Kinematic and dynamic rupture source model for seismic wave propagation: A lesson from the 2007 Mw6.6 Niigata-Chuetsu-Oki, Japan, earthquake

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The 2007 Mw6.6 Niigata-Chuetsu-Oki, Japan, earthquake is important to study from the point of view of its impact on seismic risk evaluation, particularly the unexpected strong ground motion at the closest nuclear power plant, which is located almost above the inferred fault plane. The source mechanism of this earthquake still remains questionable. The fault plane can be segmented as cross-cutting conjugate faults (Aochi and Kato, JGR, 2010, observational references therein), while most of kinematic source models adopt a single fault plane. In the southern part of the ruptured area, the thrust faulting is dipping below the power plant. This means the rupture directivity effect is not expected in the usual way. This is also confirmed from our preliminary wave propagation simulations in this region (Ducellier and Aochi, ECEE, 2010). For explaining the unexpected ground motion at the nuclear plant, it is quite well accepted that the southernmost asperity (nearest) has a significant stress drop and/or has locally a rupture directivity towards the power plant contrary to the global rupture direction. These kinematic features are quite unique, as such rupture mode has hardly been taken into account in numerical modellings. The question arises how such rupture is possible from the mechanical viewpoint.