Plinius Conference Abstracts
Vol. 14, Plinius14-26, 2012
14th EGU Plinius Conference on Mediterranean Storms
and MEDEX Final Conference

Heavy rainfall episodes over Liguria: elements controlling forecast errors of quantitative precipitation

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Liguria and Tuscany regions, in Italy, were affected by heavy rainfall and flood episodes during autumn in 2010 and 2011. Heavy precipitation, leading to hydro-meteorological consequences, was associated with the development of intense and quasi-stationary convective systems, related to different mesoscale forcing systems combined with orographic lifting.
This study aims at identifying the main physical processes responsible for the onset, lifecycle, intensity and localization/propagation of the precipitating systems, in order to improve forecasting ability, using a convection-permitting model (MOLOCH) at different spatial resolutions. It is shown that the relatively satisfactory model behaviour in forecasting the localization of the systems critically depends on the accuracy in forecasting pre-existing cold air outflow from the Po Valley to the Ligurian sea, which reinforces the evaporative cold pool associated with the convective system. As a consequence, the strength of the resulting cold pool determines where the convergence with a southerly LLJ triggers the convection over the sea and where the emerging convective line, interacting with the Apennines coastal orography, produces the precipitation maxima. Recent upgrades in model physics (microphysics, radiation etc.) proved to be beneficial for QPF. Moreover, results of sensitivity experiments indicate how the underestimation error of quantitative precipitation is alleviated by increasing model resolution.