This paper introduces a method for identifying icing events using a physical icing model, driven by atmospheric data from the Weather Research and Forecasting (WRF) model, and applies it to a wind park in Sweden. Observed wind park icing events were identified by deviation from an idealized power curve and observed temperature. The events were modeled using a physical icing model with equations for both accretion and ablation mechanisms (iceBlade). The accretion model is based on the Makkonen model but was modified to make it applicable to the blades of a wind turbine rather than a static structure, and the ablation model is newly developed. The results from iceBlade are shown to outperform a 1-day persistence model and standard cylinder model in determining the times when any turbine in the wind park is being impacted by icing. The icing model was evaluated using inputs from simulations using nine different WRF physics parameterization combinations. The combination of the Thompson microphysics parameterization and version 2 of the Mellor-Yamada-Nakanishi-Niino PBL scheme was shown to perform best at this location. The distribution of cloud mass into the appropriate hydrometeor classes was found to be very important for forecasting the correct icing period. One concern with the iceBlade approach was the relatively high false alarm rates at the end of icing events due to the ice not being removed rapidly enough. © 2014 American Meteorological Society.