The impact of range sidelobes from phased array weather radar observations to short-range convective forecasts

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Range sidelobes are an erroneous feature of radar observations that are generated by the pulse compression process used to improve the range resolution of target echoes in high resolution radar systems. Phased array weather radar (PAWR) is an advanced radar system providing very dense observations of reflectivity and Doppler radial velocity at 100m range resolution for over 100 elevation angles every 30 seconds. The use of pulse compression in PAWR to provide very high range resolution data makes it subject to these types of errors, which can result in false echoes observed at other ranges.

In this study we investigate the impact of assimilating range sidelobes from PAWR observations to short-range convective forecasts. This happens frequently in the current QC algorithm, although we plan to improve the QC in the future. We employ the use of the SCALE-LETKF system which couples the Local Ensemble Transform Kalman Filter (LETKF) with the Scalable Computing for Advanced Library and Environment (SCALE)-RM model. We focus on a convective rainfall event in August 2016 that brought heavy, intense rainfall over Osaka. PAWRs located in Suita, Osaka and in Kobe well-captured the convective system over its life cycle but featured prominent range sidelobes as part of their observations. Here, observations from both radars are first used to identify the range sidelobes before performing a series of 30-second update cycling experiments using observations from the Suita PAWR both with and without range sidelobes within a high-resolution 100-m mesh. As well as investigating their impact on short-range forecasts, we aim to show how we can further the usefulness of having two sets of PAWR observations to observe the same convective system by using them to identify and remove range sidelobes and improve short-range forecasts of severe convective events through the assimilation of this data.

Keywords: LETKF, Assimilation, Forecasts, Convection, Sidelobes

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