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A 'Boscastle-type' quasi-stationary convective system over the UK Southwest Peninsula

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Quasi-stationary convective systems (QSCSs) can produce extreme rainfall accumulations and have been responsible for many devastating flash floods worldwide. An oft-cited case from the UK is the 'Boscastle storm' which occurred on 16 August 2004 over the southwest peninsula of England. This system produced over 200 mm of precipitation in just four hours, leading to severe flooding in several coastal settlements. This presentation will focus on a QSCS from July 2010 which showed remarkable similarity to the Boscastle storm in terms of its location and structure, but produced much smaller rainfall accumulations and no flooding. First, observational data from the two cases will be compared to highlight three factors which made the Boscastle case more extreme: (1) higher rain rates, associated with a warmer and moister tropospheric column and deeper convective clouds; (2) a more stationary system, due to slower evolution of the large-scale flow; and (3) distribution of the heaviest precipitation over fewer river catchments. Results from numerical simulations of the July 2010 case (performed with convection-permitting configurations of the Met Office Unified Model) will then be presented. A control simulation, using 1.5-km grid spacing, reveals that convection was repeatedly initiated through lifting of low-level air parcels along a quasi-stationary coastal convergence line. Sensitivity tests suggest that this convergence line was a sea breeze front which temporarily stalled along the coastline due to the retarding influence of an offshore-direction background wind component. Several deficiencies are apparent in the 1.5-km model's representation of the storm system, including delayed convective initiation; however, significant improvements are observed when the grid length is reduced to 500 m. These result in part from an improved representation of the convergence line, which enhances the associated low-level ascent allowing air parcels to more readily reach their level of free convection. The implications of this finding for forecasting convective precipitation will be discussed.