Developments in Radar Refractivity Retrieval at C-band

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Radar refractivity retrievals have the potential to provide valuable insights into the variability in near-surface humidity. Radar signals propagate fractionally slower through more humid air masses and phase changes from ground clutter returns can be used to infer spatial patterns of humidity changes. Near-surface humidity can influence convective development and is still poorly represented in forecast models while other humidity observation methods generally have poor spatial representativity. It is anticipated that these retrievals will benefit Numerical Weather Prediction (NWP) models, especially for the forecasting of convective storms. A collaboration between the University of Reading and the UK Met Office has demonstrated the feasibility of retrievals with C-band radars using magnetron transmitters, which drift in frequency. Recently, further studies have been undertaken to optimise the quality of retrievals. This has been achieved by investigating the role of various operational parameters such as pulse length, scan rate, polarisation and pulse repetition frequency. Careful attention has also been paid to the characterisation of target quality and the implementation of the retrieval algorithm. We outline the results of these optimisation studies and new developments in the understanding of this technique. Future work aims to evaluate the potential benefits of assimilating refractivity retrievals in NWP models.