



Climatological aspects of ice clouds in extratropical cyclones

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Meridional transport of heat and moisture and the associated cloud condensational processes and latent heat release are key processes related to mid-latitude cyclones. Less attention has been given so far to the formation of upper-tropospheric ice clouds in the vicinity of cyclones. In a climatological sense, extratropical ice clouds impact on the radiative budget, and for individual cyclones it has been hypothesized that they impact strongly on the detailed mesoscale structure of the weather systems.

The goal of this work is to provide a first step towards the investigation of the role of ice clouds for the evolution and the structure of extratropical cyclones. To this end, ERA40 reanalysis data is used together with a cyclone identification and tracking algorithm to analyse the 3-dimensional cloud fields in the cyclones' environment. The long time period which is covered by the ERA40 data allows comprehensive statistics to analyse several aspects of the link between cyclones and ice clouds and its variability. Results will be presented on the following aspects: (i) The relative importance of cyclones for the formation of ice clouds in mid-latitudes is quantified (preliminary results indicate a high percentage of more than 50%). (ii) Preferred regions and seasons for cyclones with particularly strong/weak ice production are investigated. (iii) It is statistically evaluated whether ice production in cyclones for instance in the North Atlantic is correlated with large-scale circulation indices like the NAO. (iv) Finally, a trajectory analysis yields insight in the meteorological processes that lead to the formation of ice clouds. The advantage of this method is that the history of the air parcels in the cloud and its vicinity can be analysed. The vertical displacement of backward trajectories provides information about the importance of resolved vertical motions like warm conveyor belts for the ice cloud formation in extratropical cyclones. Together, these aspects provide important information about the processes leading to ice clouds in mid-latitude cyclones, their climatology and regional and temporal variability.

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