

Climate-based ensemble machine learning model to forecast dengue epidemics

Rochelle Schneider,
Alessandro Sebastianelli,
Dario Spiller,
James Wheeler,
Raquel Carmo,
Artur Nowakowski,
Manuel Garcia Herranz,
Do-Hyung Kim,
Hanoch Barlevi,
Zoraya El Raiss Cordero,
Silvia Liberata Ullo,
Pierre-Philippe Mathieu,
Rachel Lowe

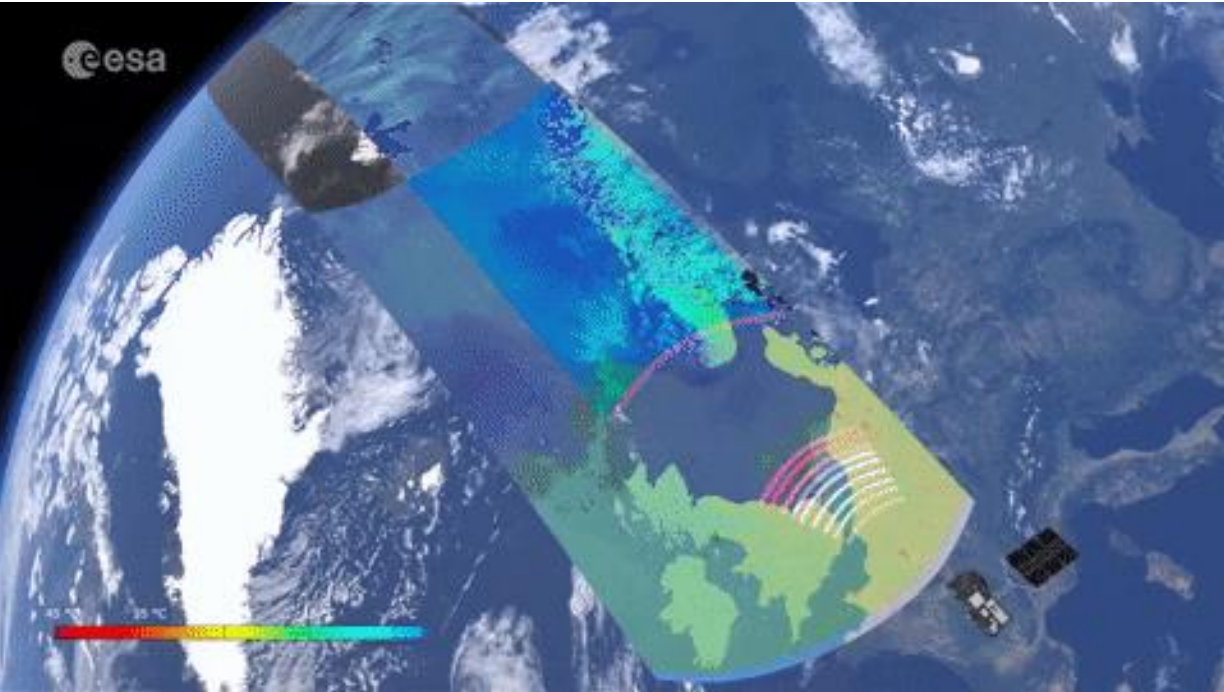
Acknowledgement:
Desiree Raquel Narvaez,
Karina Cantizano,
Carlos Calderón Bonilla.



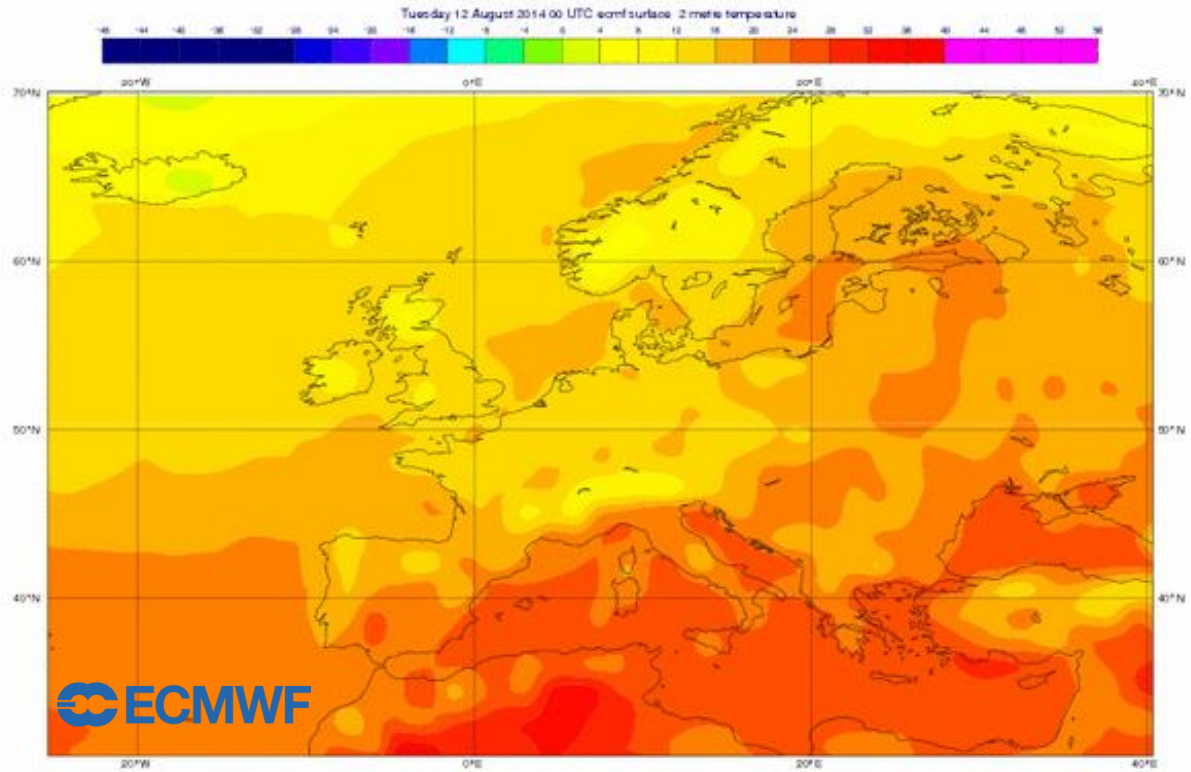
Climate-based ensemble machine learning model to forecast dengue epidemics



Environmental products collected from several Earth Observation sources

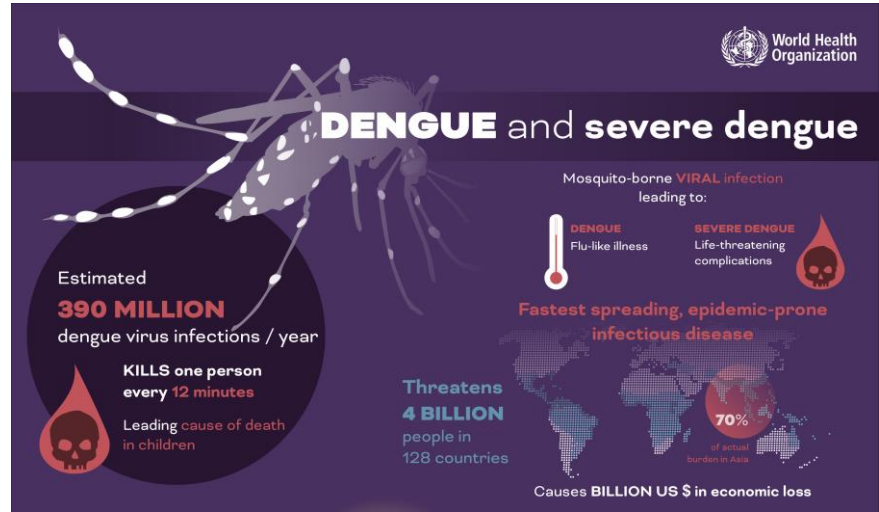


Source: https://www.esa.int/ESA_Multimedia/Videos/2016/07/Sentinel-3_s_scanning_radiometer



Source: <https://confluence.ecmwf.int/display/METV/Generating+animated+GIFs+from+Metview+plots>

Climate-based ensemble machine learning model to forecast dengue epidemics



Objective

- As a climate-sensitive disease, the risk of dengue transmission is increased by warming climates. Therefore, this ESA-UNICEF project aims to develop an AI algorithm to forecast dengue outbreak accounting for the effect of Climate Change.

Methodology

- This project explores an ensemble model of multiple machine learning approaches, combining the outputs from Long Short-Term Memory (LSTM) and Categorical Boosting (CatBoost) regression methods.

Outcome

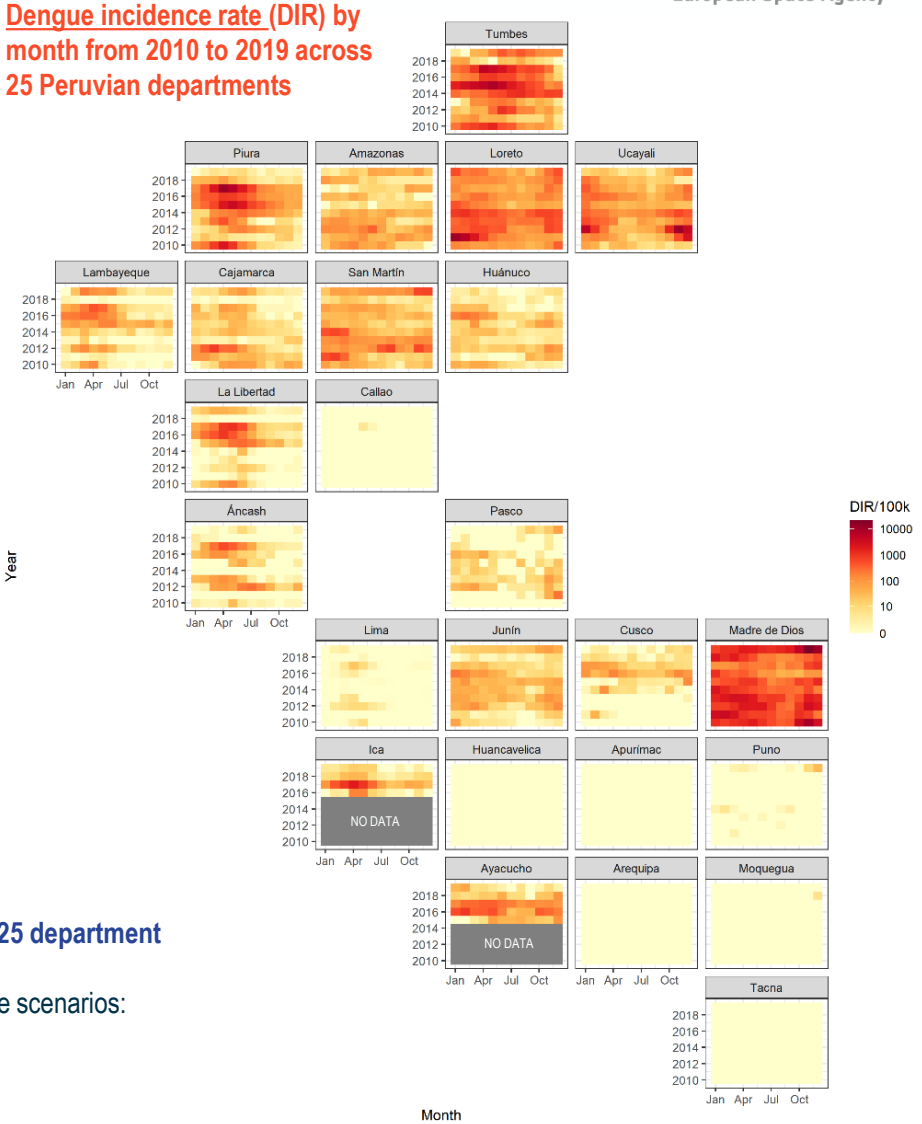
- The forecast model will be used by UNICEF to help governments on the strategy and measures to prevent the worsening and global spread of dengue incidents.



Dengue incidence rate by month from 2010 to 2019 across 25 department

The figure on the right demonstrates that Peru has three dengue scenarios:

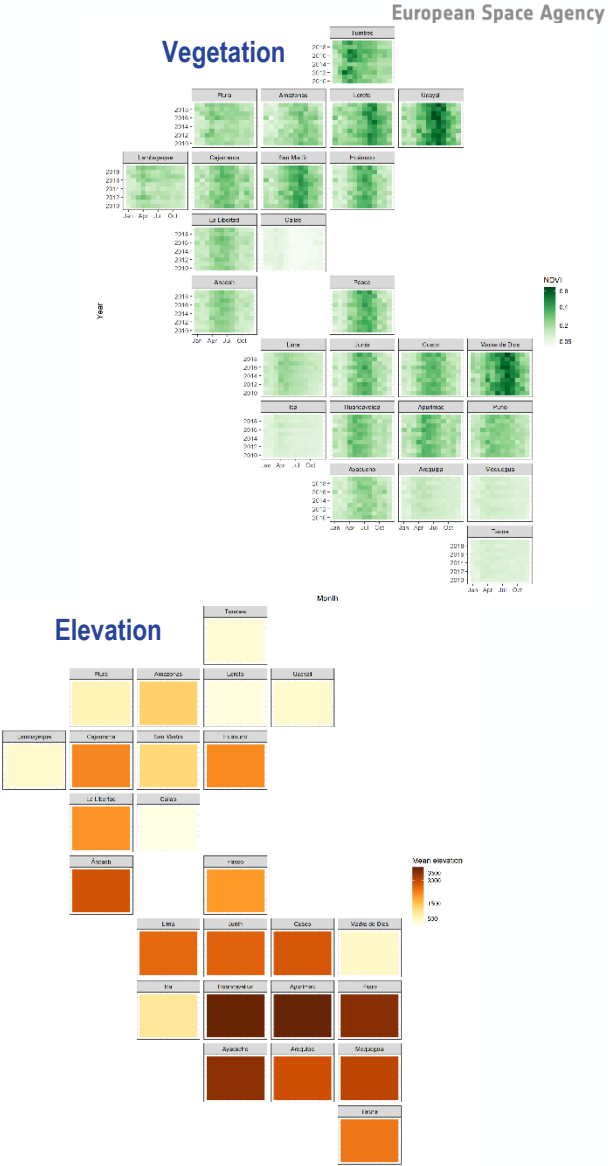
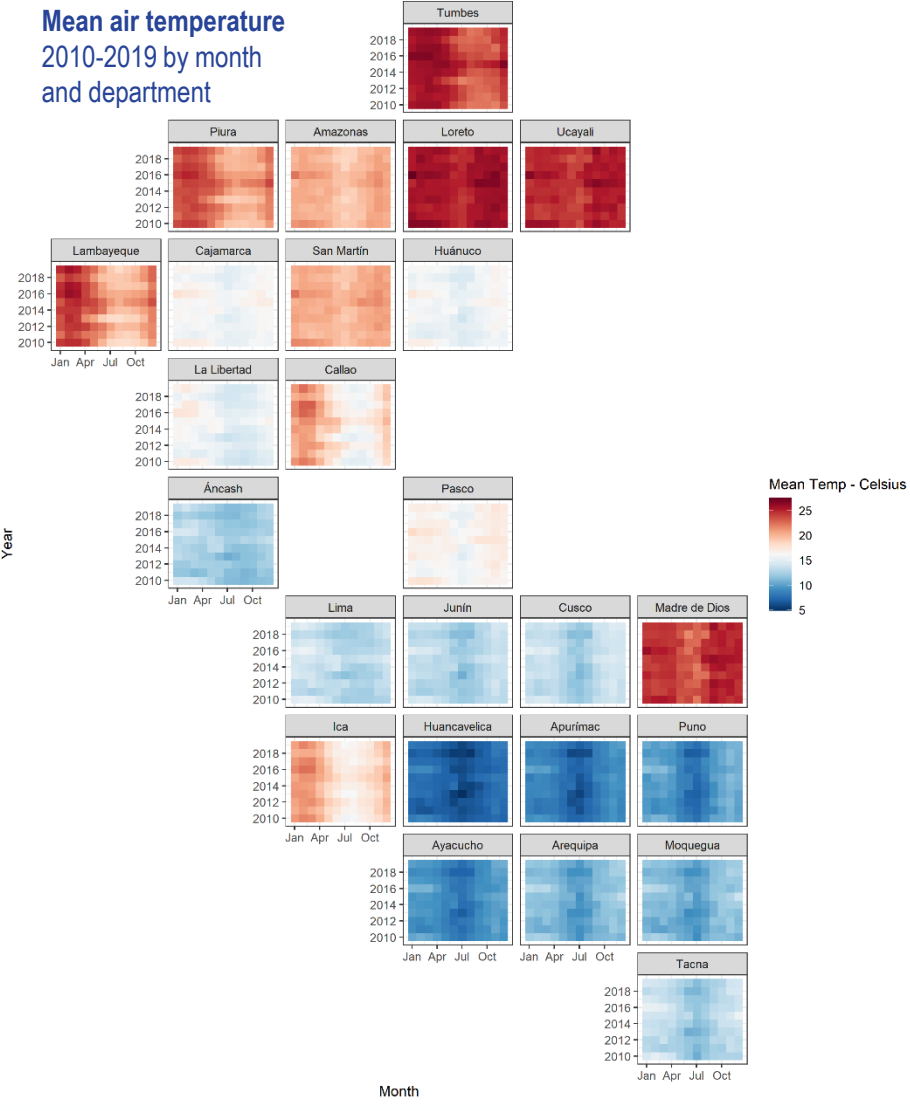
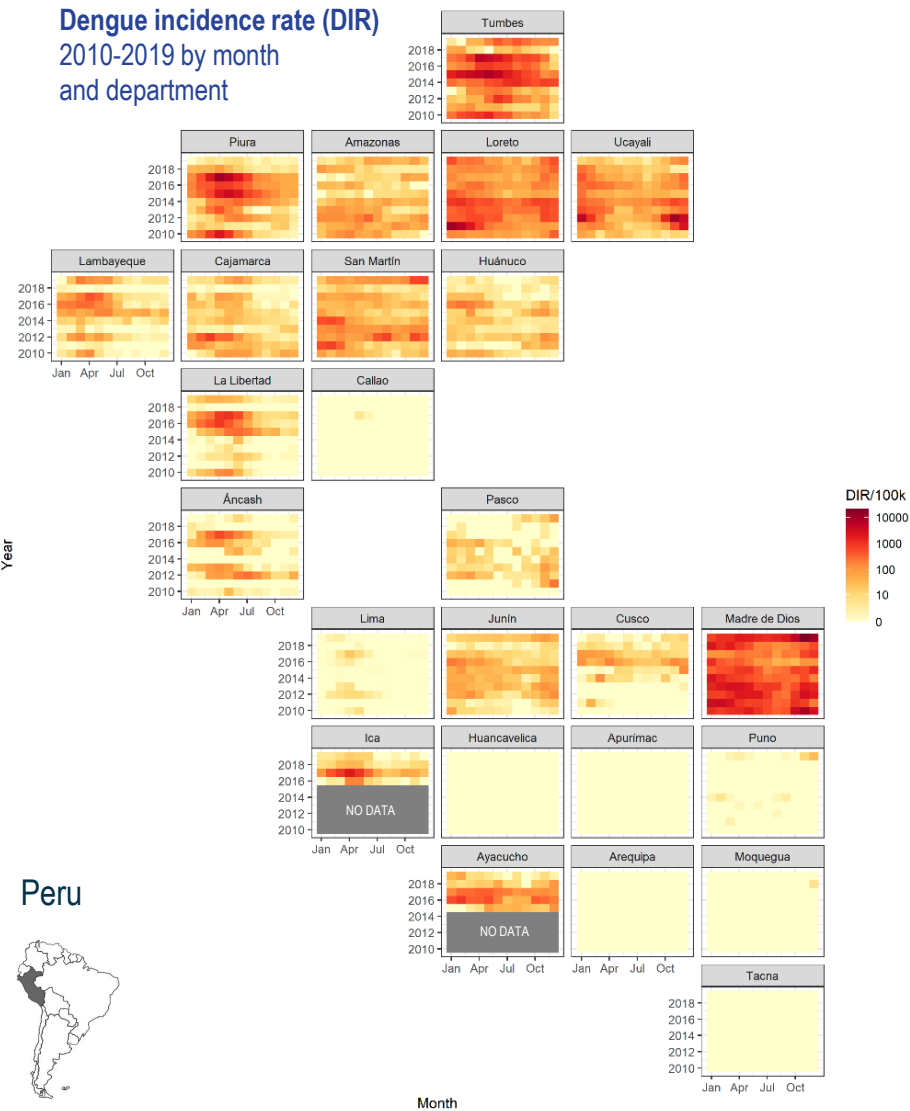
- i. Dengue-free incidence;
- ii. Dengue-seasonal incidence;
- iii. Dengue-endemic incidence.



Climate-based ensemble machine learning model to forecast dengue epidemics



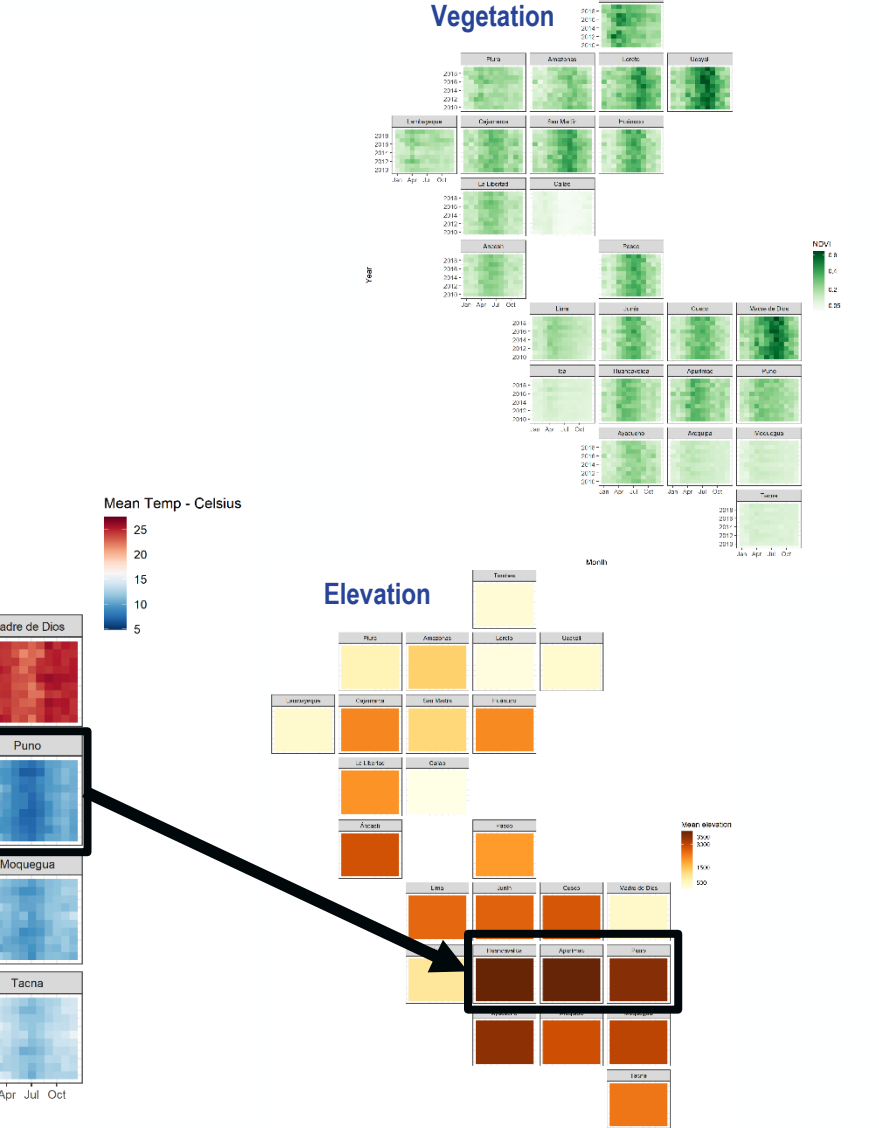
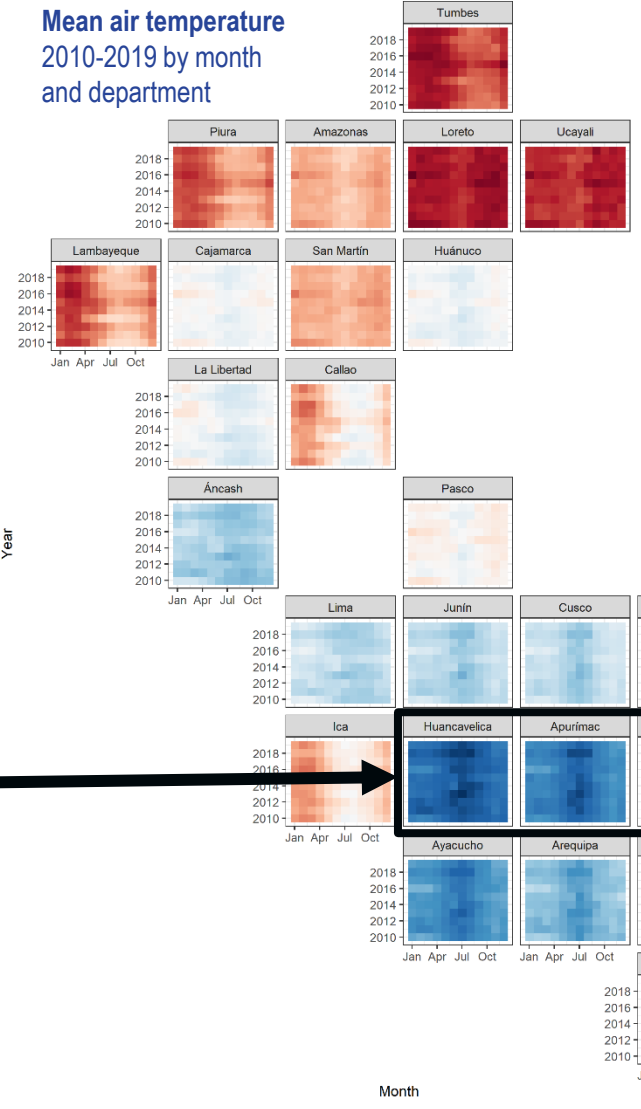
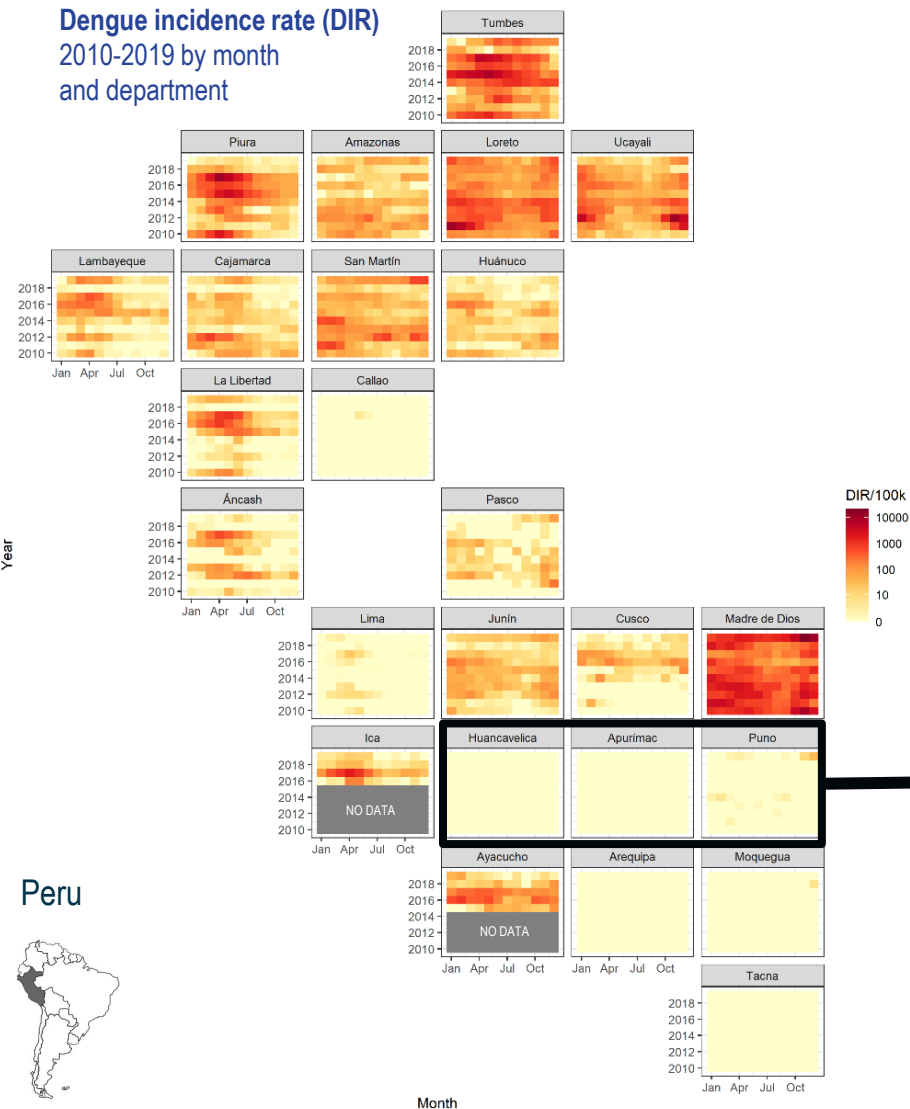
European Space Agency



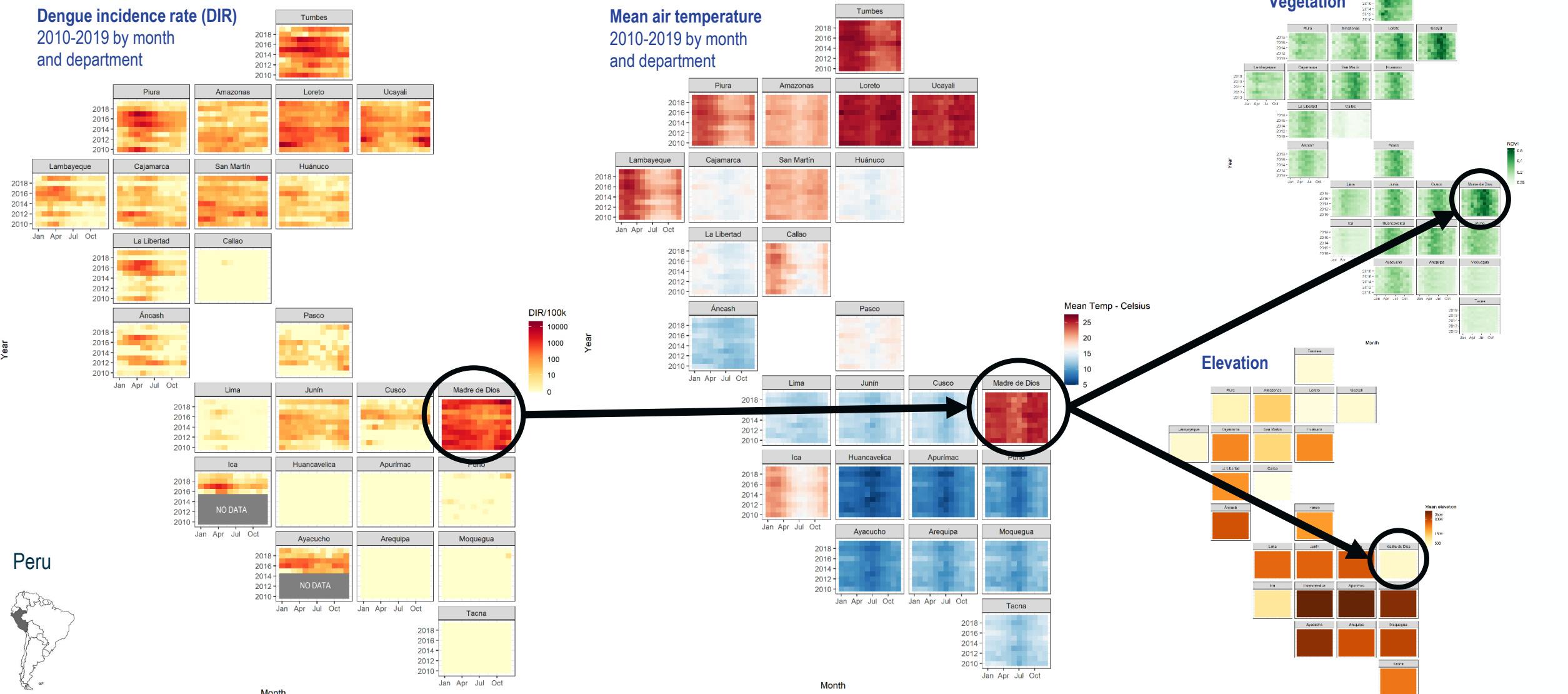
Climate-based ensemble machine learning model to forecast dengue epidemics



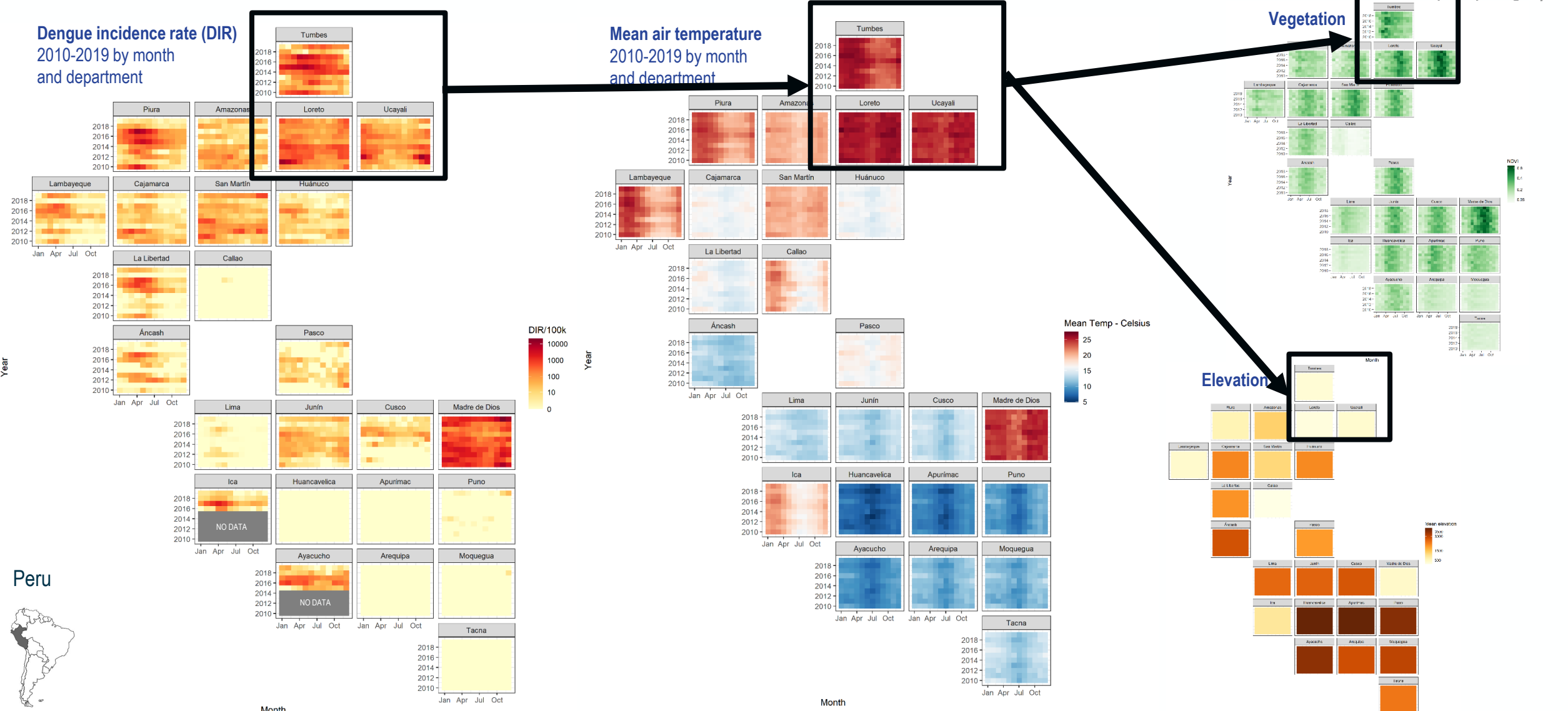
European Space Agency



Climate-based ensemble machine learning model to forecast dengue epidemics

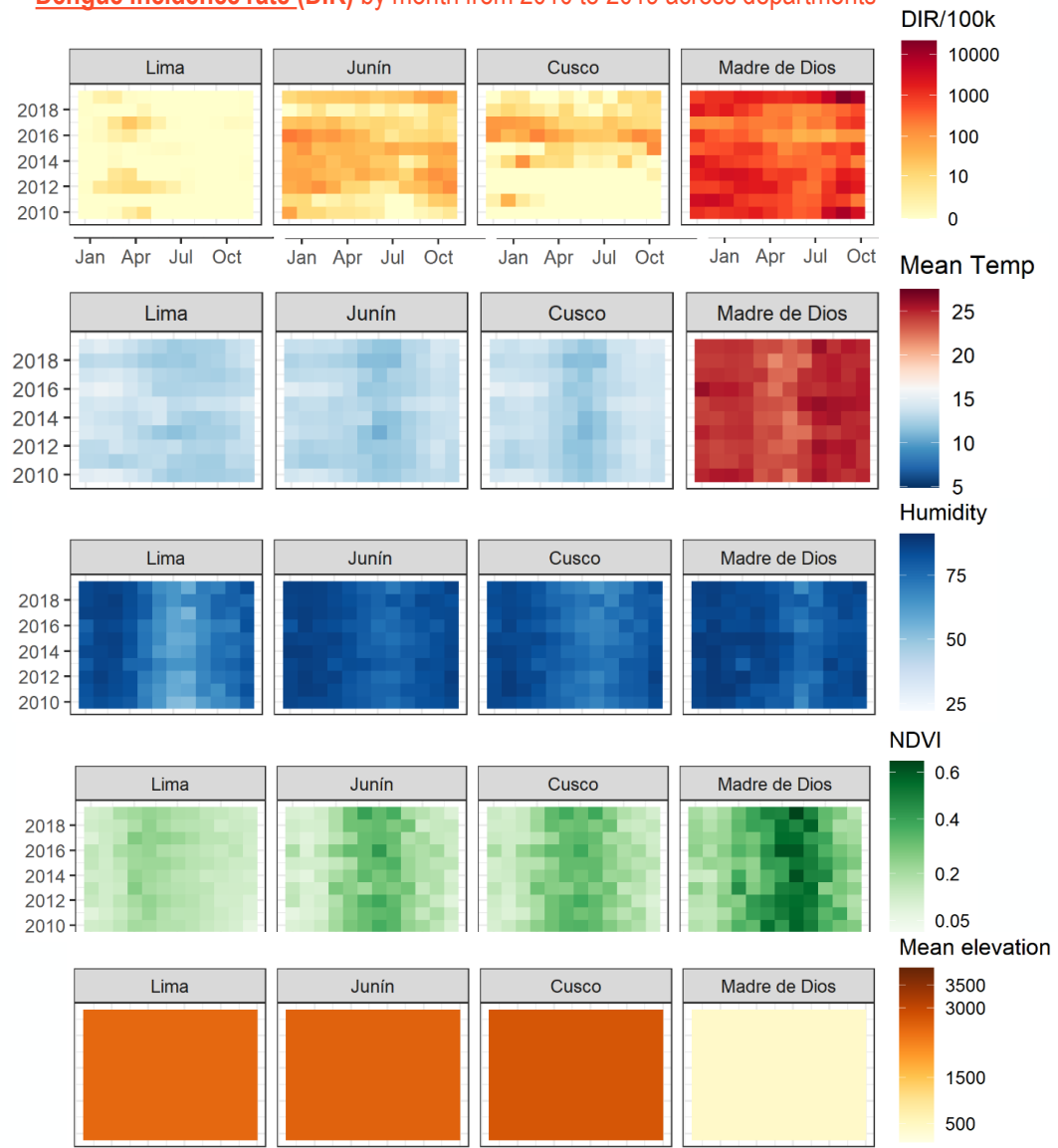


Climate-based ensemble machine learning model to forecast dengue epidemics



Climate-based ensemble machine learning model to forecast dengue epidemics

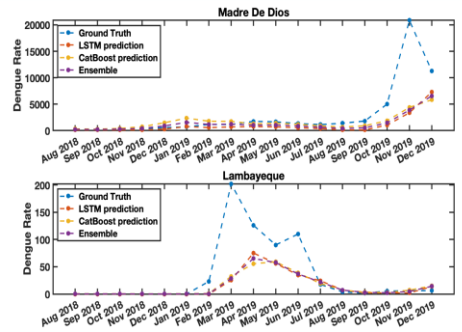
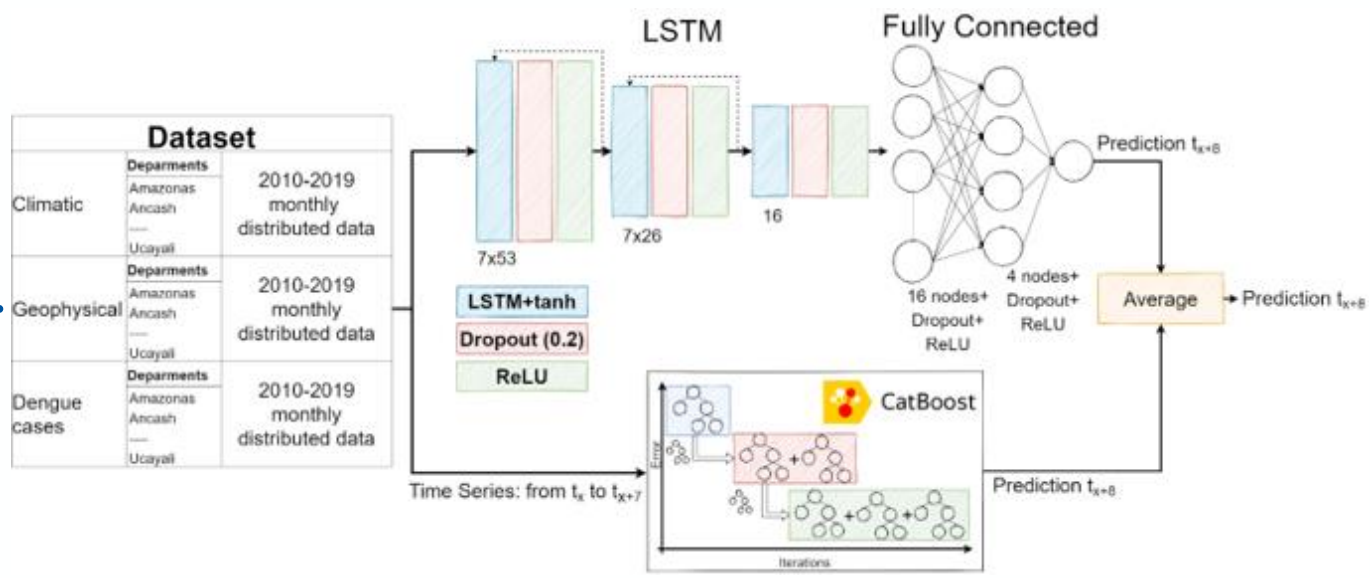
Dengue incidence rate (DIR) by month from 2010 to 2019 across departments



AI4EO4Health

LSTM

CatBoost



Next Steps - UNICEF AI4EO4Dengue cookbook

1. Scalability and sustainability of AI solution



2. Provide an open/free 'do-it-yourself' guided book: a fully-reproducible framework.



3. Share: data, AI solution framework, and Python/R scripts



Thank you!

“We need to develop the resilience and determination to tackle the climate challenges faced by children of today and tomorrow. Working with the European Space Agency that has expertise in earth observation and complex model development, it was possible to contribute to these objectives, through an understanding and an innovation on climate resilience! Like almost every other kind of innovation, it requires the ability to collaborate and share ideas with others, get feedback and understand the needs. ESA is standing for all these principles, which we, UNICEF, believe enable the conditions for cocreating safer and healthier environment for children”.

Hanoch Barlevi

UNICEF Regional Climate, Environment and Disaster Resilience

unicef 
for every child

