

PLASMA CHANNEL EVOLUTION IN THE TRIGGERD LIGHTNING DISCHARGE

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Abstract. Using the results and assumptions given in the papers (see Maslowski et al. 2006 and Tausanovic et al. 2010) detailed and efficient numerical algorithms have been developed for application in the study of the lightning channel evolution. Different engineering models were used in the calculation of the axial electric field along the channel axis – the TL, the MTLE, the MTLP, the MTLL and the GTCS model. Obtained results for electric field as well as the point form of Ohm's law have been used to calculate the profile of longitudinal electrical conductivity on the lightning channel. The comparison with the experimental results was performed. It has been shown that the mean values of the mentioned physical quantities are in accordance with the experimental results Cen et al 2015. After a detailed analysis of all engineering models, it was decided to use the GTCS model to investigate the lightning channel dynamics. For this purpose, it is necessary to precisely calculate the channel discharge function from Volterra integral equation of the first kind. This equation is solved analytically by Laplace transformation, as well as numerically by the modified composite trapezoidal formula method (MCTF method). The results show excellent agreement between analytical and numerical methods. Obtained channel discharge function is used in the calculations of other physical parameters along radial and axial directions of the channel.

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References

- Cen, J., Yuana, P., Xue, S., Wang, X.: Resistance and internal electric field in cloud-to-ground lightning channel, 2015, *Appl. Phys. Lett.*, **106**, 054104.
- Maslowski, G., Rakov, V.: A study of the lightning channel corona sheath, 2006, *J. Geophys. Res.*, **75**, D14110.
- Tausanovic, M., Markovic, S., Marjanovic, S., Cvetic, J., Cvejic, M.: Dynamics of lightning channel corona sheath using a generalized traveling current source return stroke model – theory and calculations, 2010, *IEEE Trans. EMC*, **52**, 646–656.