Ionization due to extensive air showers in humid air

C. Rutjes[1], U. Ebert[1, 2]

[1]*Centrum Wiskunde & Informatica (CWI), 1098XG Amsterdam, The Netherlands.*
[2]*Dept. Physics, Eindhoven Univ. Techn., The Netherlands.*

A correct description of conductivity of the atmosphere is of major importance for cloud microphysical processes [1] and in particular in the research of atmospheric discharges, such as thunderstorms in which the observed electric fields are too weak [2] to produce convention break-down. The most important ionization generators in the atmosphere are radioactive decay up to a few km, galactic cosmic rays (CR) from 3 to 15 km [3] and solar UV & CR above 15 km [4, 5]. Free electrons are rapidly attached to oxygen molecules forming negative oxygen ions [6]. The positive and negative ions collect water vapour and form charged droplets efficiently [7, 8] causing the electrical mobility to drop significantly.
We will present our latest results of the ionization produced by extensive air showers, in dry and in particular in humid air.

1. Extensive air showers

Ultra-high-energy cosmic particles penetrate the atmosphere of the Earth at the speed of light, where they create extensive air showers of secondary particles.

The evolution of the extensive air shower can be simulated with the Monto Carlo code, CORSKA [9].

In figure 1 we see the number of high energy secondary particles (>1 MeV) created by a primary proton of 10^{17} eV with inclination of 23°.

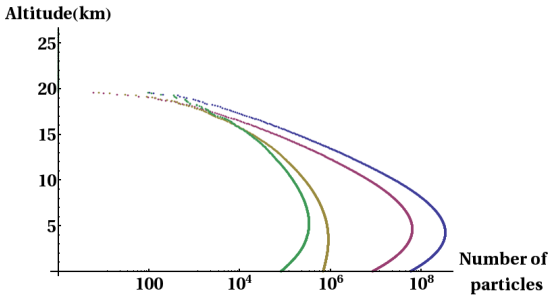

Fig 1: From left to right: hadrons, muons, electrons/positrons and gamma-rays at given altitude.

2. References

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