

## Examples showing the duration of earthquake ground motions affected by the site effects

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Earthquake magnitude is not the only factor that determines the duration of earthquake ground motions. The duration of earthquake ground motions can vary significantly for the same earthquake depending on the site characteristics. Here are some examples:

### 1. The 1997 North-western Kagoshima Prefecture, Japan, earthquake ( $M_w6.1$ )

There are many ‘calderas’ formed by past volcanic activities in Kyushu, Japan. During the March 26, 1997 North-western Kagoshima Prefecture, Japan, earthquake (Figure 1), strong ground motions were observed both inside and outside the calderas. The strong ground motions outside calderas lasted for 10 seconds at most (Figure 2). In contrast, the strong ground motions inside calderas lasted for almost 60 seconds. Calderas are a typical example of basin-like structures and basin-like structures tend to elongate the duration of strong ground motions.

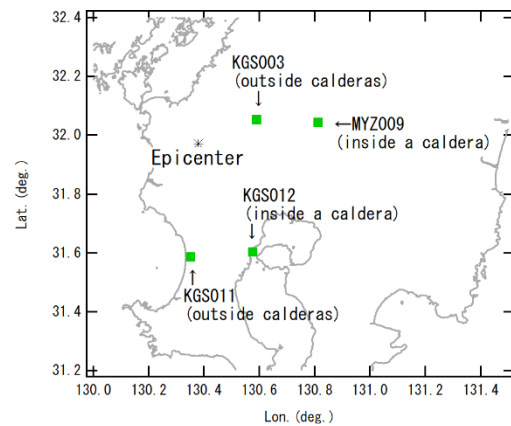


Figure 1 Locations of strong motion stations

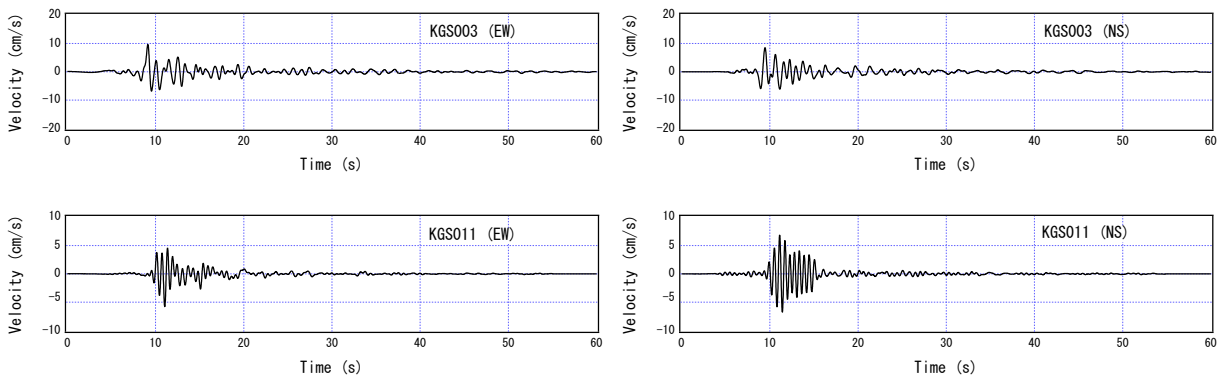


Figure 2 Ground motions observed outside calderas (0.2 – 2 Hz)

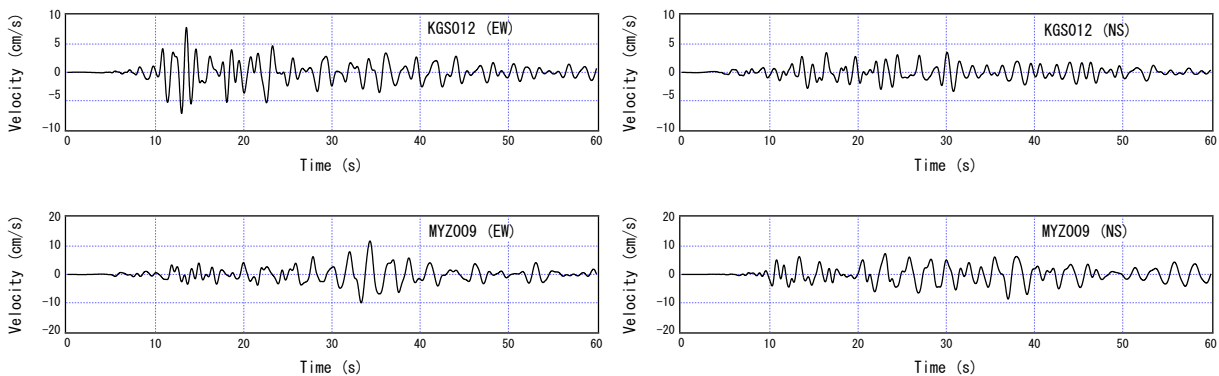


Figure 3 Ground motions observed inside calderas (0.2 – 2 Hz)

## 2. The 2003 Tokachi-oki, Japan, earthquake ( $M_w 8.3$ )

During the 2003 Tokachi-oki, Japan, earthquake, strong ground motions with significantly different durations were observed at closely-located station pairs as shown in Figures 4 – 6. They are all from the same earthquake. These examples clearly show that magnitude is not the only factor that determines the duration of earthquake ground motions. These differences are related to basin-like structures. However, it is too expensive to reveal all the details of a basin-like structure for the accurate simulation of basin-induced waves. If a project is located in a high seismic region, it is advantageous to conduct earthquake observations at a project site to reveal the site effects.

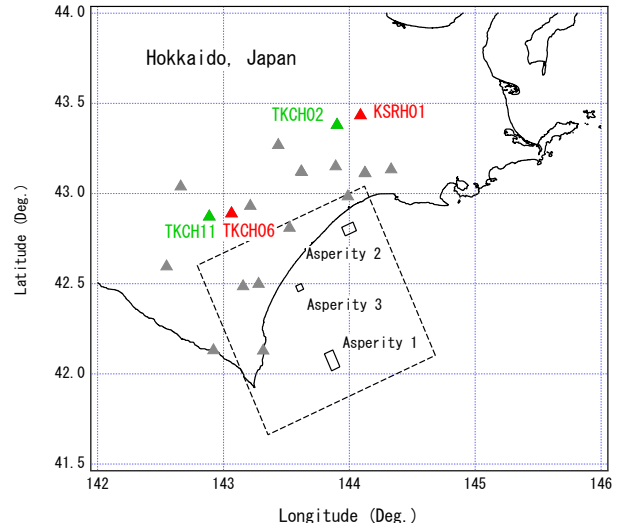


Figure 4 Locations of strong motion stations

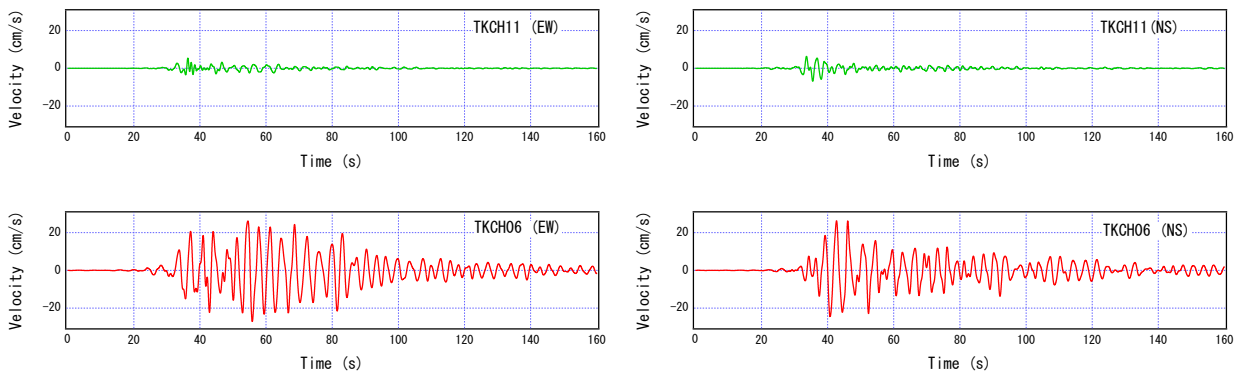


Figure 5 Ground motions observed at a closely-located station pair TKCH11 and TKCH06 (0.2 – 1 Hz)

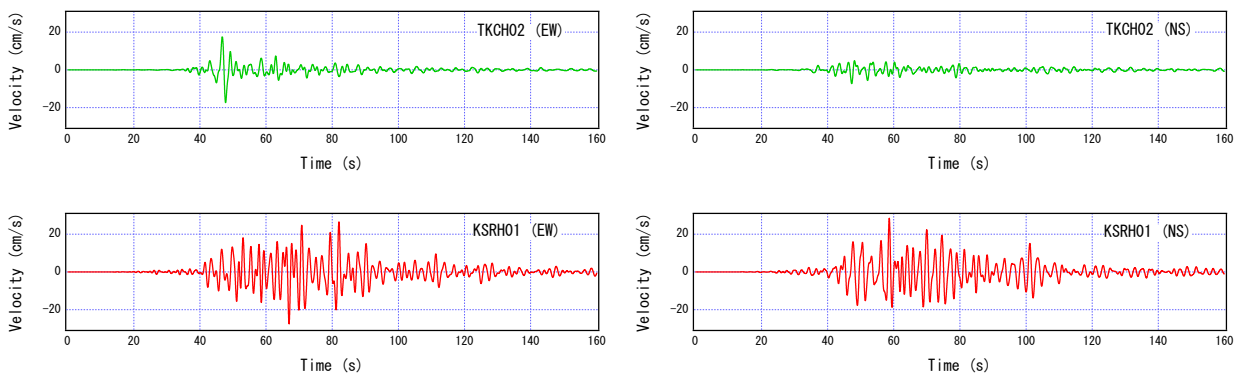


Figure 6 Ground motions observed at a closely-located station pair TKCH02 and KSRH01 (0.2 – 1 Hz)

## Acknowledgment

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