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Climatology and Real-Data Simulations of Snow Bands over the English Channel and Irish Sea during Cold-Air Outbreaks

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During the winters of 2009—2010 and 2010—2011, anti-cyclonic blocking over the north Atlantic led to cold, dry air being advected over the UK from the north and east, generating widespread snow depths not seen since the early 1980s. The societal and economical impacts of this snow were severe and diverse, including those on transport, industry, commerce, emergency services, and retail. The most distinctive precipitation features during these winters formed over the English Channel and Irish Sea, where convection frequently organised into bands, as diagnosed from Met Office NIMROD precipitation radar images, forming along the major axis of each body of water (hereafter, sea) when the boundary-layer flow was roughly parallel to each of those axes (hereafter, along-sea). In this study, we address the atmospheric conditions, diagnosed from soundings from suitable locations, at times when bands were observed and at times that they were not, during the cold-air outbreaks in these winters. We find that, for both seas, a band was present the majority of times that the 850-hPa flow was along-sea. We subsequently find that, of these times of along-sea flow, for both seas, 850-hPa wind speed and surface-to-850-hPa temperature difference were significantly greater when bands were present than when they were not. Real-data simulations using the Weather Research and Forecasting (WRF) model are then presented for a typical band over each sea and the model is found to be accurate in reproducing the structures observed on radar. Output from control runs for each band is compared to that in which topography, surface heat fluxes, and land-sea borders are each removed in turn in order to investigate how the low-level flow evolves to generate the observed bands.