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Cosmic Rays in the Earth's Atmosphere and Underground

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It is review paper on cosmic rays (CR) interactions and propagation in the Earth's atmosphere and underground, changed atmosphere influence on CR and CR influence on the atmosphere and on atmospheric processes. It consists from four parts.
In **Part 1** we consider main properties of primary and secondary CR in the atmosphere, how from CR observations in the atmosphere to obtain information about the situation in the magnetosphere and in space.
In **Part 2** we discuss the problem of the influence of changes in the atmosphere on the intensity of primary and different secondary components of CR in atmosphere and underground, so called meteorological effects of CR: barometric (containing negative absorption and decay effects, and the positive generation effect); temperature and humidity (contains positive pion and negative muon effects); snow, wind, gravitational, and atmospheric electric field effects.
In the **Part 3** we consider the inverse problem, that of how CR influences the atmosphere and atmosphere processes: through nuclear reactions of primary and secondary CR with air and aerosol matter accompanied by the formation of many unstable and stable cosmogenic nuclides, through the generation in the atmosphere of secondary relativistic electrons and EAS (Extensive Atmospheric Showers) playing a crucial role in atmospheric electric field phenomena, through air ionization
influences on the low ionosphere and radio wave propagation, through induced chemical reactions, influences on the chemistry of the atmosphere and the ozone layer as well as on the formation of clouds and influence on long-term global climate change.
In the last **Part 4** we consider realized and potential applications of CR research in the atmosphere for many different branches of Science and Technology, including the problem of Space Weather.
In more details these problems we discuss in [1].

Keywords:cosmic rays; atmosphere processes; direct and inverse effects; applications in science and technology.

References

[1] Lev I. Dorman, Cosmic Rays in the Earth's Atmosphere and Underground, Kluwer Acad. Publ., Dordrecht/Boston/London (2004).