

The increase in missing waveform images of the F-net seismographs preceding the 2004 off Kii peninsula earthquake

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1. Introduction

The F-net is a broadband seismograph network constituted of 73 STS-1 and 2 seismometers. Natural frequency of the seismometers is 120 seconds (STS-2) and longer, thus they can detect long-period ground motion. On its website, waveform images of the stations for a day or an hour are provided. The analyses on their file size have shown long-period vibrations (Sue, 2010).

2. Analysis

Variation recorded in waveform images may mean variation of ground motion. Thus operational status of the F-net is investigated. There are two sources on it.

a. Data acquisition trouble log: This is the formal information covering from instantaneous to long-lasting loss of data. Reasons for troubles are shown. While, update of the information is irregular.

b. Missing of waveform images: The website displays the message "Waveform image does not exist". It is surmised that this situation is caused by continuous loss of data exceeding 1 day (Daily plot) or 1 hour (Hourly plot). The reasons are not shown. While update of the information is regular.

So far, analyses on "missing of waveform images" for the 2011 Tohoku earthquake (M=9) has been done (Sue, 2013). As a next step, the 2004 off Kii peninsula earthquake (M=7.4), which occurred on September 5, 2004 at the Nankai trough, is carried out. For details, for the period of about 3 months from June 1, 2004 to September 10, 2004, the F-net stations located in the area between Itoigawa - Shizuoka tectonic line and Okinawa island are investigated (The one in Noto peninsula is excluded).

3. Results

Fig. 1 shows the result. During June - first half of July, 2004, which is more than 1.5 month before the main shock, the most frequent number of the image-missing station is 1, and it was stable condition. From last half of July and later, the number varied.

On August 30 and 31, which are 6 and 5 days before the earthquake, there were large increases of the number. Further, arrangement of image-missing stations is mainly in southern part and east coast of the Kyushu island respectively.

On Sept. 4, which is the previous day of the main shock, there were 3 image-missing stations, located from Shikoku island to Kyushu island alongside the Nankai trough (Fig.2).

After the earthquake, number of image-missing station decreased to zero.

The major reasons for missing images are "Network trouble" and "Electric power supply trouble".

4. Discussion

Number of F-net station with missing waveform images increases before an earthquake. The phenomena appear not only close to the epicenter, but wide area surrounding it. The phenomena are also observed at the 2011 Tohoku earthquake, thus they may usually appear before a large earthquake. Similar phenomena as shown in this paper might be observed at the anticipated Nankai trough earthquake.

Missing images of all 73 stations happened on 23 to 25 in July (Fig.1). Same phenomena appeared at the 2011 Tohoku earthquake, thus the phenomena may be a sign of unstableness of the F-net system.

It is assumed that increases of the missing waveform images preceding a big earthquake was because the F-net could not withstand possible long-period variation of the earth's surface. "Network trouble" and "Electric power supply trouble" might be causes for such situation. Such phenomena are not observed for the Hi-net seismograph network, probably because of its characteristic (NF = 1 sec).

When the DONET (Dense Oceanfloor Network System for Earthquakes and Tsunamis) detects anomaly, malfunctioning of the F-net may appear at the same time or even earlier.

The area formed by the F-net stations with missing images may have certain relation with magnitude of the earthquake.

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References

