



Do tropospheric clouds influence PSC formation in the Arctic?

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Polar Stratospheric Clouds (PSCs) play a key role in heterogeneous chemistry and ozone depletion in the lower stratosphere. The type of a PSC as well as their temporal and spatial extent is important for the occurrence of heterogeneous reactions and thus ozone depletion. The mechanisms of PSCs formation are still poorly understood. Recent studies of Antarctic PSCs have shown that the formation of PSCs can be associated with deep tropospheric clouds.

Lidar measurements aboard the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) satellite were used to investigate whether the formation of Arctic PSCs can also be associated with deep tropospheric clouds. PSCs observed by CALIPSO during winter 2007/2008 were classified into the three PSCs types – STS, NAT, and ice – and also according to the observed underlying tropospheric clouds. Our analysis revealed that 166 out of 216 observed PSCs occur in connection with tropospheric clouds. 71 % of the 166 clouds were observed over deep tropospheric clouds. Our analysis also showed that the type of PSCs seems to be connected to the underlying tropospheric cloud system. Ice PSCs during winter 2007/2008 were mainly observed in connection with deep tropospheric cloud systems. The analysis of the GDAS (Global Data Assimilation System) temperature profiles at the location of the observed ice PSCs showed that the temperature of 53 % of these clouds was above the ice formation temperature. No ice PSCs with a temperature of 3 K below the ice formation temperature were observed. Our study shows a clear connection between tropospheric and stratospheric clouds. There also seems to be a connection between the type of a the PSC and the type of an underlying tropospheric cloud.