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Simulations of Polar-Region Atmospheric Ionization Induced by the Ground Level Enhancement of January 20, 2005

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Ionizing radiation in the Earth's troposphere is mainly due to Galactic cosmic rays, but ground level enhancements (GLEs) can produce relativistic ions with such enormous intensity that their ionization effect in the Earth's lower atmosphere is significant. One of the largest GLEs ever observed occurred on January 20, 2005, which resulted in very large increases in the count rates of ground-based particle detectors, especially near the polar regions. We use data recorded by two neutron monitor stations located near the magnetic south pole (McMurdo) and north pole (Inuvik) to reconstruct particle energy spectra at the top of the atmosphere for each location as a function of time. We create realistic atmospheric models from measured meteorological data and use them along with the reconstructed particle flux to perform Monte Carlo simulations of particle-air interactions. We calculate atmospheric ionization at different altitudes and times during this GLE for each location. The time-dependent ionization profiles will also be useful for studying radiation dosage on aircraft. Partially supported by the Thailand Research Fund and a postdoctoral fellowship from Mahidol University.

Collaboration

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