



## **Cosmic ray changes in the atmospheric electrical global circuit**

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The global atmospheric electrical circuit causes a current to flow between the ionosphere and the surface, which is proportional to the ionosphere-surface potential difference and the resistance of the atmospheric column. Surface measurements of atmospheric electrical quantities have been made in Europe since the late eighteenth century, with instrumented balloon ascents beginning in the late nineteenth century. Although these measurements are very valuable, smoke and aerosol concentrations can influence surface atmospheric electrical measurements, by reducing the air conductivity and increasing the total ionosphere-surface columnar resistance. A column model of vertical current flow is used to interpret early twentieth century surface measurements. By combining atmospheric electrical measurements made simultaneously across Europe in 1909 at different sites, the effect of the polluted continental boundary layer can be reduced and an estimate of the global circuit current obtained. This approach has been combined with cosmic ray profile measurements obtained by the pioneering balloon ascents of V.Hess, to deduce changes in parameters of the global atmospheric electrical circuit.