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Nowcasting localized heavy precipitation using a multi-parameter phased array weather radar (MP-PAWR) and a 3D recurrent neural network.

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Temporal extrapolation of radar observations of precipitation is a means of nowcasting sudden localized heavy rains, i.e., restricted convective rains on a spatial scale of less than 10 km and a lifetime of a few tens of minutes. Such nowcasts are necessary to set up warning systems to anticipate damage to infrastructure and reduce the fatalities these storms cause. It is a difficult task due to the storm suddenness, their restricted area, and nonlinear behavior that are not well captured by current operational systems, even for a lead time of only 10 minutes. Often, conventional approaches use radar observations with 5 min resolution and a Lagrangian advection based extrapolation model with a poor description of the vertical dimension. In this study, we use a new Multi-Parameter Phased-Array Weather Radar (MP-PAWR) with a temporal resolution of 30 sec and a 3D recurrent neural network to improve 10-minute nowcasts of sudden localized rains. The MP-PAWR has been operational in Japan (Saitama prefecture) since 2018. The nowcast model is a supervised neural network trained with adversarial technique. It considers the 3D volume surrounding the instrument up the height of 10 km and the polarimetric information of the measurement. Improvements with conventional nowcasting techniques will be discussed with some typical examples.