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Implementation of Weather Radar Assimilation into a Numerical Weather Prediction System: a Case Study for Cyprus

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Weather radars are suitable for short-range forecasting and nowcasting activities. They have the capability to monitor precipitation, resolving very local scales, with good spatial and temporal details, with a widespread scanning range. The Cyprus Department of Meteorology operates two X-band weather radars which, however, have not been employed in a numerical weather prediction (NWP) system, until now. This process requires a design of multi-domain expertise, mixed-signal modelling and effective paths to implementation. This work describes the first results with the regional radar signal processing chain that provides the final reflectivity data assimilation (DA) in the Harmonie convection permitting numerical model. The DA technique includes one-dimensional (1-D) retrieval, followed by a three-dimensional variational (1D+3DVar) assimilation of volume of radar reflectivity data. The pre-processing approach additionally creates a regular cube grid in which a horizontal size of meshes coincides with the horizontal model resolution. This minimizes the representative error associated with the discrepancy between resolutions of informational sources. The pre-processing and assimilation of radar reflectivity has a positive impact on the convective system dynamics through controlling the intensity and location of the updraft due to maintaining the sizes and shapes of precipitation patterns in the model similar to those in the measurements. The DA performance is assessed for case studies characterized by different precipitation regimes. Results are satisfactory, especially during intense precipitation, particularly regarding its spatial and temporal characterization.