



Coopération scientifique transfrontalière pour l'observation spatiale et l'aide à la gestion de l'environnement

# RISK MAPPING OF VECTOR-BORNE DISEASES IN CROSS-BORDER AREAS (VecTrans)

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- **French Guiana:** Objective of malaria elimination (reaffirmed by Agnès Buzyn, 6th Conference for the renewing of the Global Fund to Fight AIDS, Tuberculosis and Malaria, Lyon, 2019)
- **Brasil:** *P. falciparum* elimination plan in 2015
- **Suriname:** **Decreased endemic malaria in Suriname: moving towards elimination**

Edward D. van Eer<sup>1\*</sup>, Gustavo Bretas<sup>2</sup> and Hélène Hiwat<sup>3</sup>

[Van Eer et al., 2018]

## Cross-Border Malaria: A Major Obstacle for Malaria Elimination

Kinley Wangdi\*<sup>§,1</sup>, Michelle L. Gatton<sup>†</sup>, Gerard C. Kelly\*,  
Archie CA. Clements\*

[Wangdi et al., 2015]

- **Oferta, acesso e utilização dos serviços de saúde** subnominais
- **Mobilidades** transfronteiriças de populações
  - Portadoras de patógenos
  - que se tornam "invisíveis" para os serviços de saúde (ilegalidade)
- **Desigualdade** socioeconômica importante
- **Políticas Públicas diferentes:** estratégias diferenciadas de **vigilância, prevenção e controle**
- **Falta de interoperabilidade** dos dados e sistemas de informação
  - ⇒ **Permanência** de **focos de transmissão**
  - ⇒ Surgimento de **resistências** (vetores e parasitas)
  - ⇒ **Falta** de uma **visão unificada/compartilhada**
  - ⇒ **Falta** de **ação comum, articulada**

# Variability in time and space

## Suriname

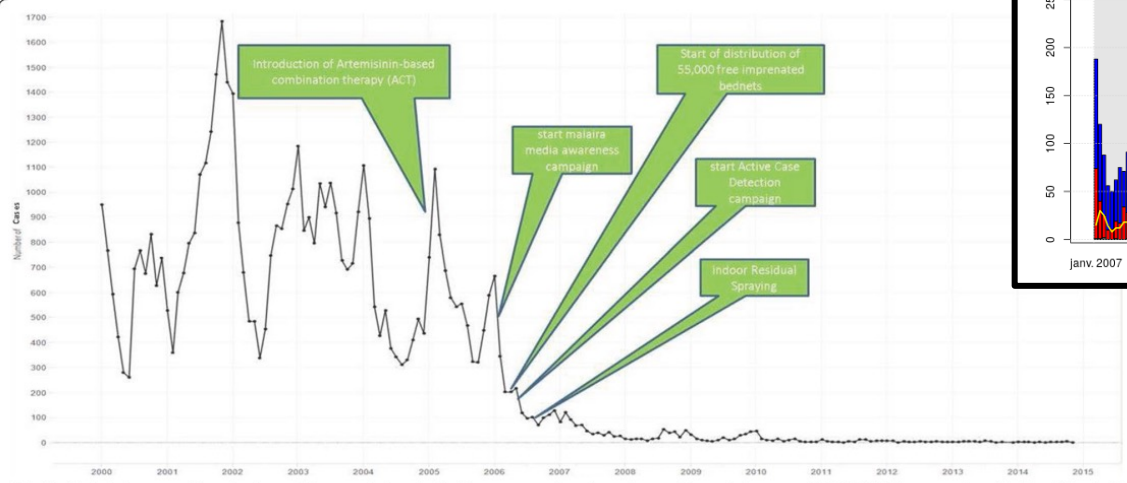
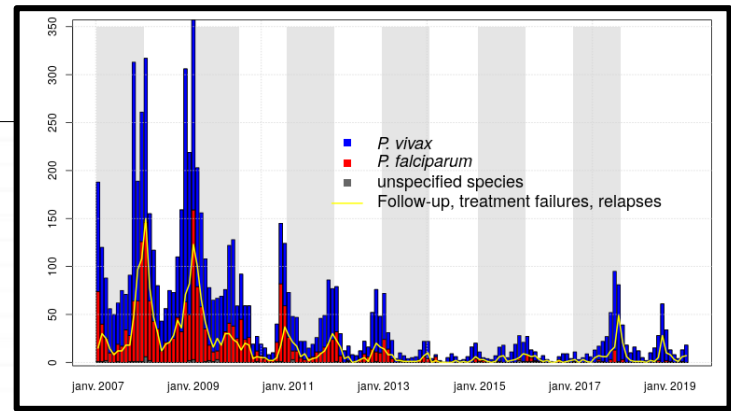


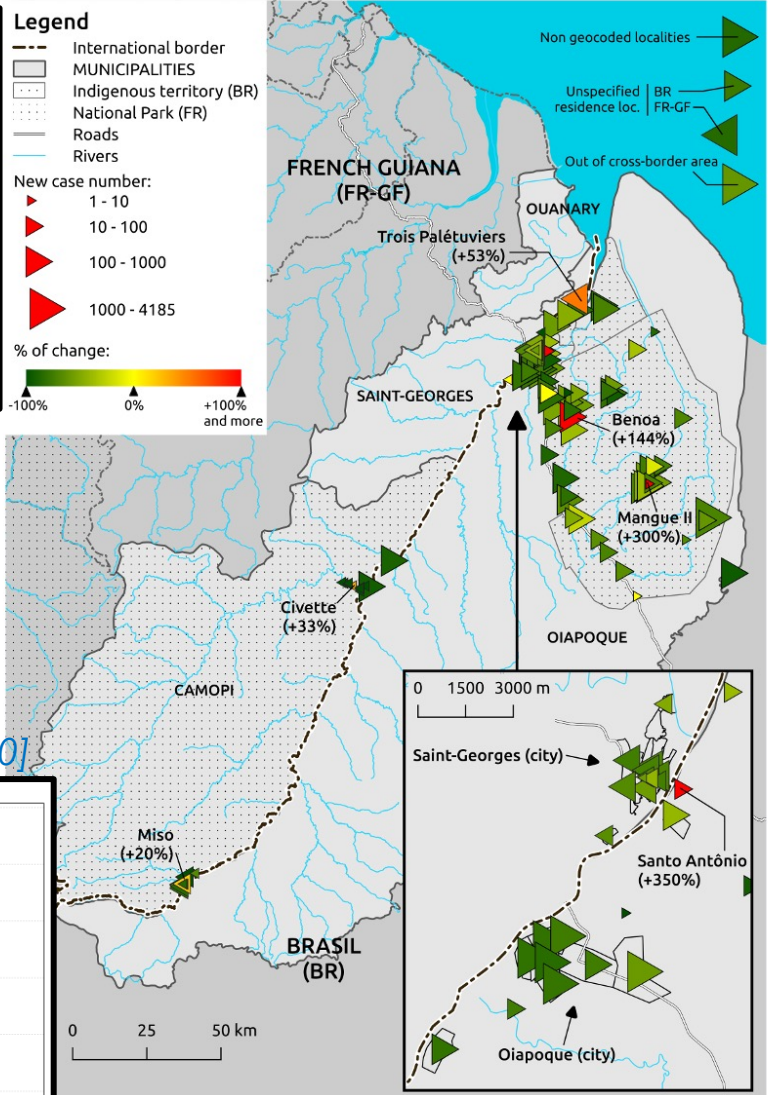
Fig. 7 Malaria interventions in the stable populations in Suriname on a timeline of monthly malaria cases 2000–2015 (source: data Medical Mission)

[Van Eer et al., 2018]

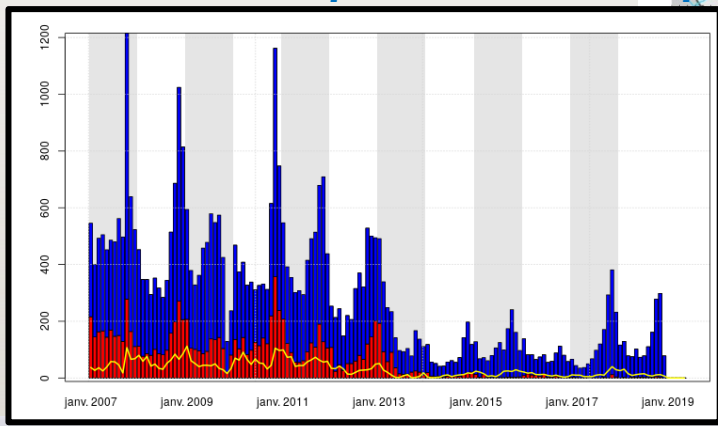
**"In 2015 more than 95% of the cases originate from French Guiana"**



## French Guiana



[Mosnier et al., 2020]

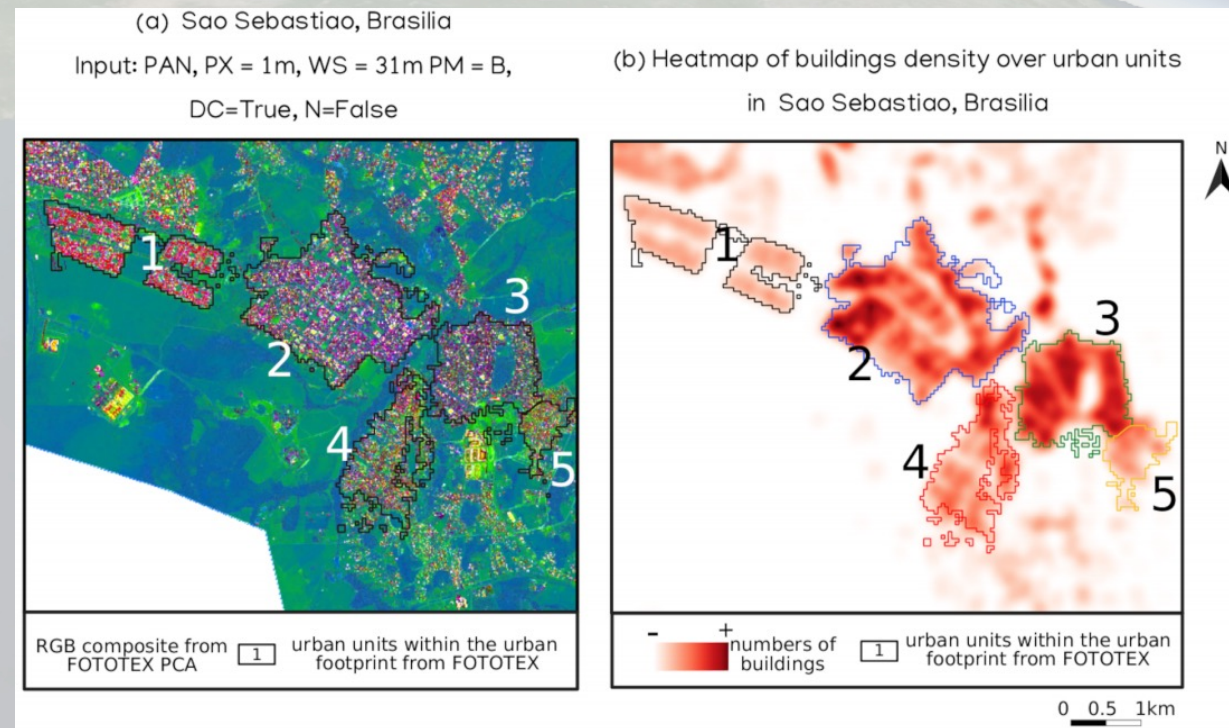


## Brazil

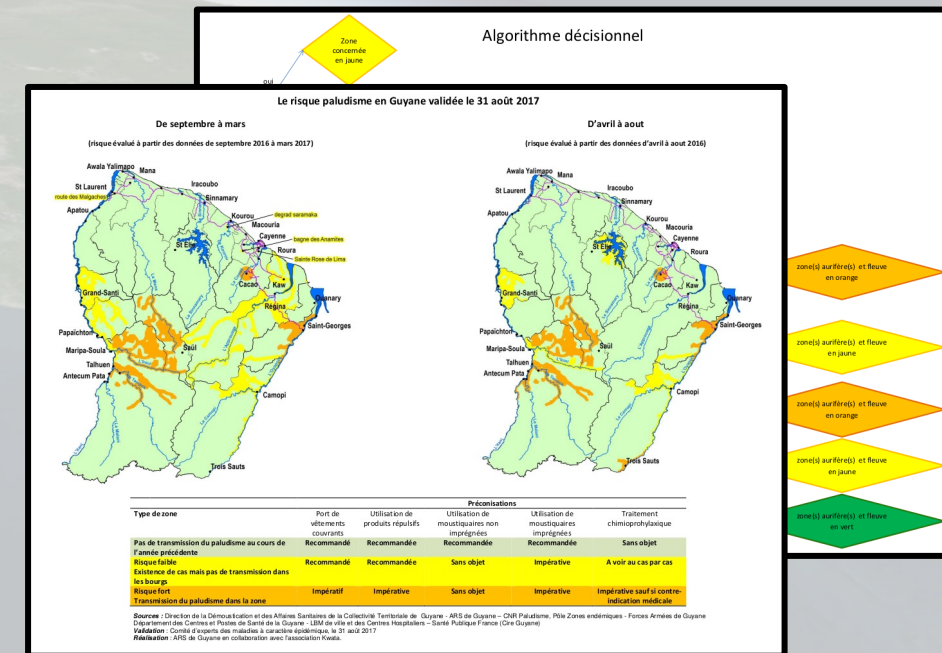
[Saldanha et al., 2020]

[Teillet et al., 2021]

- Contribution to cross-border malaria **epidemiological surveillance**
- Development of **indicators on vector habitat and population exposure to vector**
- **Satellite image processing chain implementation** (sen2chain)
- ...
- **Action-Research projects** (ELIMALAR, MALAKIT, ...) led by partners
- **On arboviroses: methods and tools for urban characterization from remote sensing data**

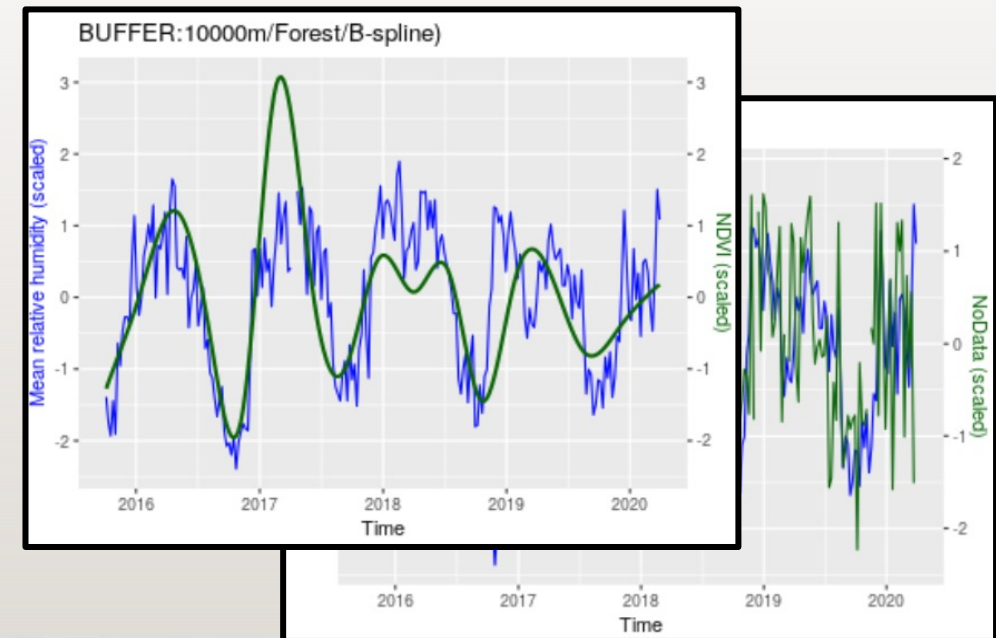
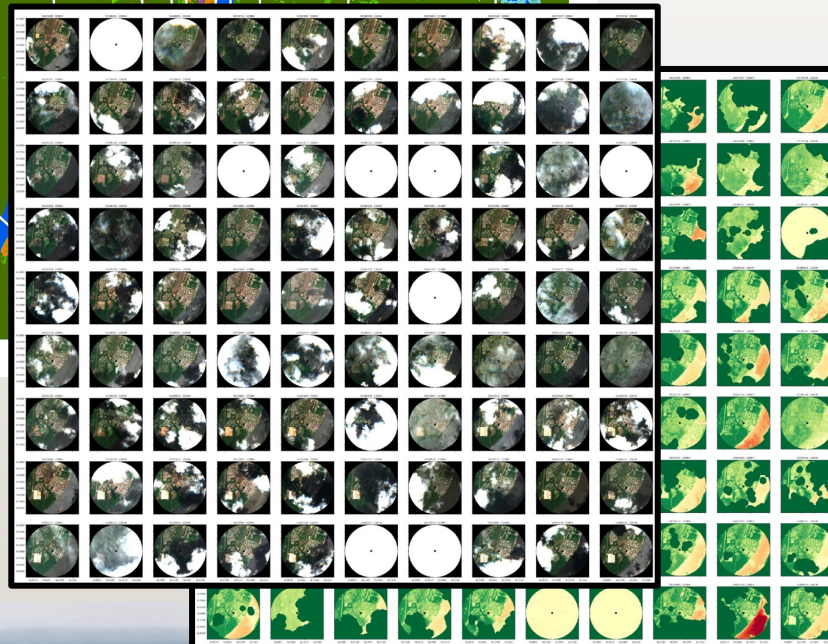
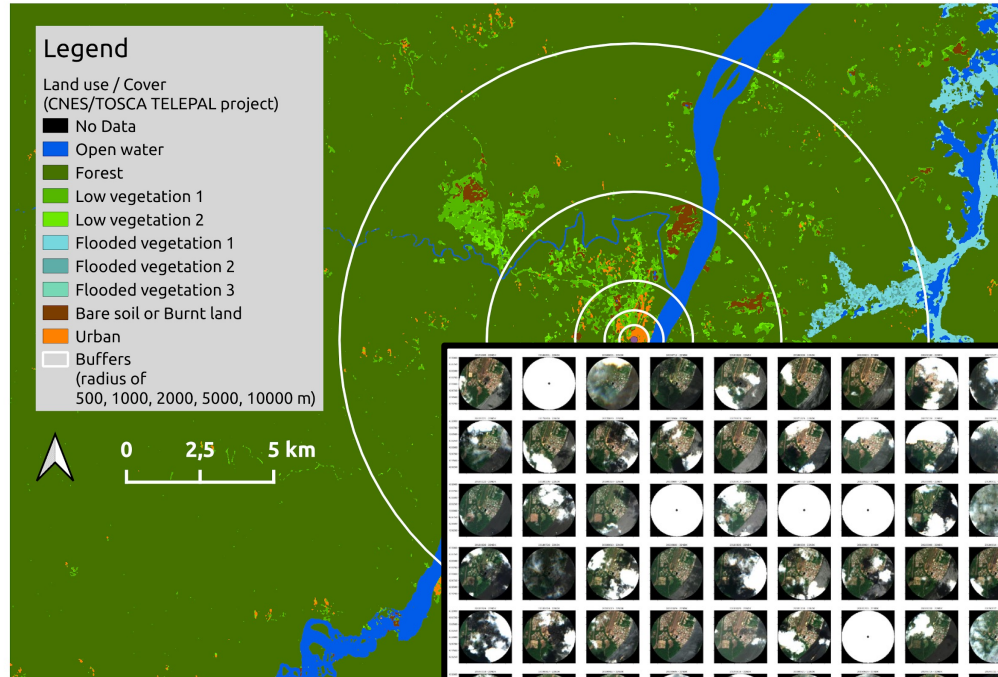


- Develop methods and tools, and product cross-border data and indicators in a **systematic and multifactorial surveillance framework**
- Adopt a **multi-disciplinary and integrated approach** making the best use of data and knowledge (One Health approach)
- Objectivate and automatically produce current **risk mapping**
- Better **identify and predict places and periods** of recrudescence/ re-emergence risks
- Facilitate **data and knowledge dissemination**
- **Transfert/adapt methods and tools to Aedes-borne arboviroses**
- Supporting implementation and functioning of the **bi-/tri-national center for epidemiological surveillance and response**

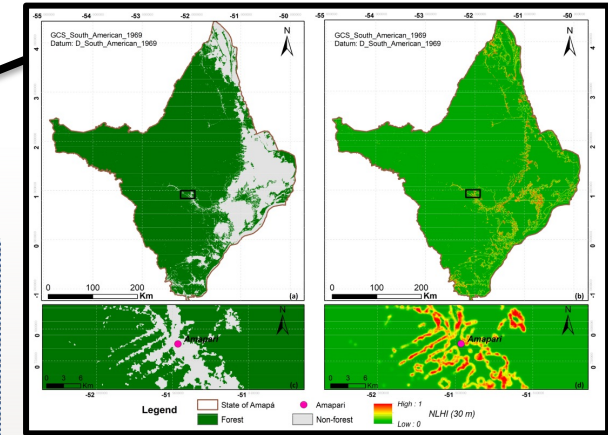


- **Automatization of the production of data and indicators in cross-border areas**

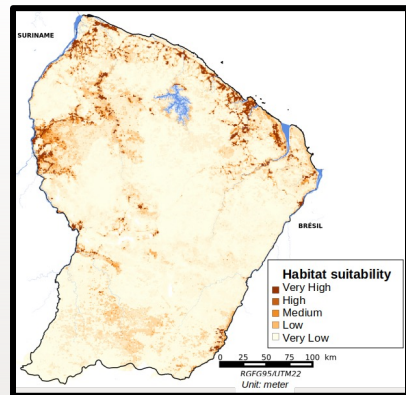
- Exploitation of remote sensing **image time-series** (sen2chain, radar data) and specific indicator production
- Exploitation of **data and indicators provided by others project workpackages** (urban, ...)
- Exploitation of **product from other providers**



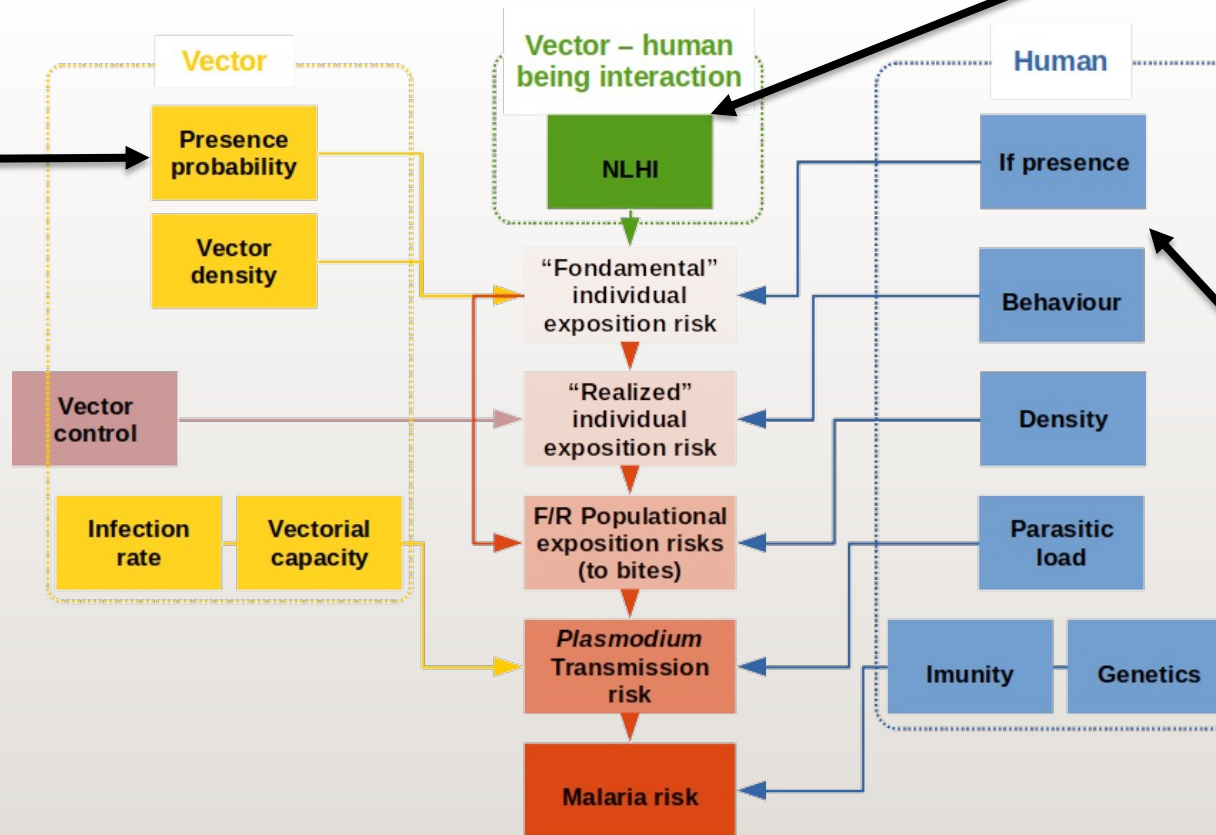
- Integration of data and indicators and knowledge (data science and expertise on processes)



[Li et al., 2017]



[Moua et al., 2016]



[Moua et al., 2016, 2017]

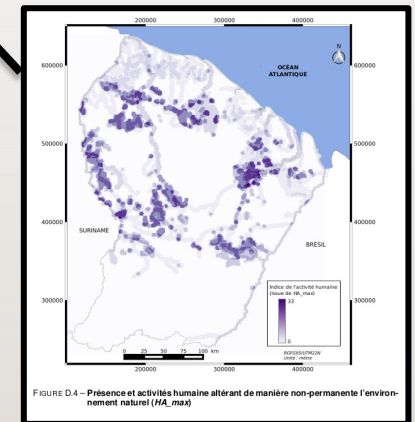
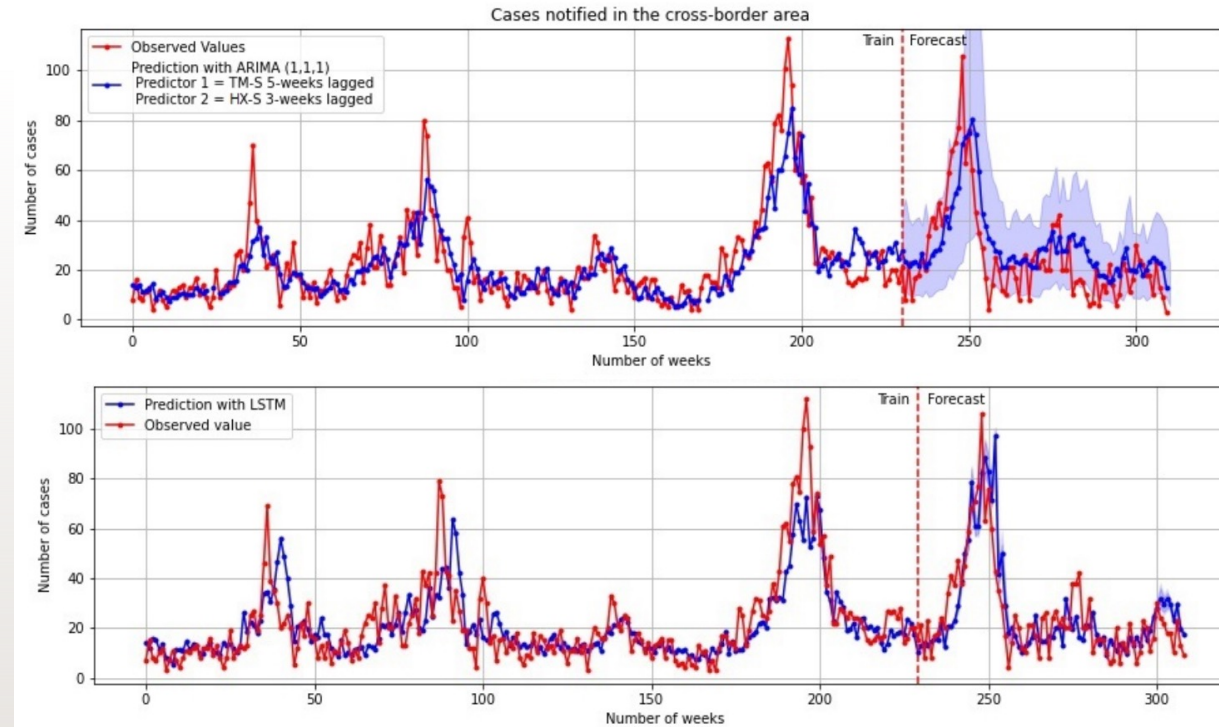
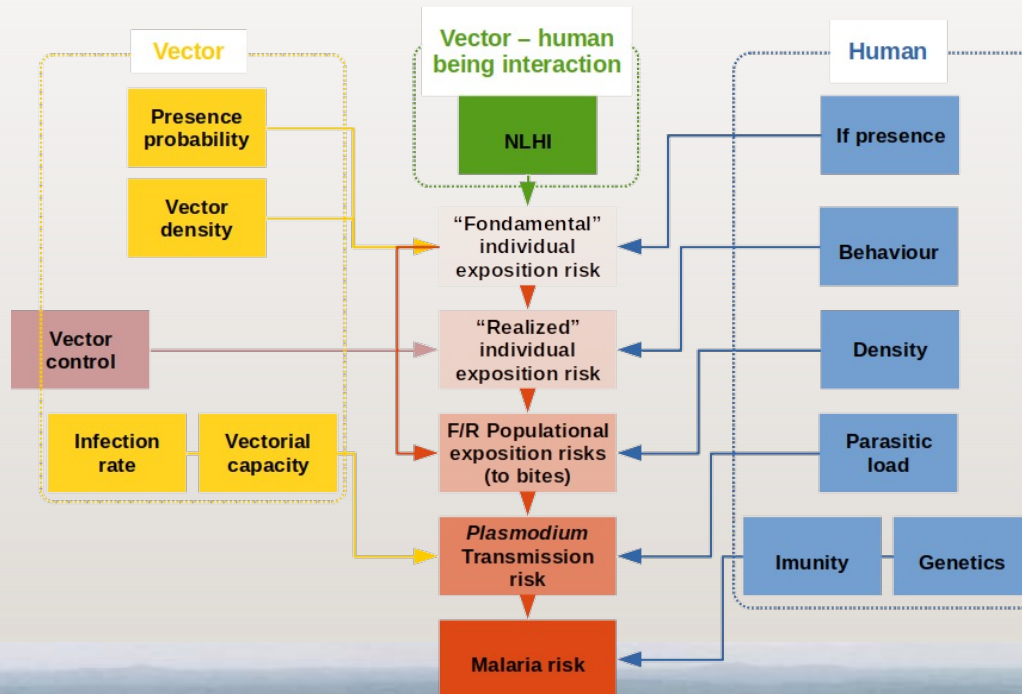


FIGURE D.4 – Présence et activités humaine altérant de manière non-permanente l'environnement naturel (HA\_max)



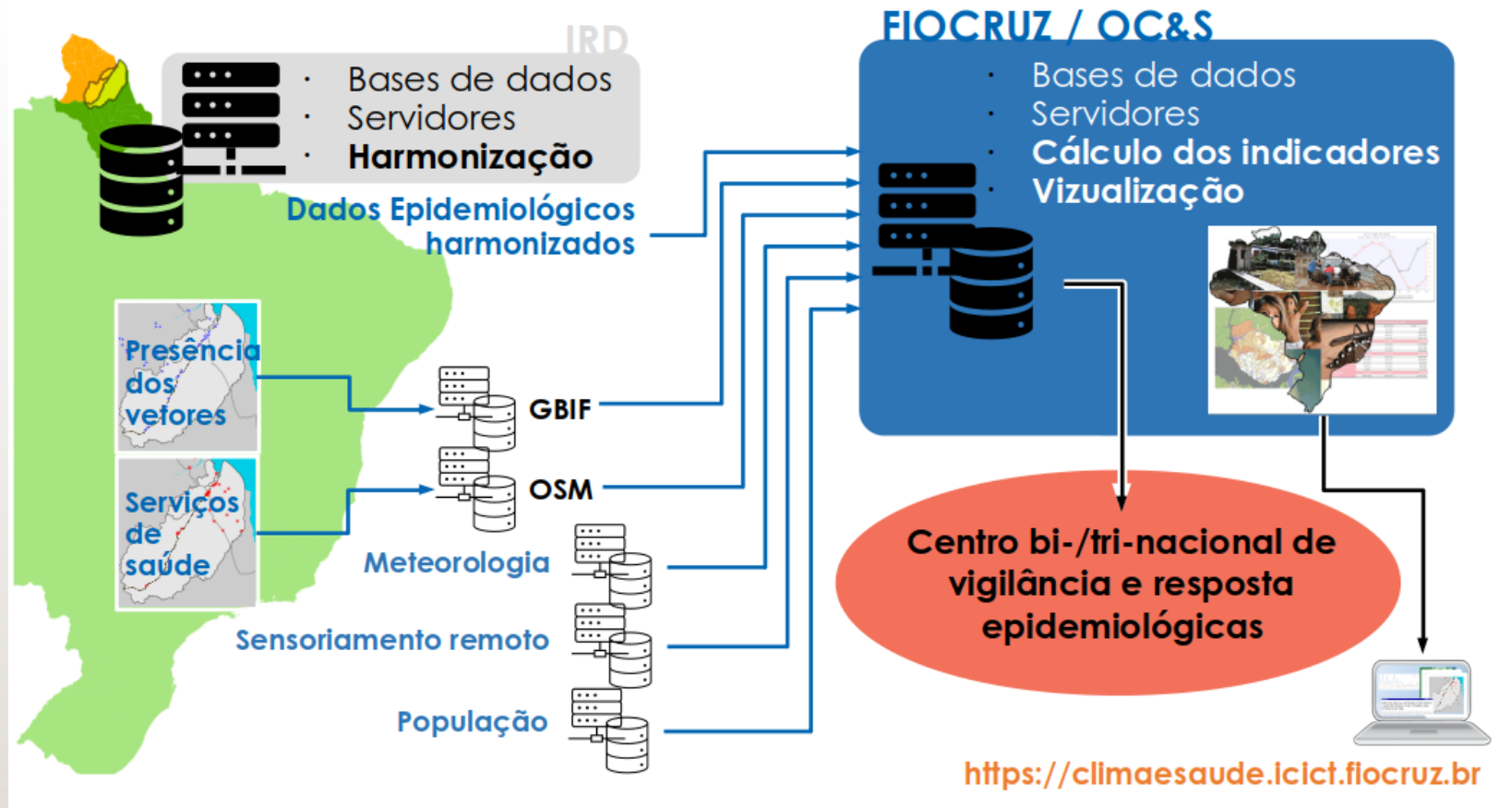
## Models

- **Conceptual models** (knowledge retrieving from experts)
- **Multi-criteria analysis** (knowledge-based risk mapping)
- **Multi-formalism modeling** (mechanistic models, machine learning, ...)



[Schincariol et al., 2021]

## Dissemination strategy and tools (data infrastructures, data/metadata standardization)





# Suriname

## Development of an operational partnership

# Brazil



# French Guiana

# Partnership

- Remote sensing
- Geomatics
- Data and model sciences
- Health geography
- Sociology/anthropology
- Epidemiology
- Parasitology/Virology
- Entomology
- Vector control
- Public Health

...

# A One Health approach

**APUREZA:** Analyses par télédétection des relations entre Paysages URbains, dengue et Zika

**CNES/TOSCA Program**  
Nadine Dessay



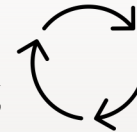
**ALERTM:** Prédiction du nombre de cas de paludisme transfrontalier à la frontière Guyane française – Brésil : vers un système d'alerte précoce

**Labex DRIHM/OHM Oyapock**  
Emmanuel Roux



## PROGYSAT

- VecTrans
- ADEUSA (Urban)
- ...



## ANISETTE

ANalyse Inter-Site : Evaluation de la Télédétection comme outil prédictif pour la surveillance et le contrôle de maladies causées par des moustiques

**CNES/TOSCA Program**  
Annelise Tran  
(CIRAD/TETIS)



**PhD project**

**Participatory cross-border surveillance** for the control of endemics, outbreaks and public health emergencies: A shared construction of information, communication and health education

**Fiocruz/INOVA program**

Paulo Peiter & Martha Mutis (Fiocruz/IOC, LMI Sentinelia)

**METEORS:** Malaria Exposure in the Tropics using Earth Observation for Resilient Societies

**ESA/EO4SOCIETY**

T.Catry, B. Pillot (IRD/SPACE-DEV) & M.-J. Escorihuela (IsardSat)