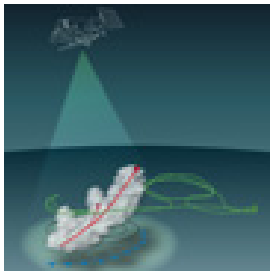

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Warm Conveyor Belts and Their Role for Cloud Radiative Forcing in the Extratropical Storm Tracks

Thursday, 12 March 2020 09:45 (25 minutes)

The link between cloud radiative forcing (CRF) and warm conveyor belts (WCBs), which are strongly ascending airstreams in extratropical cyclones, is investigated based on ERA-Interim reanalysis from 1979 to 2011. Clouds associated with WCBs can be liquid, mixed phase, or ice clouds. They interact with the longwave and shortwave radiation in different ways and thus strongly influence Earth's radiative budget in the extra- tropical storm tracks in a complex way. In this study, WCBs are identified with a Lagrangian method, where WCBs are represented by trajectories that rise at least 600 hPa in 48 h in the vicinity of an extratropical cyclone, and CRF is traced along all WCB trajectories during the considered 30-yr period. The results show that due to the poleward ascent of WCBs, they exhibit negative net cloud forcing (NetCRF) in the southern part of the associated cloud band, whereas in their northern part, NetCRF gets positive due to the lack of sunlight in the winter months. This nonuniform CRF along WCBs from low to high latitudes increases the meridional NetCRF gradient. Furthermore, in their outflow regions in the North Atlantic, where WCBs are mainly associated with ice clouds, WCBs contribute up to 10 W m2 to the global climatological NetCRF maximum in winter. The results highlight the importance of WCBs in modulating the radiative budget in the extratropics. Furthermore, the results emphasize the need for a correct representation of WCBs in climate models to correctly simulate the cloud–circulation coupling.

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