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Equatorial Kelvin waves, cirrus clouds, and dehydration in the TTL.

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A number of field-campaigns in the tropics have been conducted in the recent years with the mobile LIDAR systems MARL and ComCAL aboard the research vessel Polarstern in the tropical Atlantic and at Paramaribo in Suriname (5.8°N, 55.2°W). Generally, a high coverage with cirrus of about 80% was observed in the inner tropics. The frequency of occurrence of subvisual clouds was found to be clearly enhanced compared to similar observations performed with the same instrument at mid-latitudes. Extremely thin cirrus with optical depth below 10^{-3} were frequently observed near the cold point tropopause. We investigated the conditions of ice cloud occurrence in the tropical tropopause layer (TTL) with a newly developed trajectory model and found that the cirrus clouds are almost always present in air masses that currently experience a temperature minimum. This model also indicates that TTL cirrus efficiently dehydrates ascending air. Most likely, the extremely thin cirrus at the CPT are rather composed of nitric acid trihydrate (NAT) than of pure ice. The temperature in the TTL is influenced by downward propagating equatorial Kelvin waves. We find a clear correlation between the temperature anomalies introduced by these waves and the occurrence of thin cirrus. This finding suggests an influence of wave activity on the dehydration characteristics of the TTL.