



Lidar observations and model studies of subvisible cloud formation at the tropical tropopause.

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The Mobile Aerosol Raman Lidar (MARL) of the Alfred Wegener Institute (AWI) was operated at Paramaribo/Suriname (5.8°N, 55.2°W) in the fall dry season from September 28 to November 15 in 2004 during a campaign of the EU project STAR. MARL is capable of detecting extremely thin, subvisible cirrus clouds in the tropical tropopause region (TTL). In 81% of the obtained 140 hours of observation time ice clouds were present in the upper troposphere (above 12 km). The frequency of occurrence of subvisible clouds was found to be clearly enhanced compared to the mid-latitudes. The formation conditions of these clouds and the dehydration of the TTL was investigated by means of a newly developed trajectory model, where diabatic heating rates calculated from a radiative transfer model are used to determine the vertical motion. Subvisible cirrus clouds are shown to form due to slow ascent in the TTL. If these clouds were assumed to occur whenever the relative humidity above ice (RHI) exceeds 100% due to adiabatic cooling, a good agreement between the model and the observations is achieved. In some cases however, extremely thin layers of particles were observed at conditions where the air is not saturated. This indicates that these clouds rather consist of NAT than of water ice particles.