Supplementary Materials

1. Differences among the synoptic weather types

Table S1. Accumulated eigenvalues and proportion of variance explained for the four canonical variates (CCA1–CCA4) of the canonical correspondence analysis (CCA) model describing nine synoptic weather types based on the four variables of zonal (blowing east or west) and meridional (blowing north or south) wind speed (m/s) at 925 mb, air pressure (Pa) at surface, and accumulated total precipitation (kg/m^2) at surface from North American Regional Reanalysis points over the Gulf of Mexico. The zonal wind component estimates wind speed in the east–west direction (positive if blowing towards the east and negative if blowing towards the west), and the meridional wind component estimates wind speed in the north–south direction (positive if blowing towards the north and negative if blowing towards the south). All measurements were taken at 6:00 UTC the night prior to migrants departing stopover sites.

| CCA Model Output	CCA1	CCA2	CCA3	CCA4
Eigenvalue	0.508	0.194	0.066	0.022
Proportion explained	0.643	0.246	0.083	0.028
Cumulative proportion explained	0.643	0.889	0.972	1.000

Table S2. Permutation test (N = 199 permutations) of marginal effects of terms under the canonical correspondence analysis model describing nine synoptic weather types based on the four variables of zonal (blowing east or west) and meridional (blowing north or south) wind speed (m/s) at 925 mb, air pressure (Pa) at surface, and accumulated total precipitation (kg/m^2) at surface from North American Regional Reanalysis points over the Gulf of Mexico. The zonal wind component estimates wind speed in the east–west direction (positive if blowing towards the east and negative if blowing towards the west), and the meridional wind component estimates wind speed in the north–south direction (positive if blowing towards the north and negative if blowing towards the south). All measurements were taken at 6:00 UTC the night prior to migrants departing stopover sites.

| Variable	Degrees of Freedom	Chi-Square	F-value	P
Meridional wind	1	0.084	6.043	0.005
Zonal wind	1	0.211	15.164	0.005
Air pressure	1	0.068	4.911	0.005
Precipitation	1	0.103	7.375	0.005
Residual	519	7.211		

2. Relative influence, partial dependency plots, and interactions from the boosted regression tree model (with each synoptic weather type as a predictor variable)

Table S3. Relative influence of the 14 predictor variables on bird stopover density from the boosted regression tree model, with each synoptic weather type as an individual predictor variable (percent deviance explained = 63.2%, CV correlation = 0.655). CV correlation is the mean correlation of predictions using cross-validated (i.e., out-of-bag) data.

| Predictor Variable	Relative Percent Influence
Proportion of hardwood forest within 5 km	29.3
Longitude	27.7
Distance from the radar	25.0
Distance to the Gulf of Mexico coast	8.1
Relative elevation	3.8
Midwest Continental High	3.7
Western Gulf Front	1.1
East Coast Low	0.6
Central Gulf Front	0.2
Bermuda High	0.2
Other	0.1
Eastern Continental High	0.1
Eastern Gulf Front	0.0
Gulf High	0.0
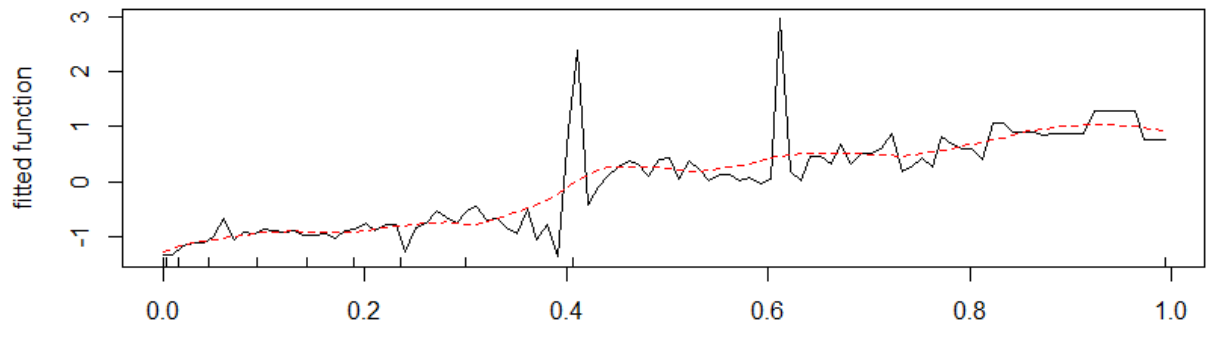
Proportion of hardwood forest within 5 km (29.3%)
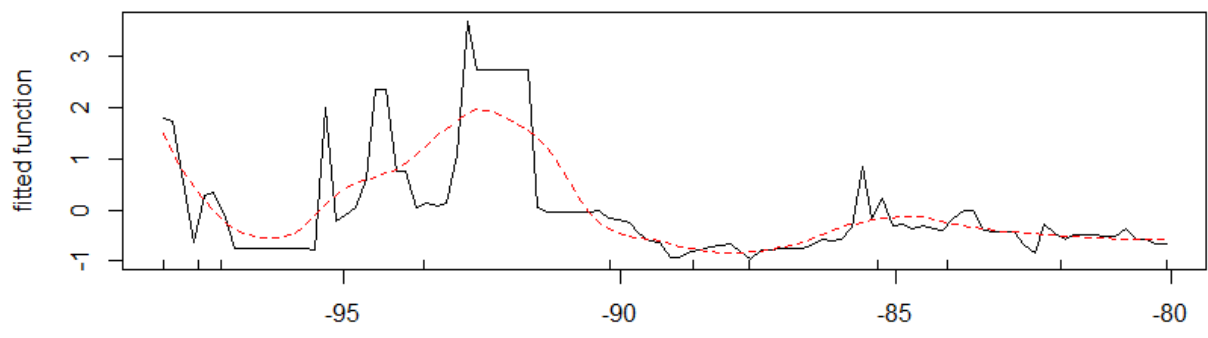
Longitude (27.7%)
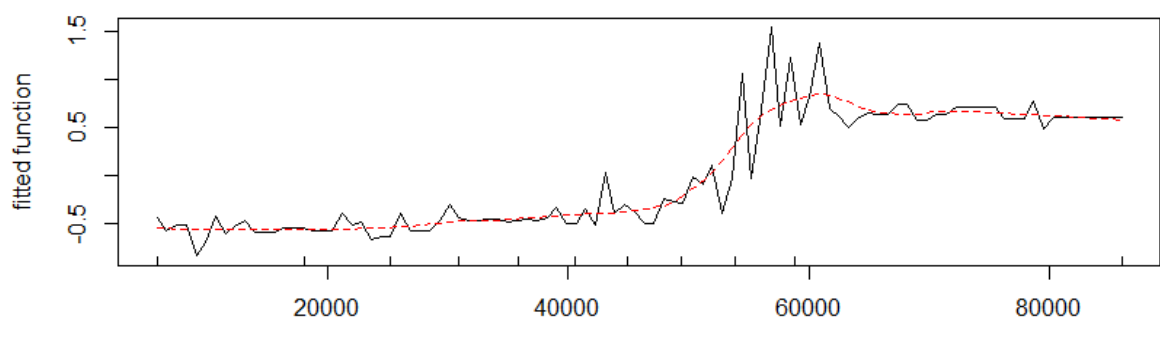
Distance to the radar (m) (25.0%)
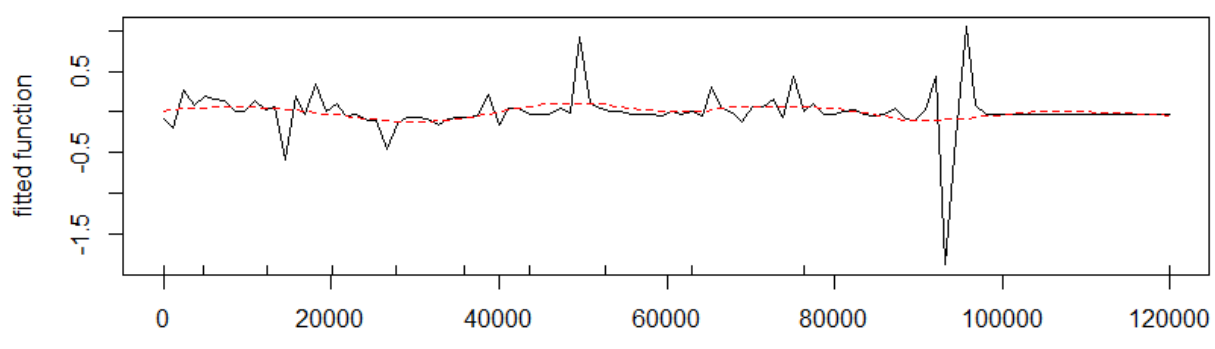
Distance from the Gulf of Mexico coast (m) (8.1%)
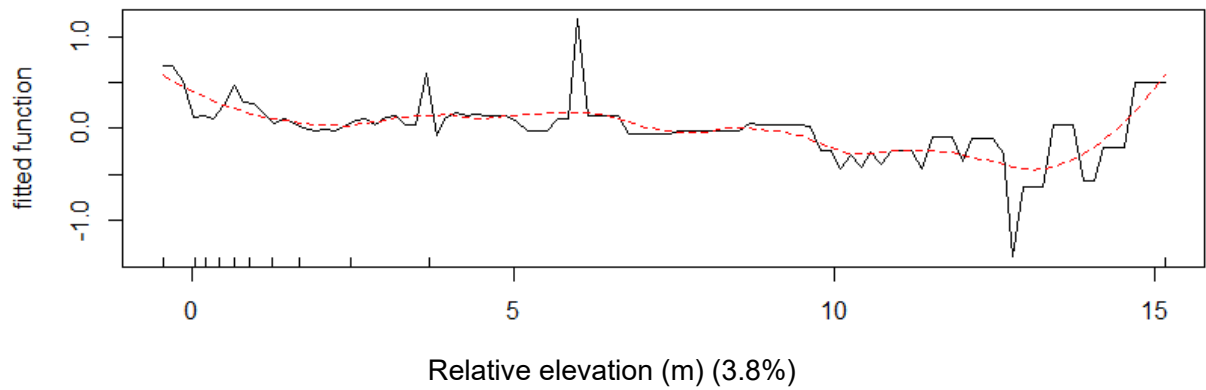
Relative elevation (m) (3.8%)

Figure S1. Partial dependence plots for geographic, landscape, and corrective predictor variables produced by the boosted regression tree model with each synoptic weather type as an individual predictor variable and mean vertically-integrated reflectivity as the response variable. The plots are ranked in order of their influence; each plot is labeled with the predictor variable and percent relative influence. The fitted function (y-axis) shows the predicted response compared to average. The red dashed line represents the smoothed predicted response, and rug plots along the x-axis indicate the deciles of the data distribution.
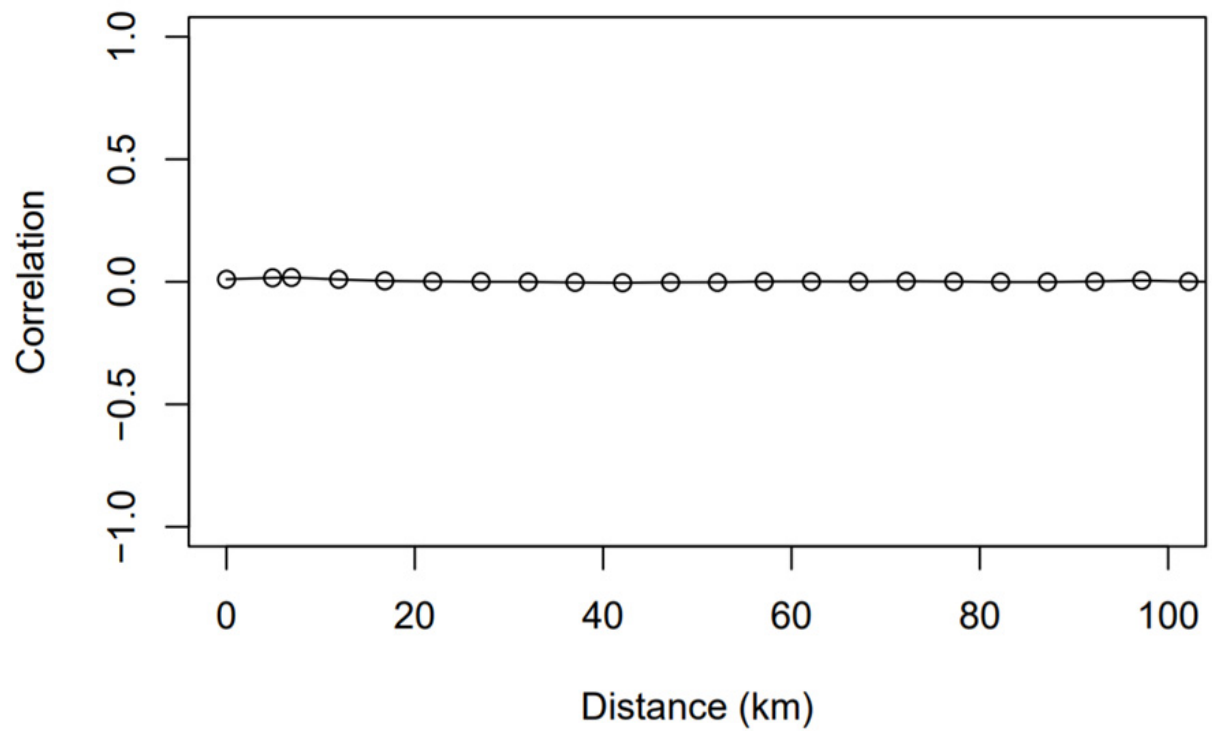
3. Test for spatial autocorrelation

Figure S2. Correlogram of spatial autocorrelation coefficient (Moran's I) of boosted regression tree model residuals plotted against lag distance between residuals.