

Lock Loss Study of bKAGRA phase-1



Yuki Miyazaki on behalf of KAGRA collaboration

Department of Physics, University of Tokyo

Email: miyazaki@granite.phys.s.u-tokyo.ac.jp

Abstract:

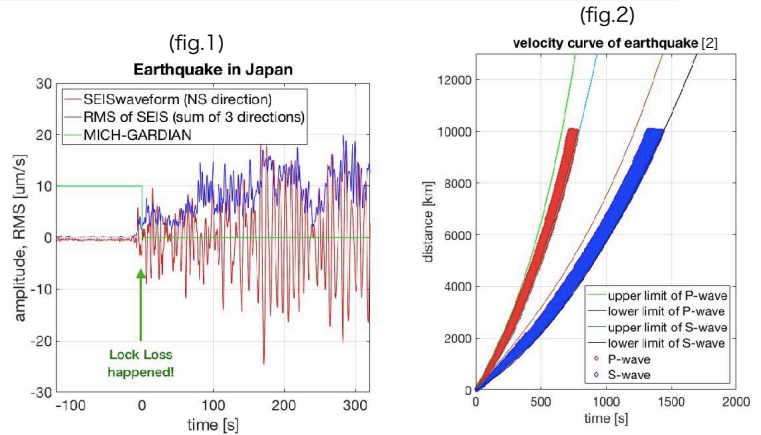
During operation the interferometer should be kept locked to the appropriate interference condition. However, big earthquakes can cause Lock Loss. In order to cope with these earthquakes appropriately, earthquakes and their relation to Lock Loss was studied. Earthquakes that happened in bKAGRA phase-1 were separated into 3 types by checking whether there was Lock Loss and whether the seismic vibration was big in the expected time of arrival. It was found that they were divided into two parts: dangerous/safe earthquakes.

1. Motivation

In bKAGRA phase-1, control of the interferometer was lost by earthquakes. By classifying earthquakes that happened during operation, we can decide if we need to respond to them.

- If **safe** → Neglect!
- If **dangerous** → Respond appropriately!

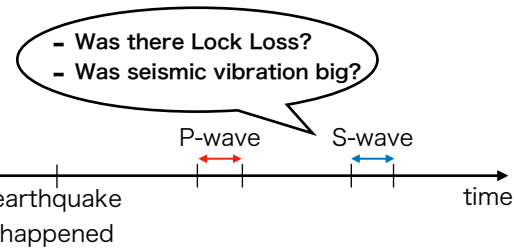
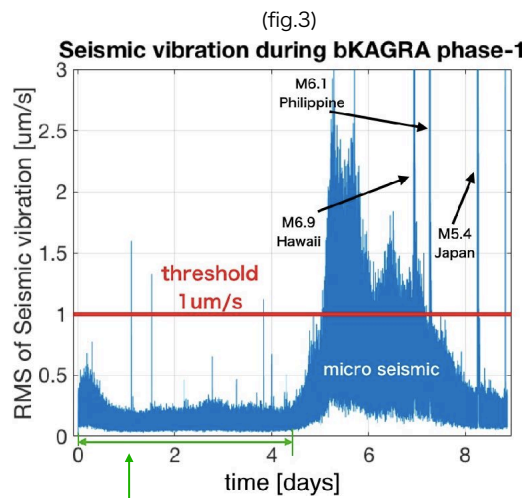
This study will help us cope with earthquakes appropriately and increase the duty cycle of KAGRA.



2. Method

Used data:

- Earthquake data [1] (place, happened time, magnitude)
- Velocity of earthquakes (fig.2) [2]
- When Lock Loss happened (fig.1)
- When the RMS of seismic vibration was big (fig.3)

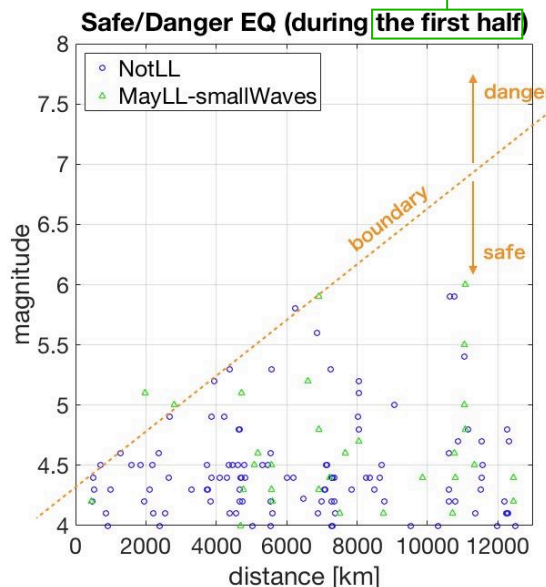
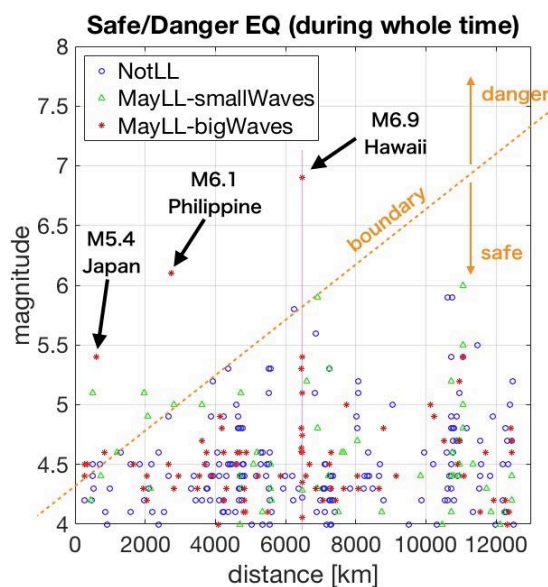


(Table.4)

	SEIS big	SEIS small
There was any Lock Loss	May cause LL with big waves	May cause LL with small waves
There was No Lock Loss	Does not cause LL (No exist)	Dose not cause LL

I separated earthquakes into 3 types: (Table.4)

3. Result



4. Conclusion

- The boundary line divides earthquakes into 2 types: dangerous or safe.
- From this study, information about distance and magnitude will teach us whether it is dangerous or not.
- We can cope with it appropriately!
- More data will help decide the boundary much precisely.

5. References

[1] USGS, <https://earthquake.usgs.gov>
 [2] JMA, http://www.data.jma.go.jp/svd/eqev/data/bulletin/catalog/appendix/trtime/trt_j.html