



World Organisation
for Animal Health



SEACFMD EPIDEMIOLOGY NETWORK MEETING

Key findings-FMD data
analysis: Trend, direction,
clusters and risk areas of
FMD outbreaks in
SEACFMD region

Presenter:
Veerasak Punyapornwithaya

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Qingdao, People's Republic of China***



Outline of the Presentation

- **Data and analysis tools**
- **Outbreak location mapping**
- **Temporal trend and change points**
- **Distribution of outbreaks**
- **Outbreak clusters**



Data

- Data : 2015-2023 / SEACFMD countries
- WAHIS (World Animal Health Information Systems)
- ARAHIS (Regional Animal Health Information System)
- WOAHA bulletins-FMD
- WOAHA FMD Reference Laboratory
- ASEAN Regional Reference Laboratory for FMD

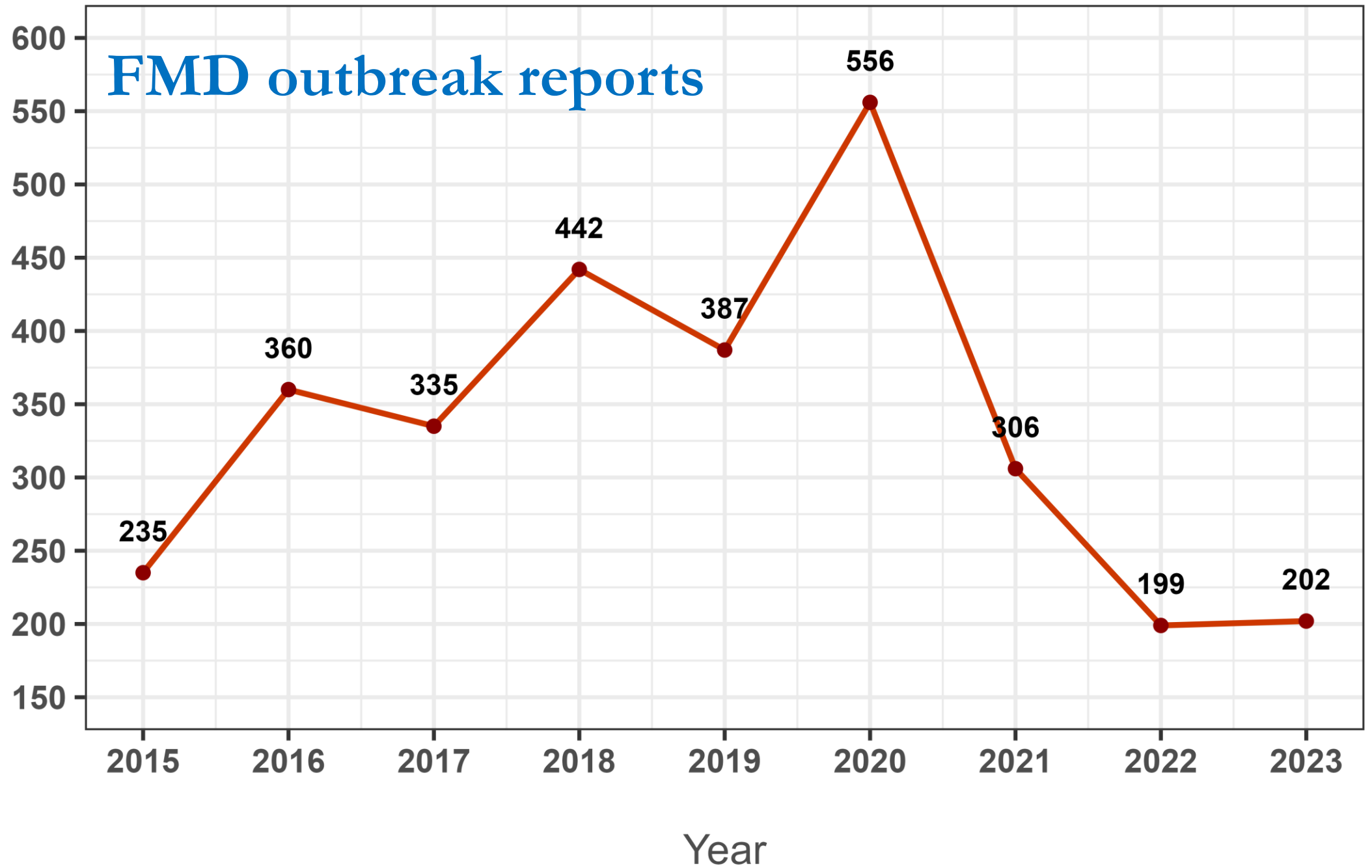


Tools

- **R software**
- **QGIS**
- **SatScan**
- **MaxEnt**

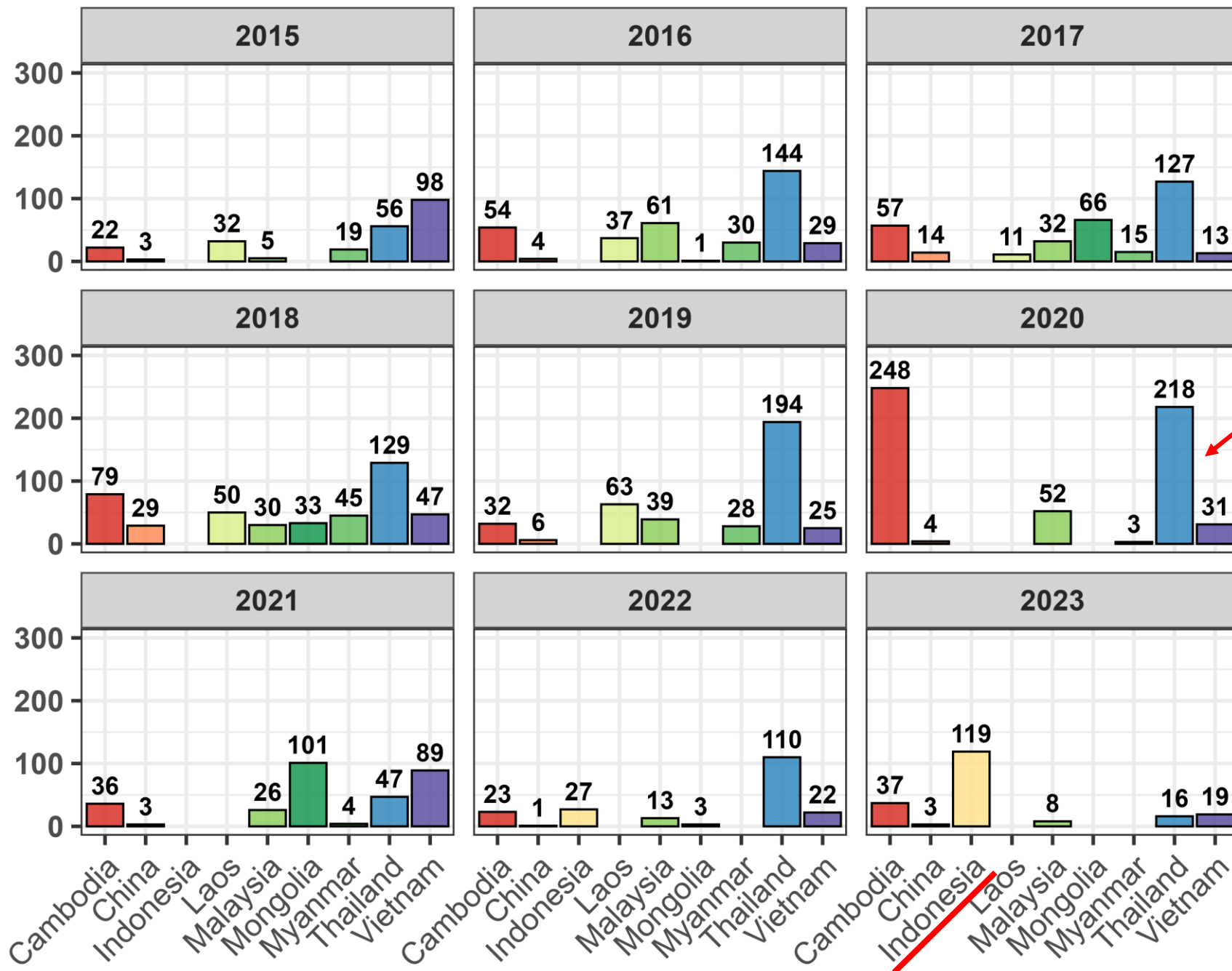


Number of Outbreaks





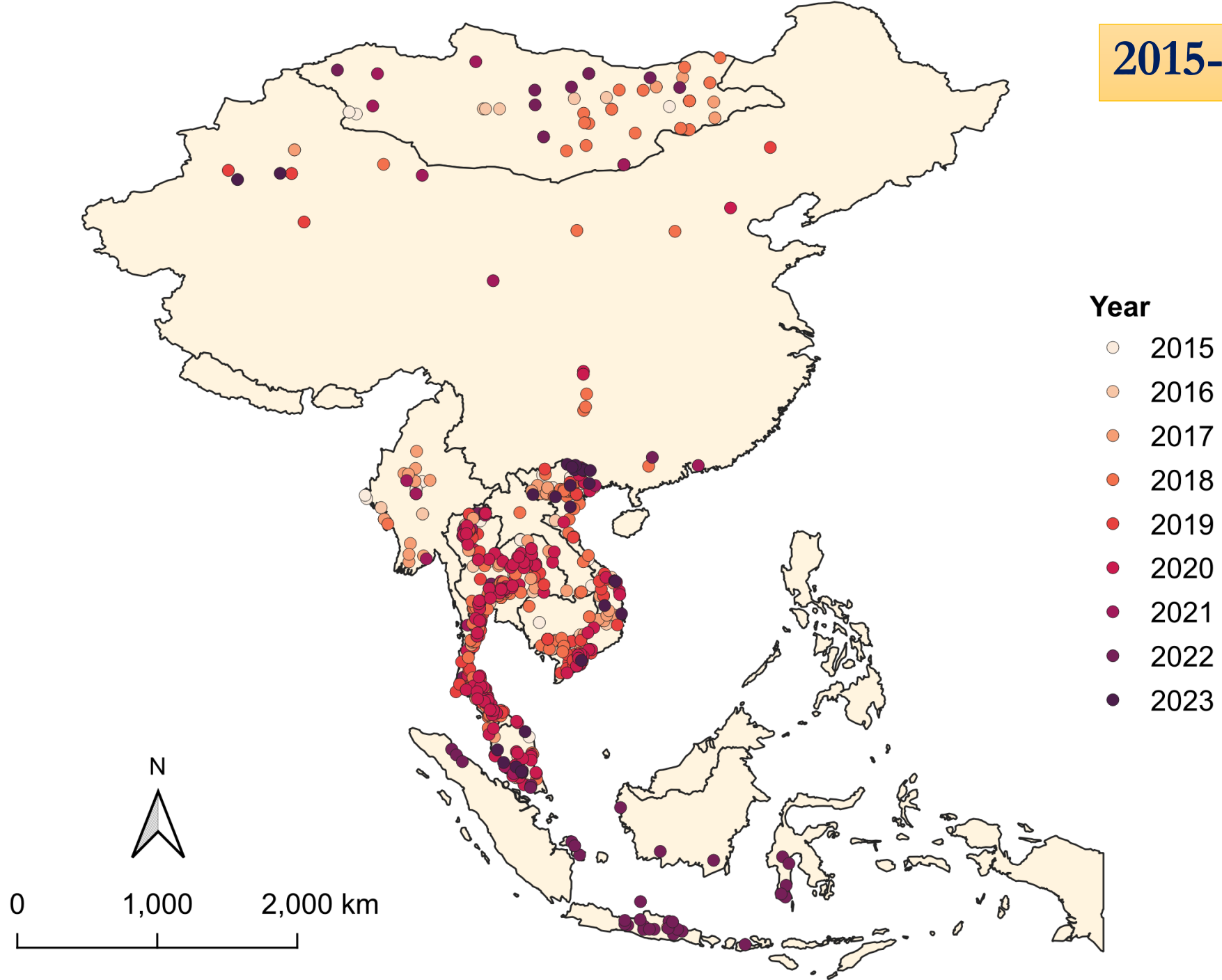
Number of Outbreaks



Thailand

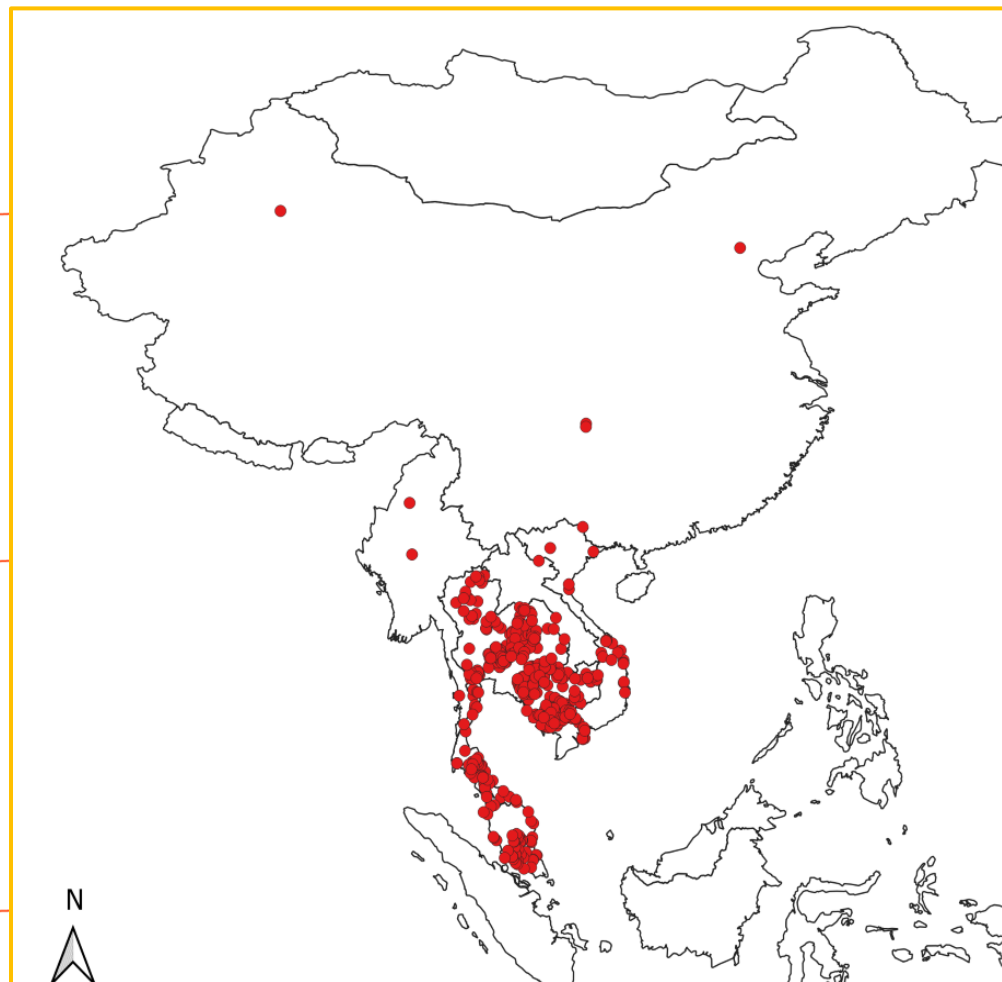


2015-2023

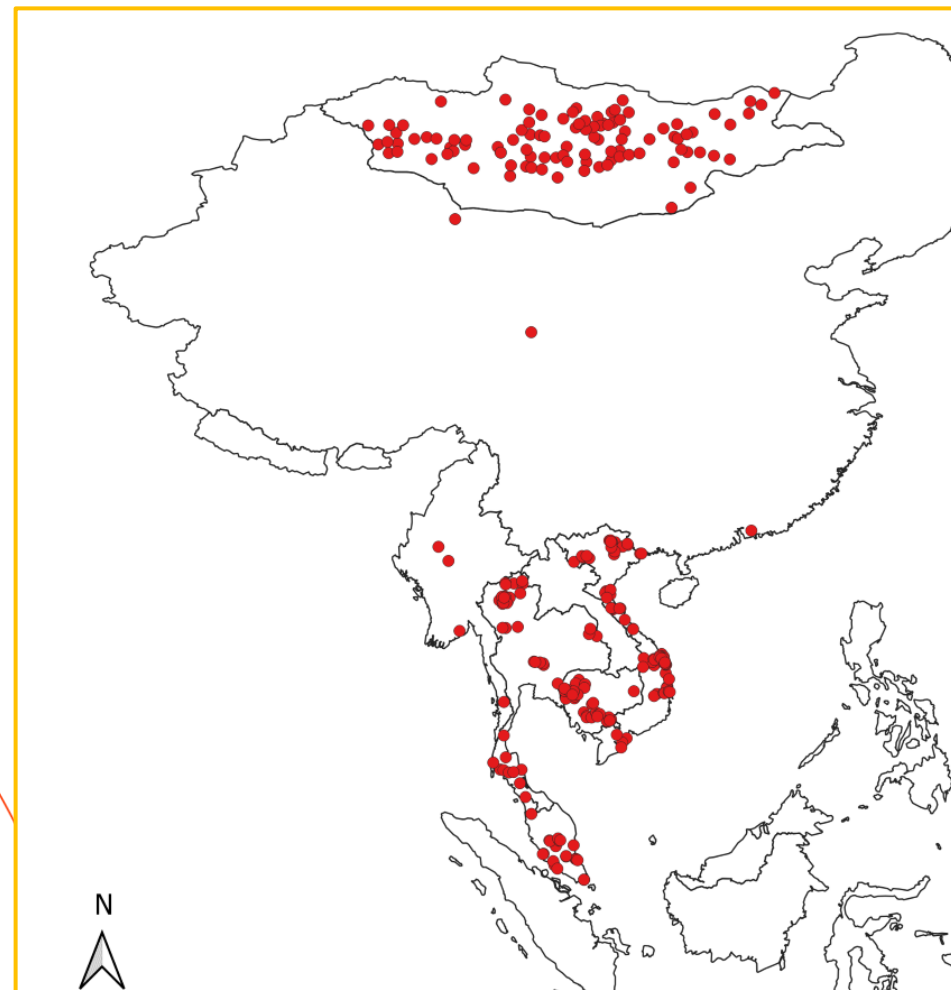




2020

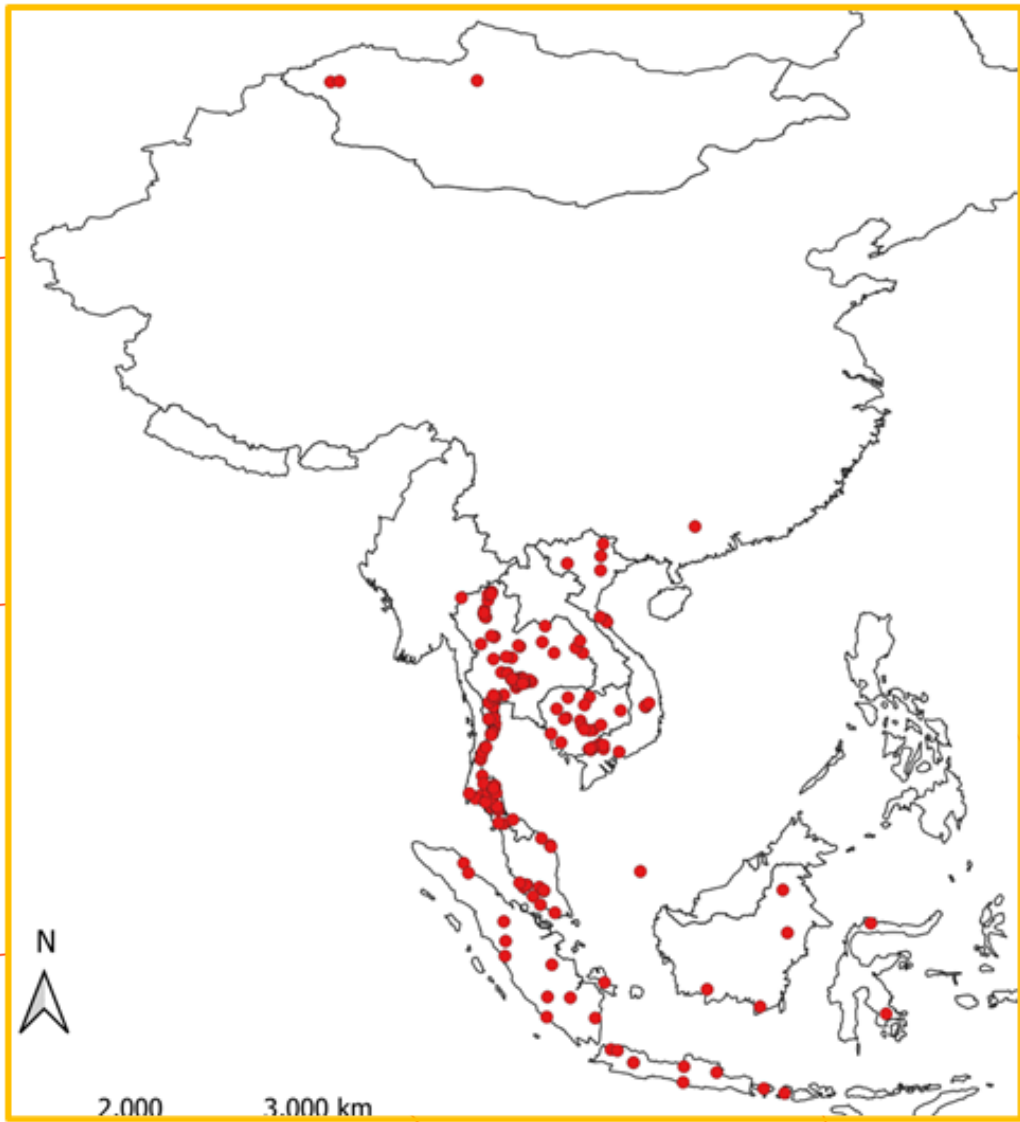


2021

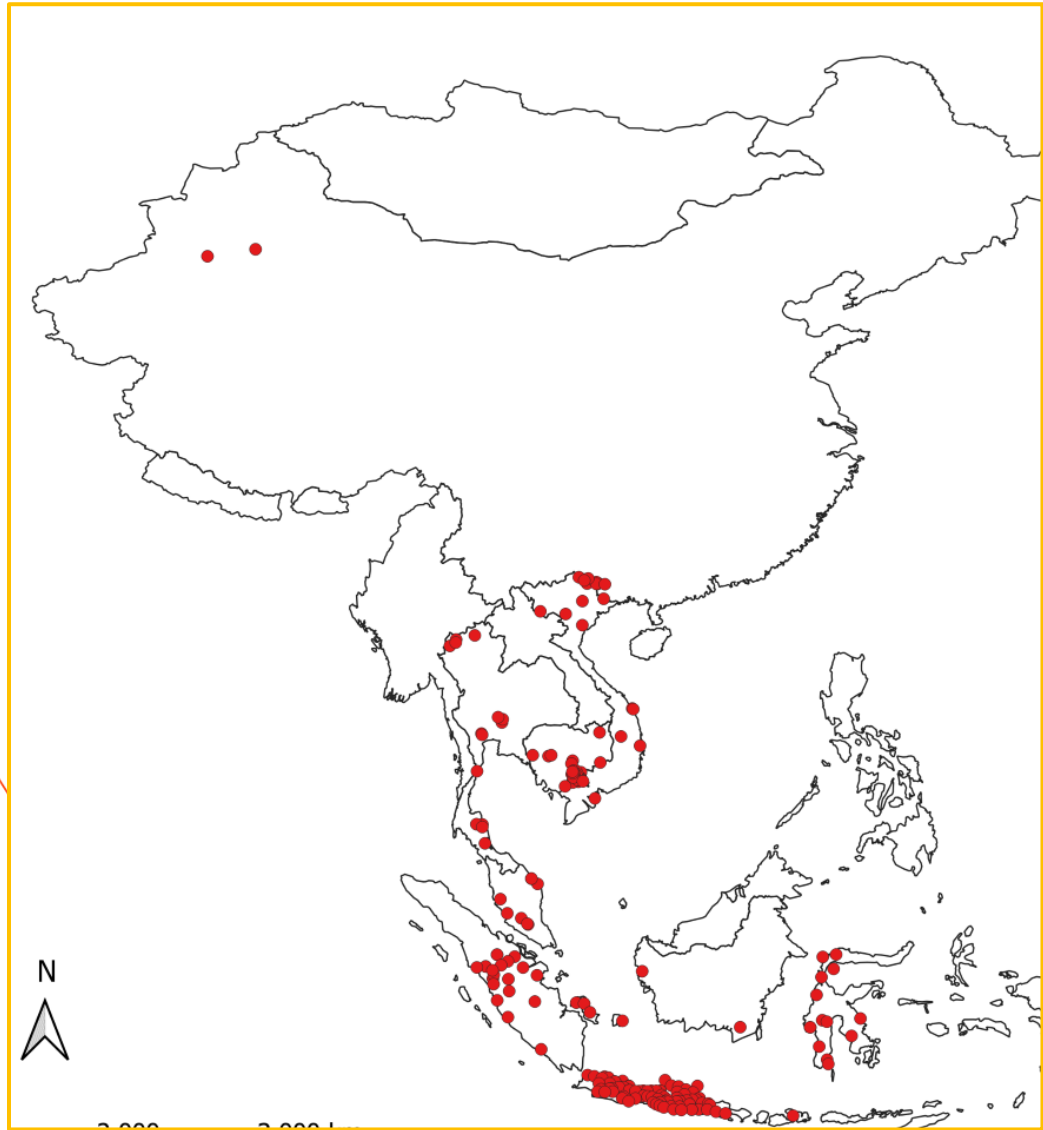




2022

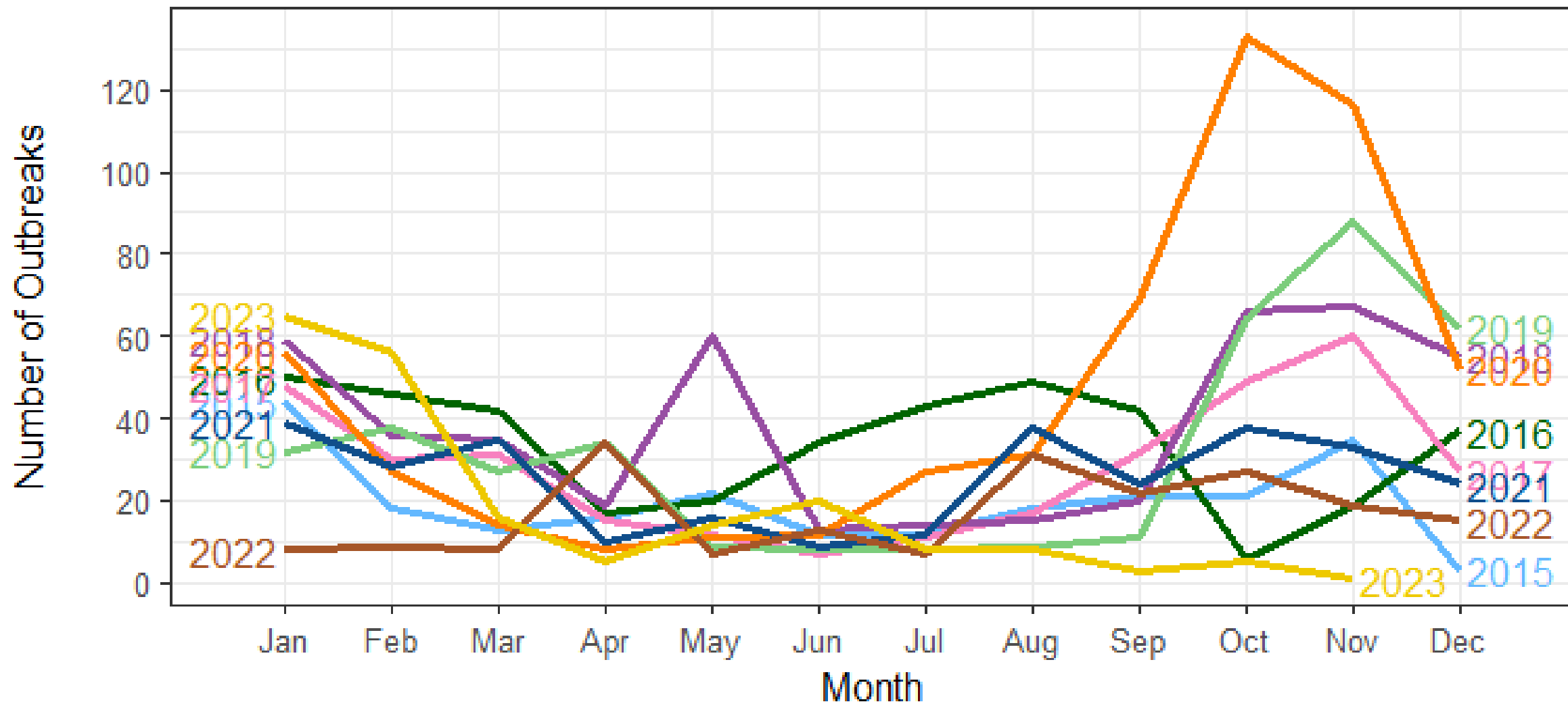


2023



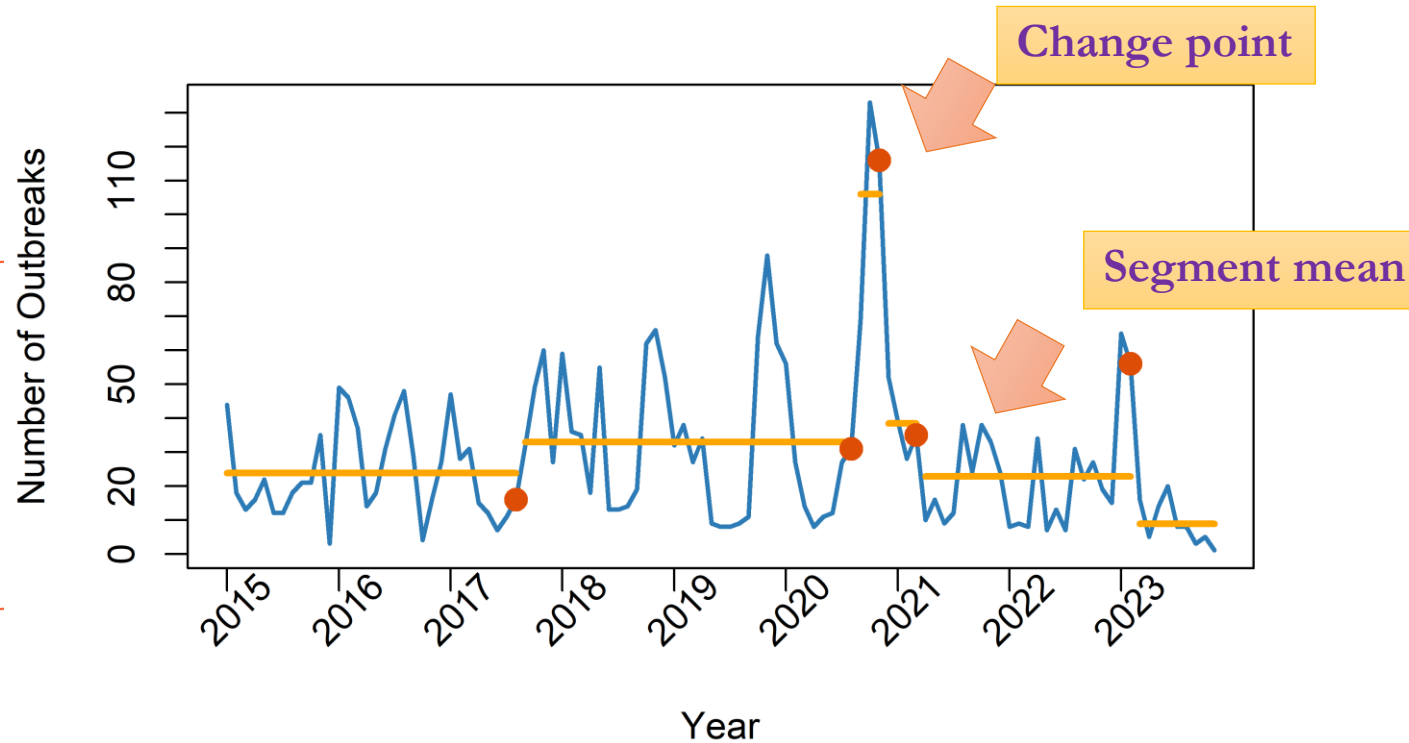


Temporal pattern





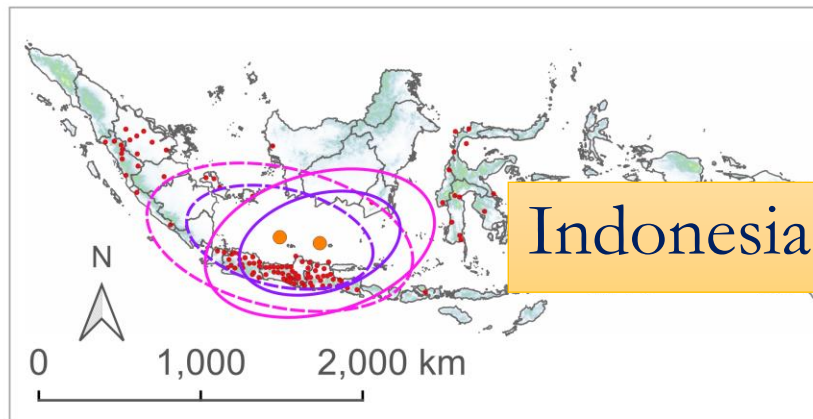
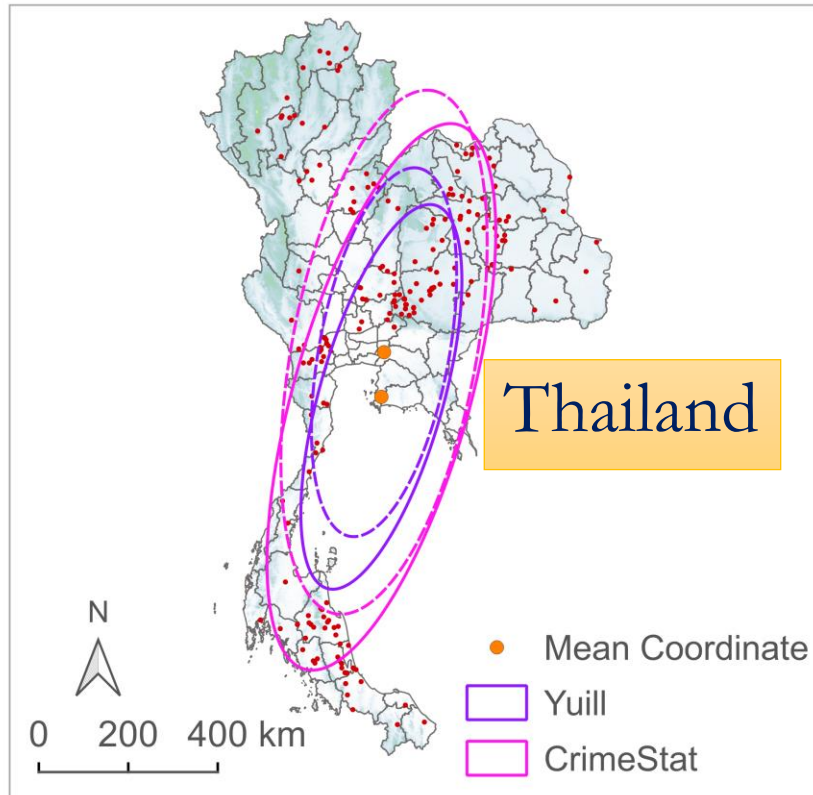
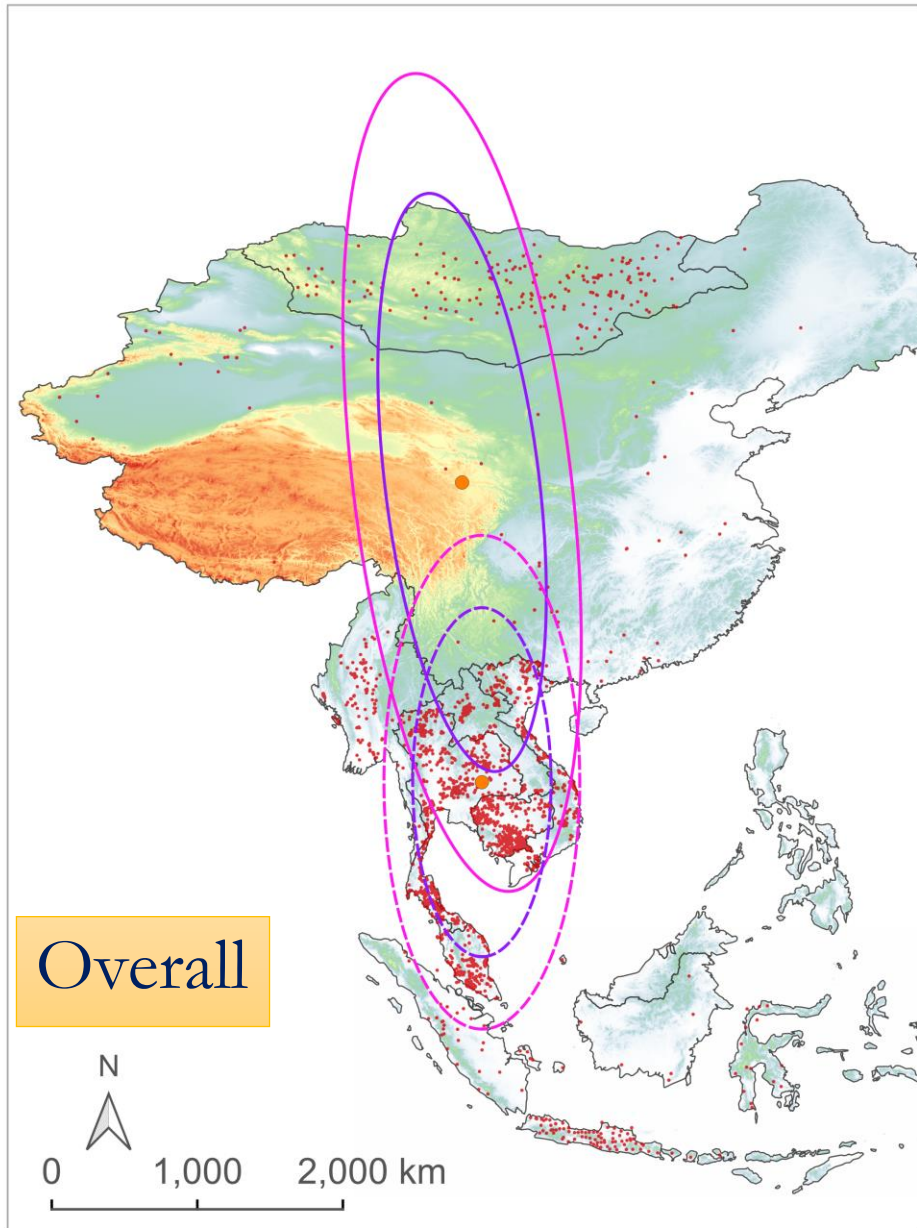
Temporal trend and changepoints



- 2017-2022: Period with high number of reports
- 2021-2023: the number of reports was lower than 2017-2022
- Early 2023: Shift in the number of reports then the trend declined



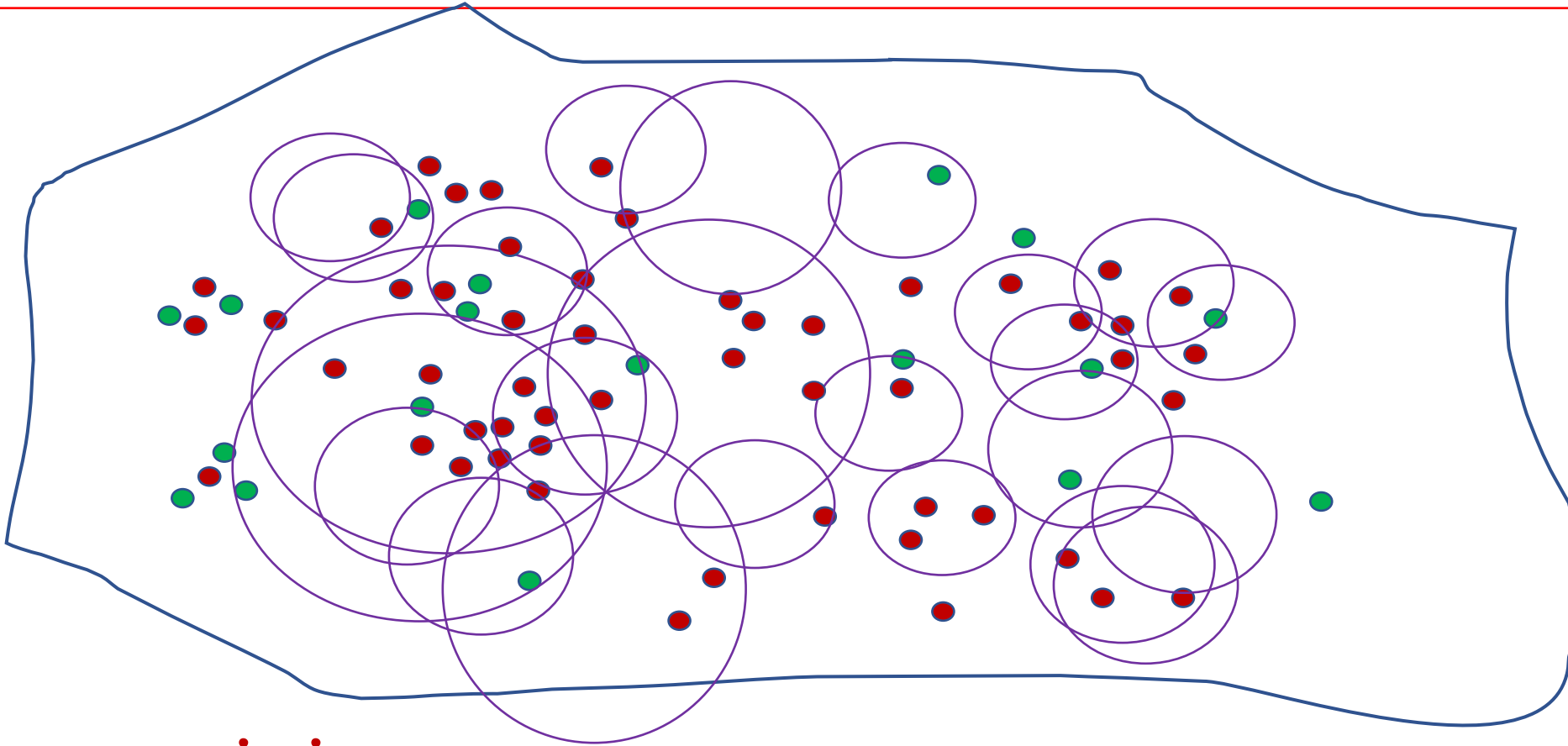
Directional distribution of FMD outbreaks



- Distribution direction
- Overall: North and south
- Thailand: North-East and South-East
- Indonesia: East and West

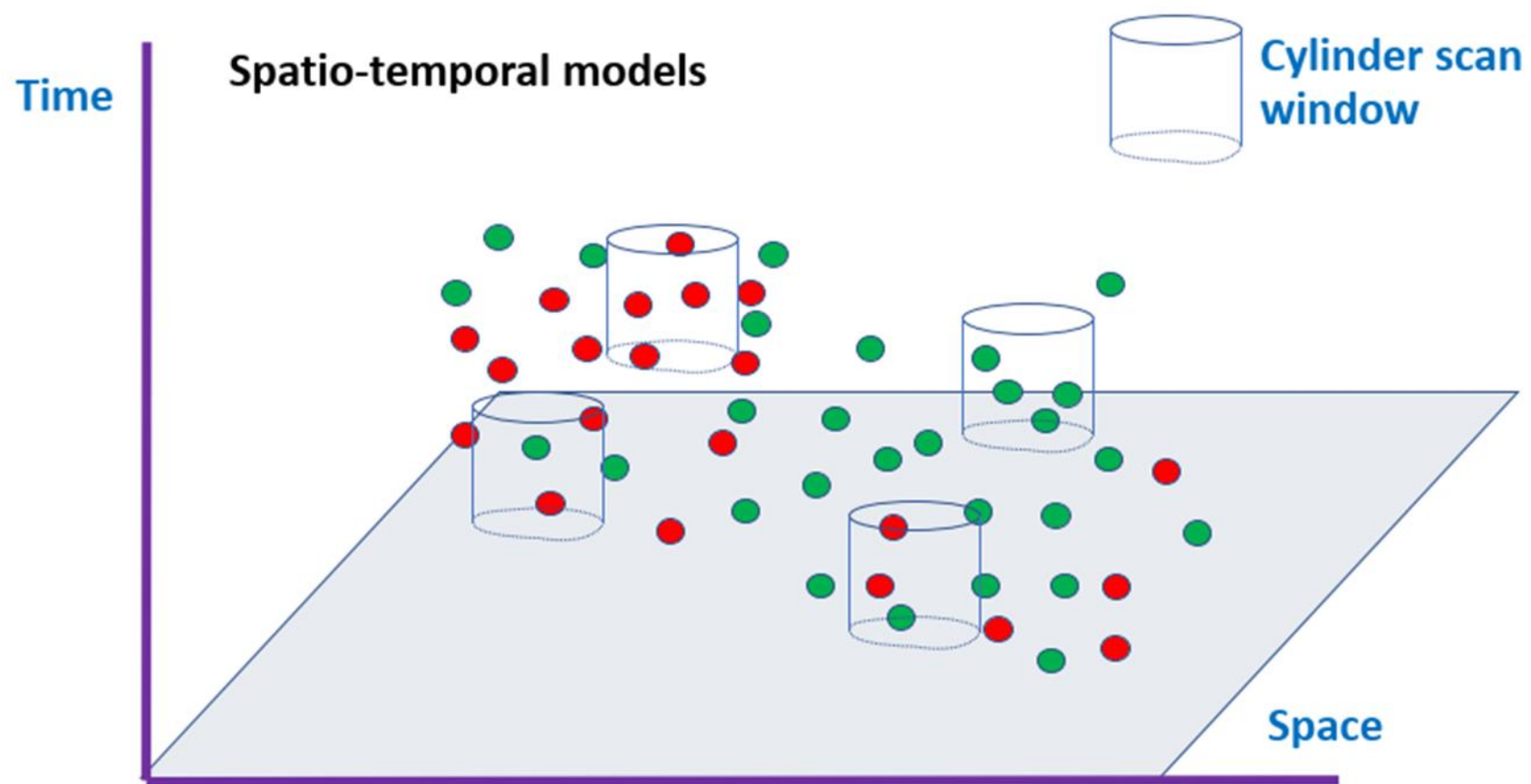


Clusters of FMD outbreaks

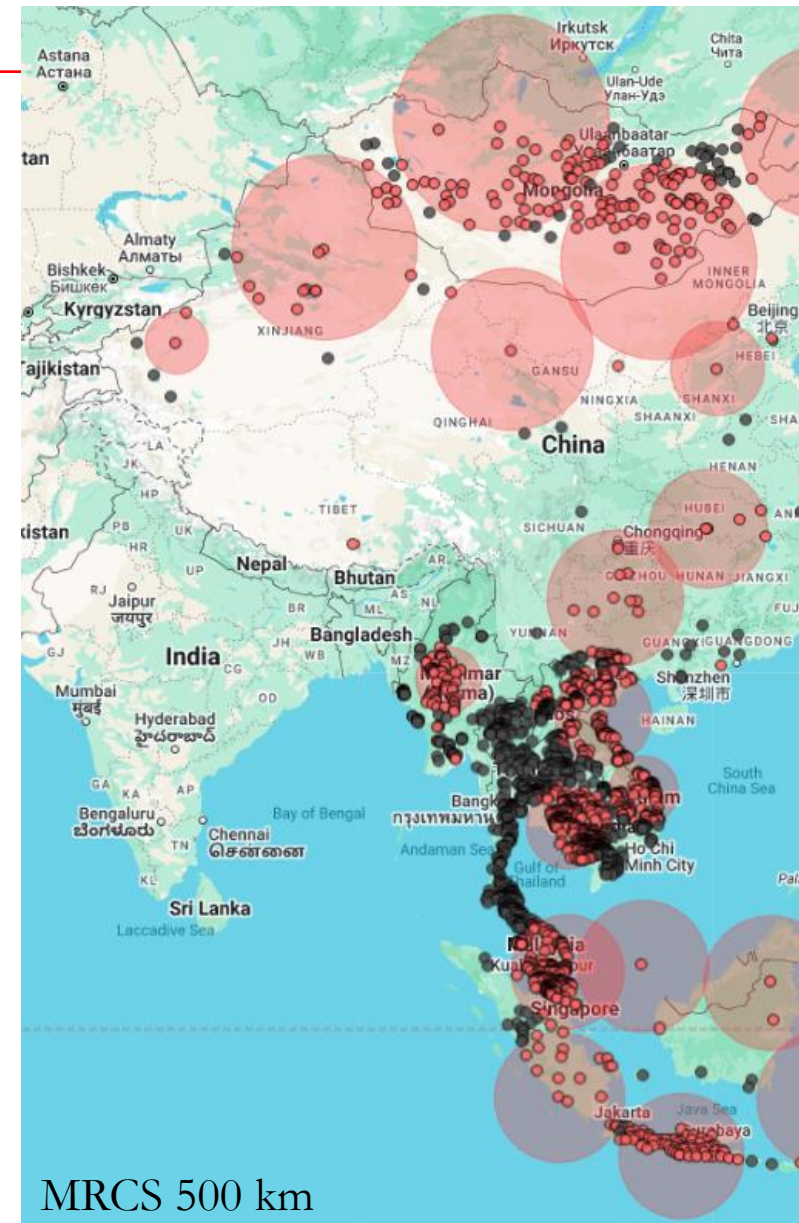
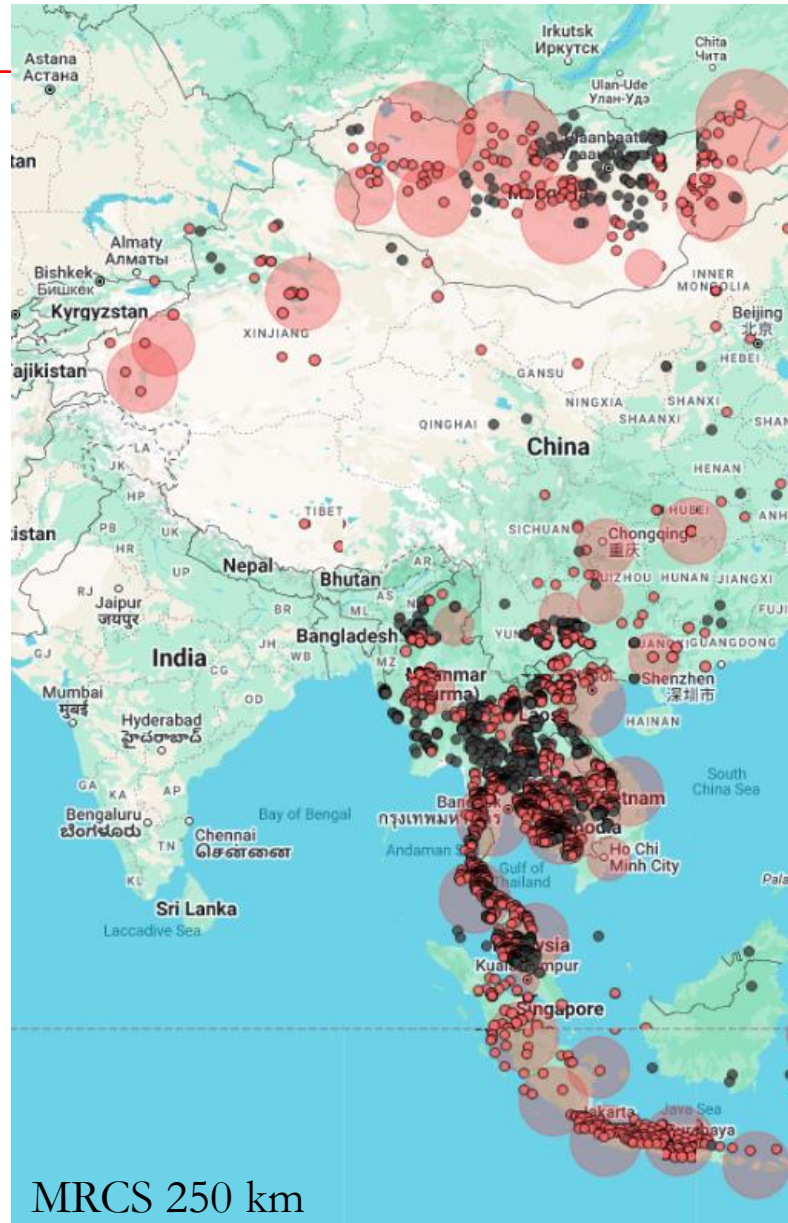


Scan statistics

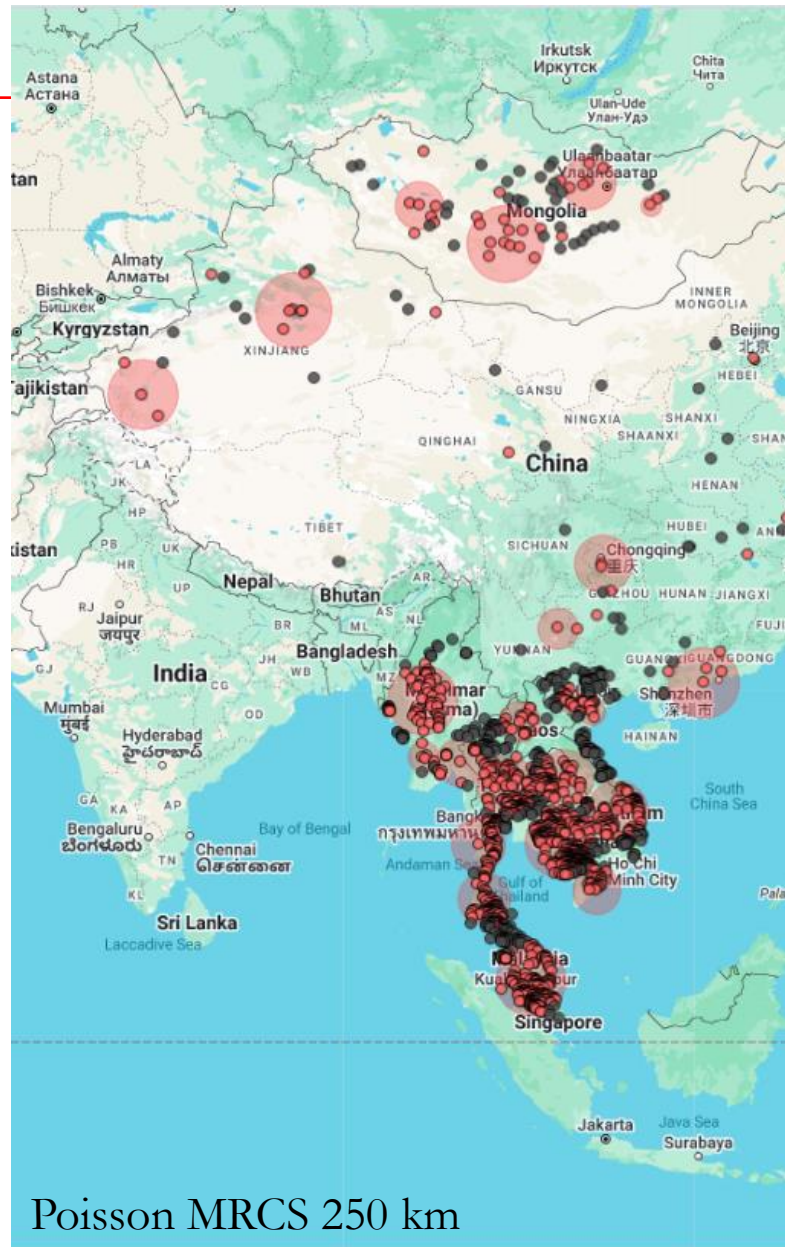
Scanning windows of different sizes are generated and moved across the area to identify clusters of FMD outbreaks.



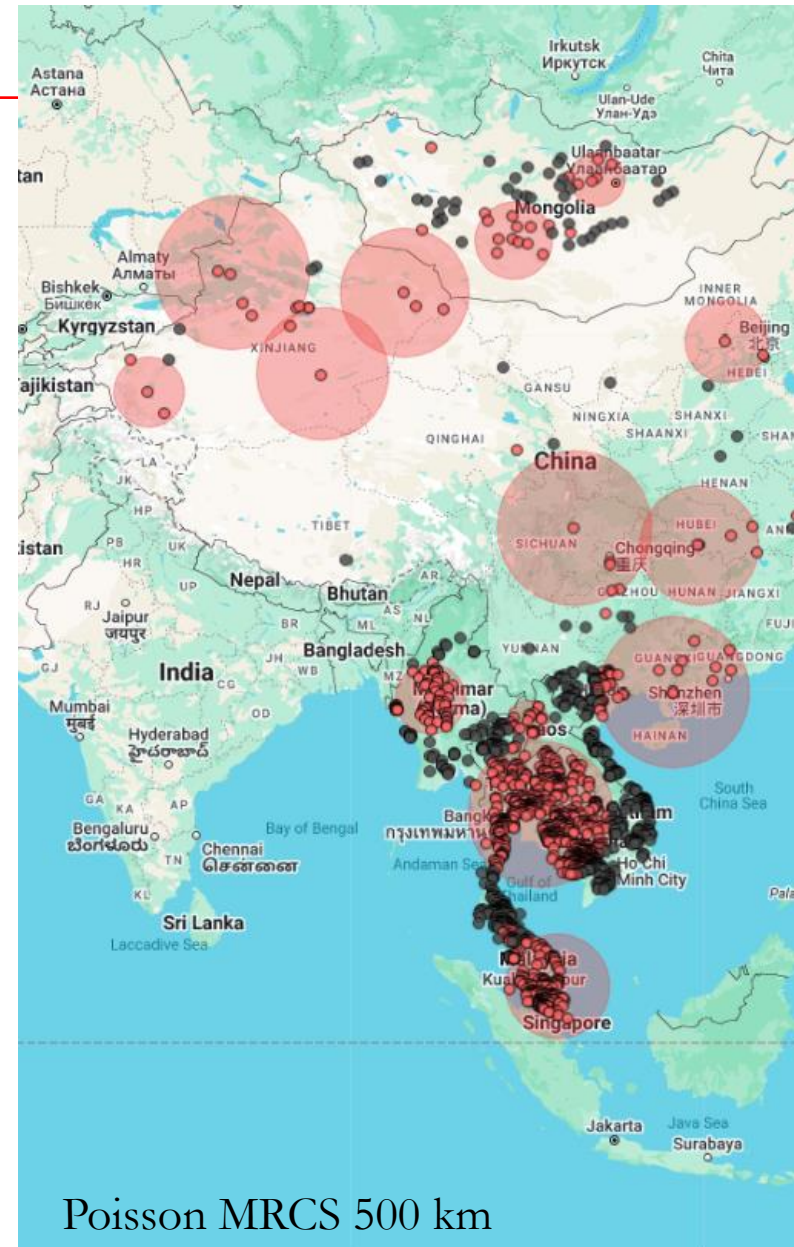
Space-time permutation (STP)



MRCS = Maximum Reported cluster size



Poisson MRCS 250 km



Poisson MRCS 500 km

Space-time permutation (STP)

- Primary and secondary clusters were detected.
- Clusters present in both individual country and multiple countries
- Spread of FMD across countries
- STP require only outbreak location and number of cases

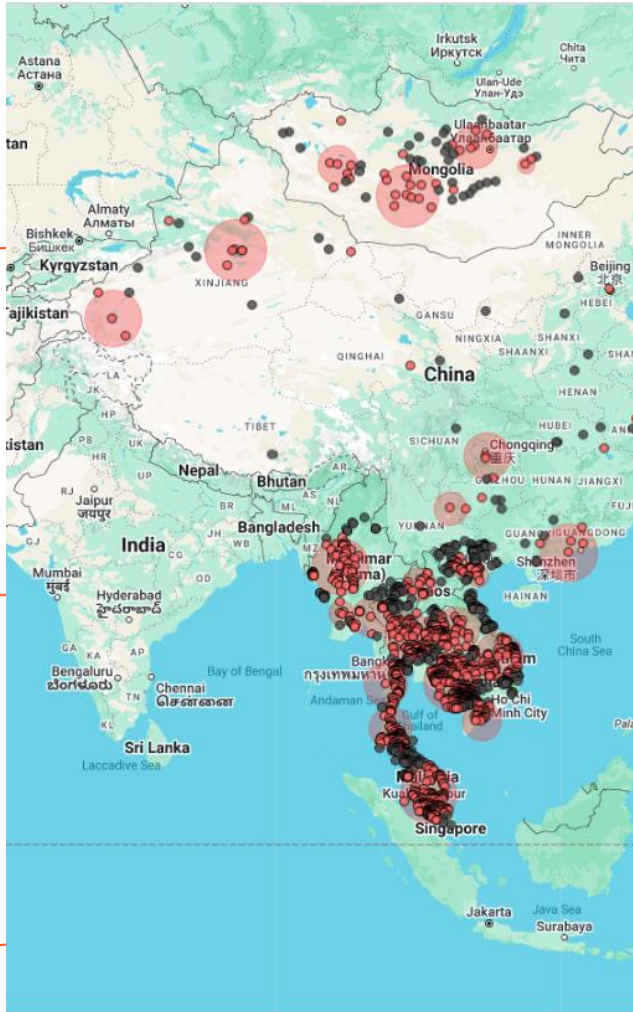


Model	Data	MRCSCoordinates / (km)radius (km)	Time frame	Number of cases	Expected cases	RR	LLR	P-value	
STP	SEAC	250	(45.629000 N, 104.128000 E) / 219.52 km	2021/7/15 to 2021/10/12	31442	5824.94	-	28340.10	< 0.001
	SEAC	500	(49.460000 N, 99.148000 E) / 494.42 km	2021/10/13 to 2022/1/10	150468	73393.63	-	42333.75	< 0.001

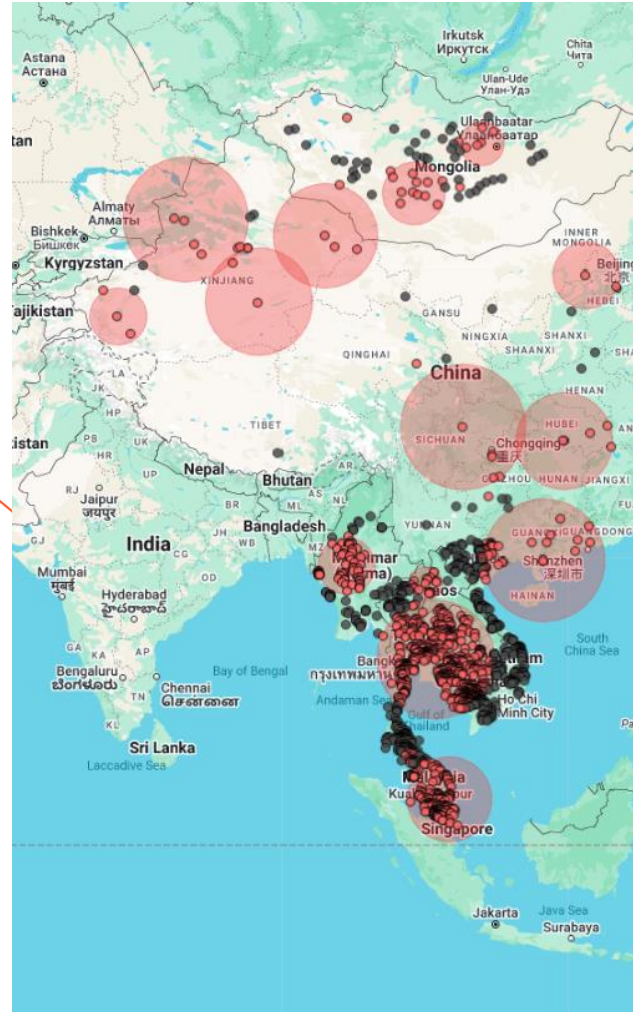
Location IDs are also included in the results, allowing us to identify which farms are in the clusters.



Space-time Poisson

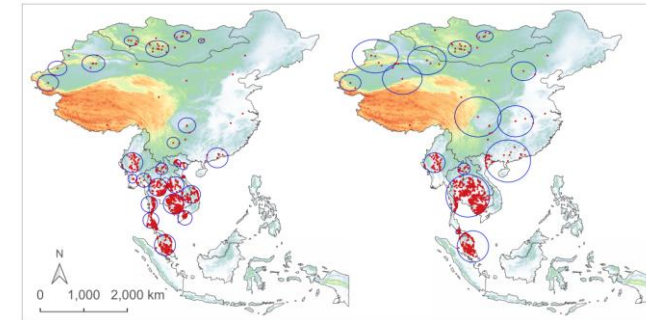


MRCS = 250 km



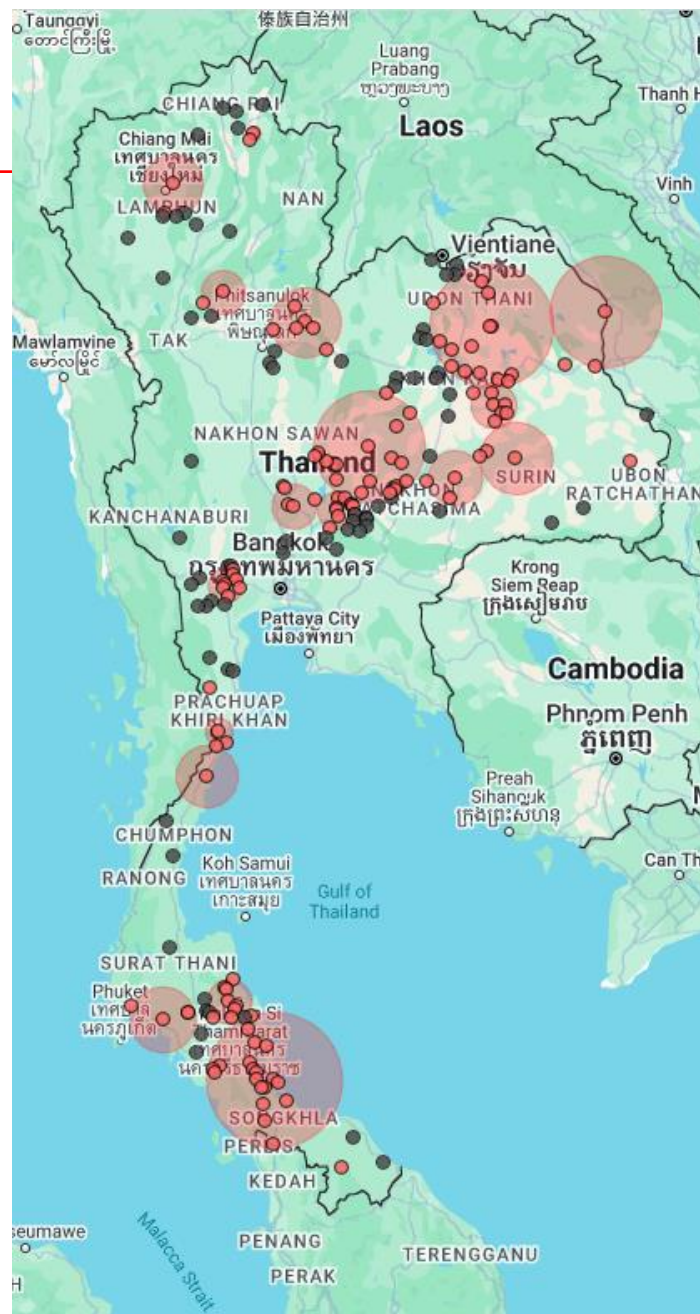
MRCS = 500 km

- Require: the number of cases and population at risk





Thailand : 2020 SPT model



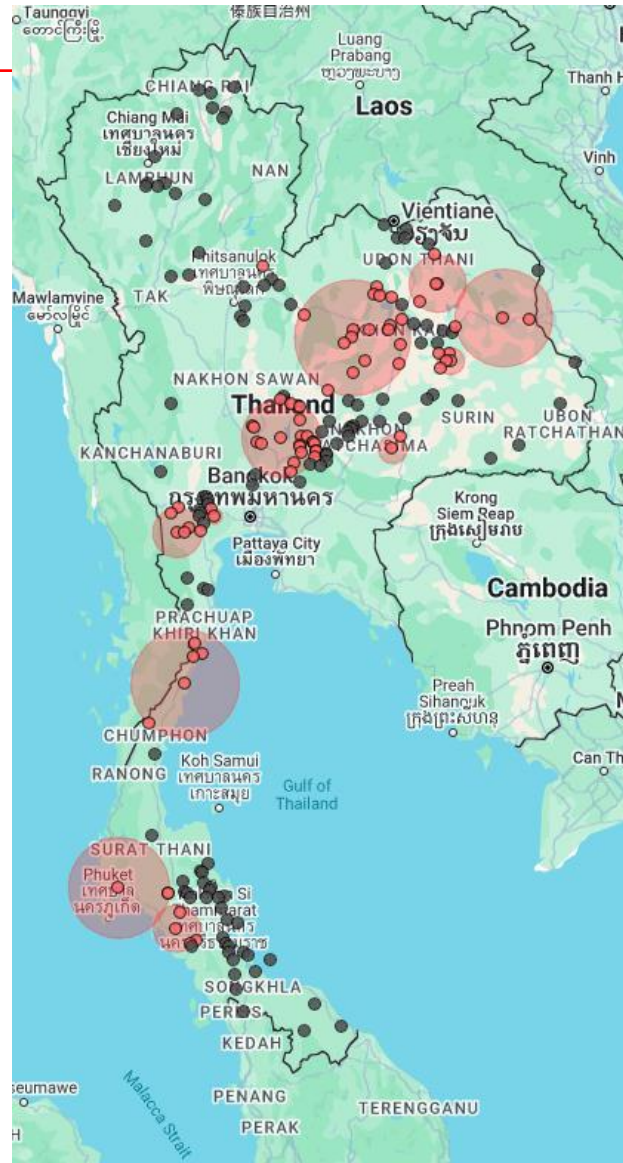
MRCS 100 km



MRCS 250 km



Thailand : 2020 Poisson model



MRCS 100 km



MRCS 250 km

Indonesia: 2023

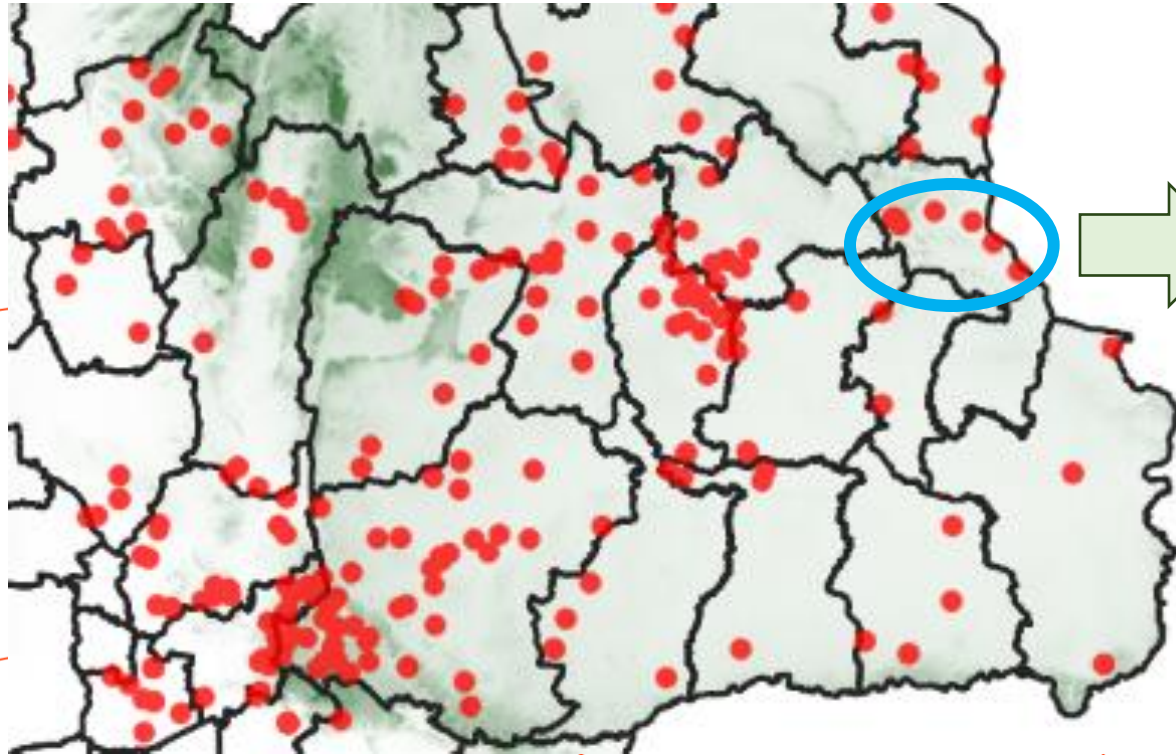
- 2022: 27 reports
2023: 119 reports
- No population at risk data





Points need to be concerned for analyses and interpretation

- Outbreak units vary in how they are reported: farm, village, district, subdistrict.
- Geographical coordinates vary: either centroid of the outbreak areas (many farms, but only one coordinate is used) or the actual farm location (coordinate of each farm) is reported.
- Determination of population at risk (e.g., population from only survey farms or farms in the outbreak areas).

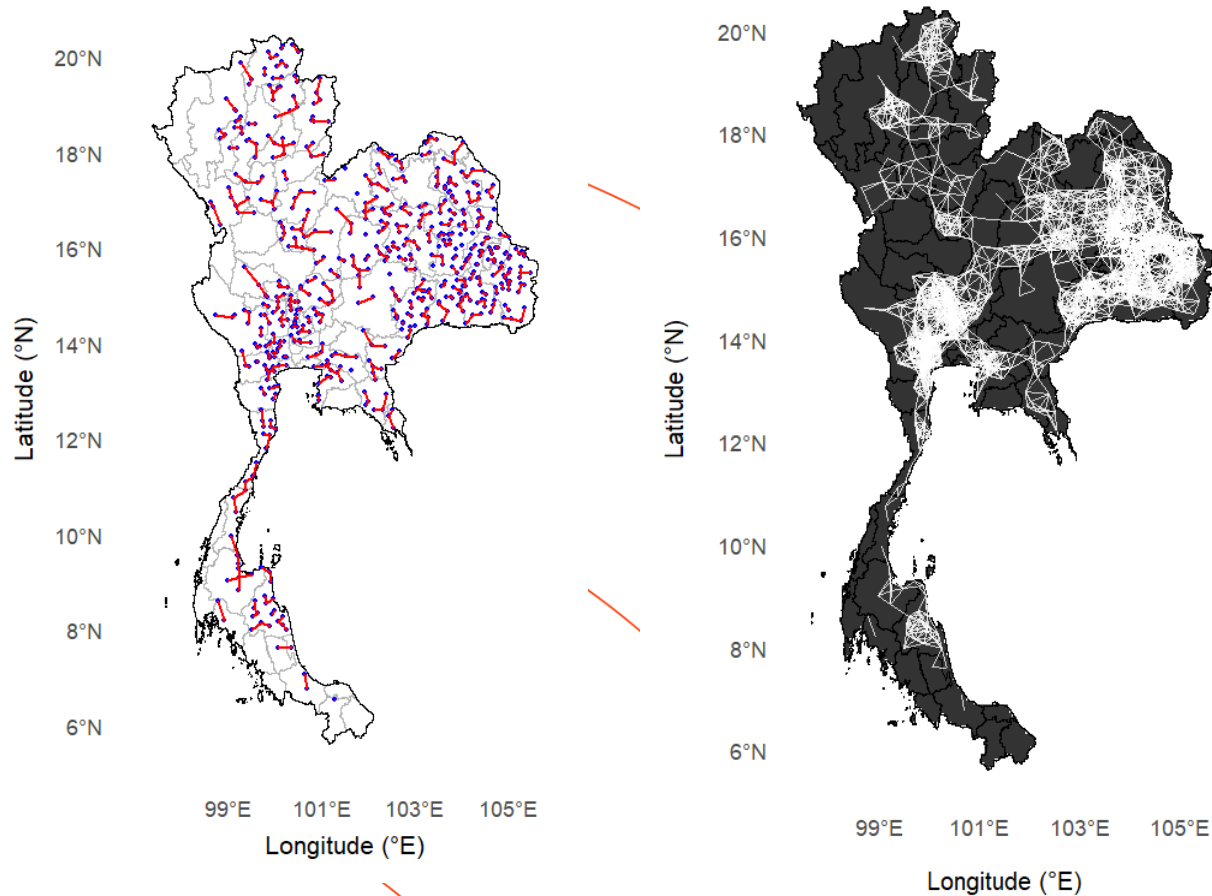


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- If farm location is used, there are 6 data points (= 6 outbreaks)
 - If centroid is used, there is only one data point (= 1 outbreak)
 - For example, 250 outbreak farms may be recorded as 1 outbreak or 250 outbreaks
 - **Both of location and centroid found in the data thus affecting the analysis.**

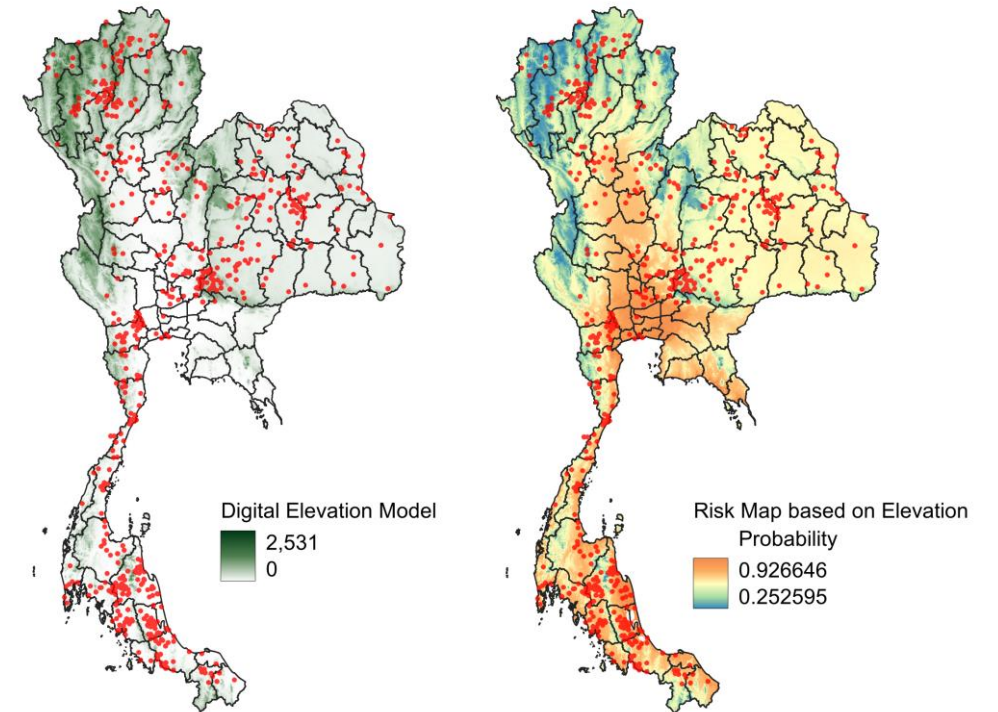


Ongoing analyses

1. Proximity characteristics among outbreak locations



2. Risk map: suitability factors for FMD outbreaks





Acknowledgements

- **World Organisation for Animal Health (WOAH)**
- **Ministry of Agriculture and Rural Affairs (MARA) of the People's Republic of China**