

BALLOON OBSERVATIONS OF LIGHTNING AND ELECTRIC FIELDS CLOSE TO ACTIVE CONVECTIVE CELLS

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In the course of the AMMA campaign measurements of the vertical component of DC and AC electric fields were performed onboard a stratospheric balloon launched from Niamey (Niger) with a ceiling altitude of 22.5 km.

During ascent the balloon crossed several cloud layers but no detectable convective activity was detected close to the balloon trajectory by the meteorological radar operating at Niamey. The DC electric field and electric conductivity measurements correspond to fair weather conditions with a moderate electric field amplitude. The most interesting observation was the crossing of thin charged aerosol layers at altitudes above the tropopause that were recognized through their signature on the quasi-DC electric field measurements. From other balloon and aircraft observations performed during the same period of time, these charged aerosol layers have been identified as thin cirrus clouds. These observations show that electric forces may play a role in the dynamics of small ice particles and thus shed a new light on coupling processes between the upper troposphere and the stratosphere in tropical regions.

During the last part of the flight, an active convective system developed south to the balloon trajectory at distances from 30 to 100 km. Simple optical detectors flown on the electric field payload detected a number of lightning. Many of the events are related to IC lightning but a comparison of the balloon observations with data from the WWLL network allows to identify some of the most intense GC/CG lightning. Throughout this period, several distinct signatures are observed on the DC and AC electric fields identified as variations of the atmospheric electric field at different scales and as EM waves emitted by lightning current and received after being propagated in the Earth-ionosphere guide. These observations will be discussed together with a detailed analysis of some particular events.

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