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Analytical framework for modeling of long-range transport of fungal plant epidemics OLEG KOGAN, KEVIN O'KEEFFE, DAVID SCHNEIDER, CHRISTOPHER MYERS, Cornell University, ANALYTICAL FRAMEWORKS FOR INFECTIOUS DISEASE DYNAMICS TEAM — A new framework for the study of long-range transport of fungal plant epidemics is proposed. The null nonlinear model includes advective transport through the free atmosphere, spore production on the ground, and transfer of spores between the ground and the advective atmospheric layer. The competition between the growth wave on the ground and the effect of the wind is most strongly reflected in upwind fronts, which can propagate into the wind for exponential initial conditions. If the rate of spore transfer into the advective layer is below critical, this happens for inititial conditions with arbitrary steepness. Upwind fronts from localized initial conditions will propagate in the direction of the wind above this critical parameter, and will not propagate below it. On the other hand, the speed of the downwind front does not have a strong dependence on the rate of spore transfer between the advective layer and the ground. Thus, even vanishingly small, but finite transfer rates result in a substantial epidemic wave in the direction of the wind. We also consider the effect of an additional, random-walk like mechanism of transport through the near-ground atmospheric boundary layer, and attempt to understand which route dominates the transport over long distances.

Oleg Kogan
Cornell University

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