

Synoptic-scale controls on the sea breeze of the central New England coast

Samuel T. K. Miller and Barry D. Keim

Using routinely available hourly surface observations and United States surface analyses for 2001, a method was developed for predicting sea-breeze events. The method is adaptable to any coastal region in the world where surface data are available. Specific prediction guidelines have been developed using Portsmouth, New Hampshire, as the forecast site. Using Portsmouth METARs (translated roughly from the French as aviation routine weather report), 167 days were determined to have conditions favorable for the occurrence of a sea breeze. Each of these 167 days are classified as either sea-breeze, marginal, or non-sea-breeze events. Sea breezes were defined as insolation-driven local onshore winds. Marginal events were weak sea breezes. Non-sea-breeze events were those days on which sufficient insolation was present but failed to produce a sea breeze at Portsmouth. The surface analyses for these 167 days were used to define a set of synoptic classes based on the arrangement of large-scale pressure systems, and meaningful interpretations resulted. For example, sea breezes and marginals account for almost 80% of one class, whereas two other classes produced no sea-breeze events. Standard surface observations were used to calculate the “regional scale” cross-shore potential temperature gradient ($\delta\theta/\delta x$) and the cross-shore geostrophic wind component (u_G) for the hour of onset (sea breeze and marginal events) or of peak heating (non-sea-breeze events). Stronger negative $\delta\theta/\delta x$ values were needed to develop a sea breeze in the presence of stronger positive u_G values. The six well-defined synoptic classes were plotted as a function of $\delta\theta/\delta x$ and u_G and occupy specific regions of the resulting diagram.