Influence of clouds on aerosol particle number concentrations in the middle and upper troposphere in different climatic regions

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MOTIVATION

Analyzing the interaction between aerosol and clouds is a major field of current research. While most studies analyze the influence of aerosol particles on clouds, only a few studies deal with the influence of clouds on aerosol particles. This study investigates statistically the influence of clouds on submicrometer particles in the upper troposphere in different climatic regions round the world.

DATASET AND METHODS

From 1997 to 2008, 125 flight sequences on four intercontinental flight routes were conducted as part of the CARIBIC project (Civil Aircraft for Regular Investigation of the Atmosphere Based on an Instrumentation Container) (Ref. 1). On these flights between Germany and the Caribbean, South America, the Maldives/Sri Lanka, and the Philippines (Fig. 1), aerosol number concentrations were measured in two size ranges at altitudes between 8 and 12 km (nucleation mode 4 to 12 nm, N_{4-12} and Aitken plus accumulation mode (>12 nm, N_{>12})). To check whether the analyzed air were in contact with a cloud recently, 3D kinematic 2-day backward trajectories were calculated every three minutes along the flight tracks. These trajectories were analyzed for cloud contact (Ref. 3), using ISCCP satellite pictures (Ref. 2).

With the cloud contact information, a statistical analysis was carried out. To distinguish climatic regions, the data were divided into 11 different regions. Figures 2 to 8 compare the cloud-influenced concentrations of N_{4-12} and N_{>12} particles (blue) with the corresponding values without cloud contact (red) for five regions. Table 1 summarizes results of all analyzed regions.

CONCLUSION

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