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The role of orography in the regeneration of convection: A case study from the Convective and Orographically-induced Precipitation Study

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Observations of a case study from the Convective and Orographically-induced Precipitation Study on 20th July 2007 showed that in the outflow region of a Mesoscale Convective System, the Black Forest was responsible for convection regeneration above the crests of the mountains. The Weather Research and Forecasting numerical model has been run with an inner domain horizontal resolution of 300m to identify the role of orography in convection regeneration. Three simulations have been performed with different representations of the inner domain orography. 1) test case with real orography, 2) the orography of the inner domain removed and set equal to the altitude of the Rhine valley, 3) the Black Forest orography of the inner domain has been represented as an idealised three-dimensional ridge. Convection regeneration occurred in each of the model simulations when the outflow encountered its respective orographies. Mechanisms that enabled regeneration were identified. These included: elevated warm moist potentially-buoyant air lifted above the boundary layer by the undercutting outflow; the development and intensification of a convergence line, resulting from forced orographic lifting and intensification of a gust front; and strong updrafts of surface air above the mountain crests. The role of orography was to force uplift of air into an atmosphere favourable for convective development.