WEBINAR

Preparing for the 2025 dengue season: insights from predictive models

October 31st, 2024

1 p.m. (London)

SIMULTANEOUS TRANSLATION

English |Portuguese| Spanish

INFO DENGUE

THE GLOBAL HEALTH NETWORK
LATIN AMERICA AND THE CARIBBEAN

FIOCRUZ

Panel

Chair: Rachel Lowe - Research Professor, Catalan Institution for Research and Advanced Studies (ICREA) and Global Health Resilience Group Leader, Barcelona Supercomputing Centre (BSC), Spain

Claudia Codeço - Senior Researcher in Public Health, Oswaldo Cruz Foundation (Fiocruz, Rio de Janeiro), Brazil

Mauricio S. Vegas - Professor, Universidad de los Andes, Bogotá, Colombia

Flavio Coelho - Associate professor, School of Applied Mathematics, Getulio Vargas Foundation (FGV, Rio de Janeiro), Brazil and Principal Investigator of the Mosqlimate Project

Marcela Lopes Santos - Technical consultant, General Coordination of Arbovirus Surveillance, Ministry of Health, Brazil

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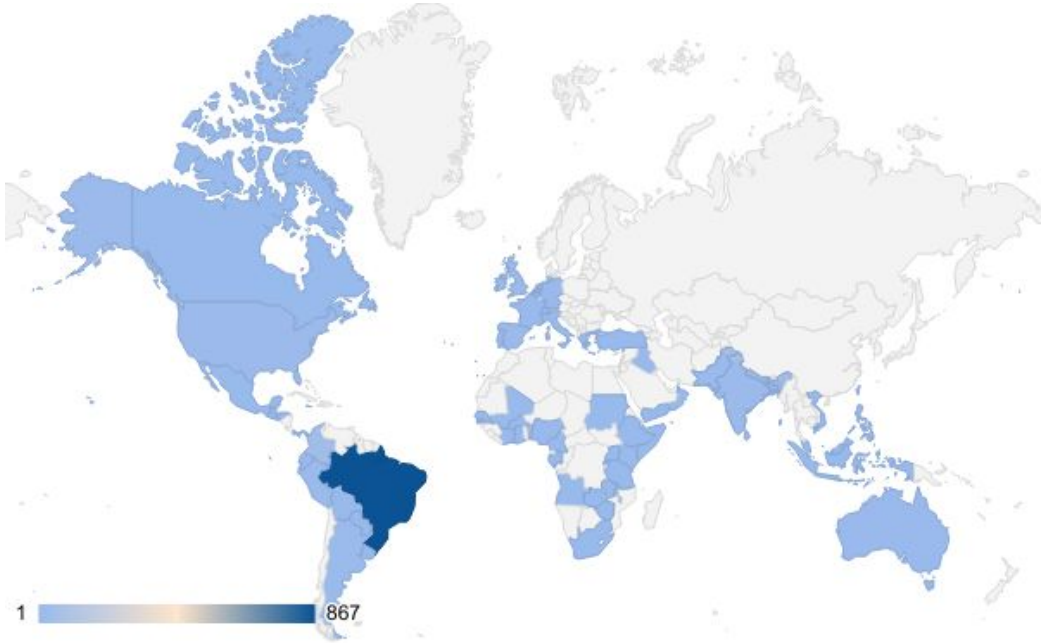
Registered in today's webinar

	Country	Count
1	Brazil	867
2	Colombia	37
3	United States	16
4	Spain	15
5	United Kingdom	14
	Total	
	65	1141



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Resources

The recording, materials and presentations will be shared on the TGHN LAC:

https://bit.ly/webinfodengue

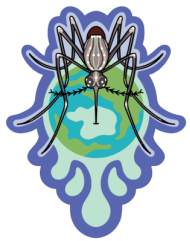
Forecasting Arbovirus Diseases

Dengue forecasting initiative

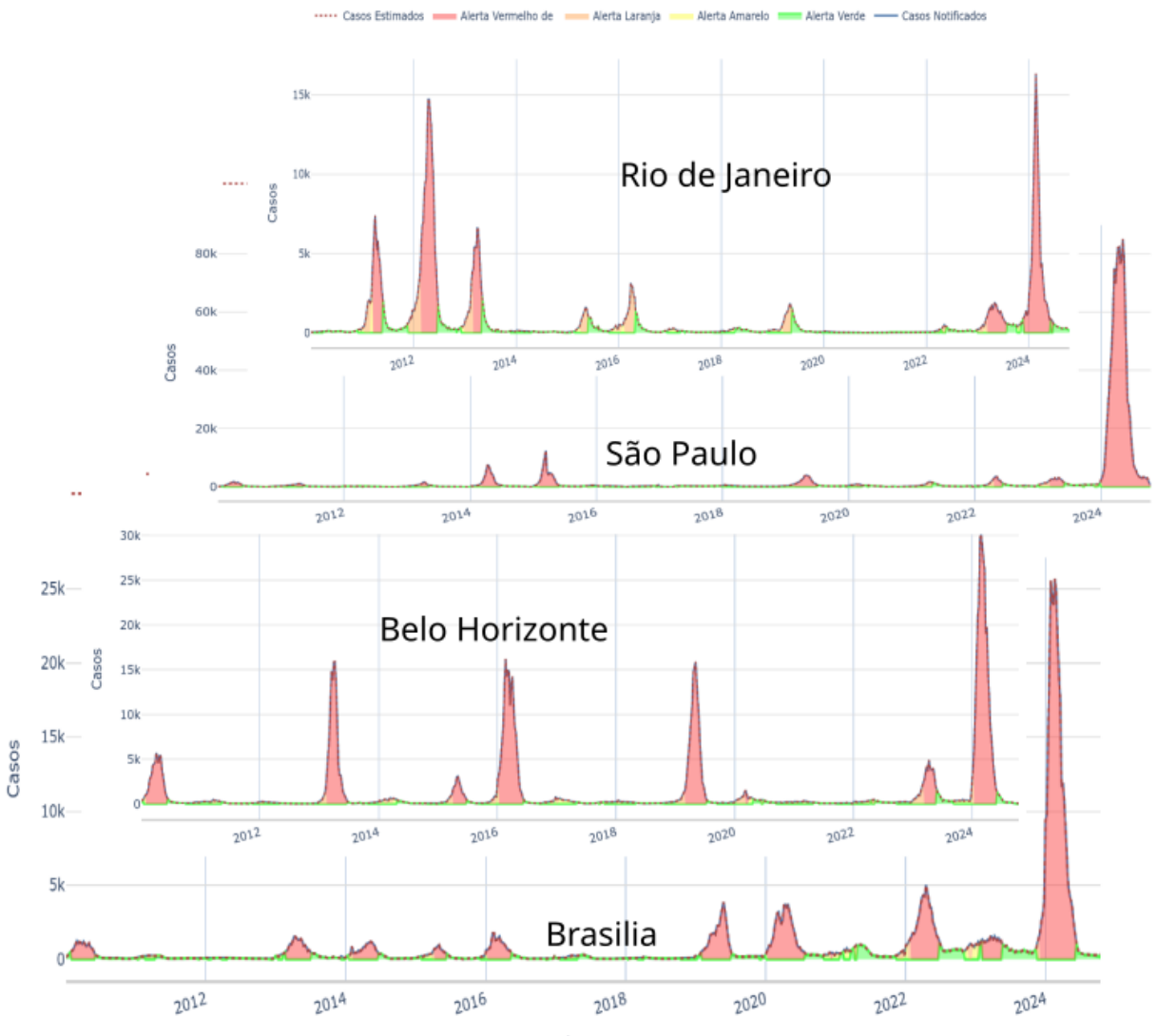
Flávio Codeço Coelho

Infodengue and Mosqlimate Projects

August 16, 2024



Dengue Dynamics [1]



[1] Source: Infodengue project

Epidemic Forecasting

What it is...

- Use our best knowledge to anticipate future events
- Understanding the Uncertainty in epidemics

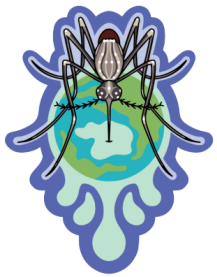
Why Forecast?

- Dengue epidemics are increasing in intensity and geographic range.
- Largest epidemic ever in 2024, with 6.4 million cases. and 5080 confirmed deaths
- Predicting where the next epidemic will hit is important for resource allocation to reduce burden.

Infodengue Forecast Sprint, 2024

Goal: Bring together experienced forecasters, to tackle dengue forecasting for 2025.

Organization:



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Funding:

wellcome

Participants

- The Infodengue project [a] works closely with the Brazilian MOH to help manage arbovirus diseases, through its early warning system.
- The Mosqlimate[b] project's mission: Facilitate modeling the impact of climate on the dynamics of Arboviruses
- The invited teams are collaborators of the Infodengue team with experience with dengue modelling.

[a] `info.dengue.mat.br`
[b] `mosqlimate.org`

Teams:

D-fense: Américo cunha (UERJ)

Dobby Data: Eduardo Araújo (FGV)

GeoHealth: Paula Moraga (KAUST)

Global Health Resilience: Rachel Lowe (BSC)

PET: Leo Bastos (PROCC-Fiocruz)

Ki-Dengu Peppa: Luiz Max Carvalho (FGV)

DS_OKSTATE: Lucas Stolerman (OSU)

The Sprint

Main goal: provide forecasts for 2025, at state level, by:

1. Organizing a community of modellers with unified goal and methods
2. Together generate a set of independent models tested using data from previous seasons
3. Train ensemble model with all submissions
4. Produce forecasts for 2025 using the best models, either single or combined.
5. Technical Report with the results
6. Update and monitor the performance of the models until 2025
7. Organize a larger Sprint initiative in 2025.

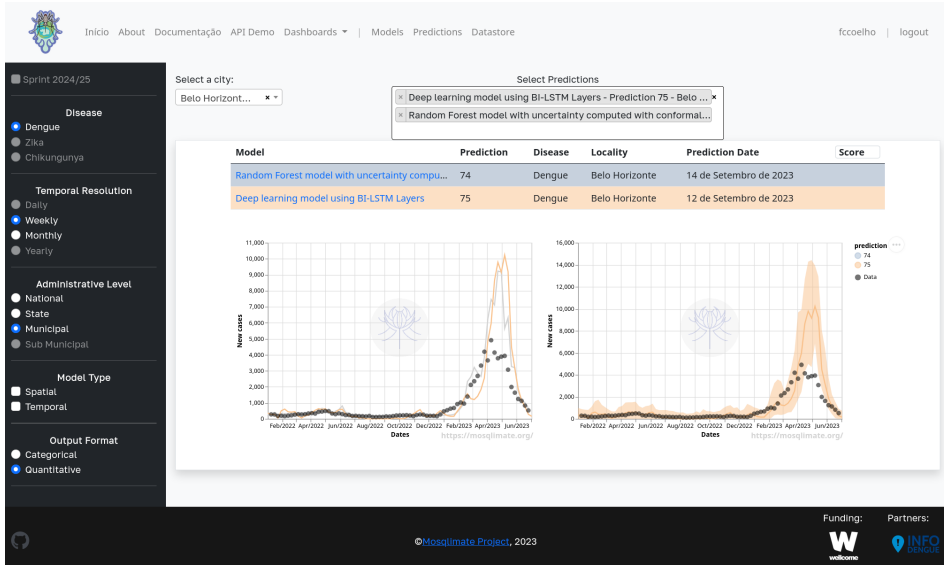
Mosqlimate's Forecast Comparison Platform

The Mosqlimate platform offers data and visualization tools for tracking arbovirus forecasting experiments:

- Open datasets (climatic, demographic and case data): https://api.mosqlimate.org/datastore/
- Model Registry: https://api.mosqlimate.org/models/
- Visualization tools: https://api.mosqlimate.org/vis/dashboard
- Forecast scoring tools: https://mosqlimate.org/mosqlimate-client/

Model Comparisons

- Continuous Ranked Probability Score (CRPS)
- Log Score
- Interval Score
- Errors around regions of interest of the prediction window: epidemic onset and peak
- Scores are computed using the code available on the Mosqlient library.



Ranking Models

Full curve challenge

SCOPE	ALL STATES		AM		CE		GO		PR		MG	
TEST YEAR	2023	2024	2023	2024	2023	2024	2023	2024	2023	2024	2023	2024
GOLD	BBM	GHR	BBM	OK	DD	BBM	BBM	GHR	BBM	GHR	BBM	GH
SILVER	DD	GH	GHR	GH	BBM	GHR	KDP1	GH	KDP1	GH	DD	DD
BRONZE	KDP1	BBM	DD	GHR	GHR	GH	GHR	KDP2	DD	KDP2	KDP1	GHR

Half curve challenge

SCOPE	ALL STATES		AM		CE		GO		PR		MG	
TEST YEAR	2023	2024	2023	2024	2023	2024	2023	2024	2023	2024	2023	2024
GOLD	BBM	GH	BBM	OK	DD	GH	BBM	GHR	BBM	GHR	BBM	GH
SILVER	DD	GHR	DD	GH	BBM	BBM	DD	GH	DD	GH	GHR	KDP2
BRONZE	GHR	OK	GHR	KDP1	GHR	GHR	GHR	DD	KDP1	KDP2	DD	GHR

Peak size

SCOPE	ALL STATES	
TEST YEAR	2023	2024
GOLD	DD	GHR
SILVER	KDP1	GH
BRONZE	BBM	KDP2

Honorable Mentions

DD predicted peak increase in most states

GHR & KDP accurately predicted the increase in 2024 in MG

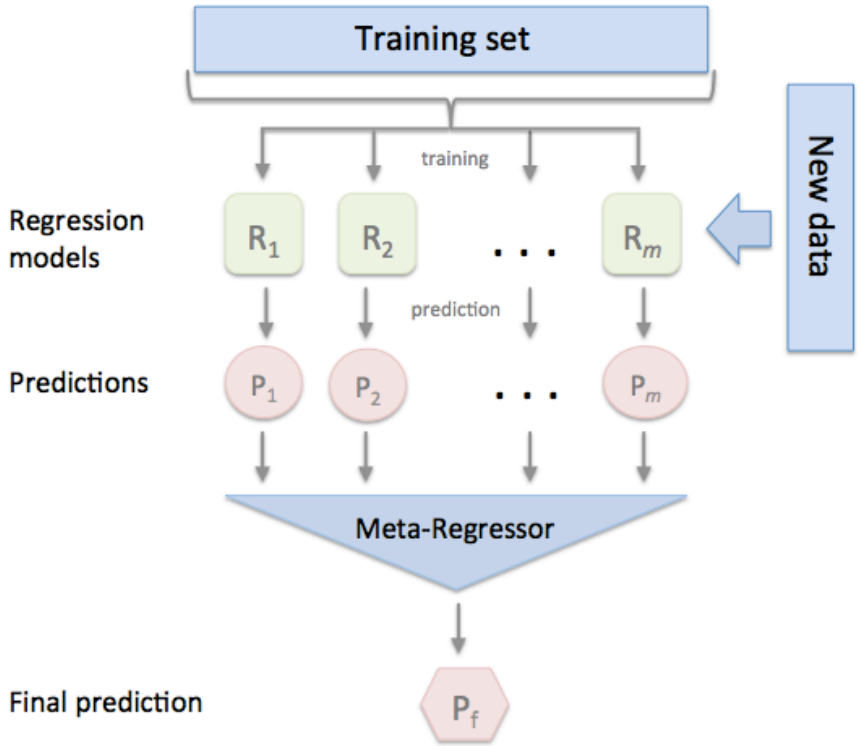
DOI 10.5281/zenodo.13367301

Sprint Report

Ensemble Model

The ensemble forecast model, combining the best, models submitted, was built as a Stacking Regression model[2]

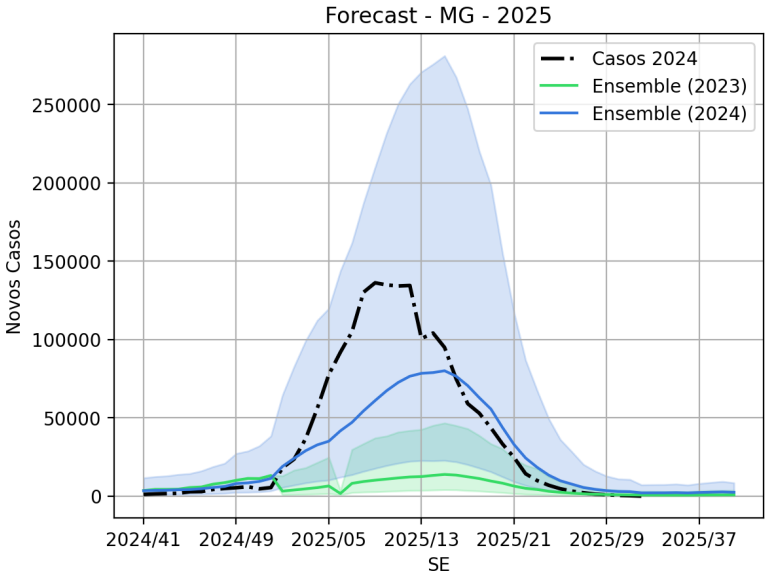
- Trained on 2 Scenarios:
  - 2023-like: medium to high transmission
  - 2024-like: high to very high transmission

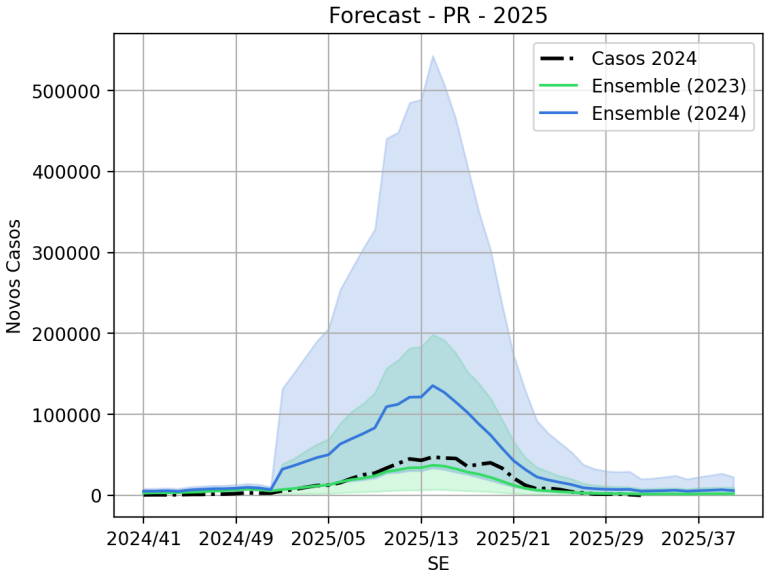


`https://github.com/rasbt/mlxtend`

[2] https://statistics.berkeley.edu/sites/default/files/tech-reports/367.pdf

What awaits us in 2025?





For the full results:

Predicted Median Incidence per 100 thousand

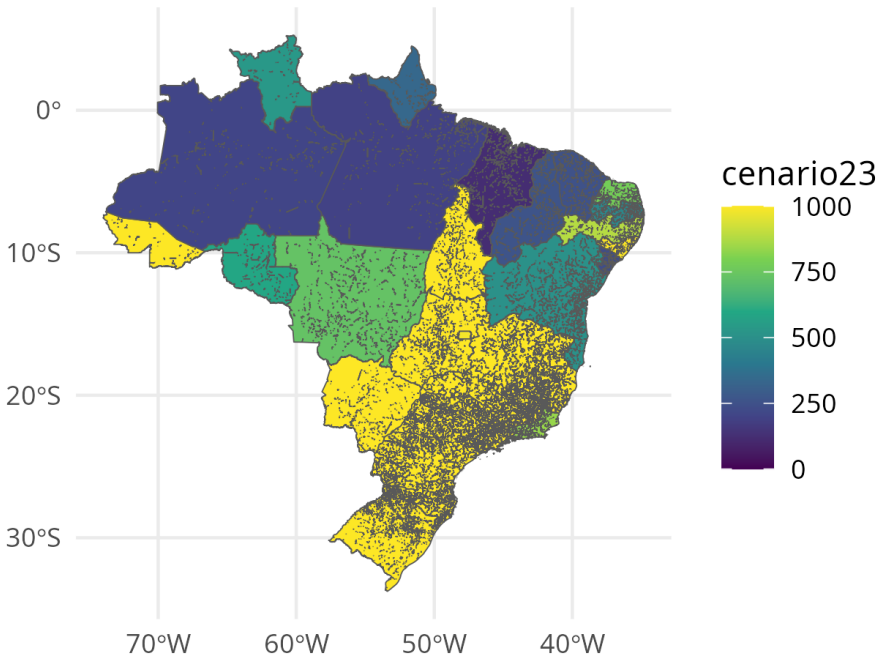
Predicted median dengue **incidence** per 100 thousand inhabitants in 2025 (from EW 41 of 2024 to EW 40 of 2025). Both scenarios.

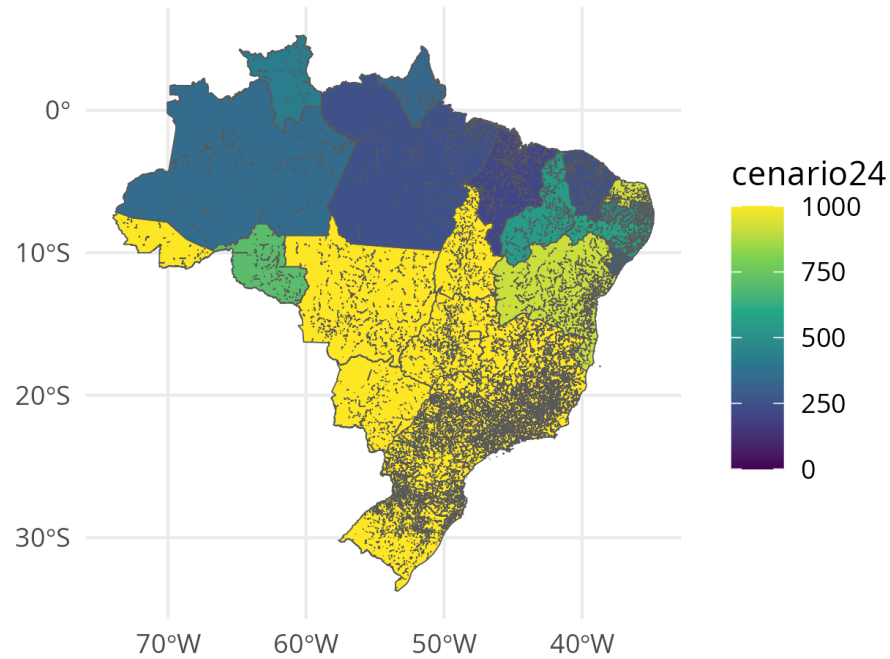
State	Ensemble 2023	Ensemble 2024	Acum. Incidence in 20
AL	681.25	500.97	484.0
BA	463.08	707.4	1688.66
CE	186.05	186.05	152.78
MA	88.08	149.14	157.48
PB	357.6	379.62	343.07
PE	455.28	484.6	361.47
PI	214.34	389.71	454.97
SE	158.98	241.5	154.8
RN	487.92	719.22	550.82
SP	1645.58	5421.43	4725.89
MG	1519.4	6478.22	8551.89
RJ	552.66	3314.83	1940.8
ES	2175.62	3294.17	1707.82

Continued...

State	Ensemble 2023	Ensemble 2024	Acum. Incidence in 20
AM	173.01	250.79	268.87
AP	177.98	191.54	1155.15
TO	865.1	579.08	416.82
RR	247.08	293.4	87.8
RO	408.03	466.29	348.34
AC	886.19	1234.07	1249.49
PA	139.18	187.98	239.7
DF	876.8	892.38	10400.08
GO	1867.66	2560.25	4895.45
MT	643.9	1055.63	1185.25
MS	1701.6	1050.31	724.73
RS	981.52	981.52	1803.75
SC	2054.05	2054.05	5128.36
PR	5110.72	17374.19	5871.73

Predicted median Incidence maps for 2025





Thanks!