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# Cosmogenic $^{7}$Be produced by extreme solar particle events in the atmosphere: A unique tracer for atmospheric dynamics

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We present a new physical model to calculate production of cosmogenic isotope $^{7}$Be in the atmosphere. The model is based on a full Monte-Carlo simulation of an electromagnetic-muon-nucleonic cascade in the atmosphere, using CORSIKA and FLUKA packages. The present results are in broad agreement with earlier empirical and semi-empirical models, and a comparison to direct and indirect measurements of the $^{7}$Be production rate in the atmosphere confirms the validity of the model in the whole range of geographical latitudes and altitudes.

Special emphasis is given to an effect of a severe solar energetic particle event of January 2005, which led to greatly enhanced production of the isotope in polar atmosphere. In a sense, the effect is similar to a bomb test with known isotope production parameters but without disturbing the atmosphere itself. Soon after production, $^{7}$Be becomes attached to atmospheric aerosols, making it possible to trace transport of air mass. Then, using a detailed atmospheric transport model and a dataset of real meteodata for those periods, the $^{7}$Be transport can be simulated and confronted with the measured values. Eventually, this will provide a unique opportunity to test the atmospheric transport models using a case study.

Thus, a new tool for a detailed study of tracing mass transport is proposed using the method of test particle with nearly instant injection during extreme solar particle events.