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Outline of the Kanto Asperity Project

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The Kanto region is one of the most densely populated urban areas in the world. Great earthquakes along the Sagami trough have repeatedly occurred. The 1703 Genroku and 1923 (Taisho) Kanto earthquakes caused severe damages in the Tokyo metropolitan area. Slow slip events (SSEs) have also repeatedly occurred in an area adjacent to the asperities of the great earthquakes, off Boso peninsula (e.g., Ozawa et al 2007).

The Kanto Asperity Project (KAP) proposes a drilling and long-term monitoring program in the southern Kanto region of southeastern Japan with the aim of determining the characteristics of the plate boundary in and around the source regions (asperities) of great earthquakes and SSEs.

Recent progress in the development of supercomputers has enabled the simulation of earthquake and SSE generation cycles, but the parameters are not based on scientific data, and are not sufficiently reliable to assess the hazards associated with future earthquakes. The establishment of a realistic earthquake-generation model is of crucial importance in mitigating the danger posed by earthquake geohazards.

We focus on three different types of seismic events occurring repeatedly at the almost same depth of the seismogenic zone along the Sagami trough (5-20 km)

(1) The 1923 M˜7.9 Taisho earthquake, located in Sagami Bay. Maximum slip is about 6 m, the recurrence interval is 200-400 yr, and the coupling rate is 80-100% (”coupling rates” = ”slip amounts during earthquakes or slow-slip events” / [”rate of motion of the Philippine Sea Plate” - ”recurrence interval”]) .

(2) The 1703 M˜8.2 Genroku earthquake, located in Sagami Bay, but also extending to the southern part of Boso Peninsula. Maximum slip is 15-20 m, the recurrence interval is ˜2000 yr, and the coupling rate at the southern part of the Boso Peninsula is 10-30%.

(3) Boso slow-slip events, located southeast of Boso Peninsula. Maximum slip is 15-20 cm over ˜10 days, the recurrence interval is 5-6 yr, and the coupling rate is 70-100%.

In the cases of Nankai and Cascadia, SSEs occur at deeper levels than the asperities, and the location can be controlled by temperature and pressure. The Boso SSEs occur at the same level as the asperities, raising the possibility that the conditions (materials, fluids, or surface roughness) in the Kanto region are different to those encountered at Nankai and Cascadia.

Our main objectives of the KAP are

Objective 1. to understand why the different types of events occur side by side at almost same depth (in same P-T conditions) and

Objective 2. to establish realistic earthquake-generation models using data on each step of the process of natural earthquakes.

We submitted one umbrella and two component proposals (Program A and B) in October 2010. Program A proposes ultra-deep drilling to intersect plate boundaries in the Boso SSE region and the Taisho asperity, in order to compare the geological materials at the two sites. Coring and logging at plate boundaries would also yield realistic frictional properties and effective normal stress, as derived from experiments on recovered materials and from measurements of pore pressure, respectively.

Program B proposes long-term monitoring (borehole observatories) for recording in detail crustal deformations and seismicity during 2-3 cycles of Boso SSEs, enabling testing of the hypothesis that SSEs can be used to assess the validity of earthquake generation models. Once Program B has yielded earthquake generation models from SSE ones, we can verify and improve the models by directly determining the values of parameters as part of Program A.

We have considered to submit one more new proposal. This will focus on the input materials on the Philippine Sea plate. One of our hypothesis on the Objective 1 is that the difference of input materials may cause the different type of slips. Saito et al. (this session) will describe the details of this hypothesis.

Keywords: asperity, slow slip, drilling, monitoring