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これからの地震学について：I. 大地震の観測
Future seismology: I. Observation of large and mega-earthquakes

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Seismology has been founded on three basic elements: observation, wave propagation media and sources. Likely, mathematics and physics of wave motion in terms of differential equations should be more fundamental and essential. Although seismometers of acceleration and velocity types have been most often employed in seismic observation, seismic observation with seismometers must be carefully screened for usability. Correctness of seismic observation is one of most basic requirements for correct understanding of large and mega-earthquakes. Actually, seismometers only measure three translational components of velocity and acceleration. For example, strong motion seismometers are nothing but an IMU without attitude information, implying that this type of seismometers is subject to all potentials problems with IMU. More importantly, since no attitude information is available from strong motion seismometers, except for first arrivals of P-waves, there is no guarantee that seismic observation of wave motion in the hypocenter of a large or mega-earthquake is usable due to the fact that the body reference frames are changing with time, as has been confirmed, once and again, by comparing high-rate GNSS with strong motion data collected in hypocenters of large earthquakes. Although there are a few more types of instruments commonly used in seismic observation, and as part of this series on future seismology, I will focus, in this talk, on high-rate space geodetic technology which should play a more and more important and even essential role, likely even far more important than seismic observation, in disaster mitigation, early warning and physical mechanisms of the sources of large and mega-earthquakes in the future.