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Features and applications of the analytical model for estimating terrestrial cosmic-ray fluxes: PARMA/EXPACS

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Galactic cosmic rays are continuously incident on the Earth, and they induce extensive air shower (EAS) by successively causing nuclear and atomic interactions in the atmosphere. Simulation of EAS for various conditions is essential not only for particle physics and astrophysics but also for geosciences and radiation research. For example, evaluation of the temporal and locational variations of cosmic ray fluxes generated through EAS is very important for estimating cosmogenic nuclide yields, radiation doses for aircrews, and soft-error rates of semi-conductor devices.

We therefore performed the EAS simulation using the Particle and Heavy Ion Transport code System PHITS [1]. By fitting the results of the EAS simulation, we developed an analytical model for instantaneously estimating the cosmic-ray fluxes nearly anytime and anywhere in the Earth's atmosphere below 20 km [2,3]. The model is named PARMA/EXPACS [4], and used for various applications such as the estimation of cosmogenic nuclide production rates [5] and the analysis of footprint characteristics for soil moisture monitoring with cosmic-ray neutrons [6]. Recently, we extended the model to be capable of estimating the cosmic-ray fluxes at the top of the atmosphere [7] as well as their zenith angle dependences [8]. The detail features and applications of PARMA/EXPACS will be presented at the meeting.

References

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