Weather Driven Psyllid Movement Within and Between Citrus Orchards

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Background
- Huanglongbing (HLB) is a disease that affects citrus plants, commonly called “citrus greening”
- HLB is caused by the bacterium *Candidatus Liberibacter asiaticus*
- The bacteria is transmitted between trees and orchards via two psyllid species, with one depicted in Figure 1
- HLB ultimately kills the tree, but takes years and includes significant asymptomatic infection periods
- The symptomatic period of HLB infection includes lopsided fruits with colour inversion and less juice
- HLB is estimated to have cost the Florida citrus industry $9.1B

Study
Our goal is to understand how wind and temperature affects HLB Spread. To this end, we
- combined high resolution historical simulations of weather with psyllid trap data [1]
- developed a mathematical model of the psyllid lifecycle and dispersal
- conducted a sensitivity analysis of the model to identify key parameters to enable optimisation of control strategies

Model
The mathematical model is divided into the sub-problems of intra- and inter-tree dynamics.
The system of equations is solved on a structured grid using a second-order finite difference method for the diffusive term, and a first-order upwind finite difference method for the advection term.

Weather effects
Aspects of psyllid growth and movement are affected by weather
- death rate of eggs
- death rate of adults
- rate of oviposition
- rate of dislodgement
- movement speed and direction

Weather variables:
- temperature
- wind speed
- wind direction

References: