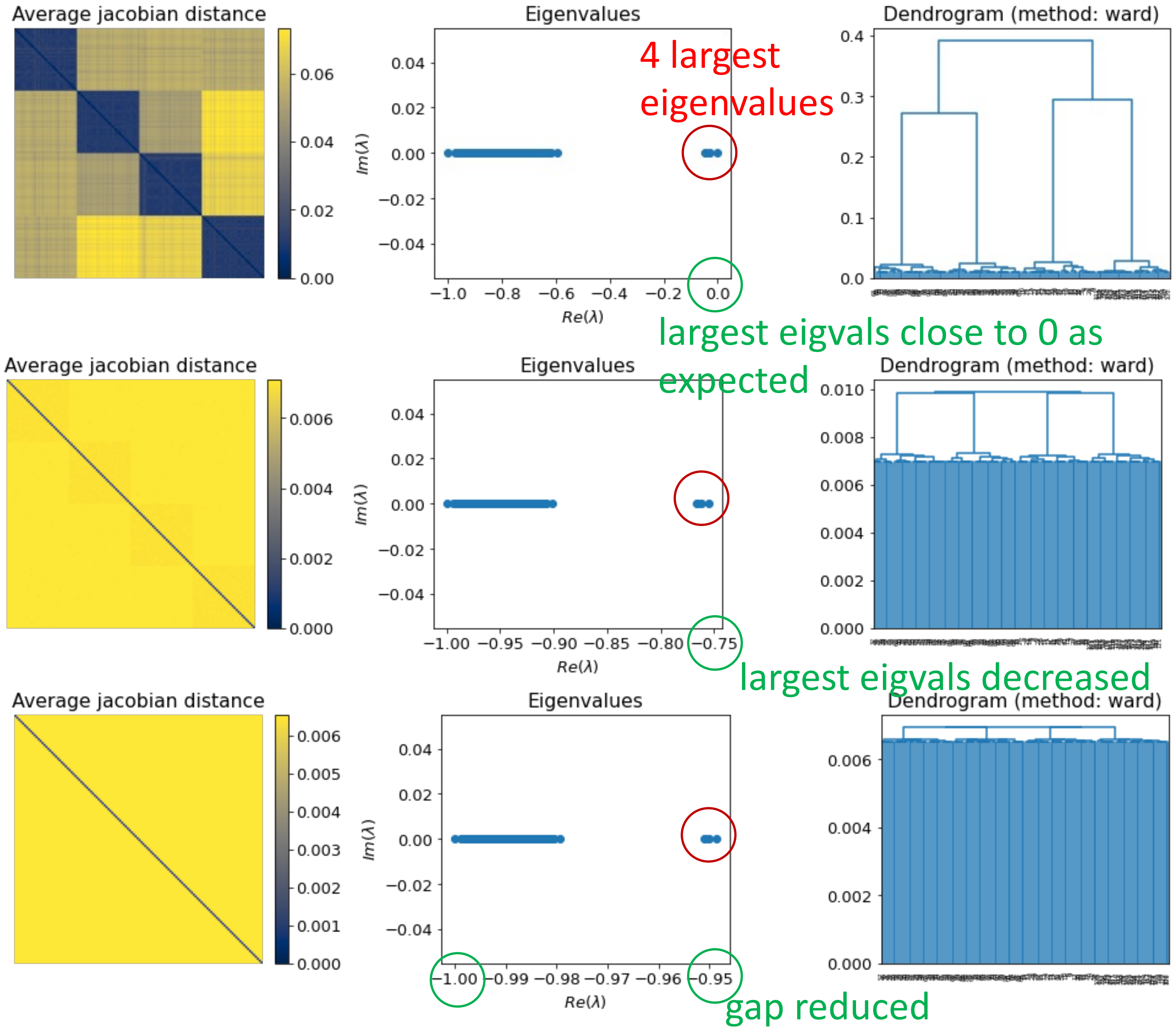
Voter model

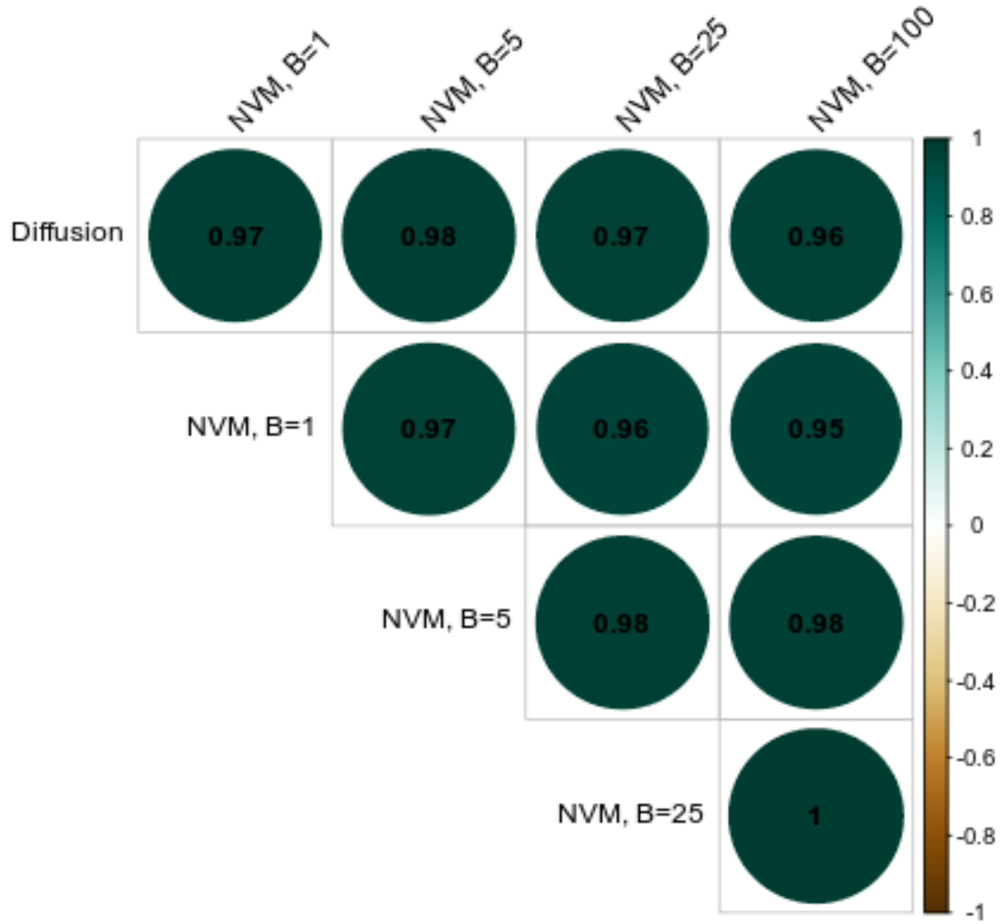
$$\frac{\mathrm{d}x_i}{\mathrm{d}t} = A - Bx_i + \frac{C}{k_i}\sum_{j=1}^{N} A_{ij}x_j$$

B=1

B=5

B=25





by increasing B:

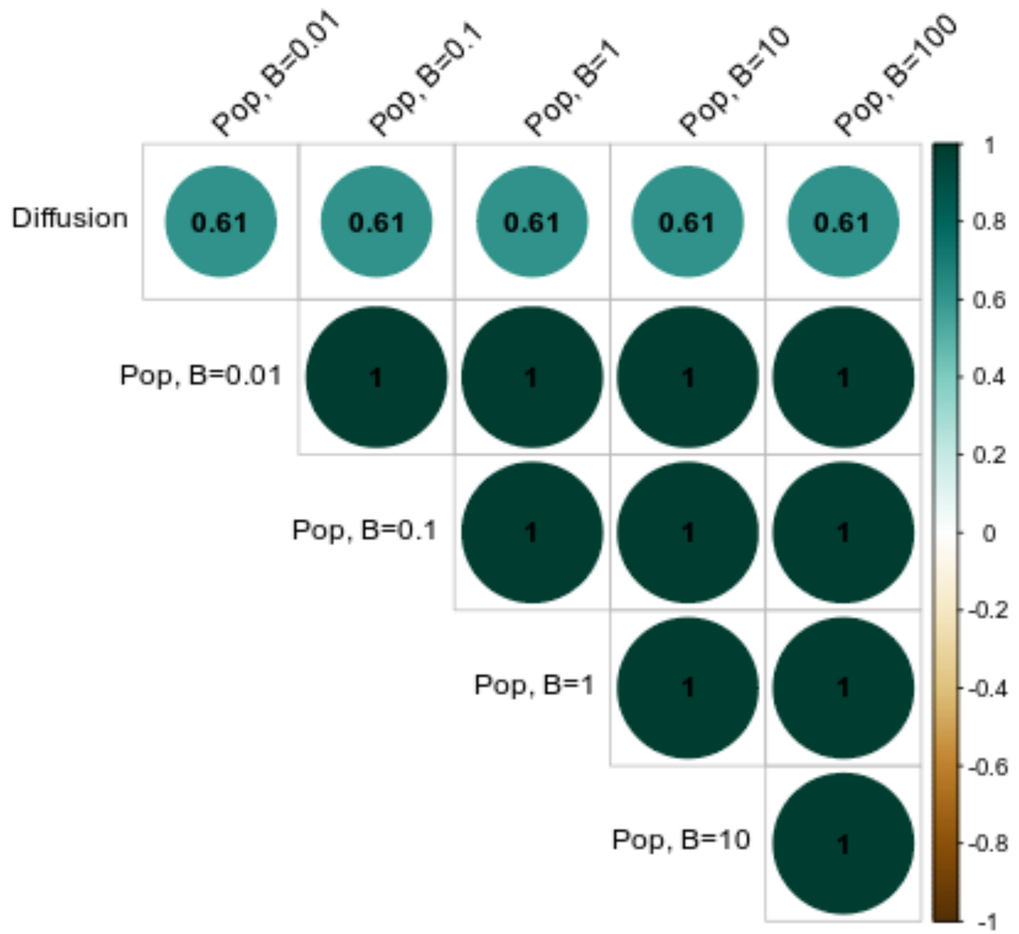
- smaller gap btw 4 largest eigenvalues
- smaller height of first levels in dendrogram
- BUT still feeling the structural communities (see corrplot of cophenetic coefficient)

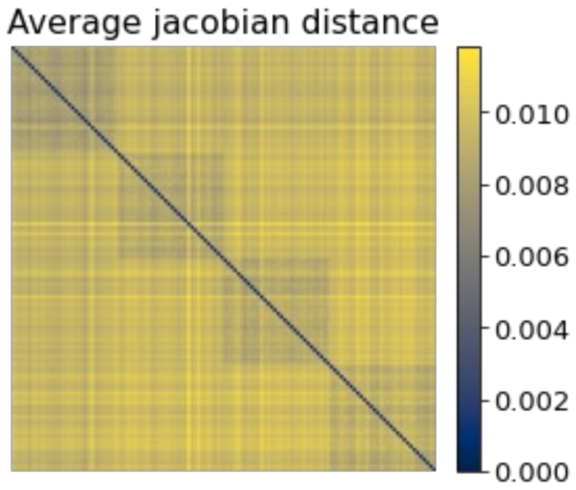
$\Rightarrow$ no qualitative change

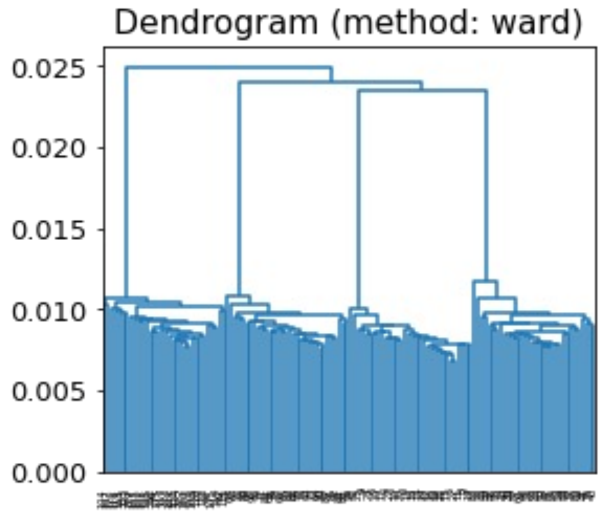
Population dynamics

$$\frac{\mathrm{d}x_i}{\mathrm{d}t} = -Bx_i^b + R\sum_{j=1}^{N} A_{ij}x_j^a$$

b=2, a=1







⇒ insensitive to B – always feeling the communities (as in Voter model)
BUT no complete accordance with diffusion distance (corr=0.61) -> different communities (?)
(maybe because interaction with neighbours is not normalized by the degree, as in the random walk dynamics??)

Epidemics (SIS dynamics)

$$\frac{\mathrm{d}x_i}{\mathrm{d}t} = -Bx_i + R\sum_{j=1}^{N} A_{ij}(1-x_i)x_j$$

- If $R \gtrsim B \rightarrow x_i$ large

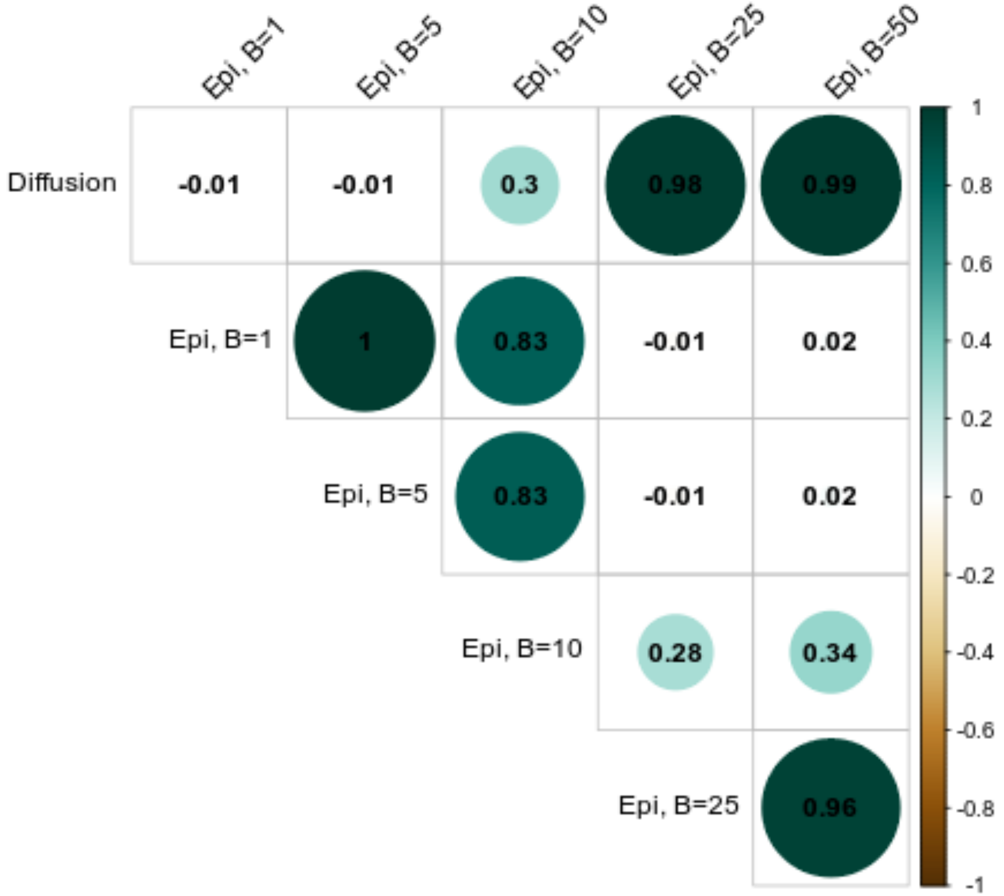
$$\frac{\mathrm{d}x_i}{\mathrm{d}t} \approx -Bx_i$$

not depends on the topology

- If $R \ll B \rightarrow x_i$ small

$$\frac{\mathrm{d}x_i}{\mathrm{d}t} \approx -x_i + \frac{1}{k_i}\sum_{j=1}^{N} A_{ij}x_j$$

diffusion-like dynamics (jacobian is equal to -laplacian)



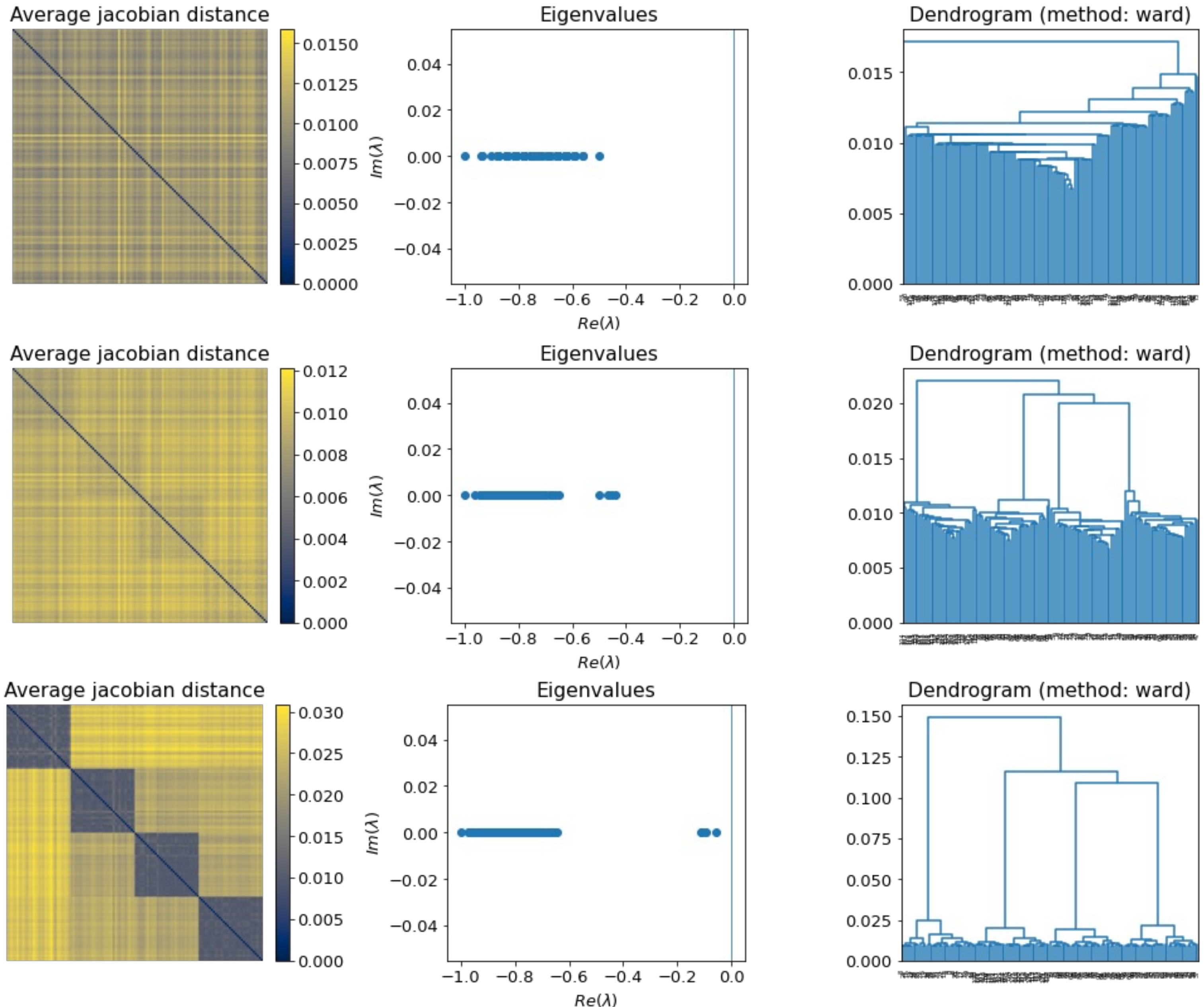
- x large = lot of infects => less sensitive to topology (low corr with diffusion distance)
- x small = few infects => more sensitive to topology (high corr with diffusion distance)

Epidemics (SIS dynamics)

B=1

B=10

B=25



by increasing B:

- larger gap btw 4 largest eigenvalues

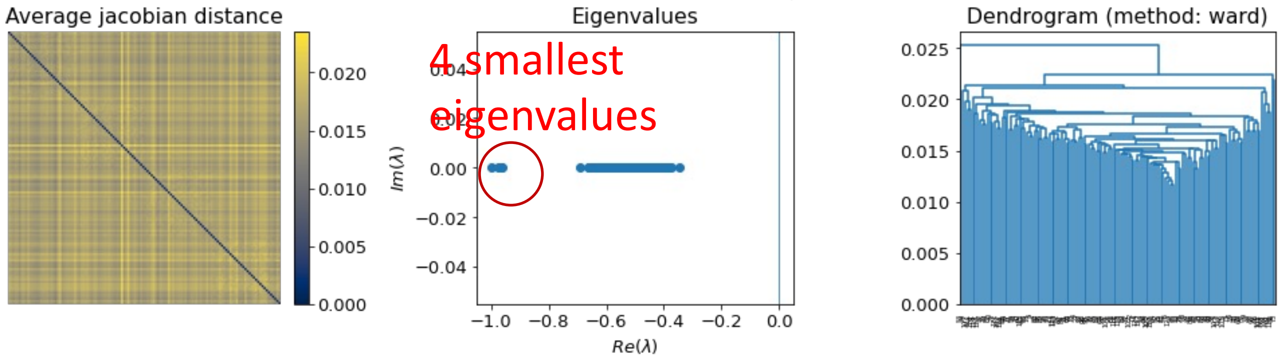
$\Rightarrow$ qualitative change

from not feeling the communities to feeling the communities

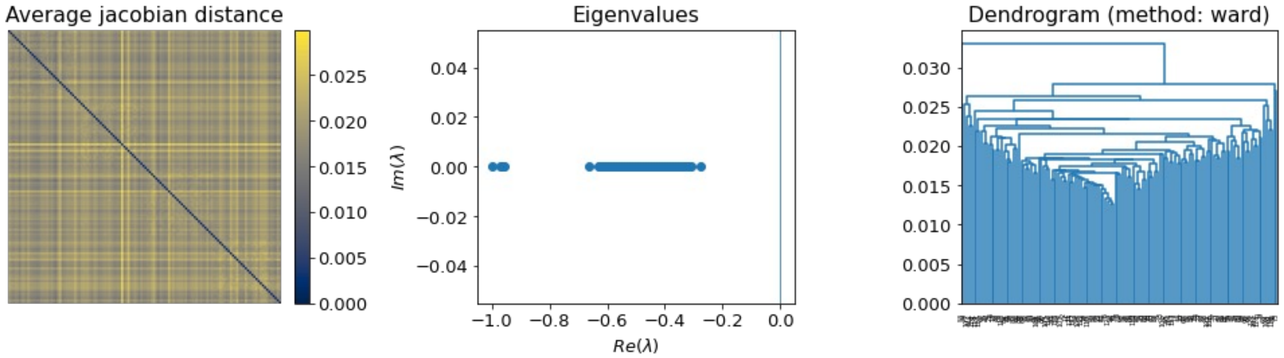
Biochemical dynamics (Mass-action kinetics)

$$\frac{\mathrm{d}x_i}{\mathrm{d}t} = F - Bx_i - R\sum_{j=1}^{N} A_{ij}x_ix_j$$

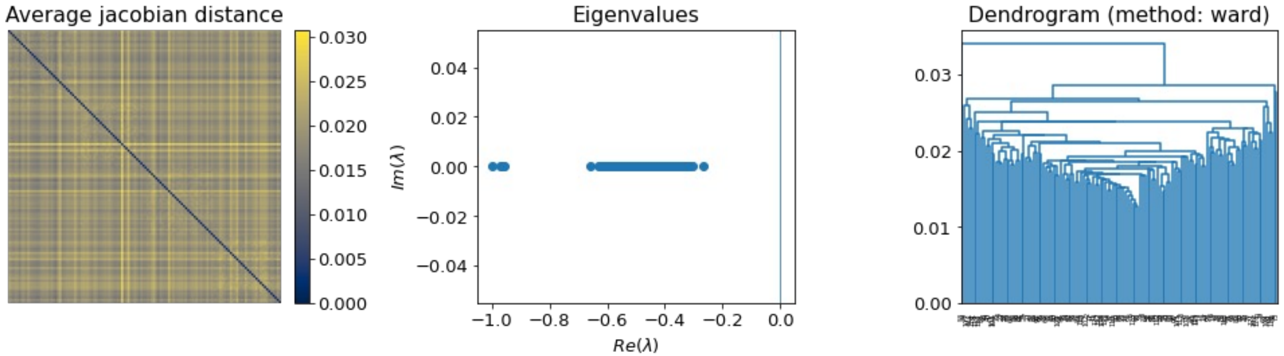
B=1

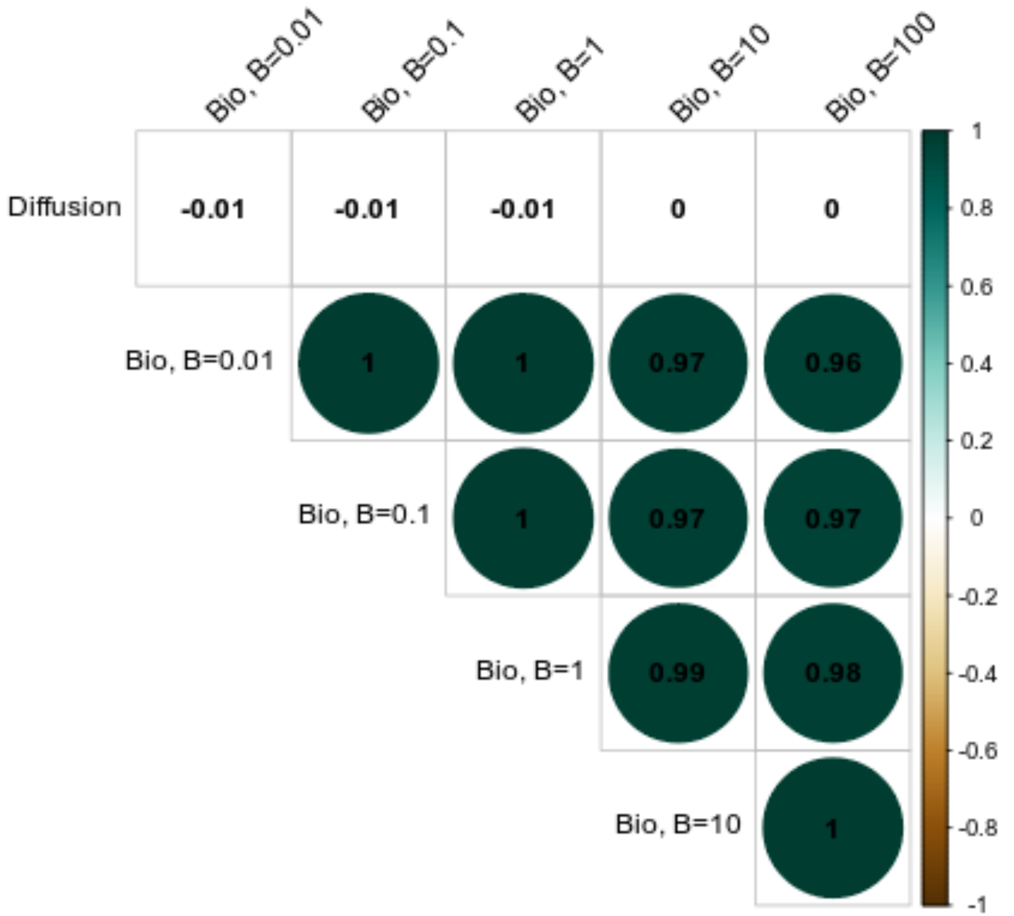


B=0.1



B=0.01

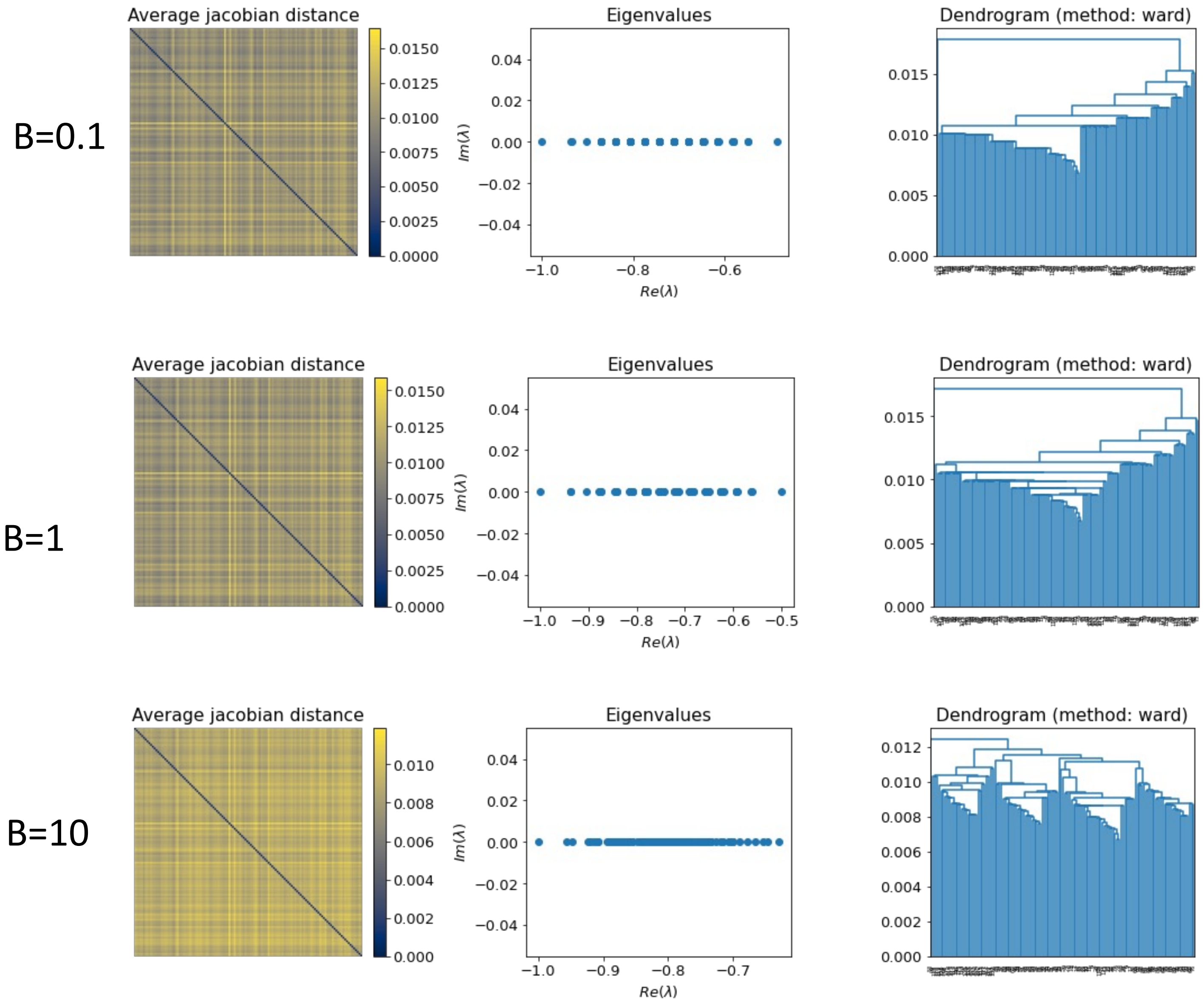


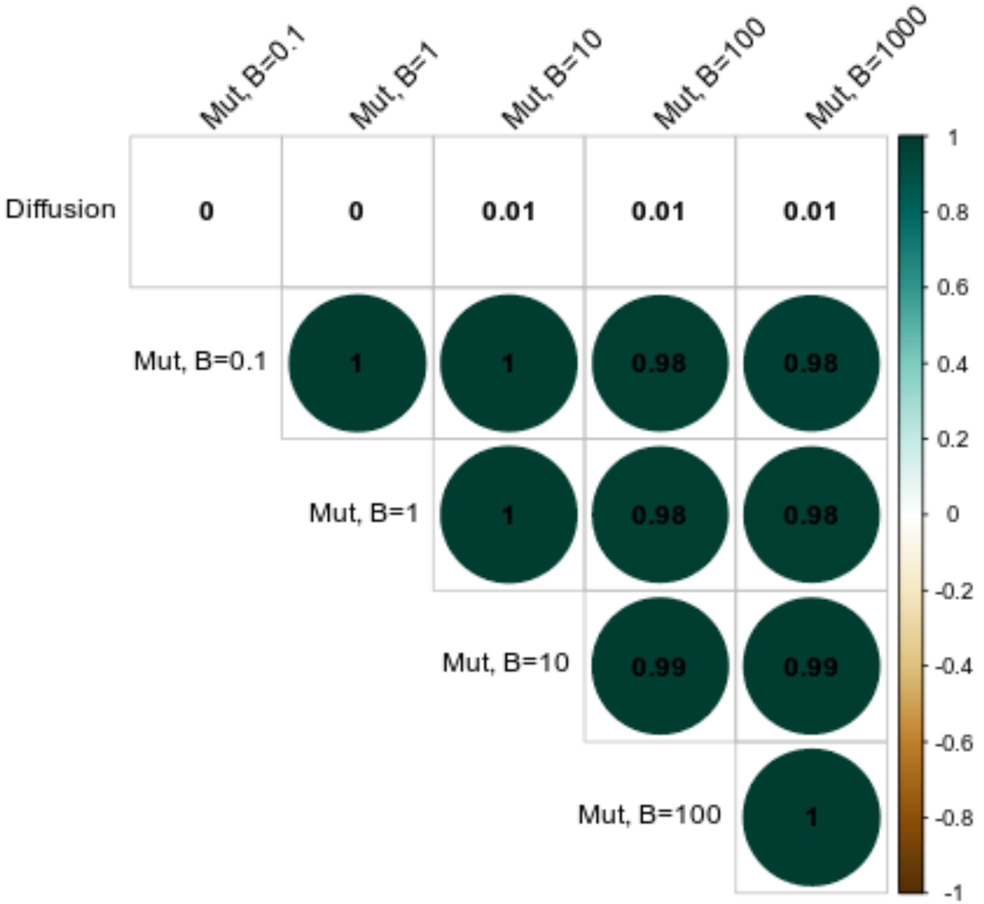


$\Rightarrow$ insensitive to B
not feeling the communities

Mutualistic dynamics

$$\frac{\mathrm{d}x_i}{\mathrm{d}t} = Bx_i(1-x_i) + R\sum_{j=1}^{N} A_{ij}x_i\frac{x_j^b}{1+x_j^b},$$





$\Rightarrow$ insensitive to B
not feeling the communities

Regulatory

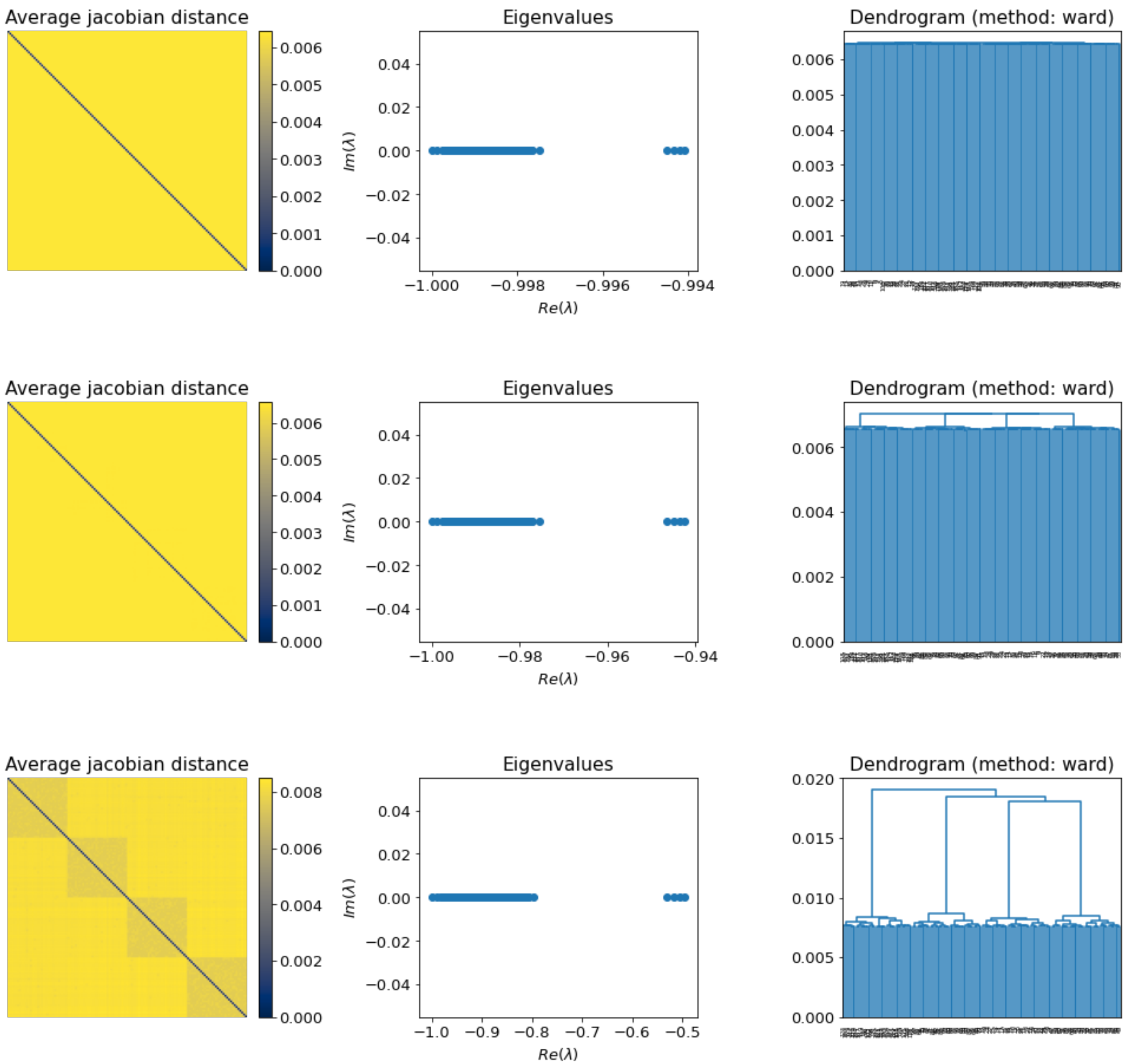
$$\frac{\mathrm{d}x_i}{\mathrm{d}t} = -Bx_i^a + R\sum_{j=1}^{N} A_{ij}\frac{x_j^h}{1+x_j^h}$$

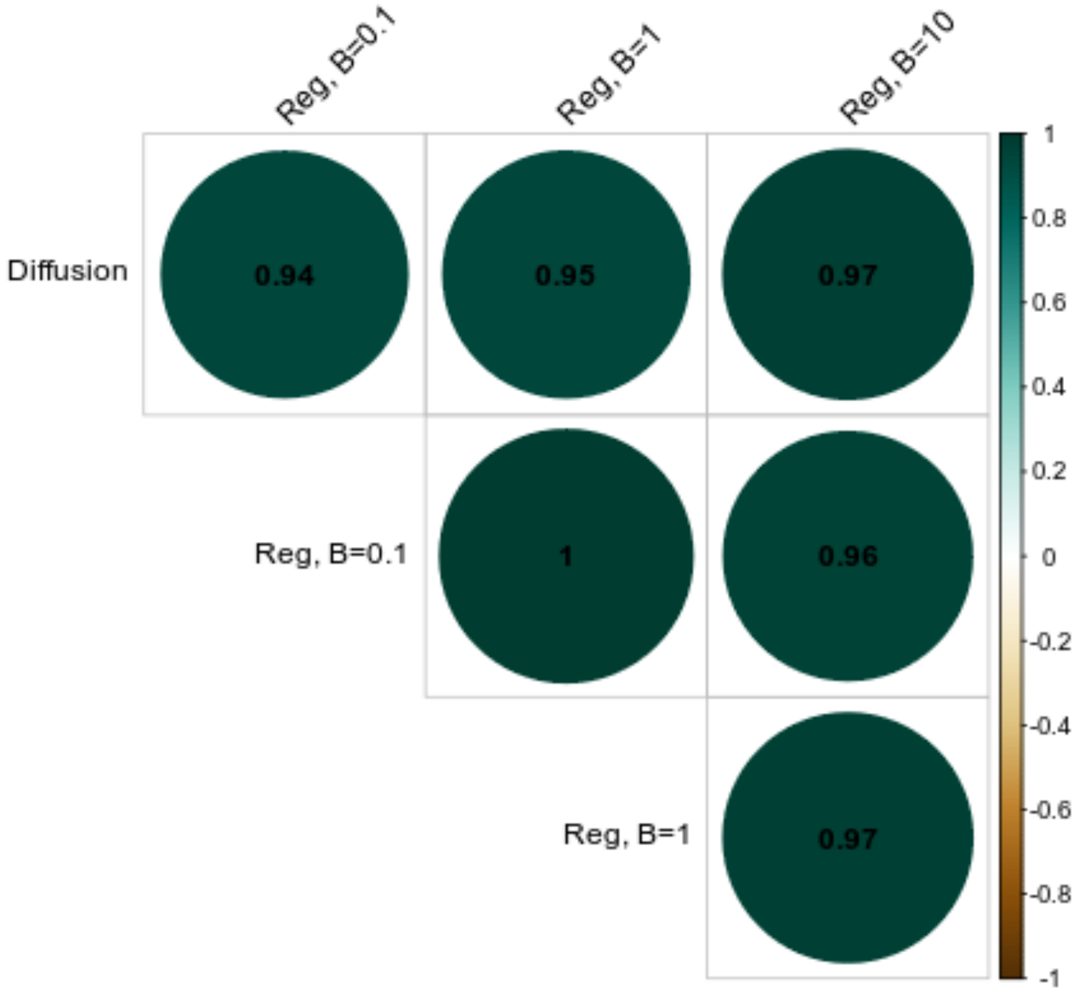
a=1, h=1

B=0.1

B=1

B=10





$\Rightarrow$ insensitive to B – always feeling the communities - as diffusion distance

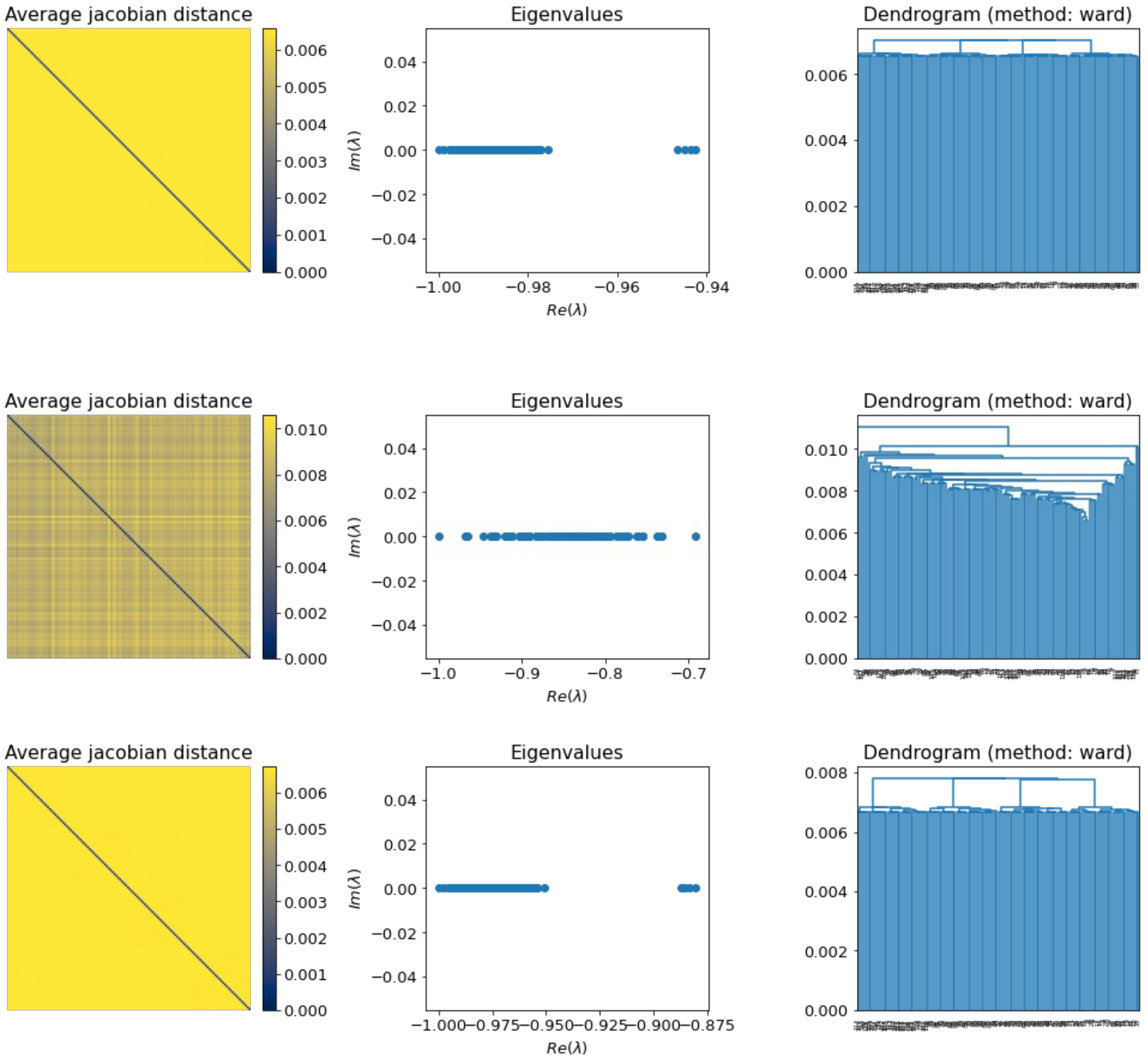
Regulatory – changing exponents

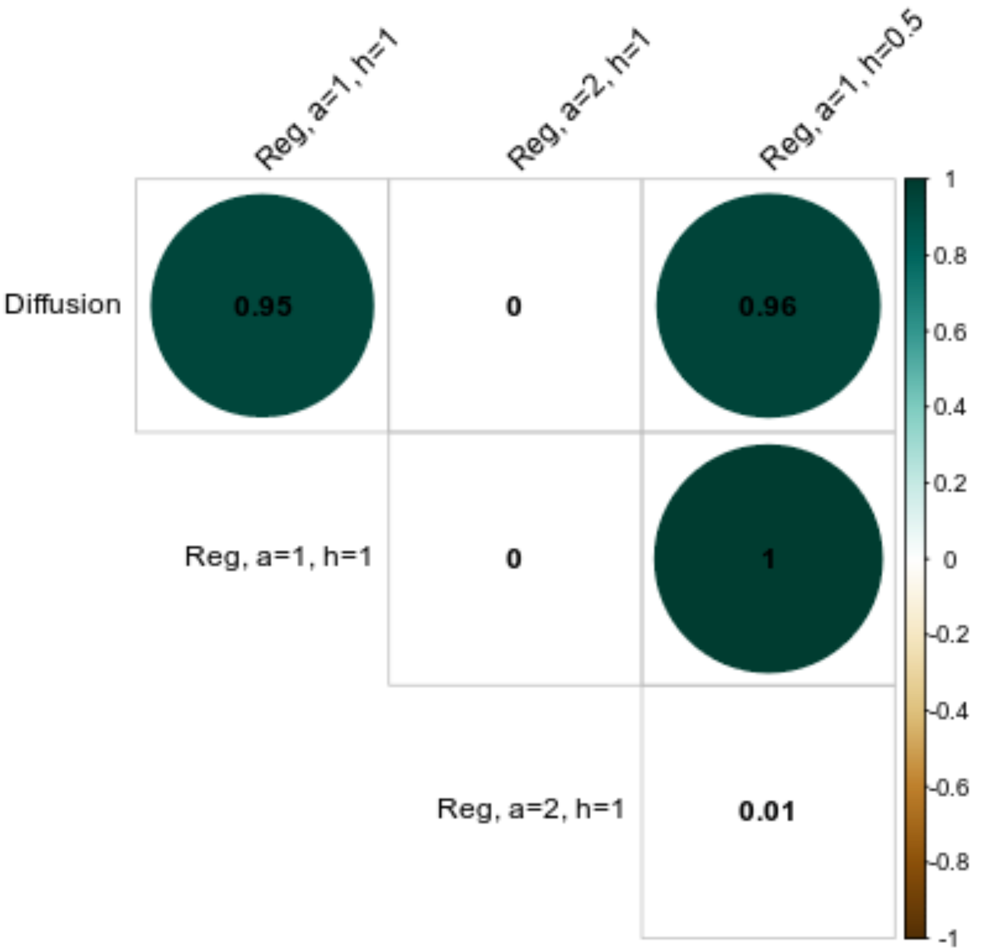
$$\frac{\mathrm{d}x_i}{\mathrm{d}t} = -Bx_i^a + R\sum_{j=1}^{N} A_{ij}\frac{x_j^h}{1+x_j^h}$$

a=1, h=1

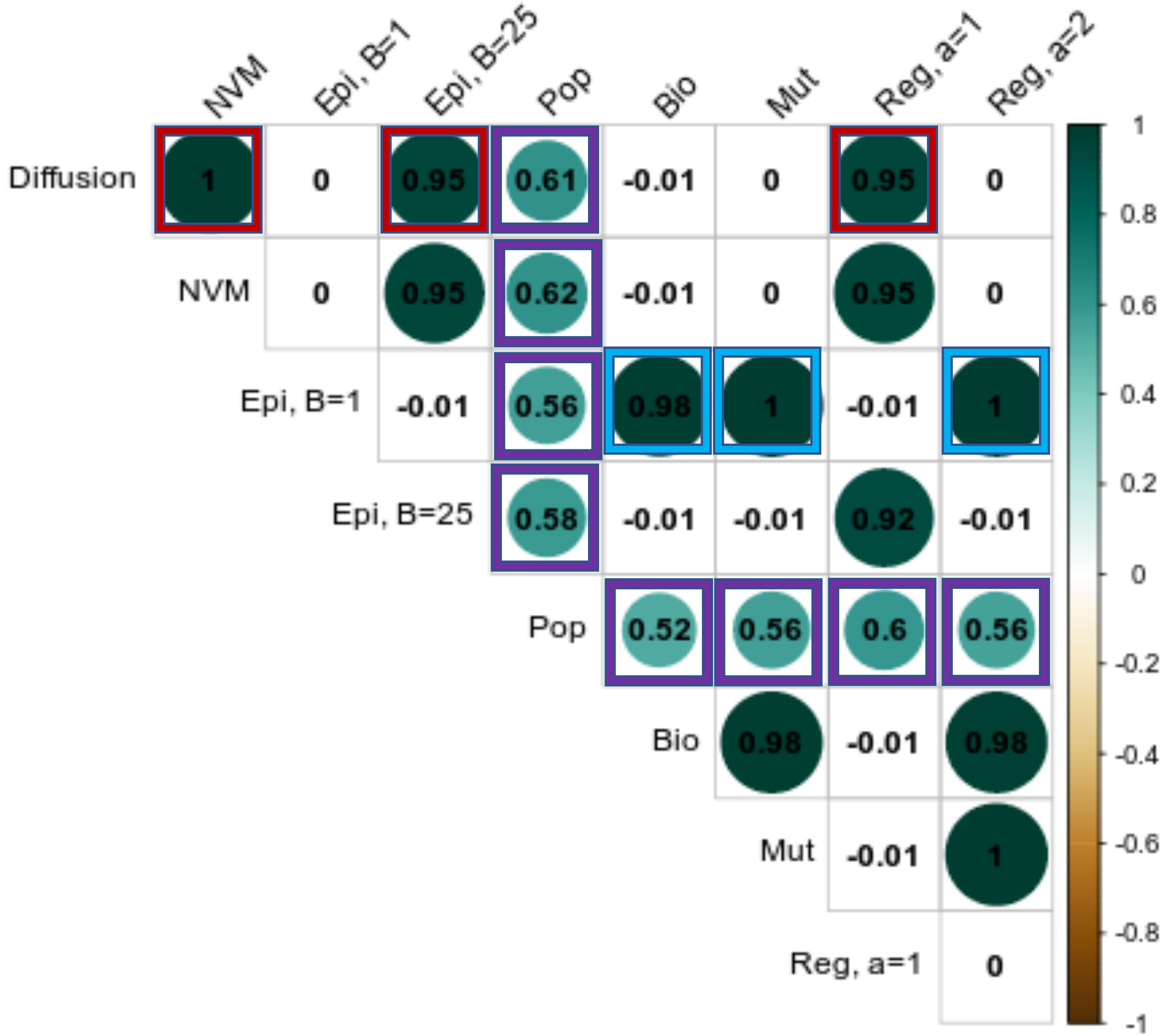
a=2, h=1

a=1, h=1/2





Comparison btw all dynamics



COMMUNITY LOVERS
diffusion, noisy voter model,
epidemics - high B, regulatory - a=1

COMMUNITY HATERS
epidemics - low B, biochemical,
mutualistic, regulatory - a=2

COMMUNITY AGNOSTICS
population