Automatic Classification of Offshore Wind Regimes With Weather Radar Observations

Weather radar observations are called to play an important role in offshore wind energy. In particular, they can enable the monitoring of weather conditions in the vicinity of large-scale offshore wind farms and thereby notify the arrival of precipitation systems associated with severe wind fluctuations. The information they provide could then be integrated into an advanced prediction system for improving offshore wind power predictability and controllability. In this paper, we address the automatic classification of offshore wind regimes (i.e., wind fluctuations with specific frequency and amplitude) using reflectivity observations from a single weather radar system. A categorical sequence of most likely wind regimes is estimated from a wind speed time series by combining a Markov-Switching model and a global decoding technique, the Viterbi algorithm. In parallel, attributes of precipitation systems are extracted from weather radar images. These attributes describe the global intensity, spatial continuity and motion of precipitation echoes on the images. Finally, a CART classification tree is used to find the broad relationships between precipitation attributes and wind regimes.