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Model of Blue Jet Formation and Propagation

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Upward-propagating luminous flashes above thunderstorms were discovered two decades ago. They were named blue jets (BJ) due to primarily blue color. It is broadly accepted that BJ are produced by a lightning leader running upward in the nonuniform atmosphere. It is also suggested that formation of a leader is governed by the contraction of the current of a streamer flash into a small radius channel. The paper presents results of simulations of the current contraction in the air as a function of the pressure, and convective heat removal time. It was shown that transition to the contracted state occurs in hysteresis mode in which contracted and diffusive stable states exist simultaneously. The critical current for the phase transition was obtained. Similarity methods were applied to the simulations of the critical contraction current, along with chosen observations of BJ, to study BJ formation and propagation in the atmosphere.