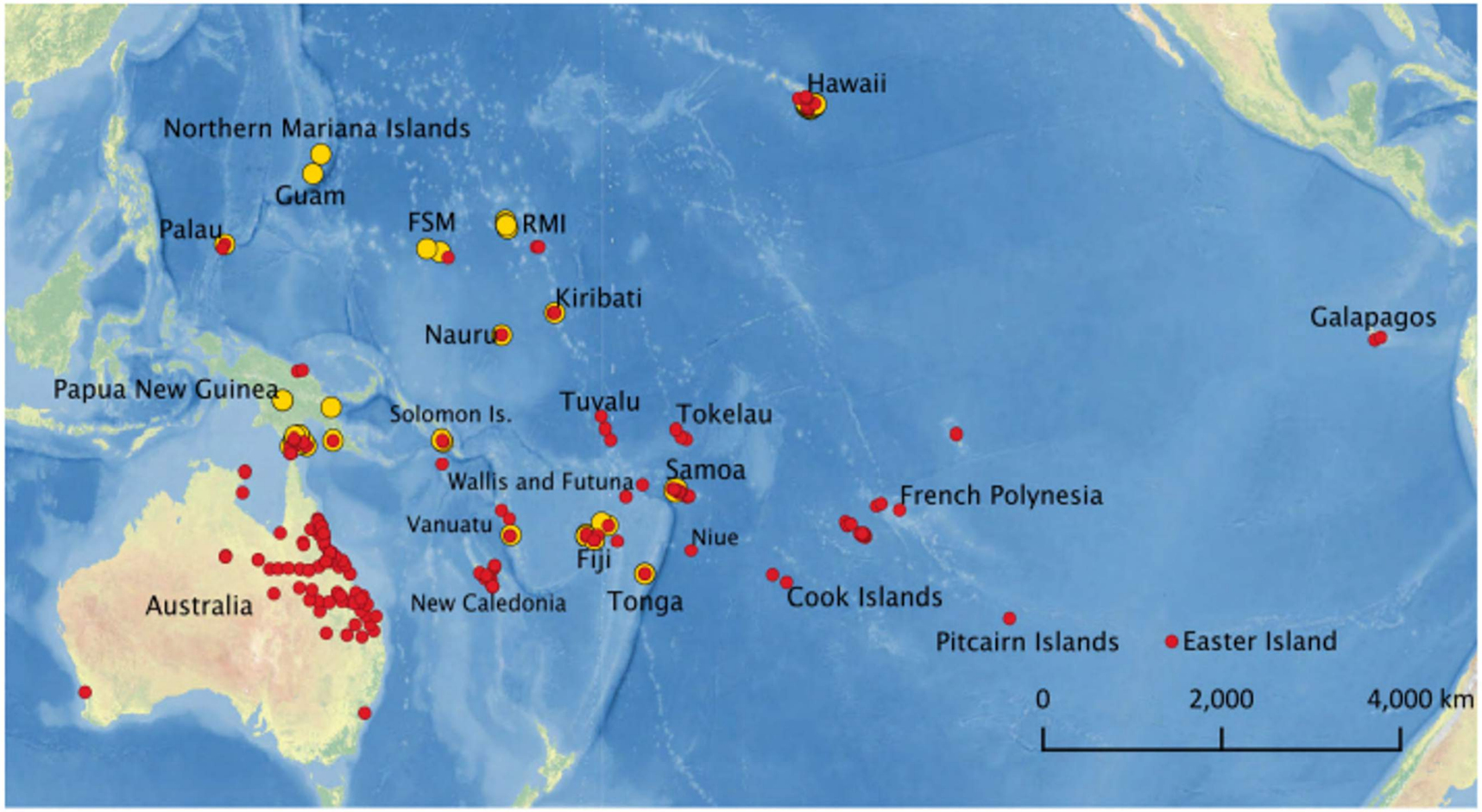
Implementing Dengue Early Warning Systems in FSM, RMI, and Palau

Tomás León
Rosanna Rabago

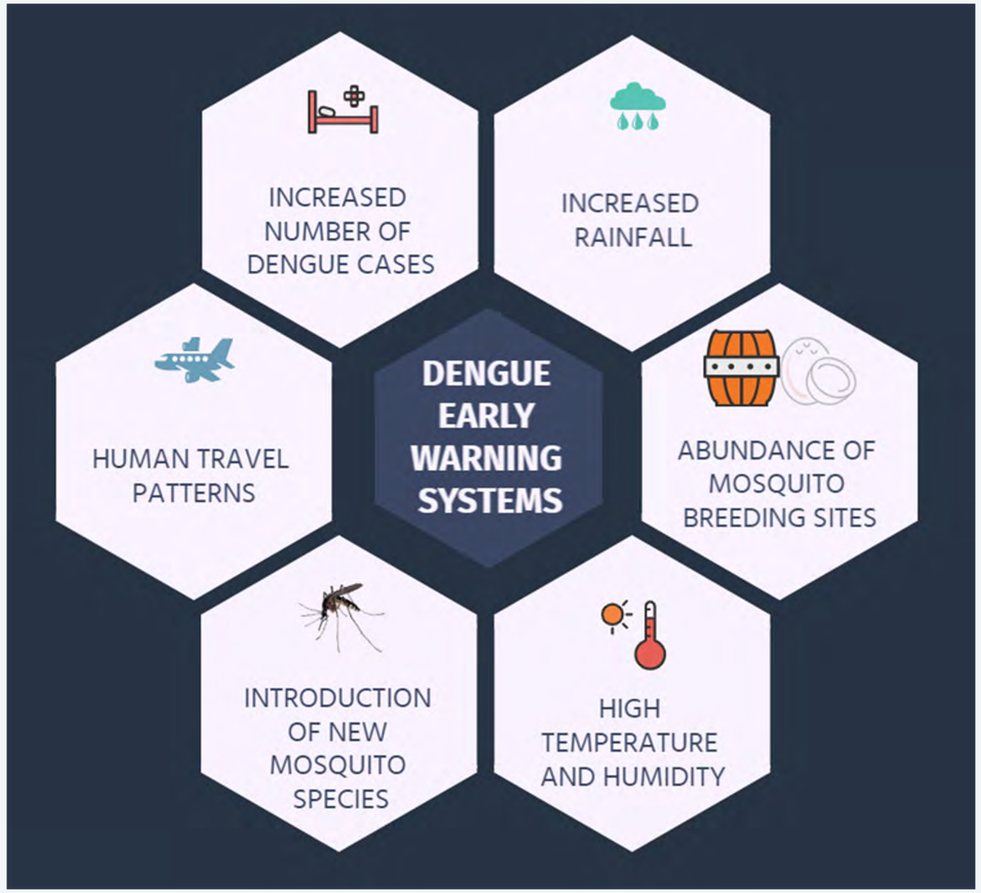
74th PIHOA Executive Board Meeting
Honolulu, March 26th

The mosquito vector is omnipresent, though disease ecology differs by country/territory



Source: Seong, S., Rax, C.D., Miller, J.H., et. Al. (2023). Arboviral disease outbreaks, *Aedes* mosquitoes, and vector control efforts in the Pacific. *Frontiers in Tropical Diseases,* 4(10), 01-13. doi: 10.3389/fitd.2023.1035273.

What is an Early Warning System?



Using available information and data to understand risk of present and future dengue outbreaks

Using this data to create predictive models that serve as early warning tools

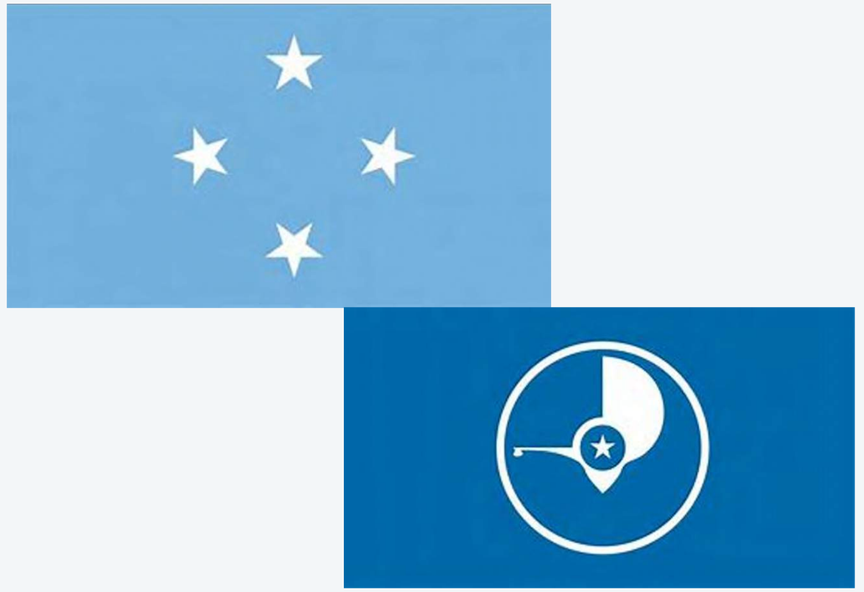
RESULT:

- Ability to use models to forecast potential for dengue outbreaks weeks or months in advance
- Allows for faster and more proactive public health response against dengue
- Prevention or reduction in the number of dengue cases
- Economic and social benefits for the community

Partner engagement and capacity building is key for future EWS success



MARSHALL ISLANDS



FSM, YAP STATE



PALAU

FSM, Yap State

PARTNERS

- Department of Health Services
  - Environmental Health
- Yap State Hospital
- NOAA Weather Services Office
- Yap State Environmental Protection Agency



Community Outreach



JACQUELYN LEFAGOYAL

Vector Borne Disease Outreach to Ulithi High School

May 4, 2022



Building Relationships and Improving Capacity







Outcomes include: Pesticide application license, data for decision management, climate data, protocol and template building (press releases and SOPs)

Republic of Marshall Islands

PARTNERS

- Ministry of Health and Human Services
  - Environmental Health
- Marshall Islands Conservation Society (MICS)
- Women United Together Marshall Islands (WUTMI)
- Council of Chiefs (12 chiefs)





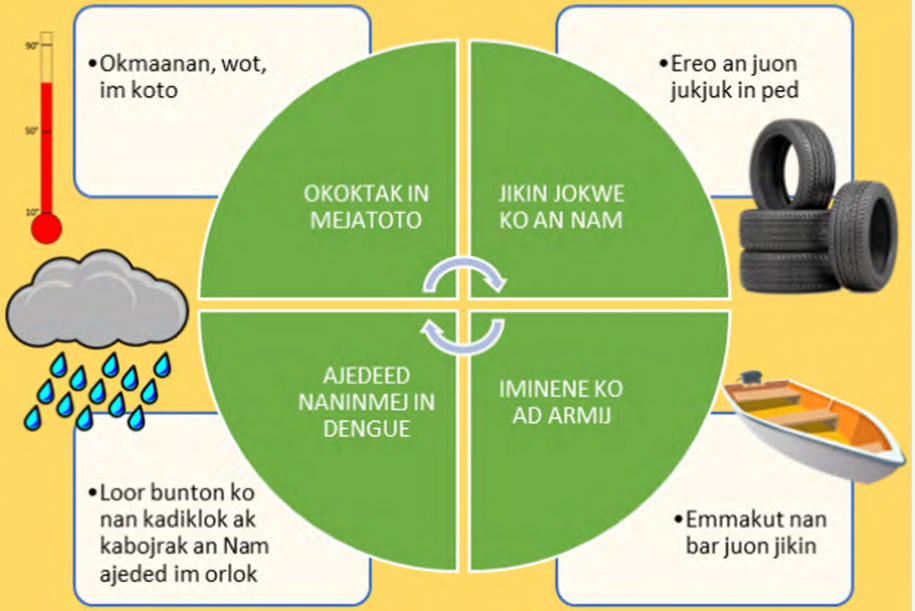


Community Outreach

Okoktak in Mejatoto Ekolaplak Kauwatata ko rej walok Naninmej in Nam

Okoktak in Mejatoto ekomman an ajedeed naninmej in Nam ilo:

- Okmaanan im ikutkut an wot
- Mokaj an orlak oran nam ko, im waeein aer mour
- Jikin Jokwe ko nan Nam
- Ajedeed in naninmej ko jen Nam (nan wanjonak Dengue)

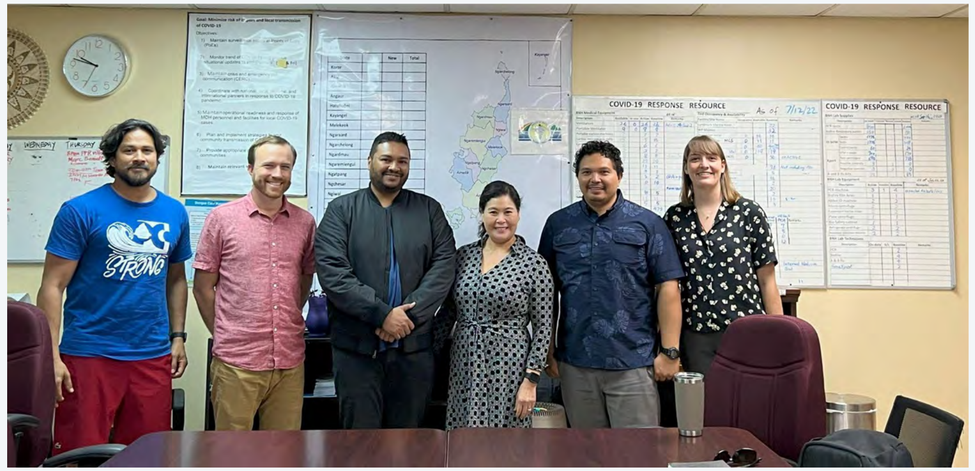


Bobrae Jen Naninmej in Nam! Man Nam Ne!

Marshall Islands Conservation Society

Republic of Palau

- Ministry of Health and Human Services
  - Division of Environmental Health
  - Office of Public Health Epidemiology
- Pacific Academic Institute for Research (PAIR), Palau Community College
- Palau Land and Resource Information System Office (PALARIS)
- Belau National Hospital





Community Surveys

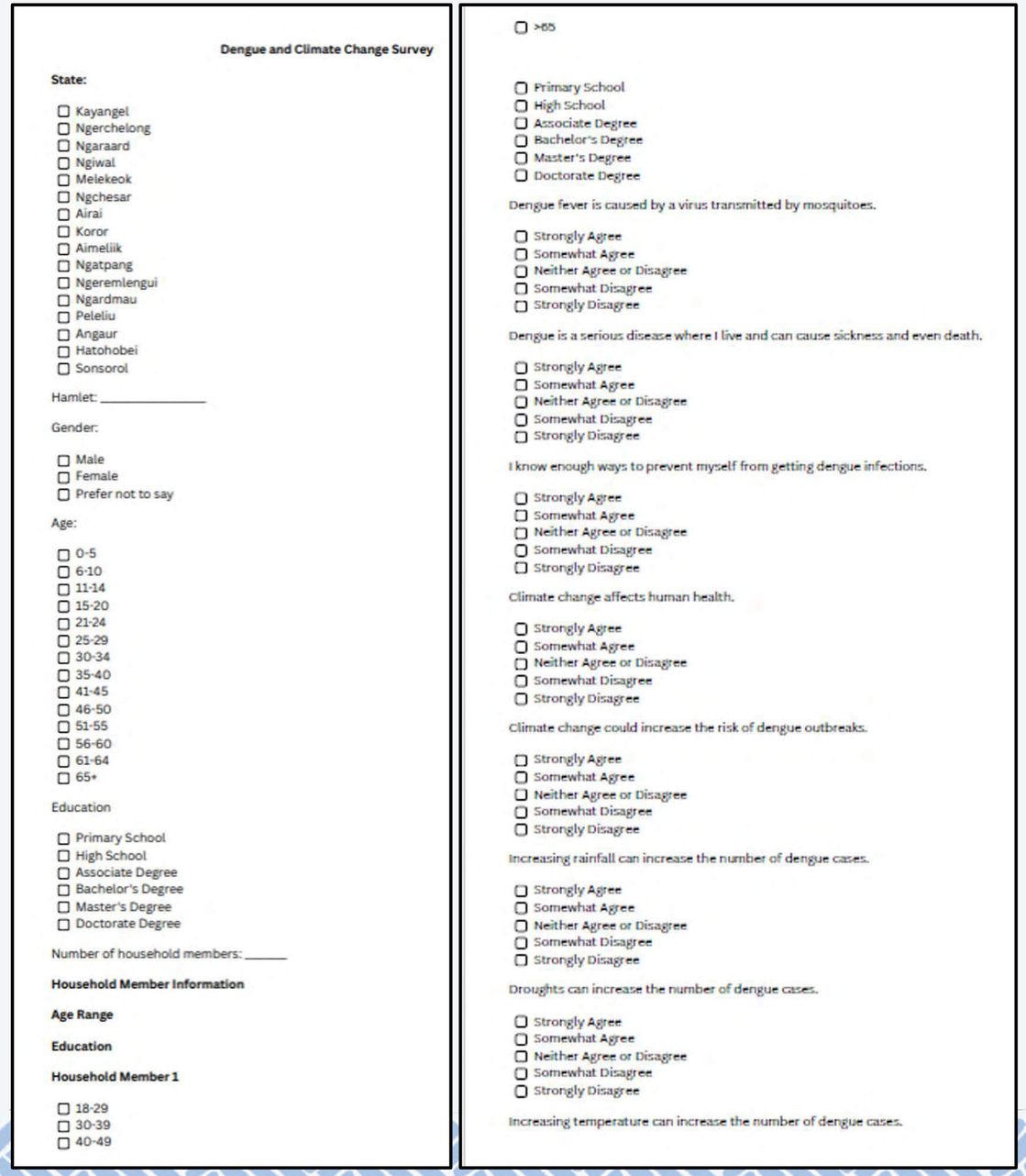
Purpose:

To obtain demographics from community and information on knowledge of dengue

More than 75 surveys have been conducted.

Data is collected and entered into KoboToolbox.

Data entry and results are on-going.



Dengue and Climate Change Survey

State:

- ☐ Kayangel
- ☐ Ngerchelong
- ☐ Ngaraard
- ☐ Ngiwal
- ☐ Melekeok
- ☐ Ngchesar
- ☐ Airai
- ☐ Koror
- ☐ Aimeliik
- ☐ Ngatpang
- ☐ Ngeremlengui
- ☐ Ngardmau
- ☐ Peleliu
- ☐ Angaur
- ☐ Hatohobei
- ☐ Sonsorol

Hamlet: _____

Gender:

- ☐ Male
- ☐ Female
- ☐ Prefer not to say

Age:

- ☐ 0-5
- ☐ 6-10
- ☐ 11-14
- ☐ 15-20
- ☐ 21-24
- ☐ 25-29
- ☐ 30-34
- ☐ 35-40
- ☐ 41-45
- ☐ 46-50
- ☐ 51-55
- ☐ 56-60
- ☐ 61-64
- ☐ 65+

Education

- ☐ Primary School
- ☐ High School
- ☐ Associate Degree
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ Doctorate Degree

Number of household members: _____

Household Member Information

Age Range

Education

Household Member 1

- ☐ 18-29
- ☐ 30-39
- ☐ 40-49
- ☐ >65

- ☐ Primary School
- ☐ High School
- ☐ Associate Degree
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ Doctorate Degree

Dengue fever is caused by a virus transmitted by mosquitoes.

- ☐ Strongly Agree
- ☐ Somewhat Agree
- ☐ Neither Agree or Disagree
- ☐ Somewhat Disagree
- ☐ Strongly Disagree

Dengue is a serious disease where I live and can cause sickness and even death.

- ☐ Strongly Agree
- ☐ Somewhat Agree
- ☐ Neither Agree or Disagree
- ☐ Somewhat Disagree
- ☐ Strongly Disagree

I know enough ways to prevent myself from getting dengue infections.

- ☐ Strongly Agree
- ☐ Somewhat Agree
- ☐ Neither Agree or Disagree
- ☐ Somewhat Disagree
- ☐ Strongly Disagree

Climate change affects human health.

- ☐ Strongly Agree
- ☐ Somewhat Agree
- ☐ Neither Agree or Disagree
- ☐ Somewhat Disagree
- ☐ Strongly Disagree

Climate change could increase the risk of dengue outbreaks.

- ☐ Strongly Agree
- ☐ Somewhat Agree
- ☐ Neither Agree or Disagree
- ☐ Somewhat Disagree
- ☐ Strongly Disagree

Increasing rainfall can increase the number of dengue cases.

- ☐ Strongly Agree
- ☐ Somewhat Agree
- ☐ Neither Agree or Disagree
- ☐ Somewhat Disagree
- ☐ Strongly Disagree

Droughts can increase the number of dengue cases.

- ☐ Strongly Agree
- ☐ Somewhat Agree
- ☐ Neither Agree or Disagree
- ☐ Somewhat Disagree
- ☐ Strongly Disagree

Increasing temperature can increase the number of dengue cases.

Key Points & Considerations for EWS

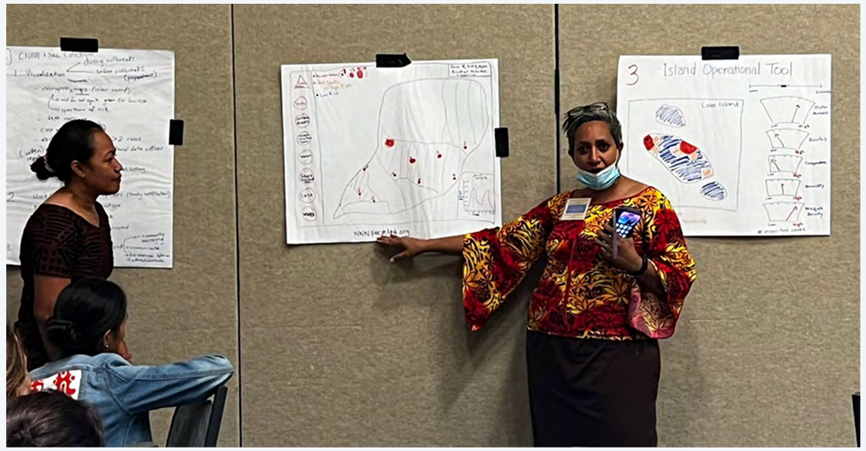
- Good models require good data
  - Data sharing & standardization
- Good models give information that is useful
  - What are the target outcomes?
- Good tools share models and their information in a meaningful way
  - Operational tool design

- What is/are the right tools for the Pacific?
  - One model/system per country/territory?
  - One regional model? Multiple regional models?
  - Multiple models can be ensembled. This is ideal and widely used for other applications/systems.

Dengue EWS Meeting, June 7-9, 2023 - Honolulu, HI

Presentors:

- Association of State and Territorial Health Officials
- East-West Center
- U.S. Department of StateHawaii Department of Health
- Institute of Environmental Science and Research Limited (ESR)
- Institut de recherche pour le Developpement (IRD)
- Columbia University, Institute Research Institute for Climate and Society



Participants:

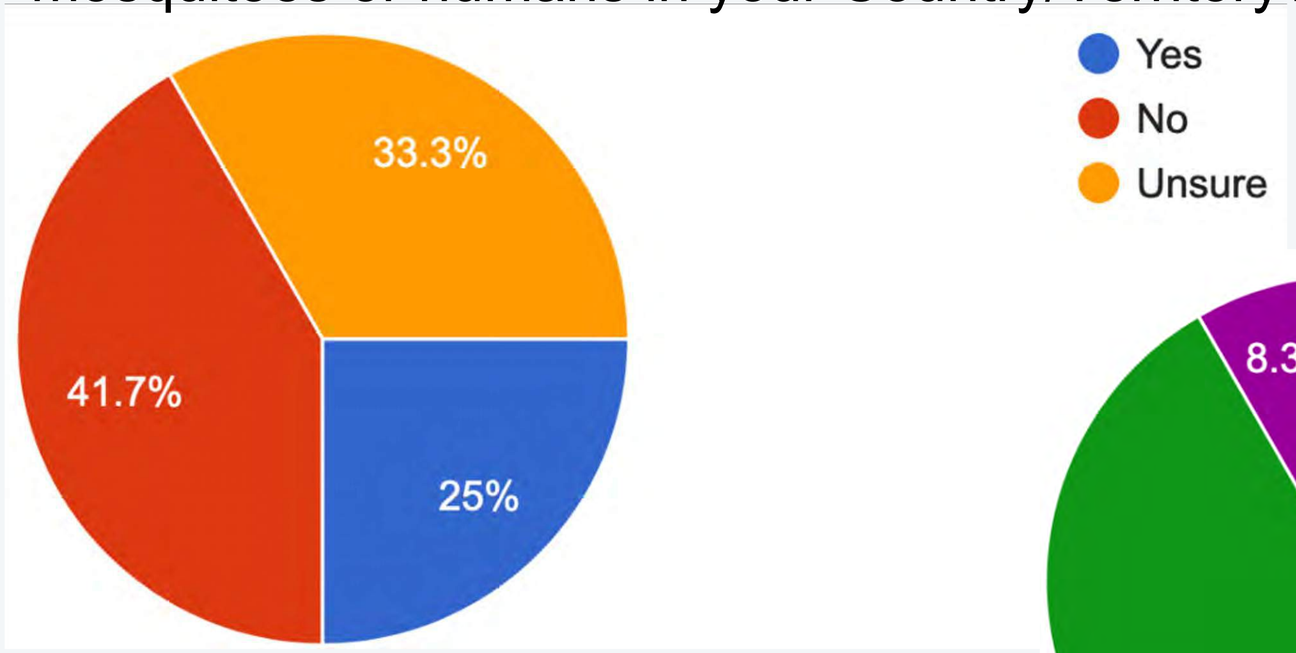
- James Cook University, Australia
- Pacific Islands Fish & Wildlife Office
- U.S. Centers for Disease Control and Prevention, Division of Vector-Borne Diseases
- U.S. Navy
- National Oceanic and Atmospheric Administration (NOAA)
- VecNet CDC, Universidad del Valle in Guatemala
- Institut of Pasteur de Nouvelle-Caledonie
- World Mosquito Program
- Department of Foreign Affairs and Trade (DFAT)
- Innovative Vector Control Consortium (IVCC)
- Ministry of Health, Labour, and Welfare (Japan)
- National Institute of Infectious Diseases (Japan)
- Malaria Consortium
- Inter-American Institute for Global Change Research



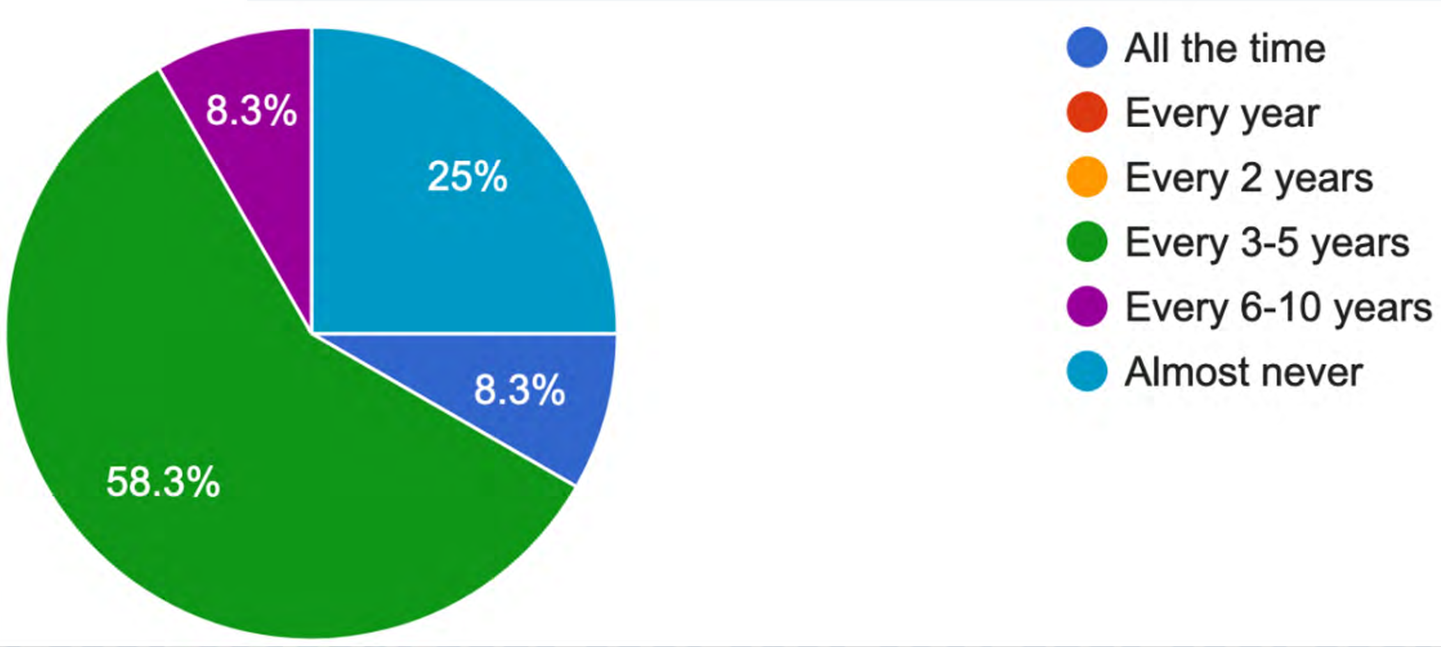


PICTs Dengue and Outbreak Experiences

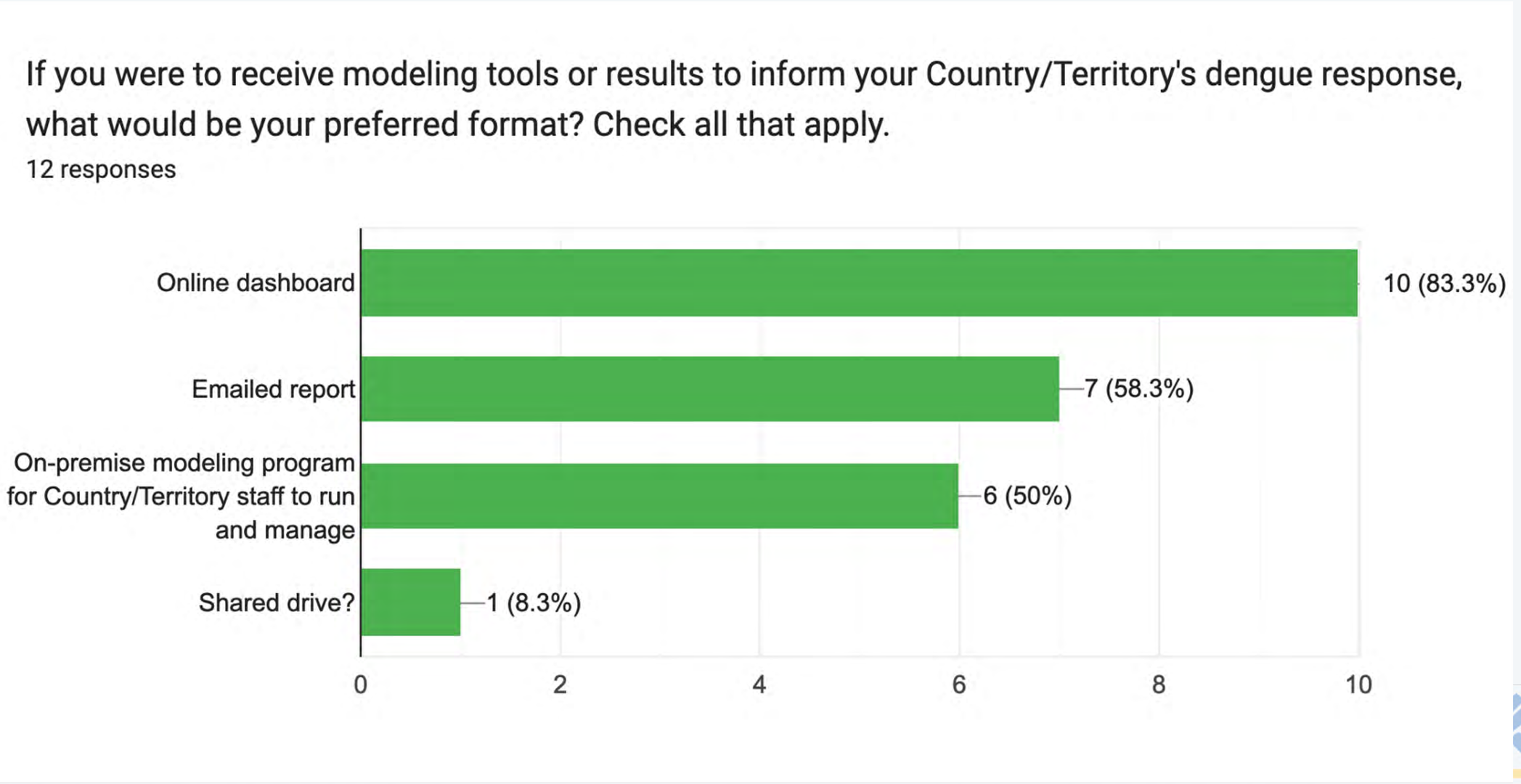
Do you think dengue is always present in mosquitoes or humans in your Country/Territory?



How often do you see dengue outbreaks in your Country/Territory?

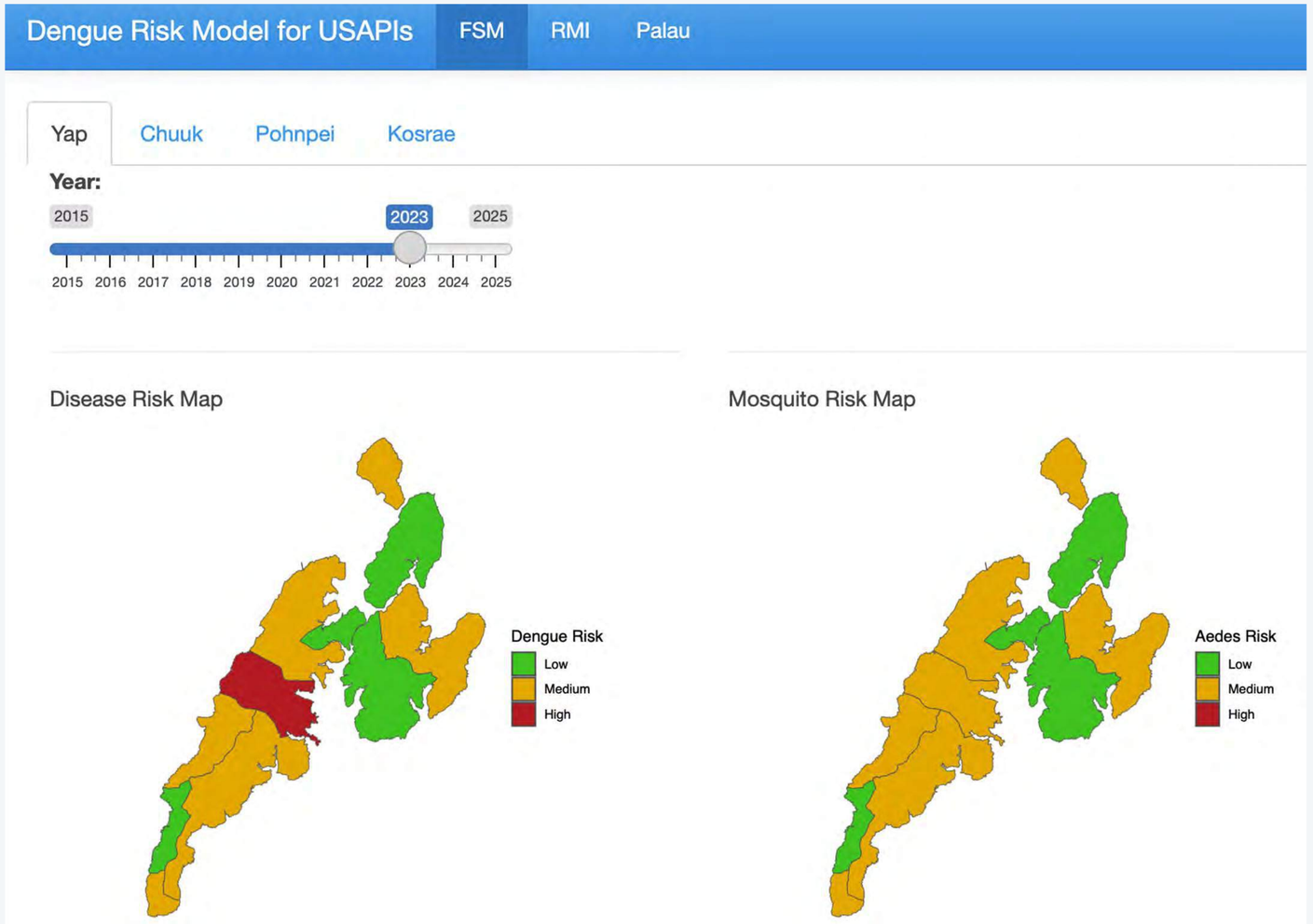


EWS Dessimination



Dengue EWS Dashboard

- Compare historical data with future climate-related risk projections
- Inclusive of major states and islands of FSM, RMI, and Palau
- Considers disease, mosquito, and climate risk by municipality
- Will continue to develop based on collaboration with local partners
- Full demo available at tomasl.shinyapps.io/USAPI_Dengue



Dashboard Visualization

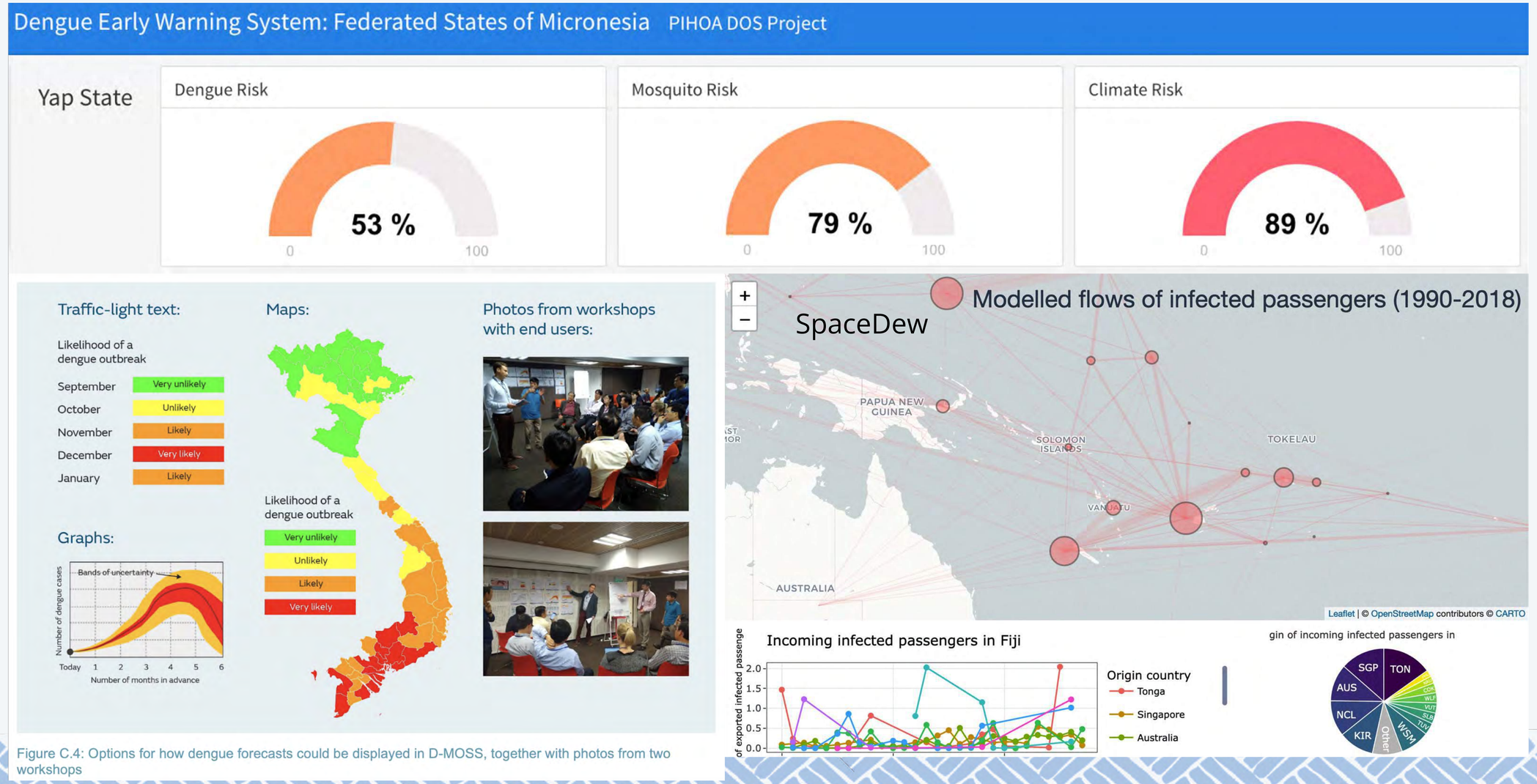
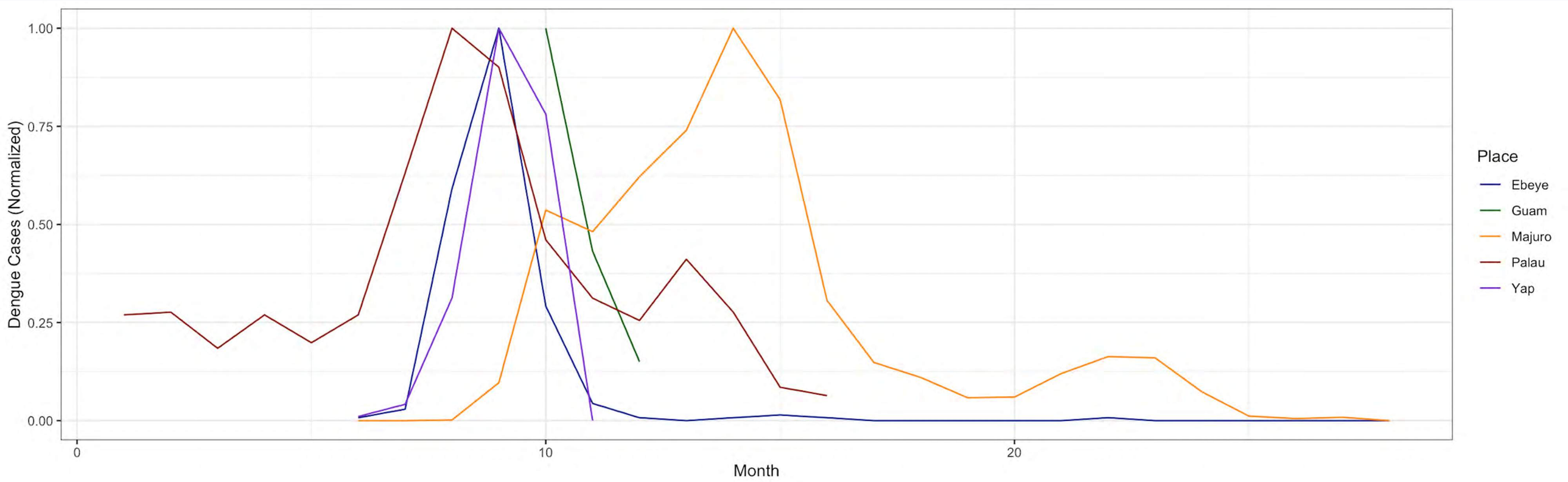


Figure C.4: Options for how dengue forecasts could be displayed in D-MOSS, together with photos from two workshops

2018-21 Dengue Epidemics Correlation

Comparing timing of DENV-3 epidemics across USAPIs to understand possible importation/exportation

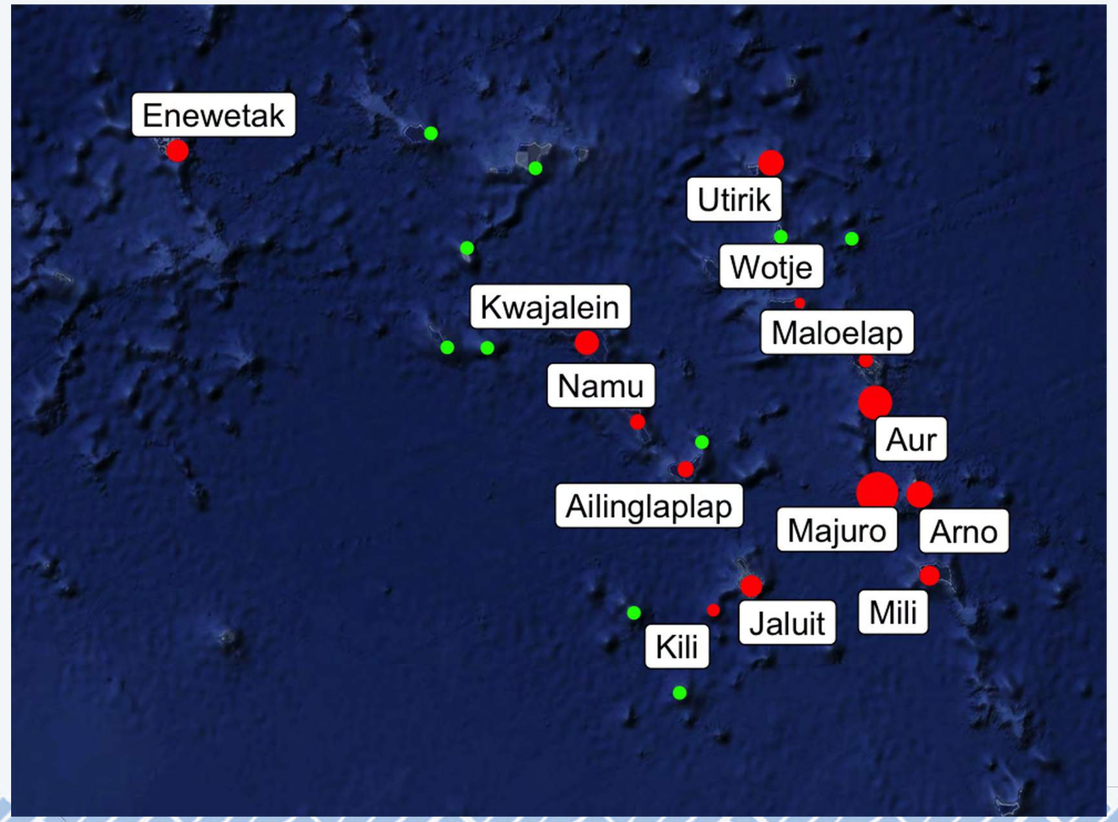


Using Data from Past Outbreaks to Understand Future Risk

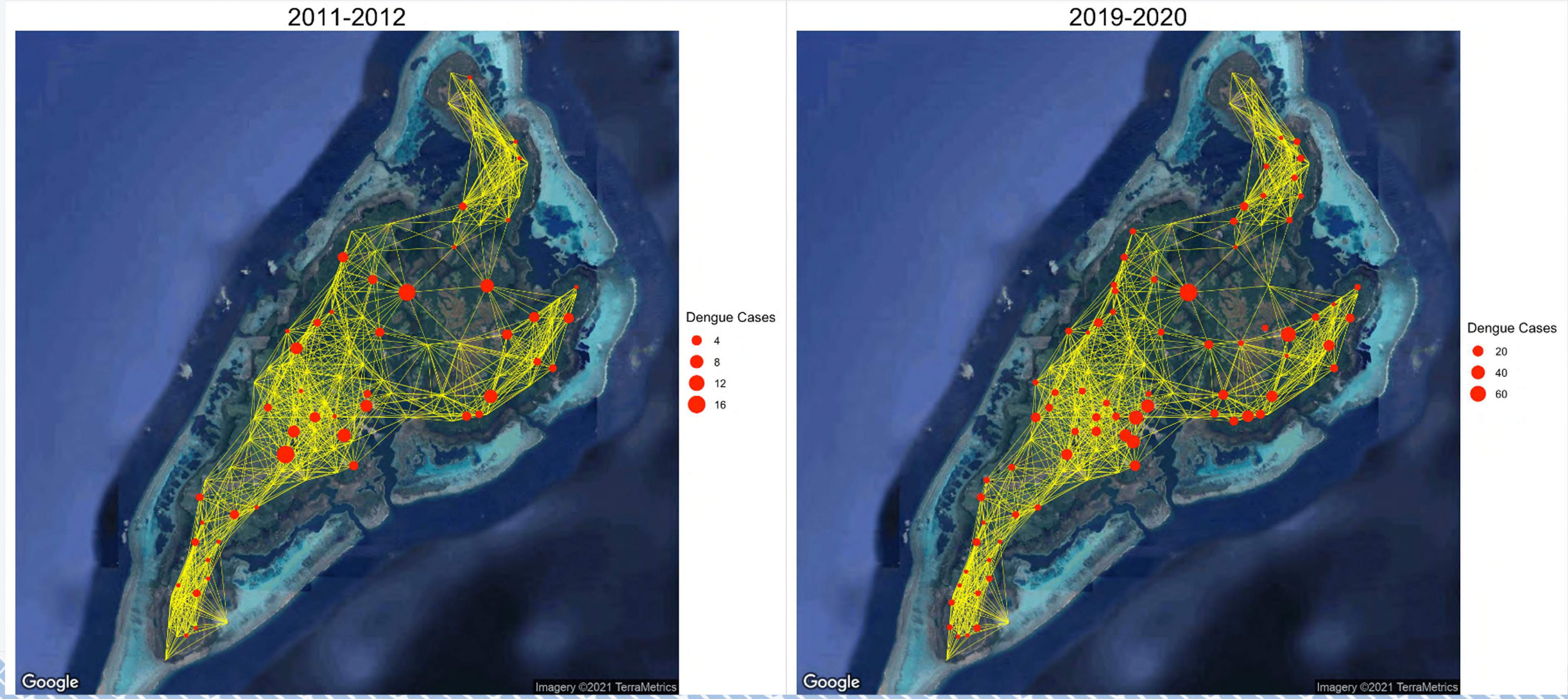
Data needed:

- Health data (dengue cases, testing, DLI)
- Mosquita data (from surveillance)
- Environmental data (temperature, rainfall, etc.)
- Travel data (flights, boats)

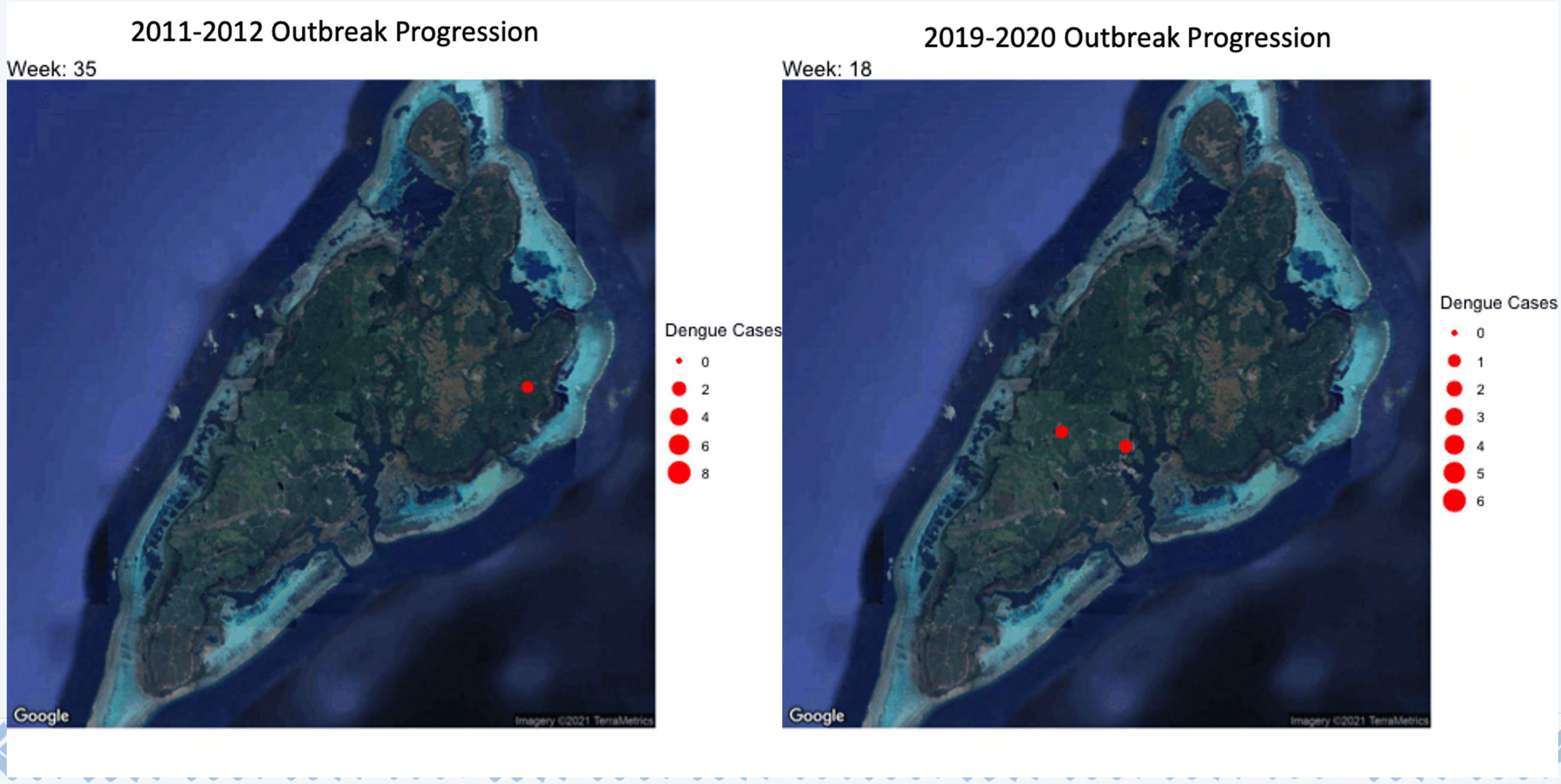
RMI 2019-21 Dengue Outbreak



Comparing Outbreaks: Establishing Patterns in Space (Yap State)



Comparing Outbreaks: Establishing Patterns in Time (Yap State)



Key Challenges

- Coordination is challenging and requires both within-country/territory cooperation and collaboration and across-country/territory coordination for a regional approach to EWS.
- Resources/capacity are limiting factors.
- PICTs have heterogeneous experiences and response to dengue outbreaks and may have slightly different needs from EWS.
- More awareness needed around modeling but there is enthusiasm for its use in dengue response.

Next Steps

- Improved data sharing needed for better local and regional dengue response
- Vector control capacity should be boosted and locally tailored
  - Attentive to local mosquito ecology on each PICT
- Using available tools to understand dengue outbreak risk and, if an outbreak happens, capacity to respond with a data-driven response
- Invest in and support tool and capacity development that meets needs of PICTs individually and regionally