Assessment of the fog and low clouds forecasts produced by the H1D single-column model

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Operations at many airports are often, but especially in winter, affected by visibility reduction. The availability of precise forecasts has proved to substantially reduce the negative impact of low visibility events both on safety and on the efficiency of the air traffic management. The Instituto Nacional de Meteorología (INM), the Spanish weather service, has developed a single-column model (SCM) in order to improve short-term forecasts of fog, visibility and low-clouds. The SCM is a one-dimensional version of the HIRLAM limited-area model. The SCM is initialised either from the column in a three-dimensional (3D) model or from a 6-hour forecast of the model itself. The lowest part of the column is then modified according to ground observations. Since SCM cannot deal with horizontal heterogeneities, the terms that depend on the horizontal structure of the atmosphere are estimated from the outputs of the 3D model and introduced into the SCM as external forcings.

At present, the SCM called H1D is operationally run for nine Spanish airports and four sites abroad, in Europe and North Africa. The sites are located in areas with quite different climatic conditions, from Warsaw, in Poland, with a relatively long period with snow-covered terrain to Casablanca, in Morocco, where frosts are rare. The topographic features are also diverse, from vast plains to relative non-homogeneous terrain, even not far from the shoreline. There is a diversity of situations regarding the spectrum of spatial scales of motion. This spectrum seems to be the key to determine the behaviour of the model in a particular site. Over non-homogeneous terrain, the prevalence of scales that are not correctly simulated by the 3D model is quite usual. Under these circumstances, the introduction of local observations into the SCM may produce improved very-short range forecasts when compared to those of the 3D model. Nevertheless, the uncertainty in the estimation of horizontal gradients and, especially, vertical motions from the 3D outputs produces a rapid decay in the verification scores.