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Evidence for global electric circuit effects on layer clouds

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Similar diurnal variations in the distance measured between the surface and the visible stratiform cloud base are apparent in measurements obtained in both hemispheres during the polar night, which have a similar phase relationship to the well-known Carnegie curve (diurnal variation) of atmospheric electricity. Coincident variations of similar magnitude have also been observed in cloud base and atmospheric electricity during the enhanced 27 day oscillation present during periods of co-rotating interacting regions (CIRs) in the heliosphere. These findings imply that variations in the vertical conduction current density may be coupled to the cloud edge properties, for example through the charging of droplets due to conduction current flow through clouds, leading to effects on the cloud microphysics. Balloon-carried measurements of cloud edge properties are presented in support of this coupling hypothesis, which indicate, in favourable conditions, that substantial charging of droplets on cloud edges can occur. Details of the associated cloud microphysics effects remain to be fully simulated, but existing modelling work shows that droplet-droplet collection processes may be considerably enhanced over the usual assumption of entirely uncharged interactions.