

Towards understanding the formation of lightning: simulating the inception of streamer discharges

J. Teunissen¹, C. Li¹, A. Sun¹ and U. Ebert^{1,2}

¹Centrum Wiskunde & Informatica, Amsterdam, The Netherlands

²Dept. Physics, Eindhoven Univ. Techn., The Netherlands

Streamers are thin conducting plasma channels surrounded by a space charge layer that propagate at a high velocity. They create the ionized paths that can later become lightning leaders as they heat up, or they are directly seen as sprite discharges. Experimental observations have provided more insight in the formation of streamers near electrodes, showing a growing 'inception cloud' that destabilizes into one or more thin channels. Several fundamental questions arise: When does such a cloud form and when does it destabilize into streamers? How does this determine streamer properties like velocity or radius? To help answer these questions we have developed a particle based 3D simulation of the streamer inception process near positive electrodes. We present our simulation technique and results, indicate possible improvements and discuss how inception could naturally occur in a thundercloud.