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An assessment of extreme precipitation within cyclone composites using ERA5

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Extra-tropical cyclones are key components of the atmospheric general circulation due to their ability to transport large quantities of heat, moisture, and momentum. Cyclones are an important contributor to extreme weather as their passage is associated with strong winds, and large precipitation accumulations. Here we connect a cyclone compositing scheme with regionally derived distributions of precipitation to present a framework for classifying spatially dependent extremes relative to the cyclone centre. Using this framework, cyclone composites for both average (50th percentile) and extreme (90th and 98th percentile) precipitation are derived from ERA5 reanalysis output. Composites are then partitioned into different stages of the cyclone lifecycle to assess the spatial and temporal evolution of precipitation extremes. We find that most extreme precipitation occurs within the comma-cloud structure close to the cyclone centre, with the extreme precipitation occurrence and intensity occurring in that region. Extreme precipitation is also identified to be largest during the period of deepening before the maximum cyclone intensity is reached. These regions of the cyclone correspond to places where large fractions of precipitation are above the extreme threshold. Strong spatial correlation are also seen between the average and extreme precipitation during the deepening phase for the precipitation mean, occurrence and fraction. This correlation weakens as the cyclone evolves and as the threshold used to determine extreme precipitation increases.