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Assessment of slantwise convection within mid-latitude cyclones from reanalysis data

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Slantwise convection, the process by which moist symmetric instability is released, has often been linked to banded clouds and precipitation, especially in frontal zones within mid-latitude cyclones. Studies also suggest that the latent-heat release associated with slantwise convection can lead to a spinup of surface frontogenesis, which can enhance the rapid intensification of extratropical cyclones. This study provides a statistical investigation of the climatology of the potential occurrence of slantwise convection, in terms of conditional symmetric instability, and its relationship with surface precipitation as well as the cyclone activity. Using the 6 hourly ERA-interim analysis, two different indices are calculated, namely SCAPE (slantwise convective available potential energy) and VRS (vertically integrated extent of realizable symmetric instability) to assess the likelihood of occurrence of slantwise convection around the globe. The susceptibility of northern-hemisphere midlatitude cyclones to slantwise convection at different stages of their lifecycle or with different intensification rate is also investigated. As compared to the non-explosive cyclone cases, the time evolution of SCAPE (but not CAPE) and VRS within rapidly deepening cyclones exhibit higher values before, and a more significant drop after, the onset of rapid intensification, supporting the idea that the release of moist symmetric instability might contribute to the intensification of storms.