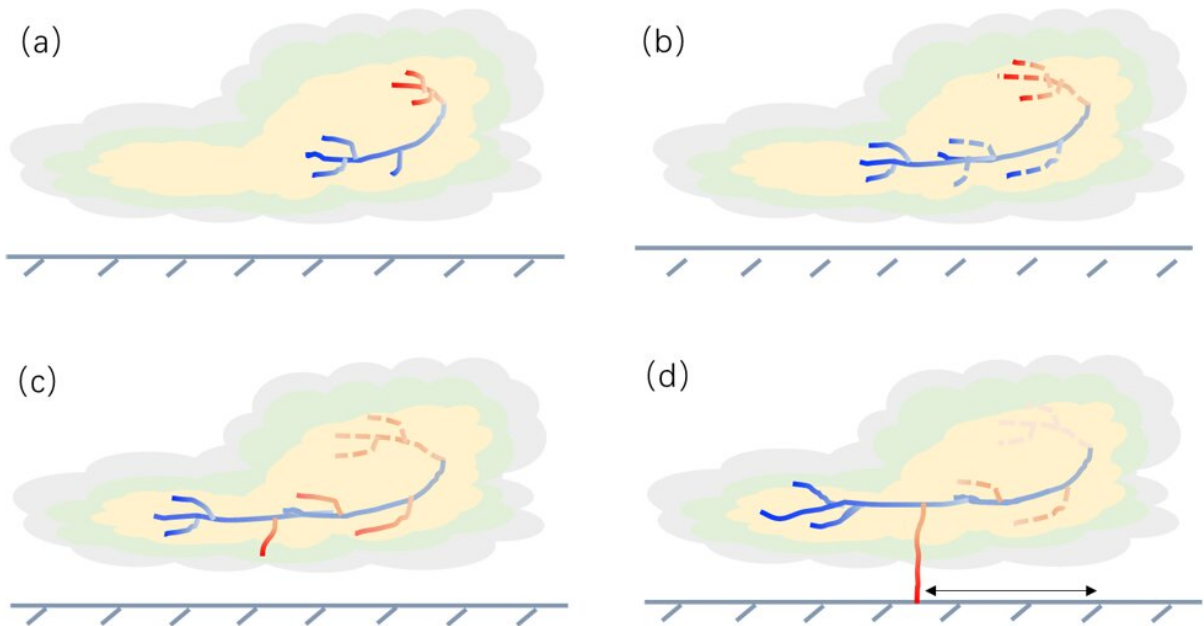


# How does positive cloud-to-ground lightning strike so far away from its origin?

September 30 2021, by Li Yuan



Conceptual model of side discharges from the negative leader and the formation of +CG lightning. Credit: YUAN Shanfeng

A bolt of cloud-to-ground (CG) lightning forms if a lightning leader develops out of the cloud and reaches the ground. Positive CG (+CG) lightning is formed by a downward positive leader and transfers positive charge into the ground.

The [horizontal distance](#) between the initiation region and the ground

point of +CG lightning can reach tens of kilometers. A positive leader could not propagate so far in hundreds of milliseconds with its typical speed, so how does such positive ground lightning strike the area so far away from its origin?

Recently, researchers from the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences gave an answer to the question. Their findings were published in *Geophysical Research Letters*.

"We find two kinds of side discharges from the active negative leaders in a +CG lightning flash. Some km-long negative leader branches get reactivated. Such reactivations can promote the propagation of the advancing negative leader," said Yuan Shanfeng from IAP, the first author of the study. "The new positive leader can initiate from the bright negative channel to propagate downward and contact the ground to form positive ground lightning."

"In such a scenario, the downward positive leader emerged from the horizontally propagating negative leader," said the corresponding author Jiang Rubin, an associate professor from the IAP. "The speed of negative leaders is nearly an order faster than positive leaders, so that the strike point can be much further from the origin than normal positive ground lightning."

This work reveals a more complicated dynamics of natural lightning leaders. During sustained lightning leader propagation, the older channel or branches will disconnect from the main channel. Therefore, side discharges should be a typical process for natural [lightning](#).

**More information:** Shanfeng Yuan et al, Side Discharges From the Active Negative Leaders in a Positive Cloud-To-Ground Lightning Flash, *Geophysical Research Letters* (2021). [DOI: 10.1029/2021GL094127](#)

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