

The main focus of this thesis is, first of all, electromagnetic radiation generated by natural lightning discharges. More specifically, the thesis is oriented towards analysis of the return strokes and preliminary breakdown processes. This thesis also summarizes our current knowledge of lightning discharges, aiming more in detail at results of previous work concerning return strokes and their initiation. The analysis of measurements of the SLAVIA sensors provided us with detailed information on the character of 92 return strokes and 40 preliminary breakdown pulses which were recorded between October 2013 and June 2014. In 63 % of lightning flashes the amplitude of the largest preliminary breakdown pulse was lower than the amplitude of the corresponding return stroke, although the ratio of these amplitudes was prone to seasonal changes. In summer the sensors detected a higher percentage of lightning flashes for which the amplitude of the largest preliminary breakdown pulse was higher than the amplitude of the return stroke. The average time interval between the largest preliminary breakdown pulse and the first return stroke was approximately 10 ms. This measurement was also prone to seasonal changes, with the average time interval raising in summer. Moreover, the return strokes varied as to the shape of the pulses based on their different leading edge widths, widths of the pulses, and amplitudes.