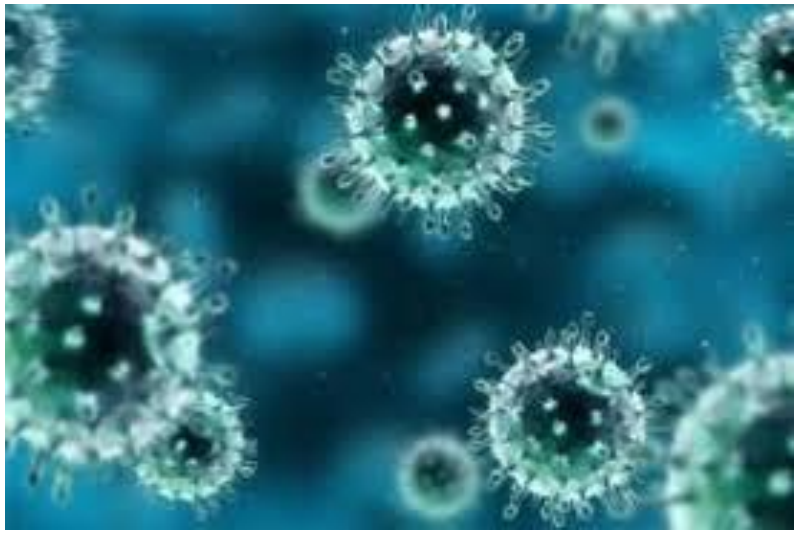
Tempering the Spread of Epidemics on Aerial Networks

Group 38 : Amaury Combes, Alexandre Daeniker, Manuel Faysse & Alexis Montavon

A Network tour of Data Science, January 2019

A new type of infectious disease breaks out in Geneva, and contaminates a small part of the population. With every passing day, the epidemic spreads across the globe...



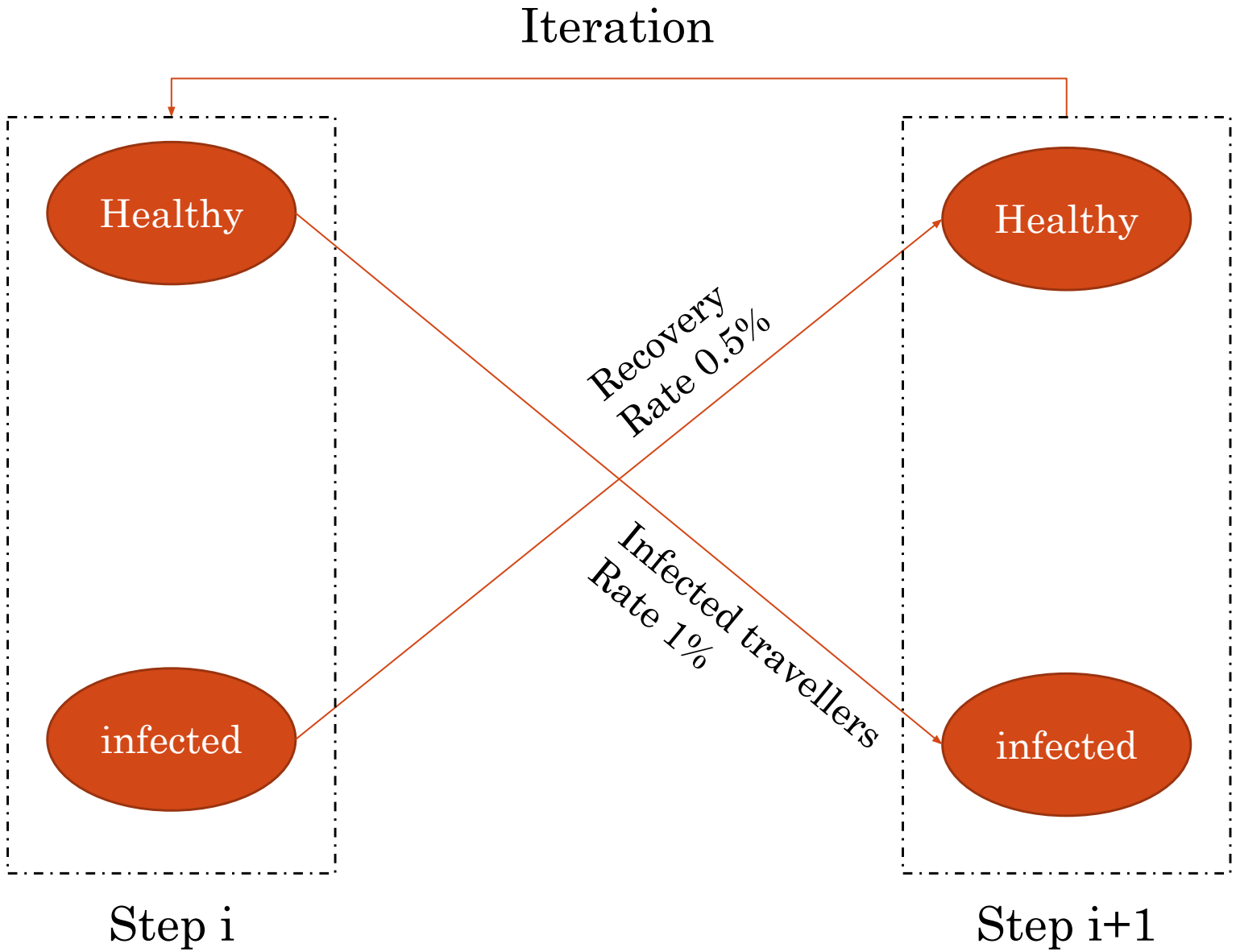
Goal :

find a way to reduce the spreading while keeping a good efficiency in the aerial network

Graph specification

- Number of airport : 3143
- Number of flight : 18586
- Diameter : 12
- Average shortest path length : 3.95
- Average degree : 21.038

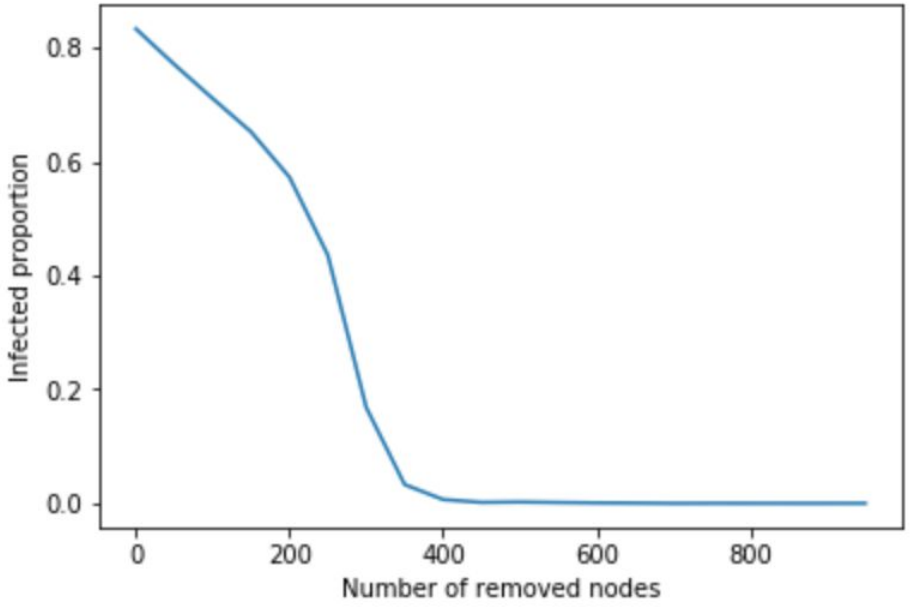
Pandemic model : SIS model



The naive approach

Deleting nodes by degree carefree of the network's connectedness

- Diameter : ∞
- Average shortest path length : ∞



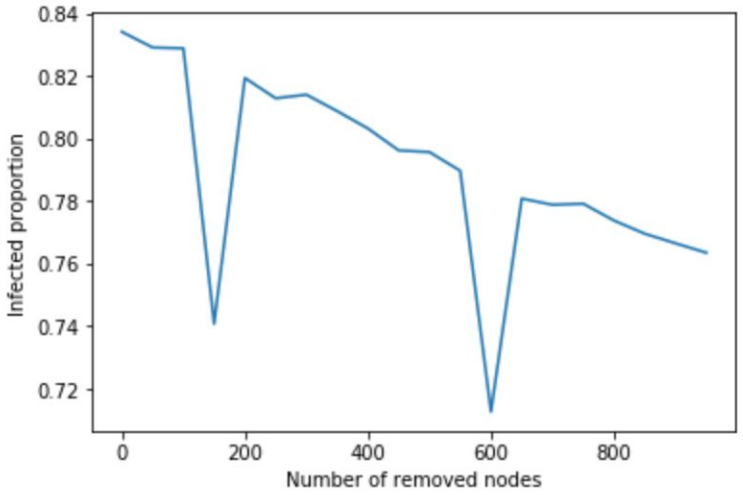
Modify the network, How?

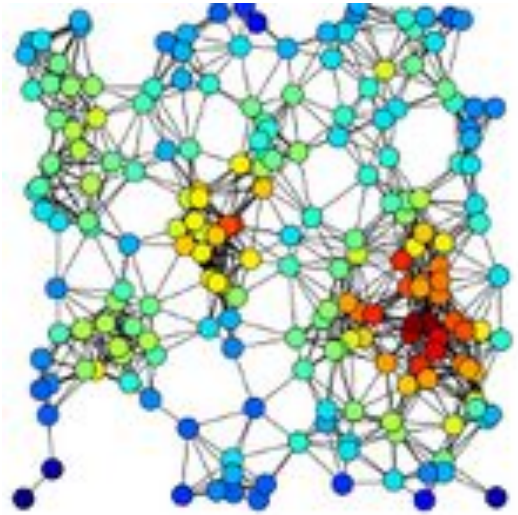
Deleting nodes according to 3 different criteria :

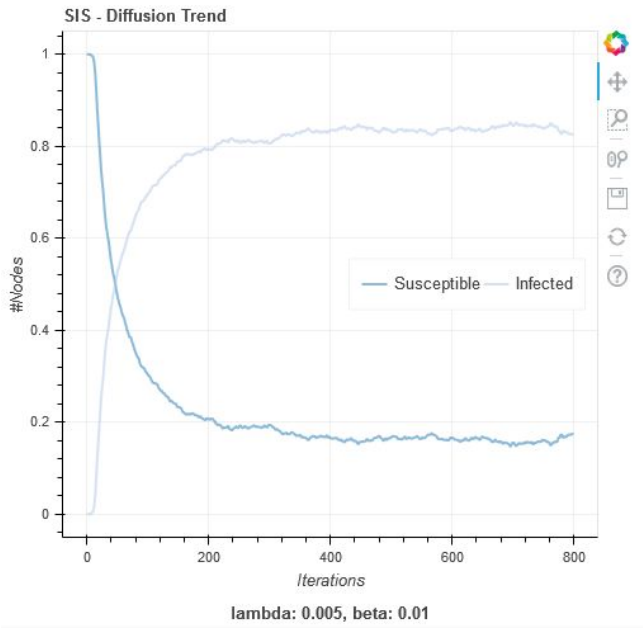
- Degree centrality : number of connected nodes per node
- Betweenness centrality : number of "shortest path" passing by a node
- Closeness centrality : average of shortest path length for a node to all the others ones

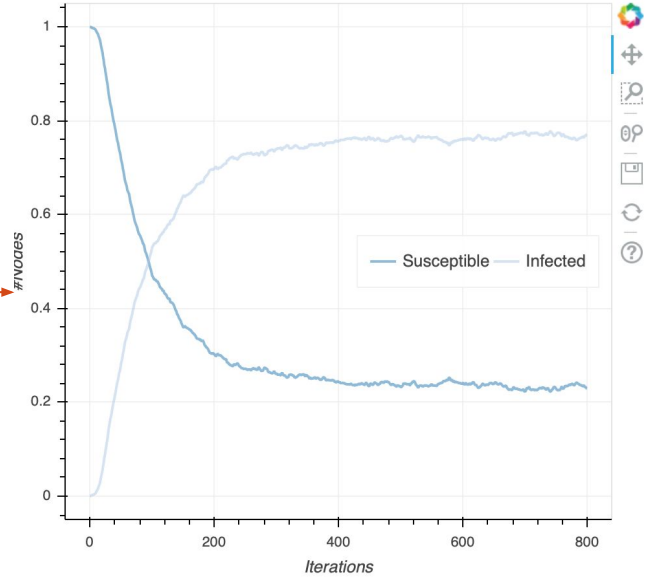
Centrality Used : Degree

- Diameter : 24
- Average shortest path length : 4.718
- Average degree : 4.823



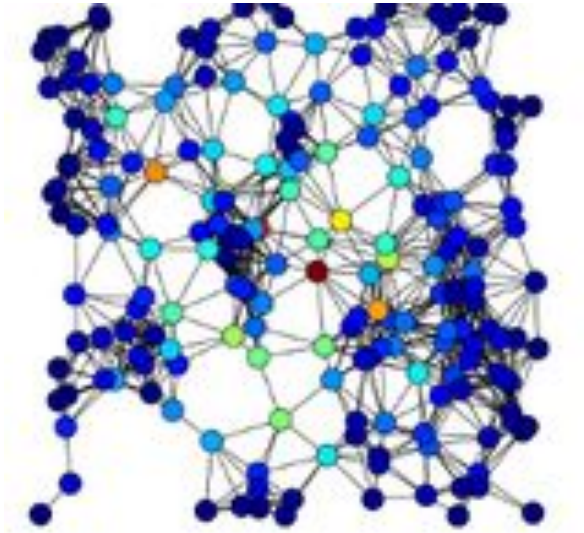


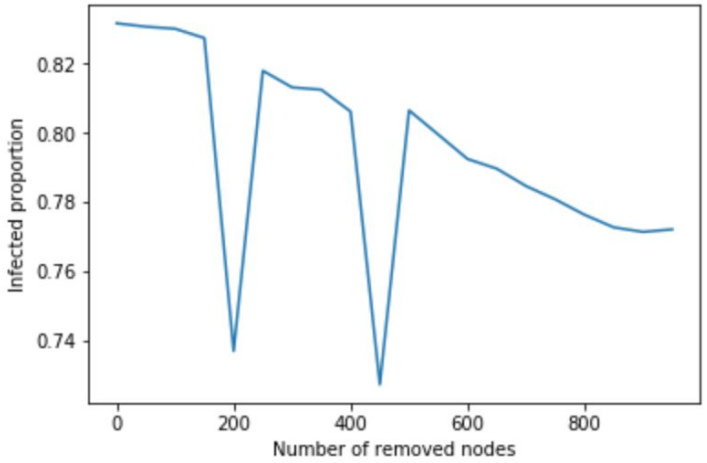


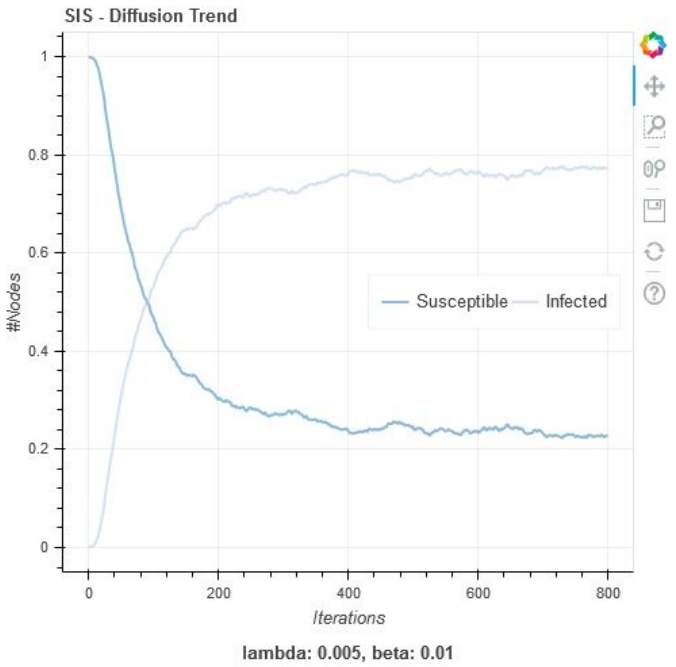


Centrality Used : Betweenness

- Diameter : 24
- Average shortest path length : 4.459
- Average degree : 8.729

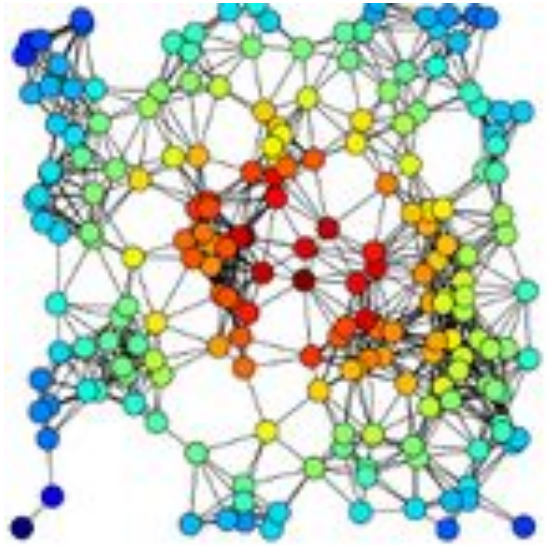


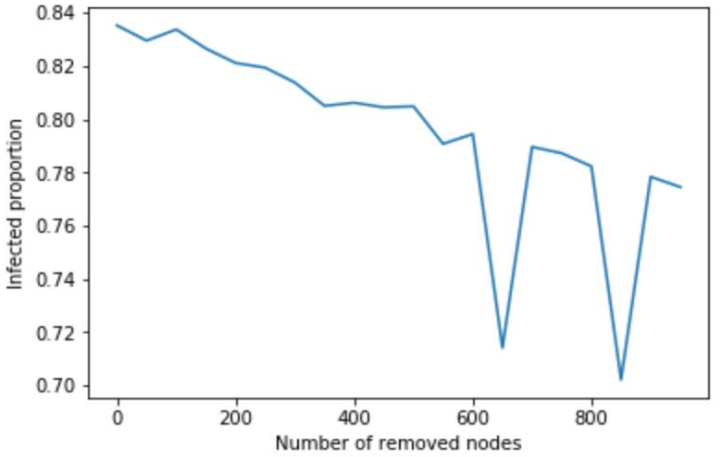


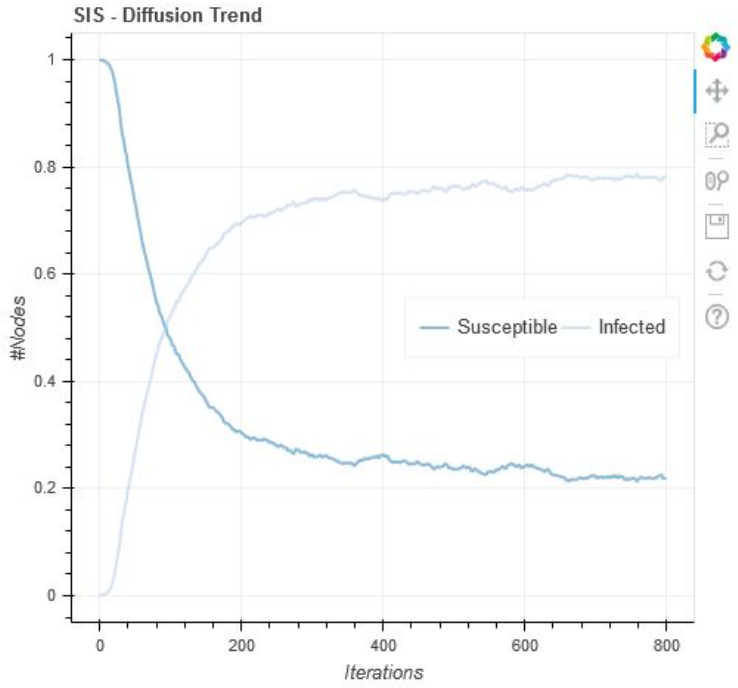


Centrality Used : Closeness

- Diameter : 21
- Average shortest path length : 4.725
- Average degree : 5.377

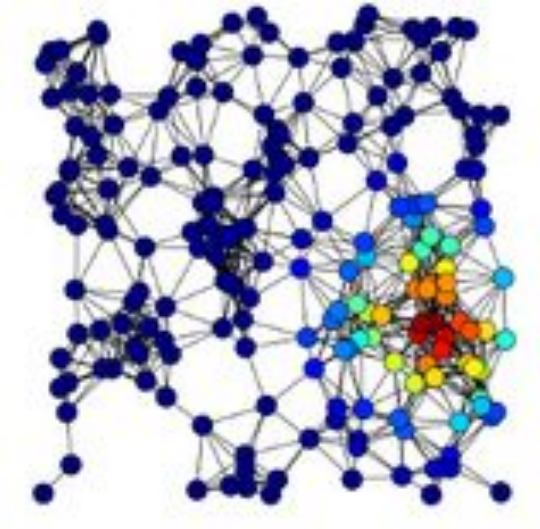


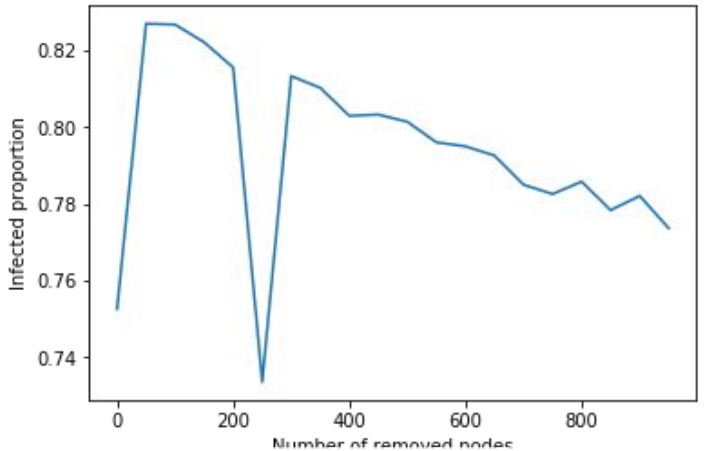


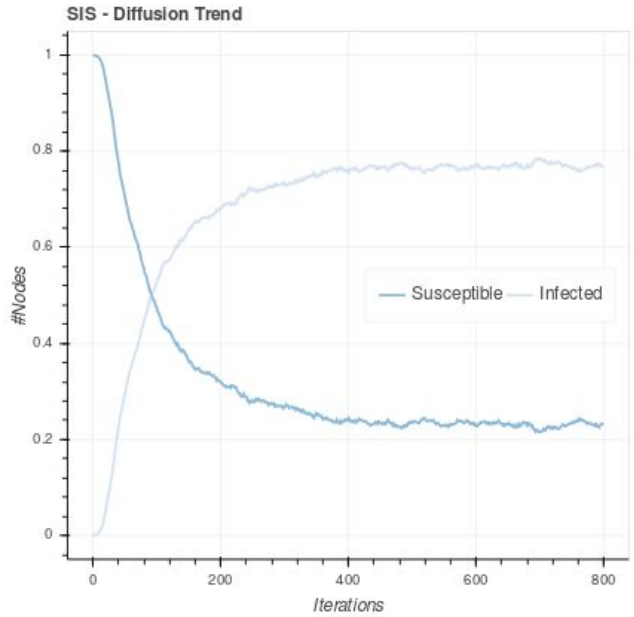


Centrality Used: Eigenvector

- Diameter : 18
- Average shortest path length : 4.65
- Average degree : 5.24

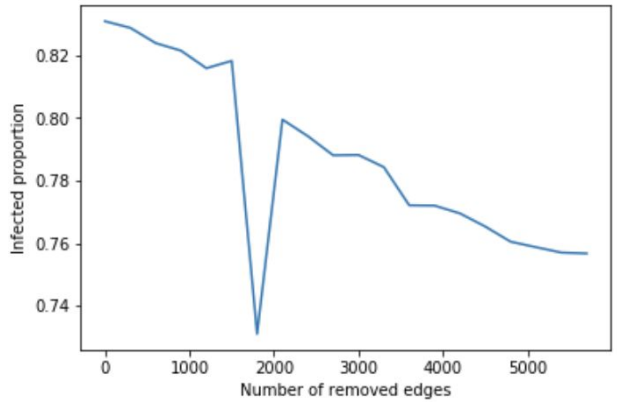


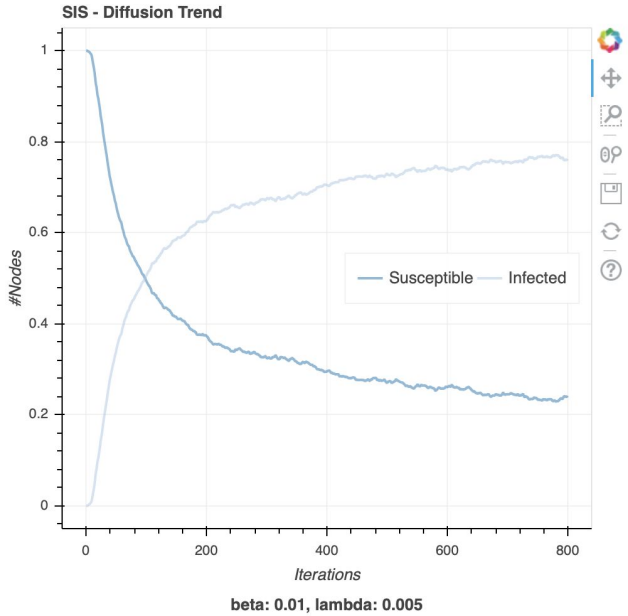




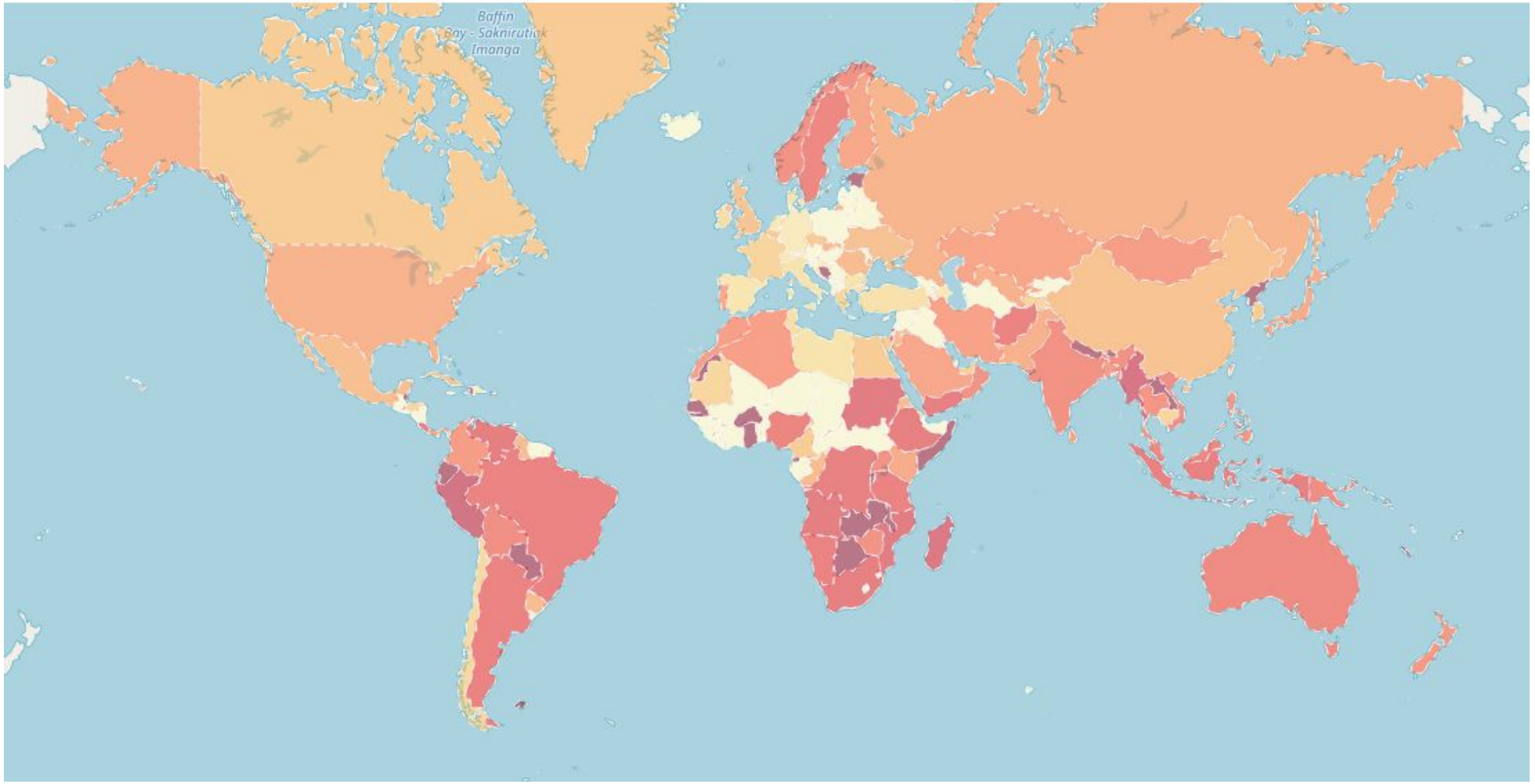
Removing edges w/ betweenness

- Diameter : 26
- Average shortest path length : 6.495
- Average degree : 15.155





Infection Map



Thank you for your attention