



# Predicting the Next Dengue Pandemic

*Prepared by Brenda Hall  
Data Scientist*

**400,000,000**

people are infected yearly

Source: The Centers for Disease Control

**500,000**

cases develop into dengue  
hemorrhagic fever

Source: The Centers for Disease Control

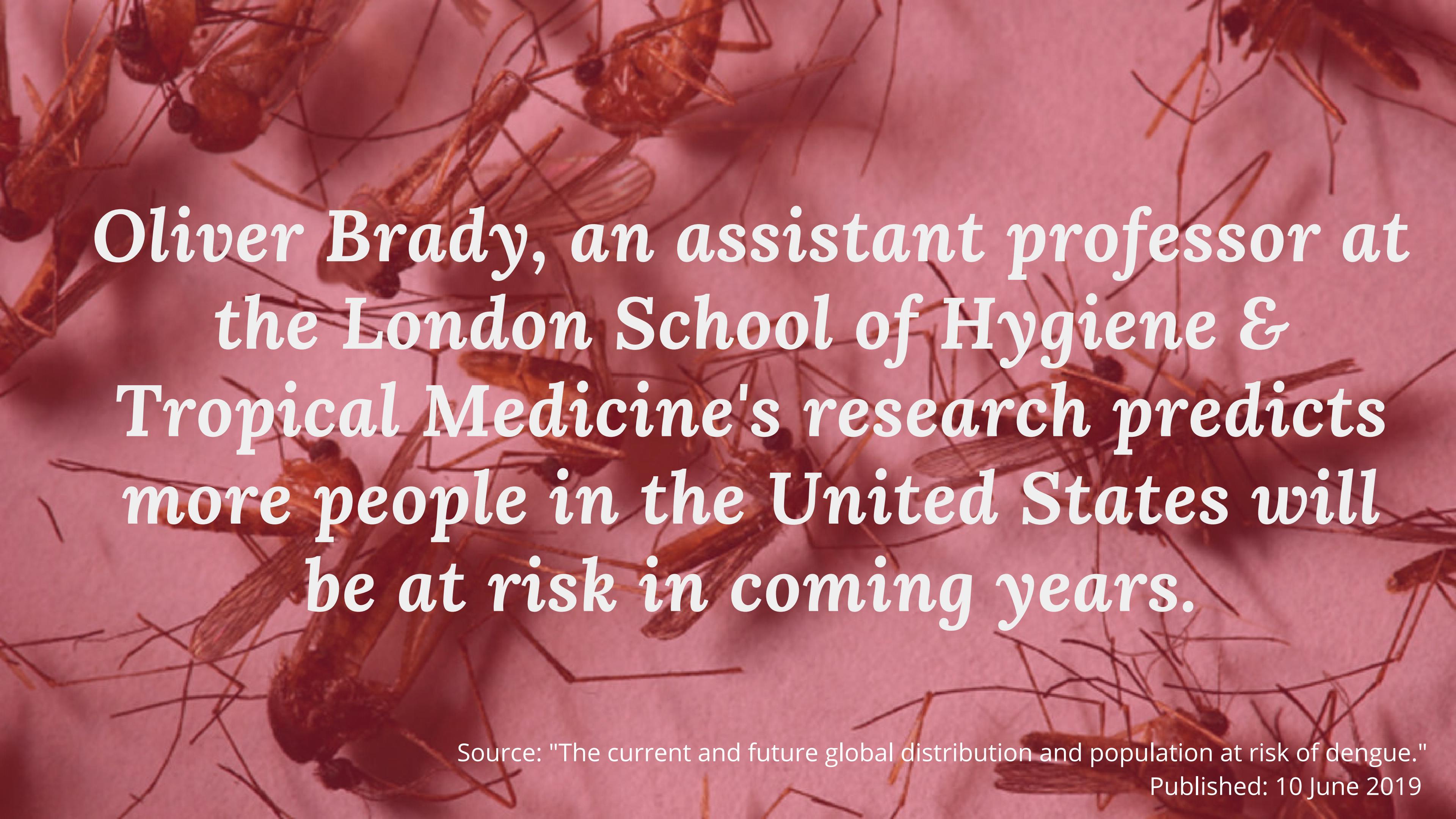
**breakbone  
fever**

*"I live in the U.S., why  
should I care?"*

**One half of the  
world population**

**is predicted to be affected in 2080**

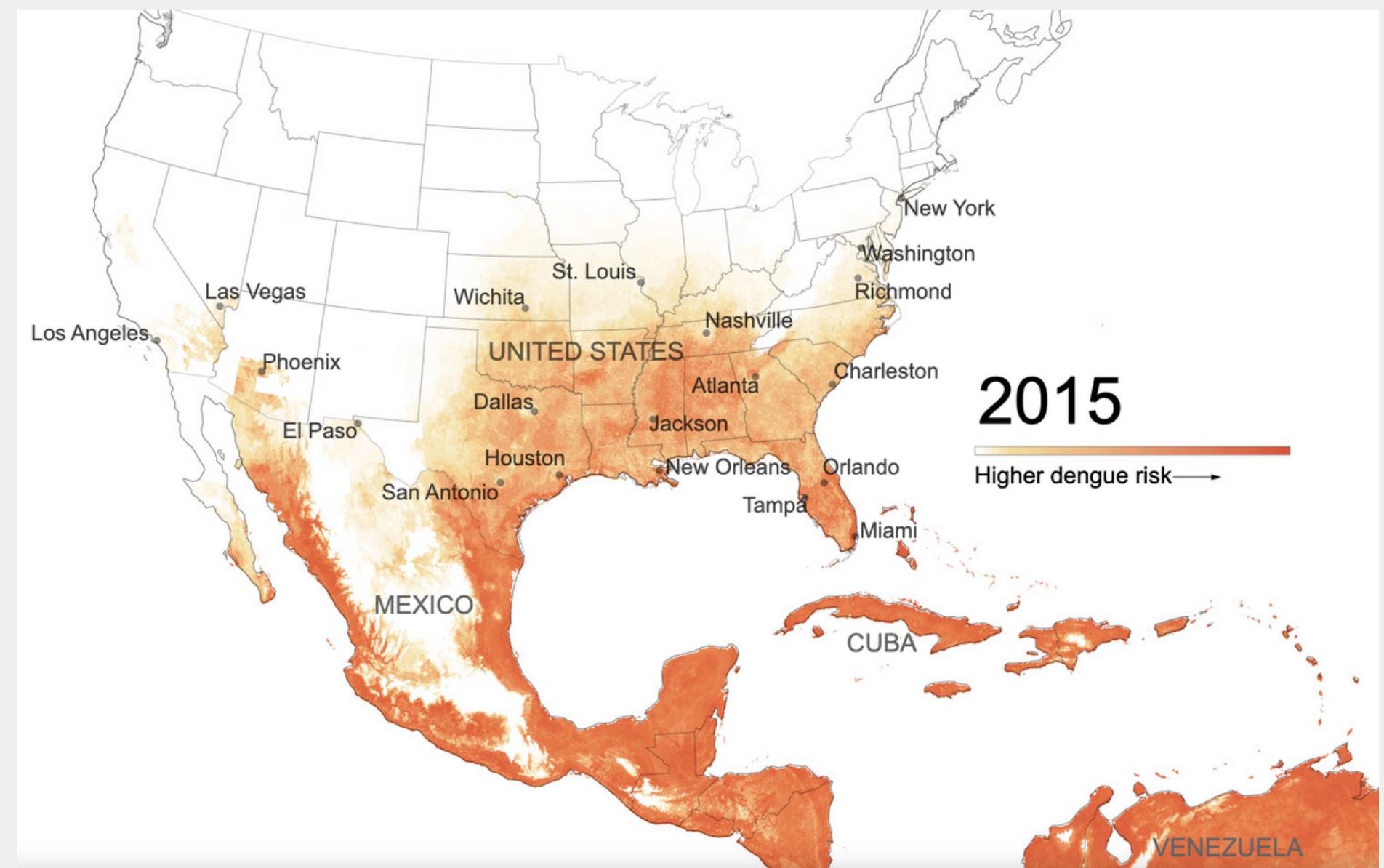
Source: "The current and future global distribution and population at risk of dengue."  
Published: 10 June 2019

A close-up photograph showing a large number of mosquito larvae and pupae swimming in water. The insects have long, thin legs and segmented bodies, appearing in various stages of development. They are scattered across the frame against a dark, textured background.

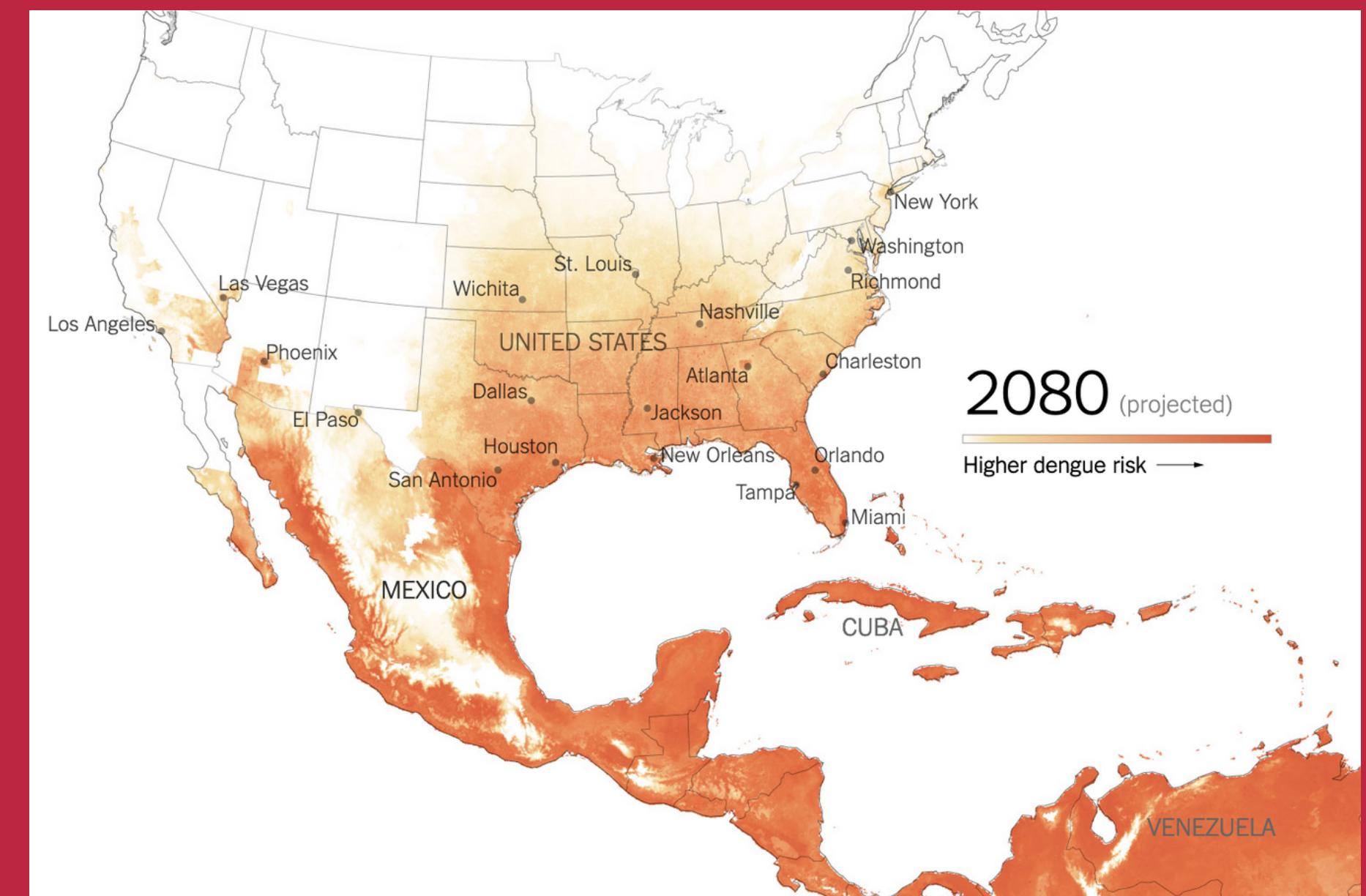
*Oliver Brady, an assistant professor at  
the London School of Hygiene &  
Tropical Medicine's research predicts  
more people in the United States will  
be at risk in coming years.*

Source: "The current and future global distribution and population at risk of dengue."

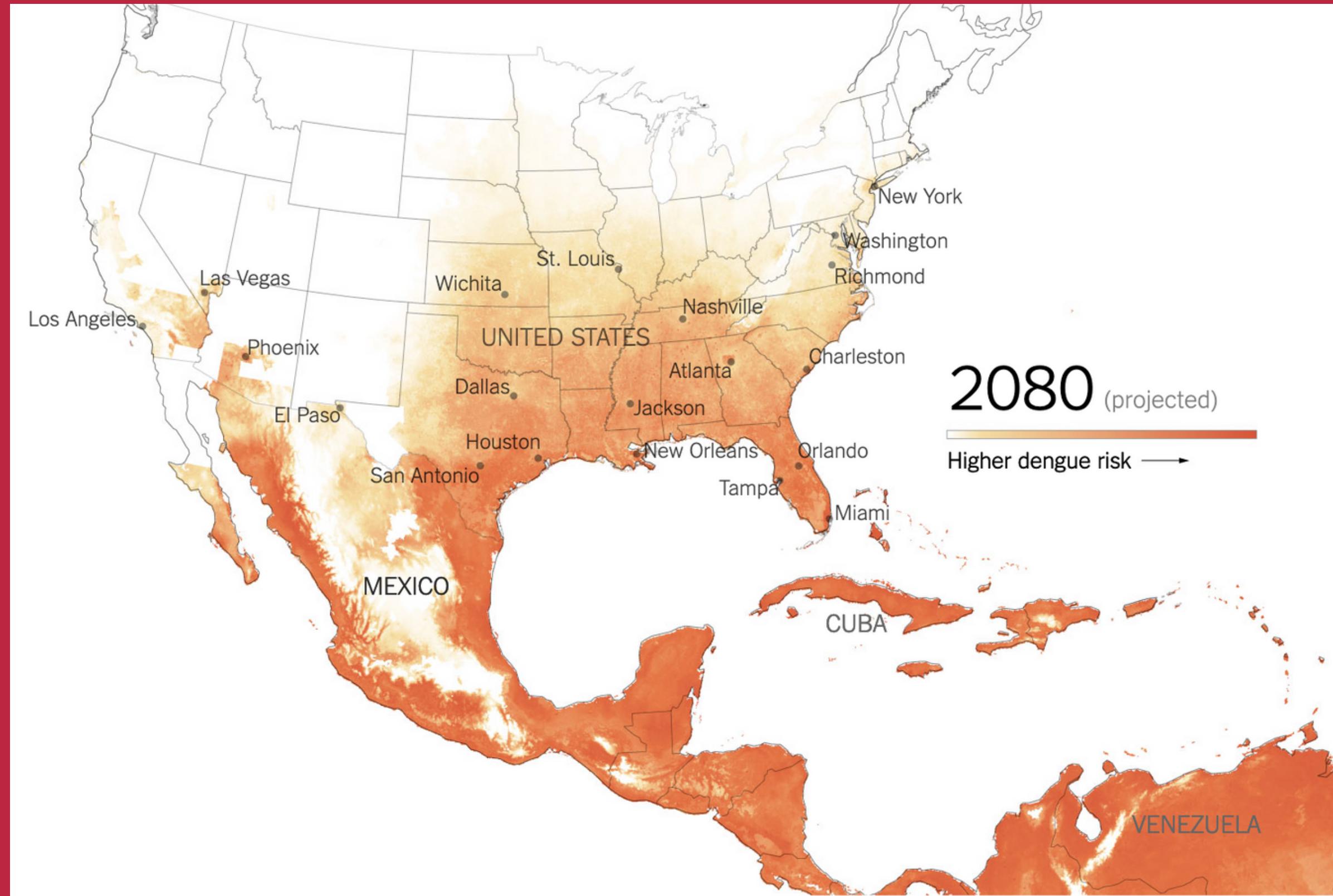
Published: 10 June 2019



"How Dengue, a Deadly Mosquito-Borne Disease,  
Could Spread in a Warming World."  
The New York Times - Published: 10 June 2019



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# **Incidence of dengue is positively correlated with climatic conditions**



Temperature



Humidity



Precipitation levels



Vegetation

*"Dengue morbidity can be reduced by implementing improved outbreak prediction and detection through coordinated epidemiological and entomological surveillance"*

The World Health Organization (WHO)  
*"Global strategy for dengue prevention and control 2012-2020"*

**How well would we be able  
to predict future cases of  
the disease based on  
climate variables that are  
included in weather  
forecasts?**

# Dengue Surveillance Project Data

**U.S. Federal Government joined efforts to create a comprehensive dataset**

*Survival and  
cases data:*

- U.S. Centers for Disease Control and prevention,
- Department of Defense's Naval Medical Research Unit 6
- Armed Forces Health Surveillance Center
- Peruvian government
- U.S. universities.

*Environmental  
and climate  
data:*

- National Oceanic and Atmospheric Administration (NOAA).
- U.S. Department of Commerce.

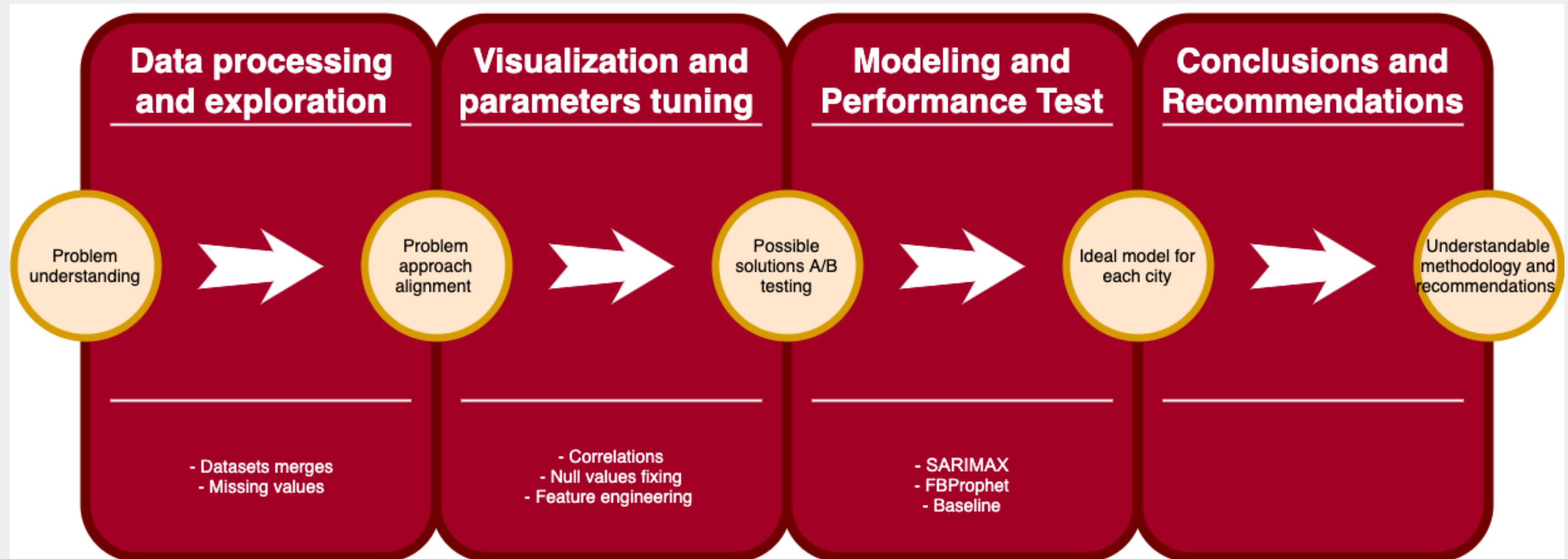
# Dengue Surveillance Project Data

## *Time frame*

\*almost\* byweekly  
data  
2000  
to  
2013

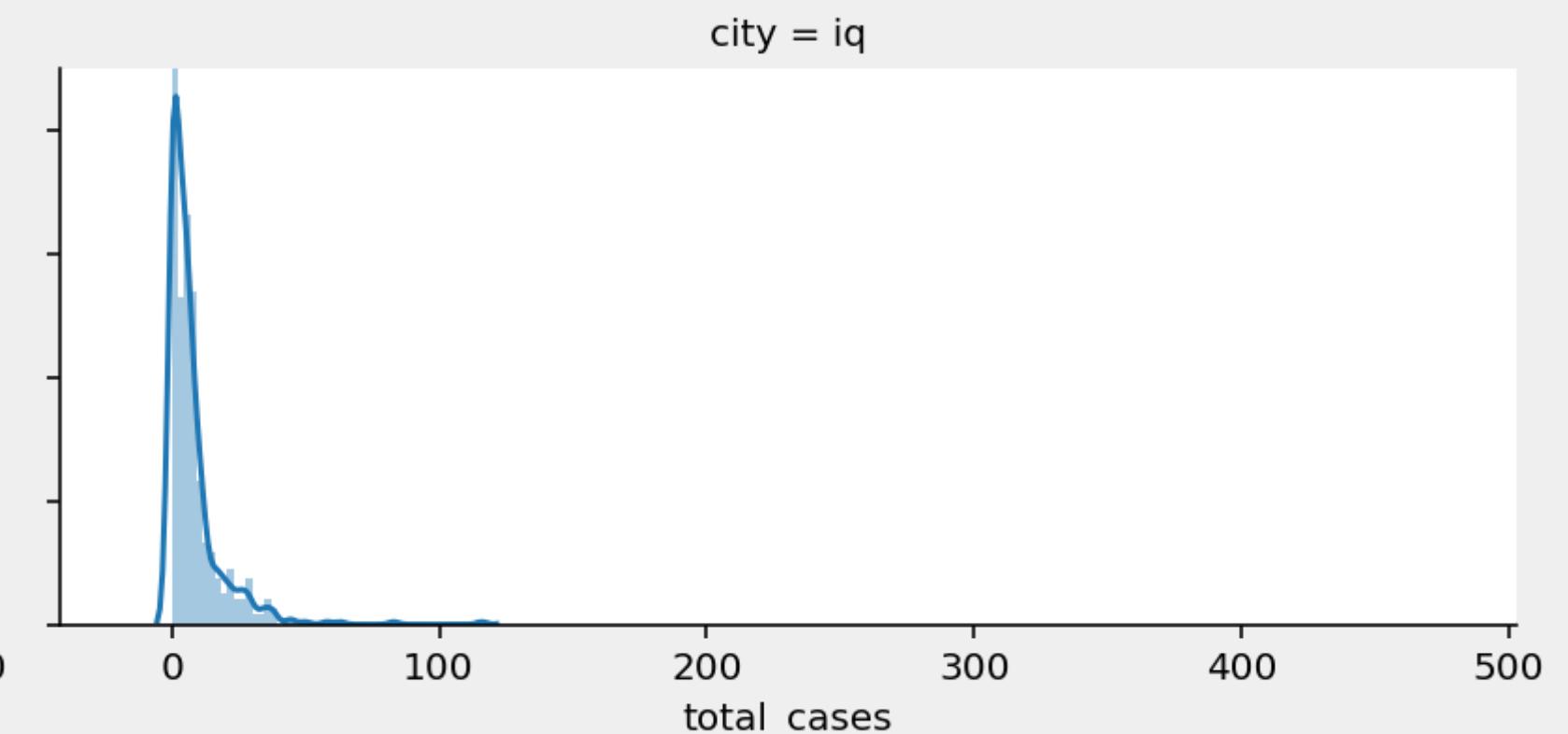
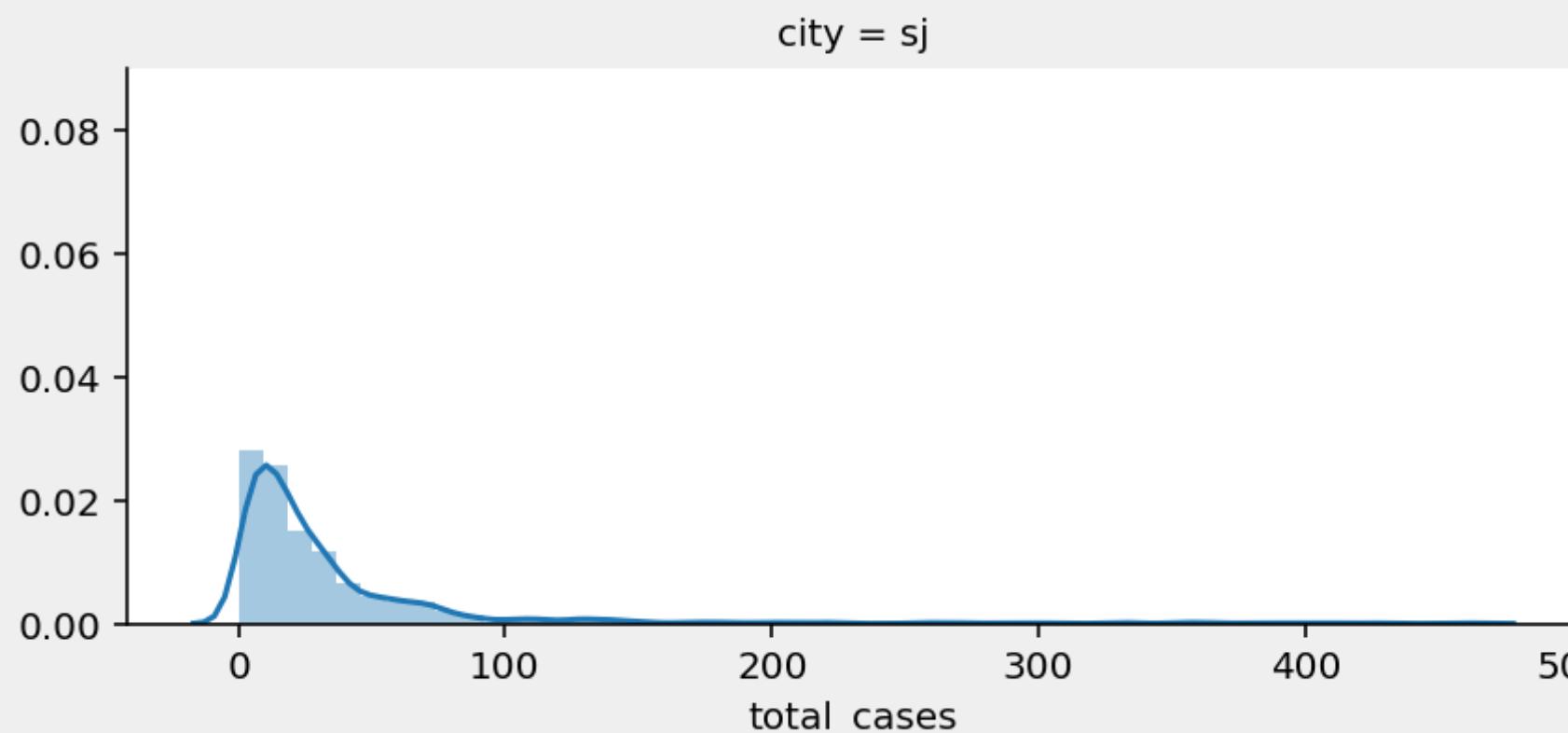
## *Features*

Total cases  
Precipitation Levels  
Vegetation  
Humidity

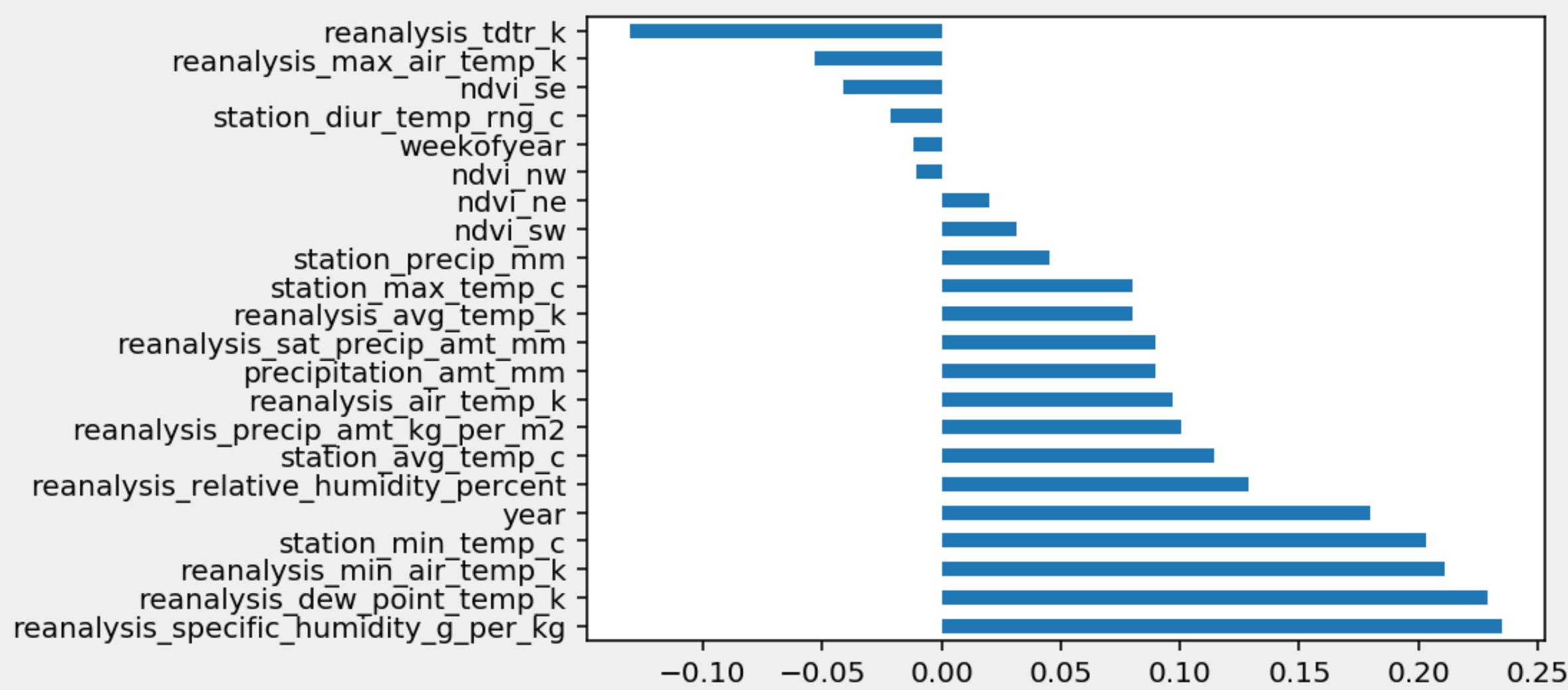
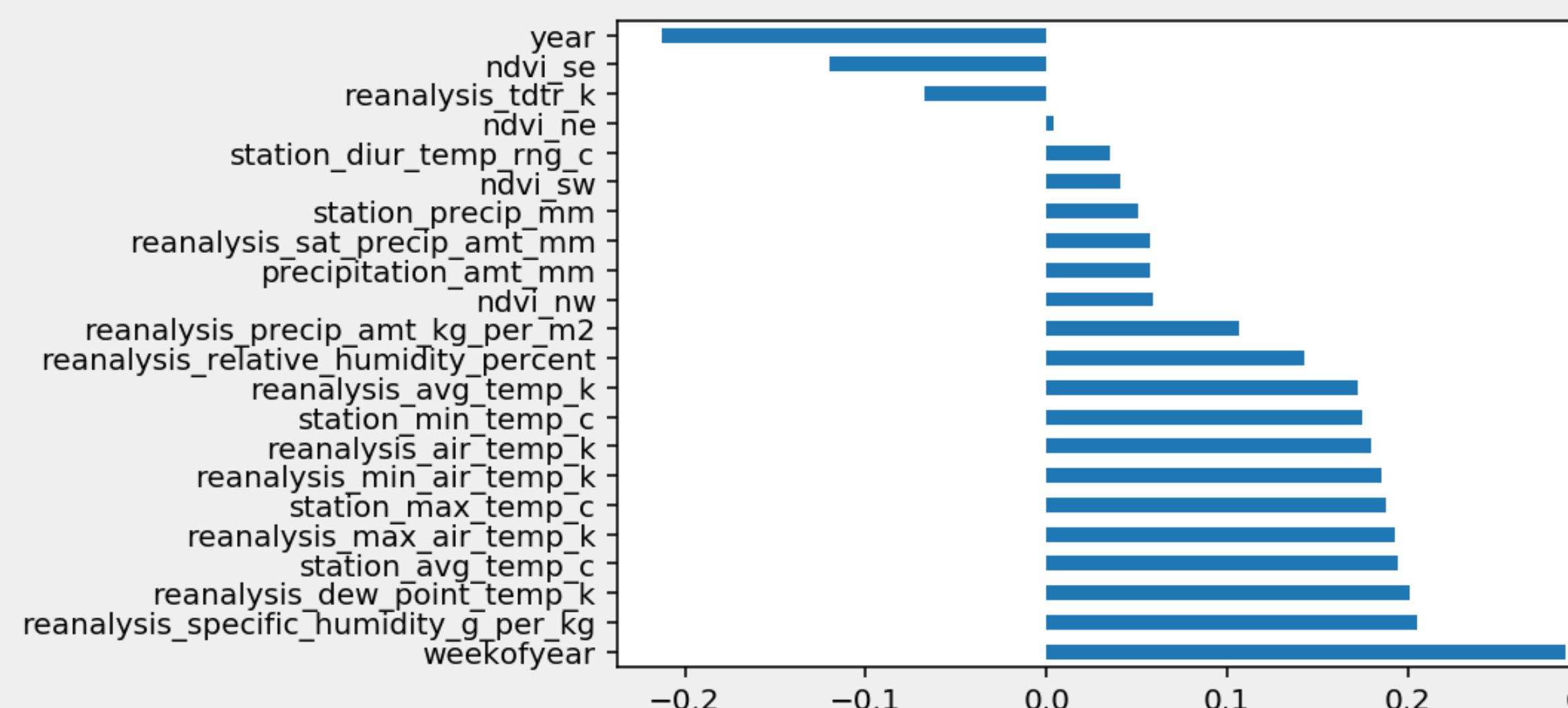


# **Getting to know the data**

# Total cases per city

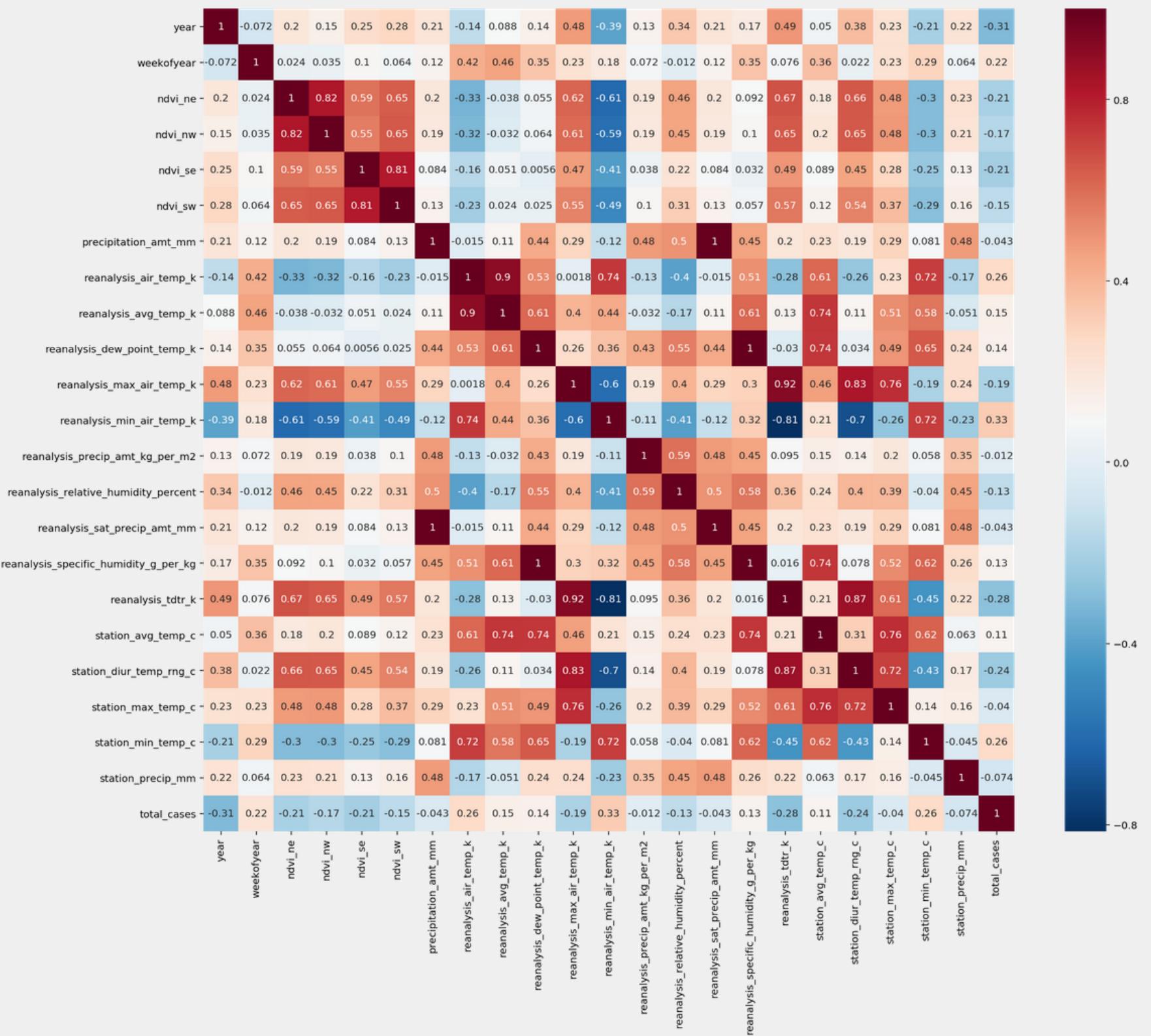


# Features



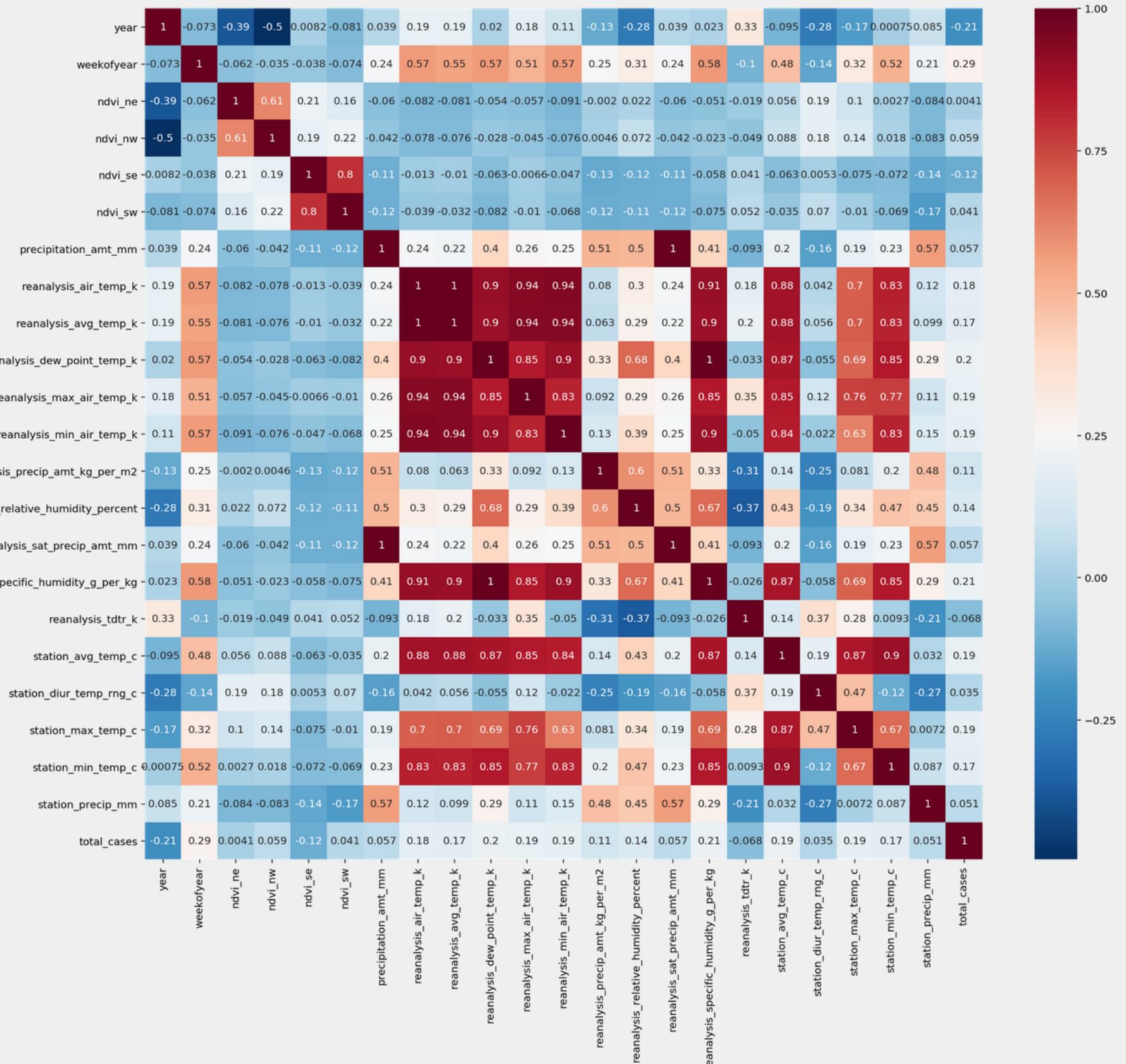
# Correlations

All data



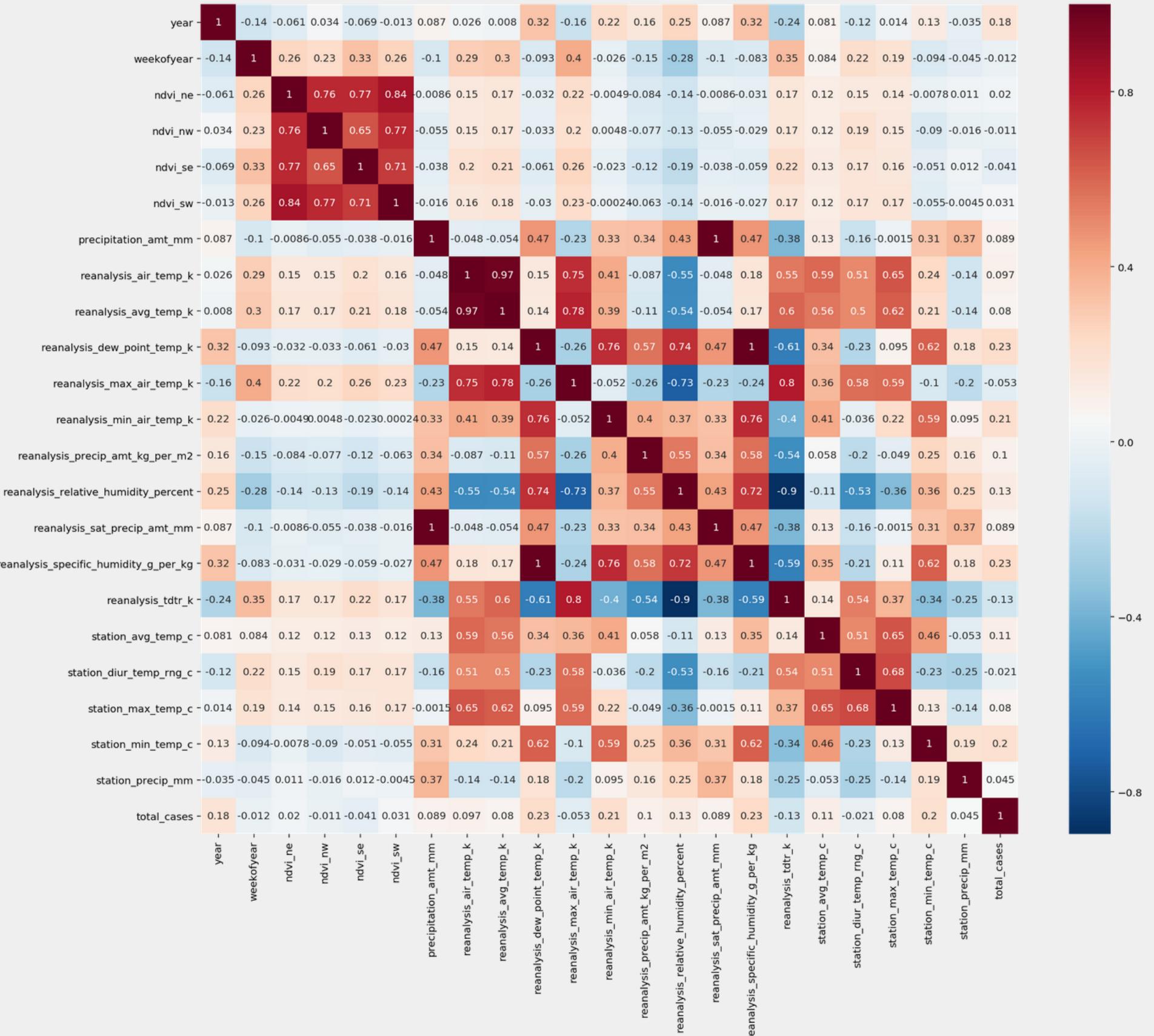
# Correlations

San Juan

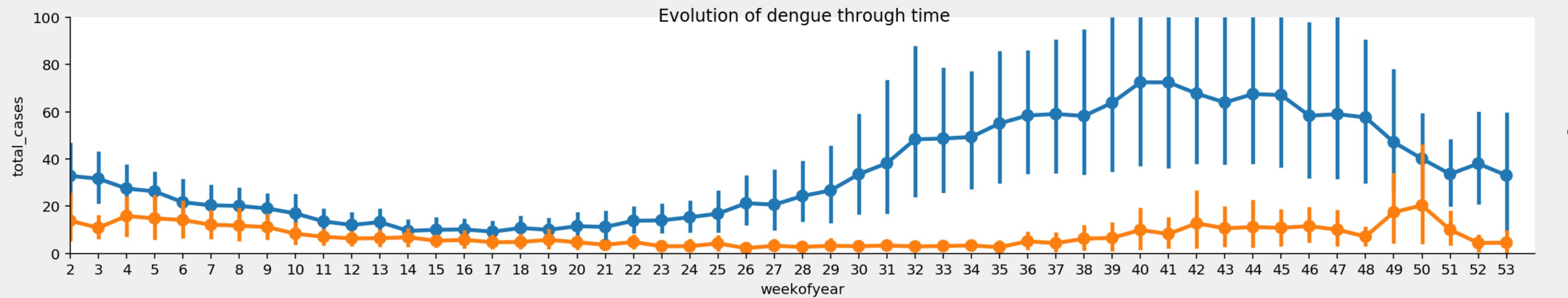


# Correlations

Iquitos



# Evolution of Dengue in time



# MODELING



*Baseline model*

Feature engineering

Features selection

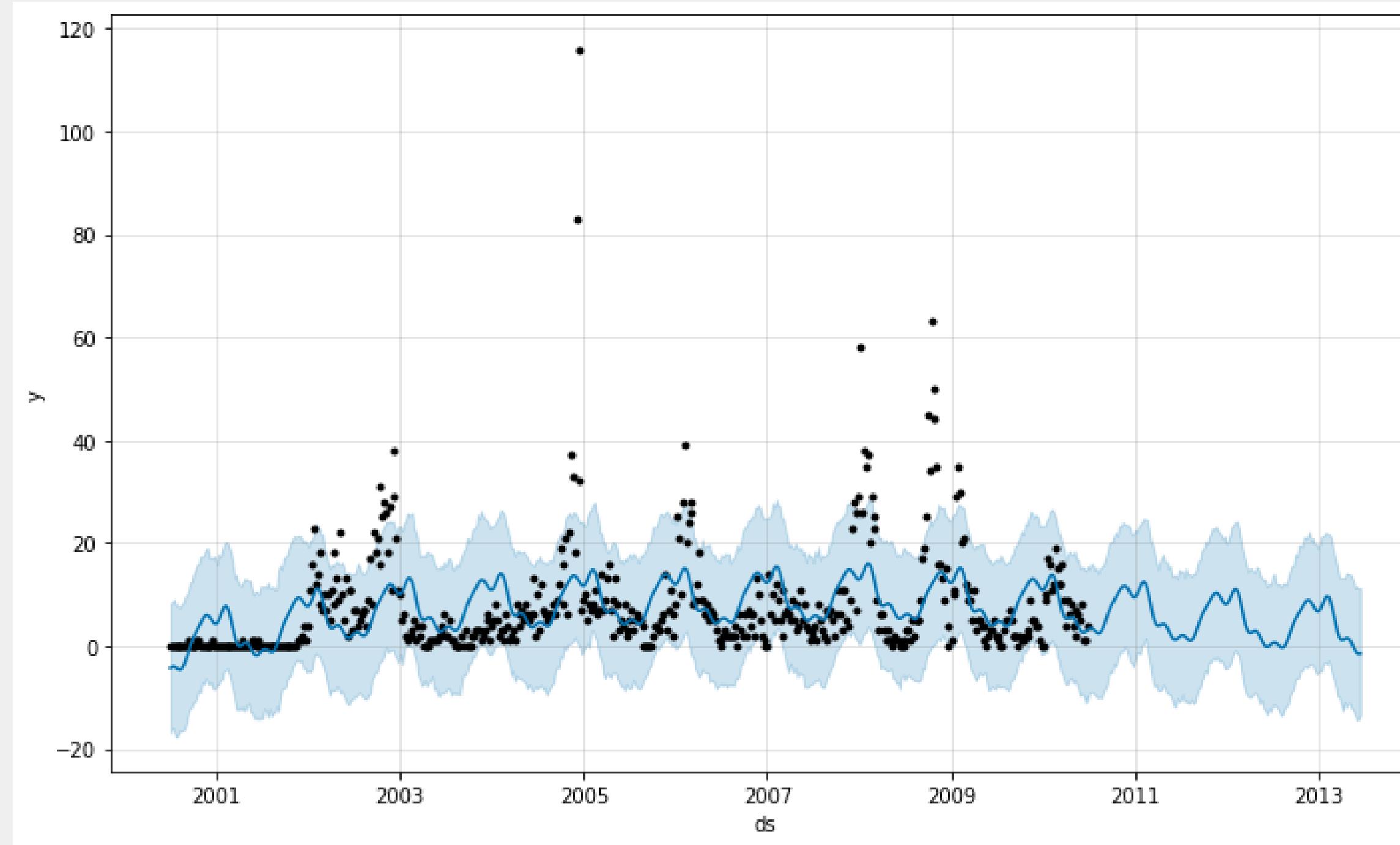
*FBProphet*

Timeseries

*SARIMAX*

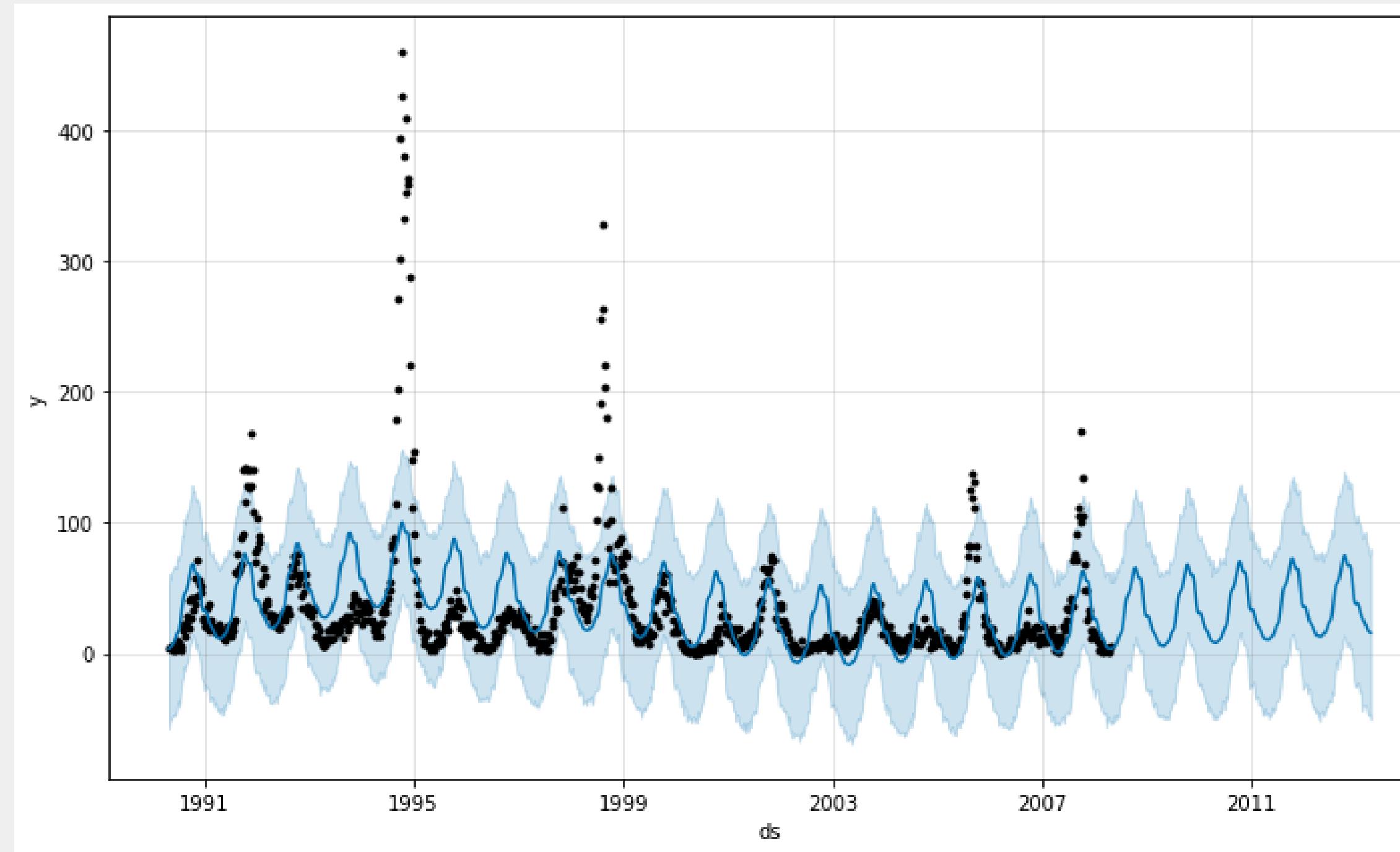
Timeseries model

# FBProphet Predictions



Iquitos

# FBProphet Predictions



San Juan

# Conclusions

*Right now, given that there is not enough organized data, dengue is still a difficult to predict and prevent accurately*

Hyperparameters and feature engineering matter!

*"This week" weather is not important.*

Mosquitoes reproduce better in warm, humid weather. Eggs take from 4 to 6 weeks to hatch. And from 4 to 8 months for the first cases to appear

# Next Steps

*Collect More data from other resources and compare the models developed*

*With enough data, create a model that can be replicable*

# Questions?