# Earthquake lights: Mechanism of energetic coupling of Earth's crust to the lower atmosphere

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## 1. Extended Abstract

Earthquake lights (EQLs) are an atmospheric luminous phenomenon occurring during strong earthquakes and lasting from a fraction of a second to a few minutes [e.g., 1]. In accordance with eyewitness reports [2] one of the types of the EQLs exhibits similarities with the blue glow observed in St. Elmo's fire (corona) occurring during thunderstorms. Laboratory experiments [3] demonstrate that rocks subjected to stress force can generate electric currents. During earthquakes these currents can deliver significant amounts of net positive charge to the ground-air interface leading to enhancements in the electric field and corona discharges around tall ground objects [4]. It has been suggested recently that the same type of currents can map upward to the ionosphere triggering variations in the total electron content [5].

The recently developed global electric circuit (GEC) model [6] features finite conductivity of the earth and allows quantitative investigations of the effects of source currents of various configurations placed inside the earth. We have also developed and tested approximate formulation allowing effective solution of the same problems using analytical theory. In the present work the source current is assumed to be a dipole and it is shown that a large scale dipole located at 5 and 15 km below earth's surface requires energy significantly exceeding that available even in major earthquakes. We will present numerical and analytical results providing the most physical scenario allowing to explain experimentally observed features of EQLs. In particular, the most likely setup is found to be when the upper pole of the source current dipole is shifted close to the earth's surface.

## 2. References

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