

THE ATMOSPHERIC ELECTRIC CIRCUIT: ITS RELATION TO AND INFLUENCE ON WEATHER AND CLIMATE

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The dominant generator of the atmospheric electric circuit is meteorological activity in the form of thunderstorms and electrified clouds, while the flow of the current within the circuit is principally controlled by atmospheric ionisation by cosmic rays. Cosmic rays impacting the Earth's atmosphere are modulated by the solar wind. The atmospheric electric circuit thus links weather with solar variability.

Evidence will be presented linking the variations in station level pressure at Vostok to modulations in the Interplanetary Magnetic Field of the solar wind, the so-called Mansurov effect. The relationship between the solar wind and station level pressure will be shown to support the hypothesis that this linkage occurs via the modulation of the local atmospheric circuit current and an associated influence on local cloud formation, the Tinsley mechanism. Using Vertical electric field measurements at Vostok as a proxy for the local atmospheric current, it will be demonstrated that a stronger influence over the station-level pressure is obtained. This result suggests a linkage between equatorial and Antarctic plateau meteorology and provides additional observational support for the Tinsley mechanism.

Thunderstorm activity is dominantly a summer, equatorial, land-based phenomena. It has been estimated that for a 1°C increase in equatorial temperatures, global thunderstorm activity would increase by 10%. The present status of understanding of linkages between the atmospheric circuit as measured at Vostok on the Antarctic plateau and global weather, and of a proposal for quantifying these associations using multi-site measurements during the International Polar Year, will be presented.