Rigid rotation of outer Southwest Japan and its implication for the safety of Ikata Nuclear Power Plant

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After the severe accident at the Fukushima Daiichi Nuclear Power Plant in 2011, the examination system of the nuclear power plants in Japan was renovated; now the conformity to the new regulation is examined by the Nuclear Regulation Authority, Japan. The documents of the meetings are open to the public via the website at http://www.nsr.go.jp/disclosure/committee/yuushikisya/tekigousei.html; the scientists can check the appropriateness of the examination if they want to do so. However, because earth scientists are so busy, they will not view the documents unless they are forced to do so. I was also one of those people who did not have enough time to open those documents, however, I recently had a chance to read the documents about the design ground motion of the Ikata Nuclear Power Plant. What I found there was that part of the process of strong motion evaluation is not reasonable. One of those problems will be presented in my presentation. The problem is not related to the simulation of strong ground motion; it is rather related to tectonics. Therefore, the topic is not so closely related to my own specialty. My intention here is to attract the attention of the specialists to this important problem. I hope this presentation will stimulate discussion among specialists of tectonics.

The evaluation process of the design ground motion of Ikata Nuclear Power Plant can be found in a document submitted by the Shikoku Electric Power Company to a meeting on March 20, 2015 (http://www.nsr.go.jp/data/000100928.pdf). Because the Median Tectonic Line is located in front of the power plant site, its activity is considered in the evaluation of the design ground motions. In this process, the dip angle is basically assumed to be 90 degrees and its uncertainty is considered. However, although the dip angle of 30 degrees is considered in the north-dipping case where the source fault is far from the power plant, the dip angle of no less than 80 degrees is considered in the south-dipping case where the source fault is close to the power plant (page 55). It looks like the power company intentionally avoided the critical case.

The Geospatial Information Authority of Japan shows a map of crustal deformation (http://www.gsi.go.jp/kyusyu/test.html), where the outer Southwest Japan is rotating anticlockwise; this movement is in agreement with the occurrence of the 2016 Kumamoto earthquake. The animation shows that Ikata Nuclear Power Plant belongs to a region of contraction. Although the power company says that the site is located in a transition zone from a right-lateral faulting to a normal faulting in another document submitted to the same meeting (https://www.nsr.go.jp/data/000100933.pdf), the fact is that the site is located in a contraction zone; the right-lateral faulting will accompany reverse faulting rather than normal faulting.

The question is whether the fault is north-dipping or south-dipping. If we assume a reverse faulting along a north-dipping plane, it will be in conflict with the long-term uplift of the southern side of the Median Tectonic Line. Therefore, a reverse faulting along a south-dipping plane is likely to occur with the right-lateral movement. Therefore, it is not appropriate to focus on north-dipping plane.

It should be noted that this discussion does not imply that the northwest oriented crustal movement of Western Shikoku will entirely be contributing to a large event along the Median Tectonic Line; most of it will be canceled by huge subduction earthquakes along the Nankai Trough. However, it should be noted that the rotation of outer Southwest Japan is in agreement with the occurrence of the 2016 Kumamoto earthquake. Therefore, the rotation may cause a big earthquake along the Median Tectonic Line which is in consistent with the rotation, that is, a right-lateral earthquake with significant dip slip. The occurrence

of such an earthquake may be approaching due to the accumulation of strain with the subduction of Philippine Sea Plate.

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