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Where, when and why do extratropical cyclones cluster?

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The weather conditions in the mid-latitudes are largely determined by the absence or presence of extratropical cyclones. Frequent passage of cyclones over the same location in quick succession (serial clustering) can lead to accumulated impacts such as flooding and wind damage. These impacts have motivated a wide variety of research studies into serial cyclone clustering. However, the different definitions, metrics and datasets used in this research makes comparison of results difficult. The aim of this study is to review the previous research and provide clear a framework for serial cyclone clustering into which past and future studies can be placed, allowing easier comparison of results irrespective of the research direction.

We find that several climatologies of serial cyclone clustering agree as to where clustering occurs preferentially, but these studies are largely limited to the North Atlantic. Future projections of cyclone clustering are highly uncertain. This is largely due to sample uncertainty, caused by short timeseries, and poor representation of key processes such as Rossby wave breaking, caused by low spatial resolution. Research investigating the dynamical mechanisms determining when and why serial cyclone clustering occurs have shown that clustering is linked to the position of the jet stream and the occurrence of Rossby wave breaking. Studies have investigated this link for different aggregation timescales. On daily timescales cyclone clustering is related to jet streaks and families of cyclones forming on the same frontal feature. On seasonal timescales active seasons are often associate with persistent large-scale flow patterns and successive Rossby wave breaking events. Current knowledge gaps and future research directions are identified.