On the usage of divergence nudging in the DMI nowcasting system

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DMI has recently proposed a new method for nudging radar reflectivity CAPPI products into their operational nowcasting system. The system is based on rapid update cycles (with hourly frequency) with the High Resolution Limited Area Model combined with surface and upper air analysis at each initial time. During the first 1.5 hours of a simulation the model dynamical state is nudged in accordance with the CAPPI product after which a free forecast is produced with a forecast length of 12 hours. The nudging method is based on the assumption that precipitation is forced by low level moisture convergence and an enhanced moisture source will lead to convective triggering of the model cloud scheme. If the model under-predicts precipitation before cut-off horizontal low level divergence is nudged towards an estimated value. These pseudo observations are calculated from the CAPPI product by assuming a specific vertical profile of the change in divergence field. The strength of the nudging is proportional to the difference between observed and modelled precipitation. When over-predicting, the low level moisture source is reduced, and in-cloud moisture is nudged towards environmental values. Results have been analysed in terms of the fractions skill score and the ability of the nudging method to position the precipitation cells correctly is discussed. The ability of the model to retain memory of the precipitation systems in the free forecast has also been investigated and examples of combining the nudging method with extrapolated reflectivity fields are also shown.