JING LI, The University of Western Ontario

An epidemic model with non-local infections on a patchy environment

With the assumptions that the infectious disease has a fixed latent period and the individuals in the latent period may disperse, we formulate an SIR model for a population living in an n-patch environment (cities, towns, or countries, etc.). The model is given by a system of delay differential equations with a fixed delay accounting for the latency and non-local terms caused by the mobility of the individuals during the latent period. An expression for the basic reproduction number $\mathcal{R}_0$ is derived, and the disease-free equilibrium is shown to be globally asymptotically stable when $\mathcal{R}_0 < 1$. At least one endemic equilibrium exists and the disease will be uniformly persistent for $\mathcal{R}_0 > 1$. For a simpler case with 2 patches only, two examples are given to illustrate that the population dispersal rate plays an important role for spread of the disease with latency, from which we can see the joint effect of the disease latency and population mobility on the disease dynamics. In addition to the existences of the disease-free equilibrium and interior endemic equilibrium, existence of boundary equilibria and their stability are also discussed in both examples.