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Properties of the unusually short pulse sequences occurring prior to the first strokes of negative cloud-to-ground lightning flashes

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We analyze pulse sequences occurring prior to first return strokes of negative cloud-to-ground lightning flashes. The magnetic-field waveforms are measured close to the thunderstorm using a broad-band analyzer with a sampling interval of 12.5 ns. The electric-field waveforms are measured at the distance of $\sim$ 400 km using an analyzer with a sampling interval of 80 ns. The sequence is usually composed of three parts. It begins with a larger pulse train which is believed to be connected with initial breakdown processes. The train of preliminary breakdown pulses ("B" part) is followed by a relatively low and irregular pulse activity ("I" part), which is sometimes missing. The sequence ends with a pulse train attributed to the stepped leader ("L" part). We recognize two different patterns ("B-I-L" and "B-L" types) in recorded waveforms. For the first time, we analyze the time evolution of the pulse amplitudes in the "B" part of "B-I-L" type sequences. The pulse amplitude is decreasing on average by 34% of the maximum value within a given train. We observe an unusually short duration of sequences. This is probably linked to a low height of the thundercloud. Another possible explanation may be based on an untypical precipitation mix resulting in faster steeped leaders.