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Observation of thin charged clouds in the lower tropical stratosphere, origin and possible consequences on water transport in the UTLS

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Atmospheric electric field measurements were performed on a balloon flight launched from Niamey during the 2006 AMMA campaign in Africa. The balloon reached an altitude of $\sim$ 23 kilometres and, above about 8 kilometres, the electric field instrument provided good measurements of the vertical component of the atmospheric electric field from DC to $\sim$ 3 kHz. Super-imposed on the slowly varying altitude profile of the quasi-DC vertical electric field several small scale features were identified during the ascent above the tropopause, between about 16.5 and 19 kilometres. These features arise from the crossing of thin charged aerosol layers during the balloon ascent and, from other balloon and high altitude aircraft observations during the same period, these aerosols can be identified as ice particles. It seems likely that such ice clouds are remnants of ice geysers injected to stratospheric altitudes above convective clouds. From the evaluated average electrical charge of the particles and based on the time constant for neutralization deduced from conductivity measurements performed by the electric field instrument, it can be inferred that the ice particles were injected within $\sim$ 100 km up wind (east) of the balloon location In this region only moderately active clouds were observed by meteorological radars while the major convective clouds were located at a much larger distance. This new observation appears to indicate that ice geysers could be a rather frequent phenomenon possibly occurring over moderately active clouds with only the most intense events above MCS being detected by meteorological radars. If confirmed by further observations, this finding may have a significant impact on the transport of water in the tropical UTLS and on the water content in the lower stratosphere.