

# Causes of spatial synchrony in UK aphids

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**Abstract:** We examine 35 years of variation in UK climate and aphid data from 11 sites, including counts and phenological data for 20 important species. We apply a Morlet wavelet transform to break down the fluctuations into complex components with different timescales of variability. The mean field of the wavelet components indicates the synchrony of the different sites. Long timescale fluctuations are more spatially synchronous than short timescale fluctuations. We introduce a technique based on spatially synchronous surrogates to determine the significance of the coherence between the aphid and climate transforms. We find statistically significant relationships between the winter NAO, local temperatures, and aphid ecology, particularly at timescales greater than 4 years. Those species showing greatest wavelet coherence with climatic variation have the highest spatial synchrony. We introduce a frequency specific Moran theorem and show that on average approximately 70% of the spatial synchrony of long timescale fluctuations in aphid first flight times can be explained by the influence of winter climate fluctuations.