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Influence of Model Hydrometeor Form on Probability of Discharge Initiation from Artificial Charged Water Aerosol Cloud

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Abstract : Hypothesis of the lightning initiation on the arrays of large hydrometeors are in the consideration. There is no agreement about the form the hydrometeors that could be the best for the lightning initiation from the thundercloud. Artificial charged water aerosol clouds of the positive or negative polarity could help investigate the possible influence of the hydrometeor form on the peculiarities and the probability of the lightning discharge initiation between the thundercloud and the ground. Artificial charged aerosol clouds that could create the electric field strength in the range of 5-6 kV/cm to 16-18 kV/cm have been used in experiments. The array of the model hydrometeors of the volume and plate form has been disposed near the bottom cloud boundary. It was established that the different kinds of the discharge could be initiated in the presence of the model hydrometeors array – from the cloud discharges up to the diffuse and channel discharges between the charged cloud and the ground. It was found that the form of the model hydrometeors could significantly influence the channel discharge initiation from the artificial charged aerosol cloud of the negative or positive polarity correspondingly. Analysis and generalization of the experimental results have shown that the maximal probability of the channel discharge initiation and propagation stimulation has been observed for the artificial charged cloud of the positive polarity when the arrays of the model hydrometeors of the cylinder revolution form have been used. At the same time, for the artificial charged clouds of the negative polarity, application of the model hydrometeor array of the plate rhombus form has provided the maximal probability of the channel discharge formation between the charged cloud and the ground. The established influence of the form of the model hydrometeors on the channel discharge initiation and from the artificial charged water aerosol cloud and its following successful propagation has been related with the different character of the positive and negative streamer and volume leader development on the model hydrometeors array being near the bottom boundary of the charged cloud. The received experimental results have shown the possibly important role of the form of the large hail particles precipitated in thundercloud on the discharge initiation.

Keywords : cloud and channel discharges, hydrometeor form, lightning initiation, negative and positive artificial charged aerosol cloud
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