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Solar energetic particle propagation from solar flare

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Solar flare is the huge explosion on the Sun's surface and releases the solar energetic particles (SEPs) to interplanetary medium. The objective of this work is studying the propagation of SEPs from the Sun to the Earth. We simulate the particle propagation for the solar event on August 9, 2011 with the transport equation of Ruffolo 1998. We solve the transport equation by the numerical technique of finite different method. We find injection duration by fitting the simulation results and the particle data from spacecraft. The X-ray class of the selected solar event is X6.9, the solar flare position on the Sun is N18W68, and the solar wind speed is 551.5 km/s. We found the solar flare on August 9, 2011 is the gradual flare. This flare had the long injection time from the Sun to the Earth corresponding to the shock wave detected after explosion in the interplanetary space 13 minutes. In the path of the solar flare affected on the Earth, the Kp-index (the value of the earth's magnetic field variable) was considered. The Kp-index of these solar flares was less than 3, which they didn't affect on the Earth.

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