Investigation report for roughness changes after HOKKAIDO IBURI earthquake Japan, by using Smartphone roughness measurement

by

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Past Earthquake in Japan

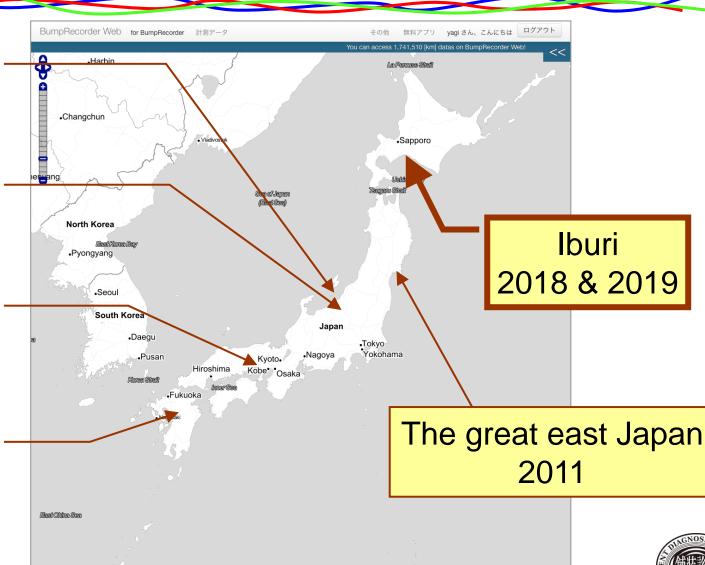


Chuetu oki 2007

Chuetu 2004

> Kobe 1995

Kumamoto 2016



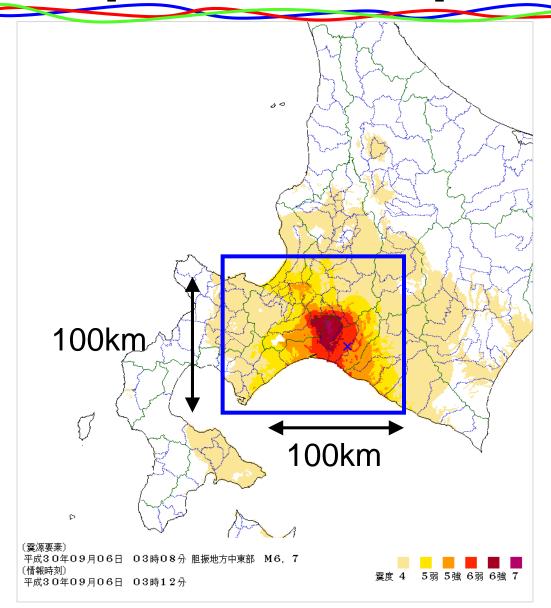
Map tiles by Stamen Design, under CC BY 3.0, Data by OpenStreetMap, under ODbl



RPUG-PDRG 1st Joint Meeting

IBURI earthquake 2018 Sep.

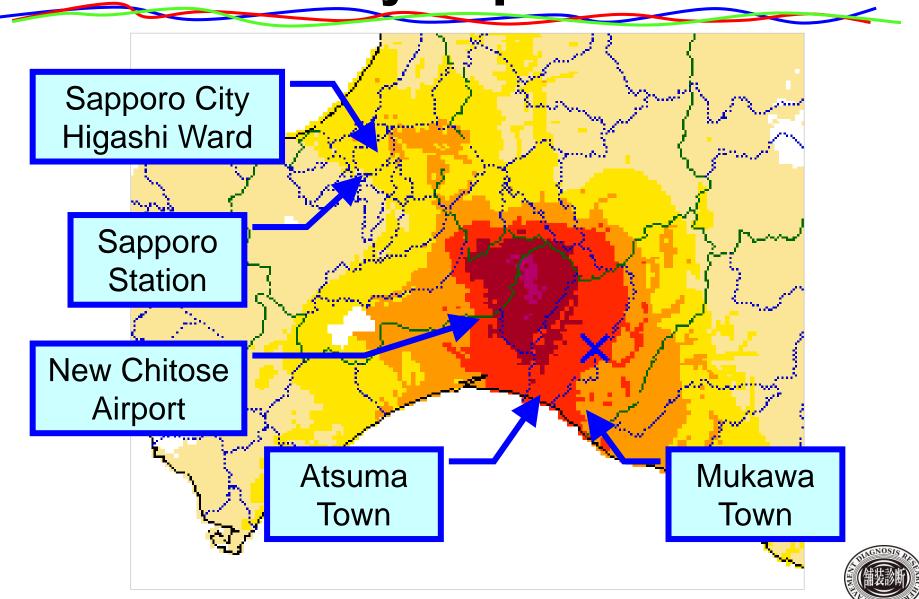






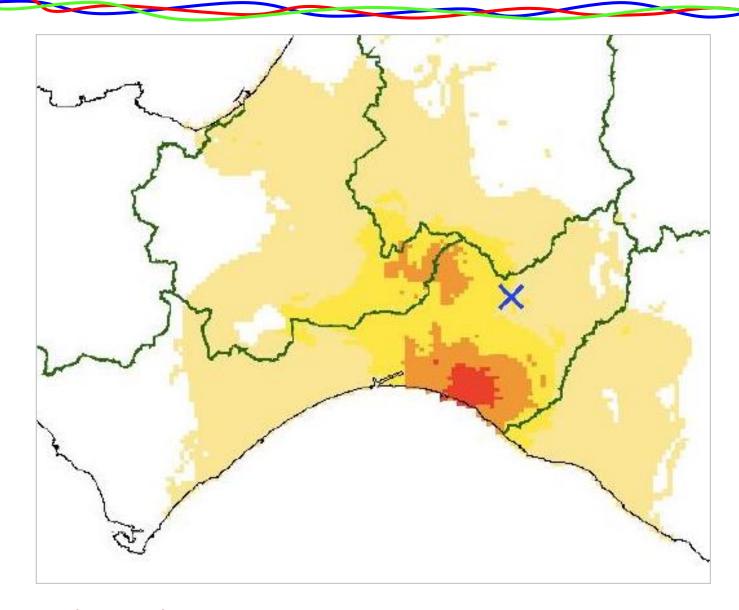
Seismic intensity map





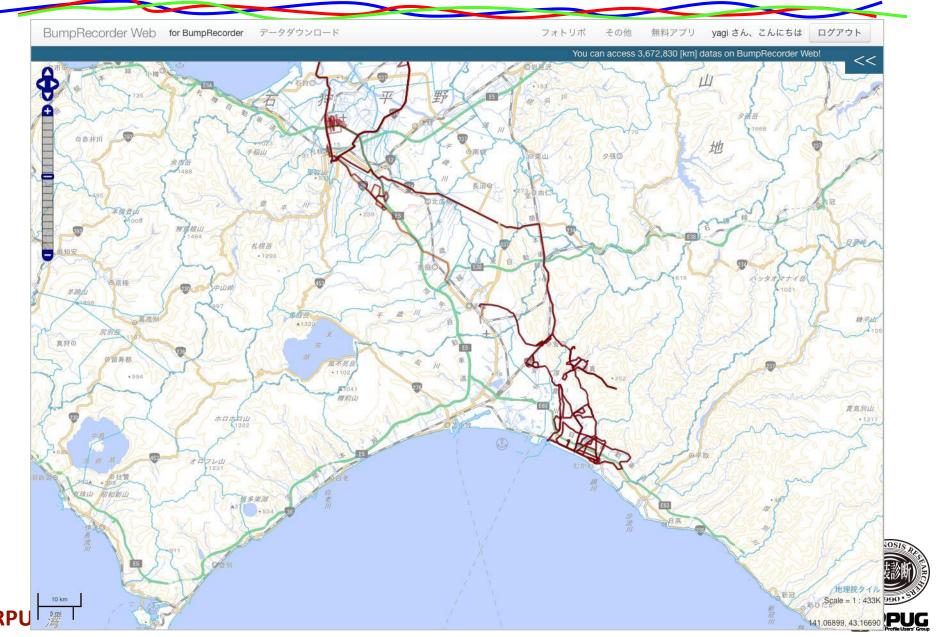
IBURI earthquake 2019 Feb.







Research distance up to 1,600km BumpRecorder





Measurement Method and Evaluation Index

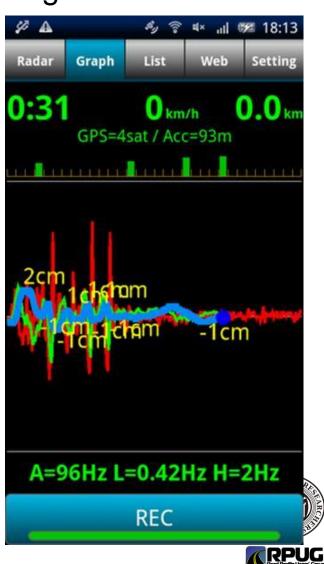


Smartphone type measurement



Vibration data is collected under driving situations.





IRI Class 2 calculation process

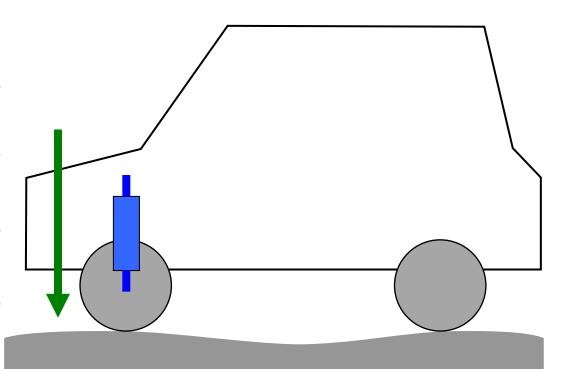


Measure acceleration (a)

Suspension estimation (b)

Inverted QC simulation (c)

Calculate profile (d)





Using profile, compute indexes

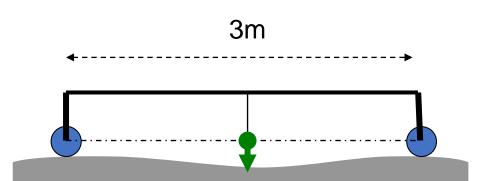


IRI - International Roughness Index Average of suspension expansion & compression under 80km/h driving situation. It includes longer wave length.

(3) Calculate IRI
(2) QC simulation
(1) Measured profile

HEITANSEI sigma 平たん性σ

JRI - Japanese Roughness Index Standard deviation of 3m profilometer measurement value. It indicate shorter wave length situation.





Using profile, compute indexes



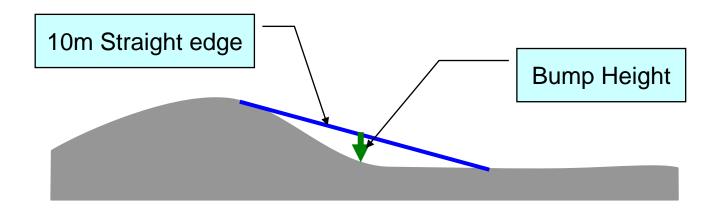
IRI / JRI - Roughness

Representative value on the segment.

BBI - Boeing Bump Index

Pointed information of the bump size and location.

10m straight edge is used, and deepest depth is defined Bump Height.







Measurement Results around Atsuma Town and Mukawa Town



Measurement result after earthquake





Result before and after 2018





After earthquake roughness situation draw by red line. Before earthquake draw by blue line.



Result before and after 2019

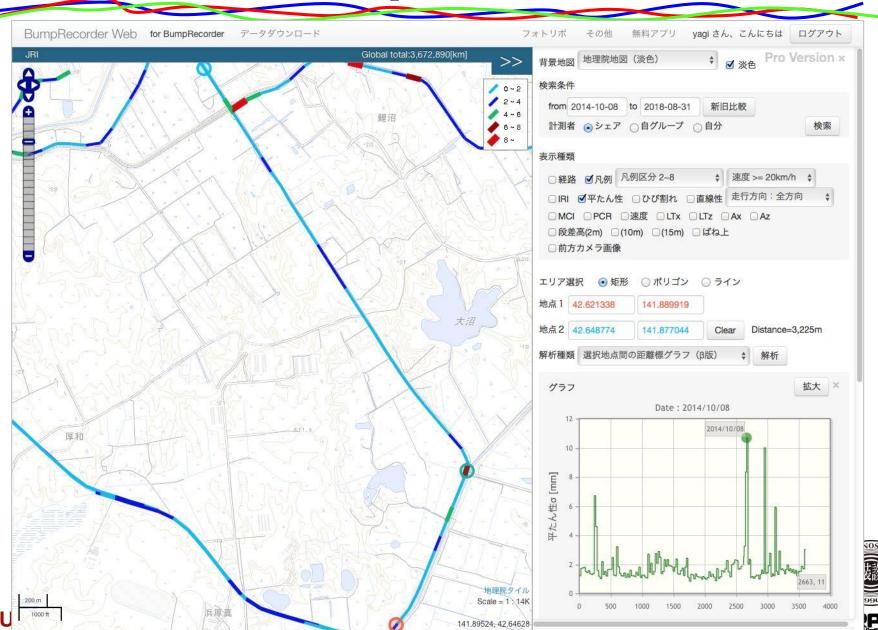






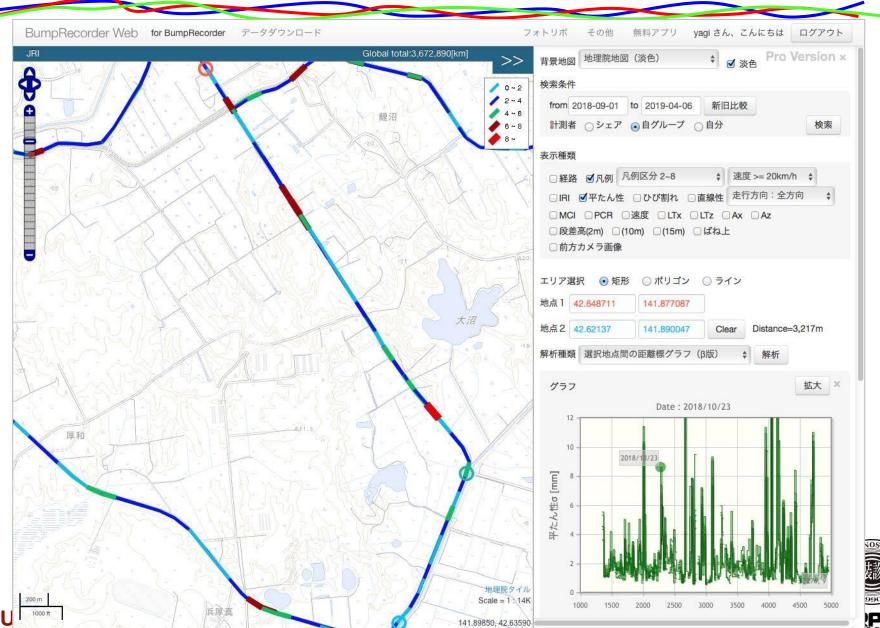
JRI before earthquake





JRI after earthquake





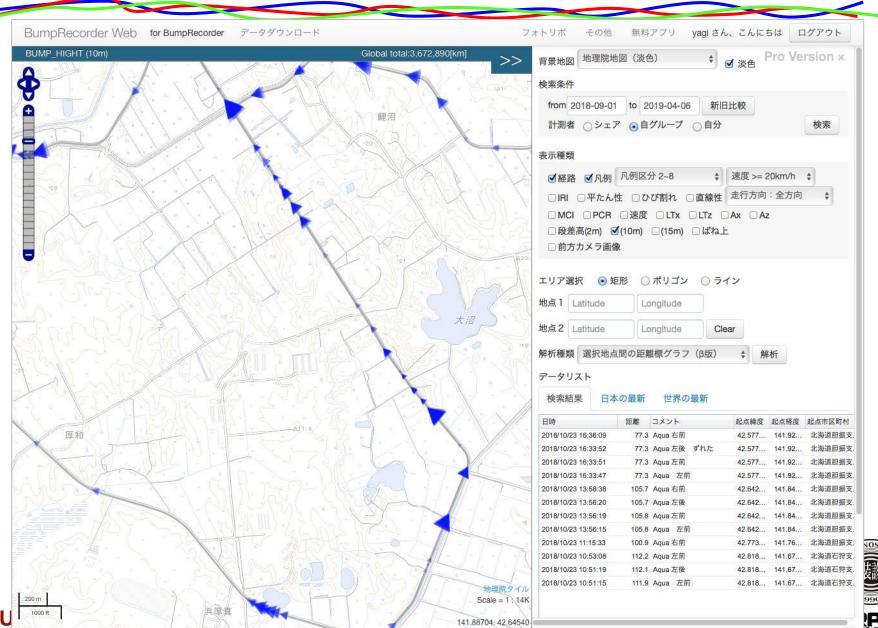
BBI before earthquake





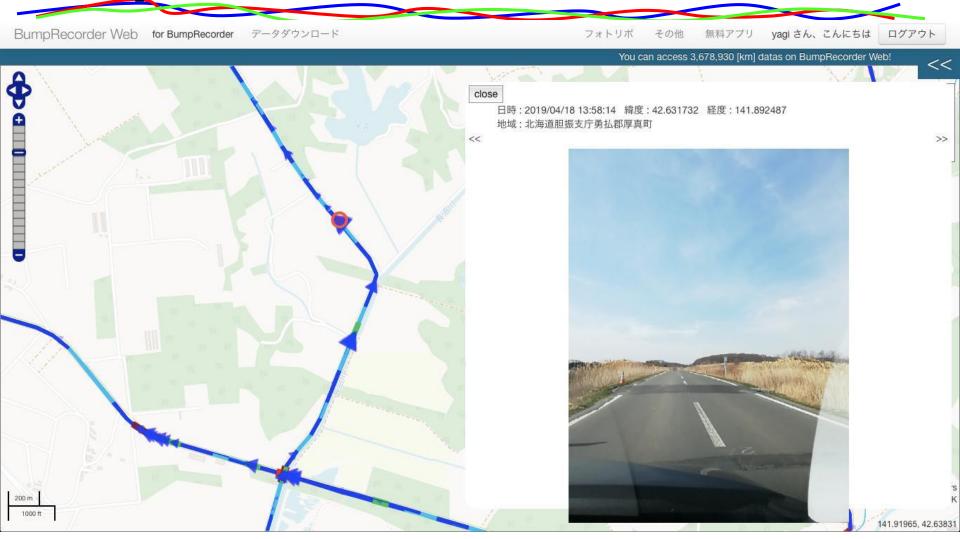
BBI after earthquake





Bump situation







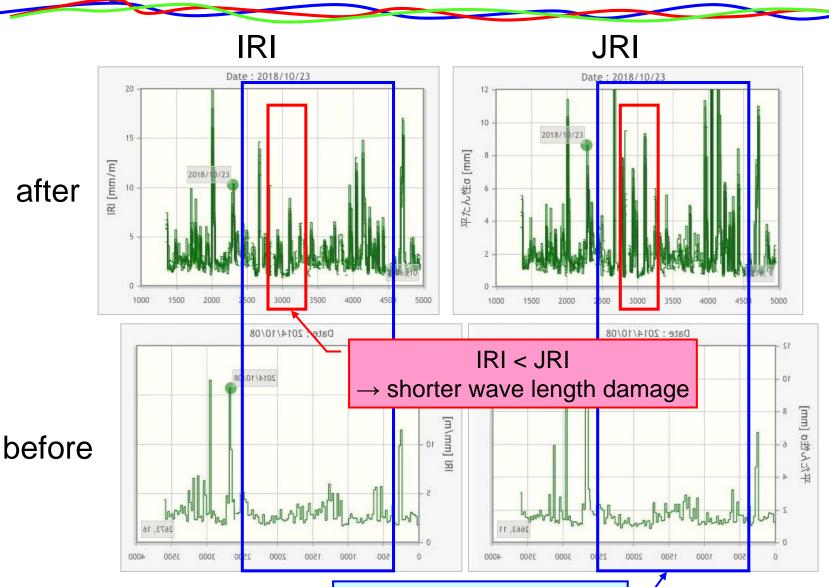
Bump situation





Comparison IRI and JRI







before < after → damage



Measurement Results around Sapporo City Higashi Ward





Measurement result after earthquake





Result before and after 2018







Result before and after 2019

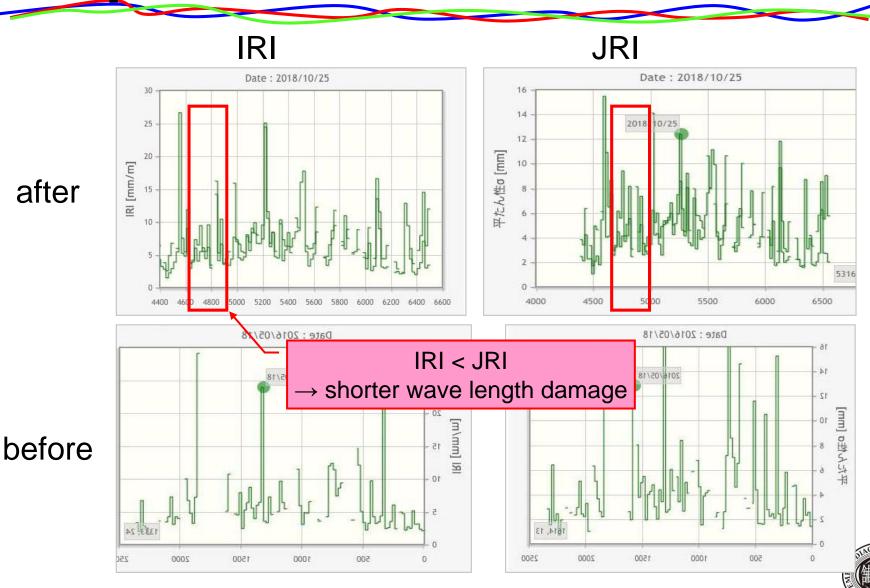






Comparison IRI and JRI







Conclusion



Conclusion



- By using Smartphone, roughness condition can be measured quick, easy and wide area, low cost.
- Roughness situation is changed after earthquake.
- Comparison before and after is clearly indicate road damage.
- IRI, JRI, BBI can indicate road damage, and sometime their characteristic is not same.

Important is

- not only after but also before, collecting data.
- not only IRI but also JRI, BBI also using.





Question(s)?

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