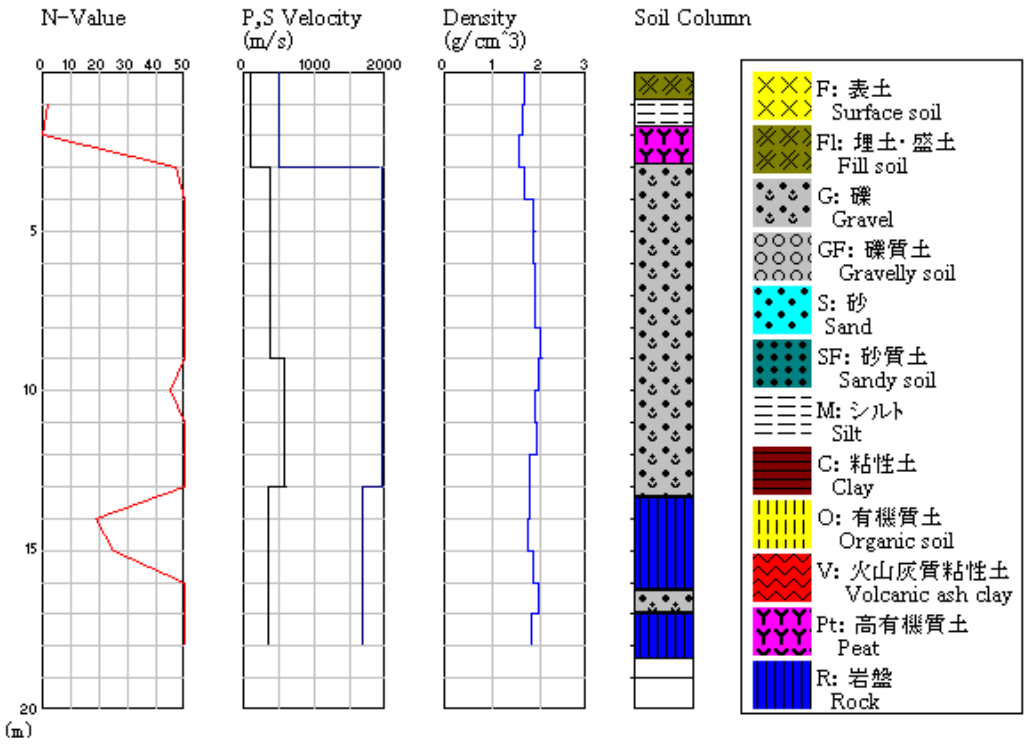
7 STRONG MOTION RECORDS AND THEIR CHARACTERISTICS

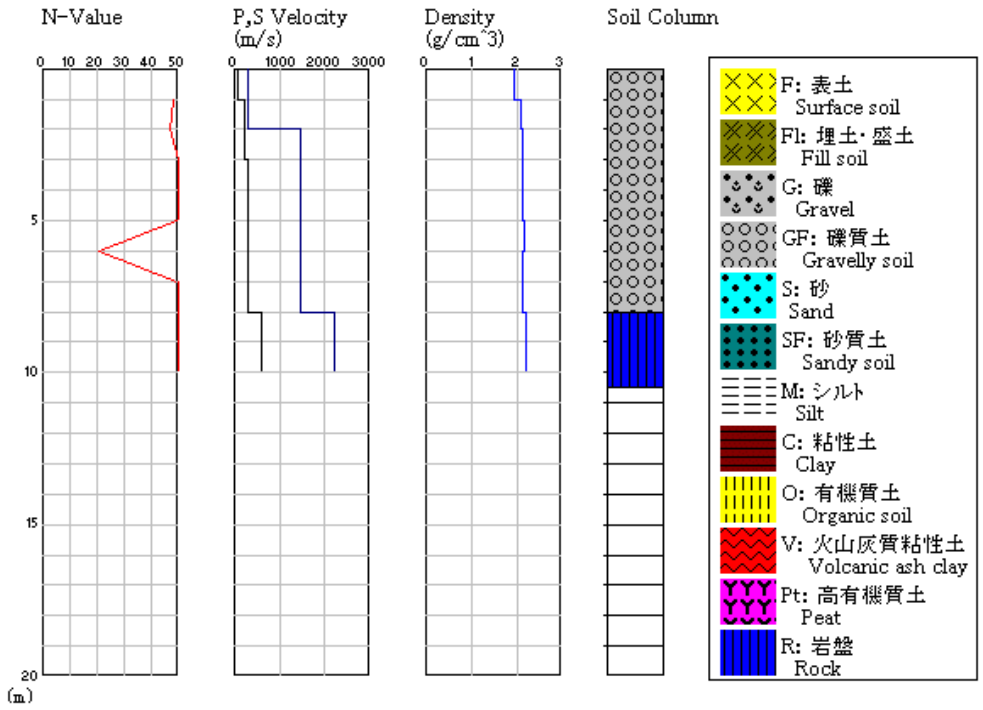
The strong motion networks of Japan Meteorological Agency, K-Net, Kik-Net of NIED Japan Railways and Japan Highways recorded very high accelerations in the epicentral area. The maximum ground acceleration was observed in Tokamachi and it was more than 1700 gal while the ground acceleration was more than 1500 gal in Ojiya. Figure 7.1 shows the borehole logs and geotechnical characteristics of ground conditions at strong motion stations of Ojiya and Toka-machi. At both stations soft soil is about 2-3m deep. Therefore, the amplification effect of soft soil beneath the stations should be negligible except the well-known effect of free surface, that is, the amplification of ground surface deformation is twice that at far field for elastic response.

Figures 7.2 and 7.3 show the acceleration records and integrated velocity records released by K-Net of NIED. As noted from these figures they are strikingly different from each other. Ojiya is on the hanging-wall of the causative fault and it has numerous large cycles of acceleration. On the other hand, Tokamachi is at the south-end of the causative fault and it had an impulsive character. Figure 7.4 shows the contours of the absolute and EW, NS and UD maximum ground accelerations recorded by K-Net and Kik-Net. These records clearly indicate that the characteristics of ground acceleration differ from each other and there is a strong directivity effect associated with rupturing process.

Figure 7.5 shows acceleration response spectra for Ojiya, Toka-machi and Nagaoka records with a damping ratio of 5%. Toka-machi and Nagaoka response spectra have some similarities while their absolute values are different. While the peak acceleration spectra values are almost same for Ojiya and Toka-machi, the periods at the peak accelerations are different from each other. In other words, the structures having shorter period should be more affected in Toka-machi while structures with longer periods would be affected by the shaking in Ojiya. Nevertheless, the response acceleration values are 4 times that of the base acceleration.



(a) Ojiya



(b) Tokamachi

Figure 7.1: Geological borehole logs at Ojiya and Tokamachi strong motion stations

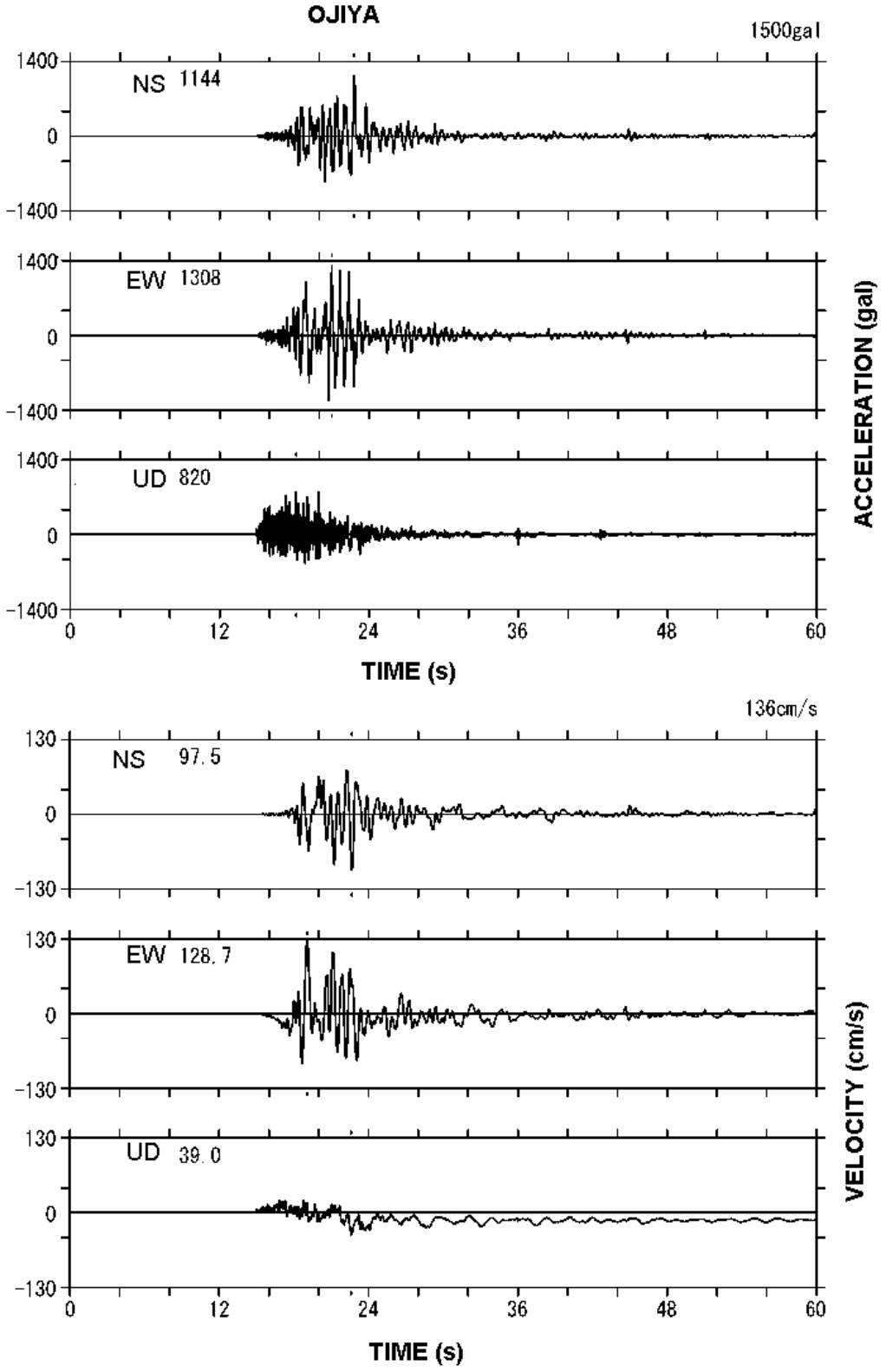


Figure 7.2: Acceleration and velocity records for Ojiya station (K-Net)

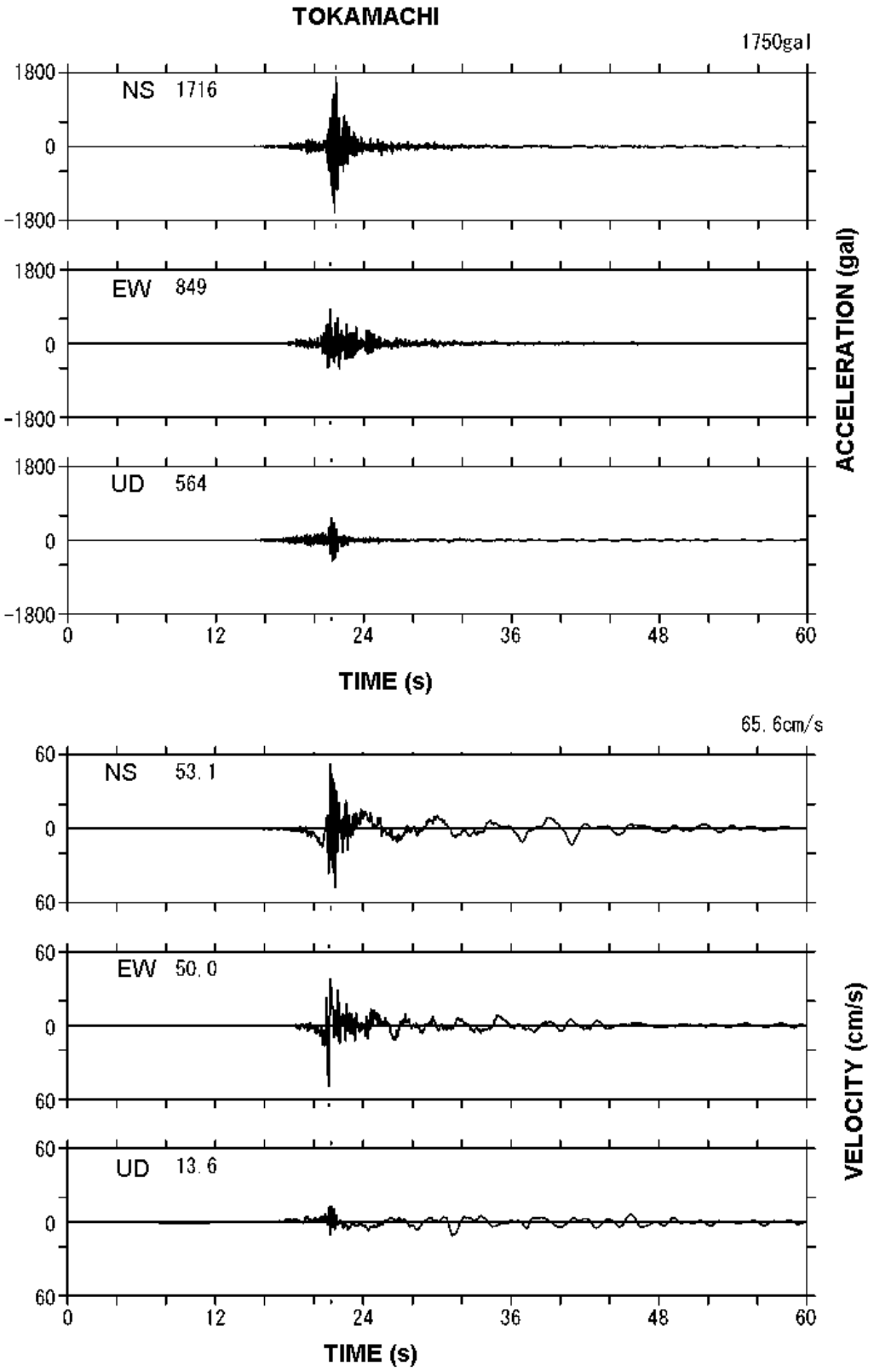
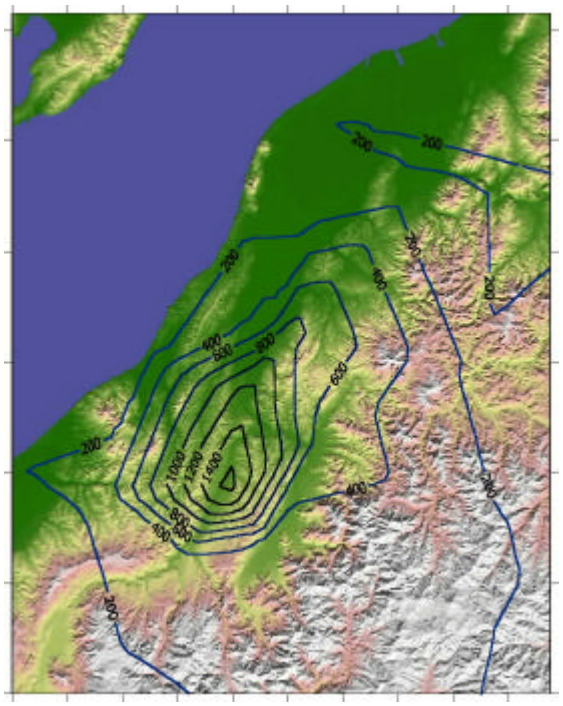
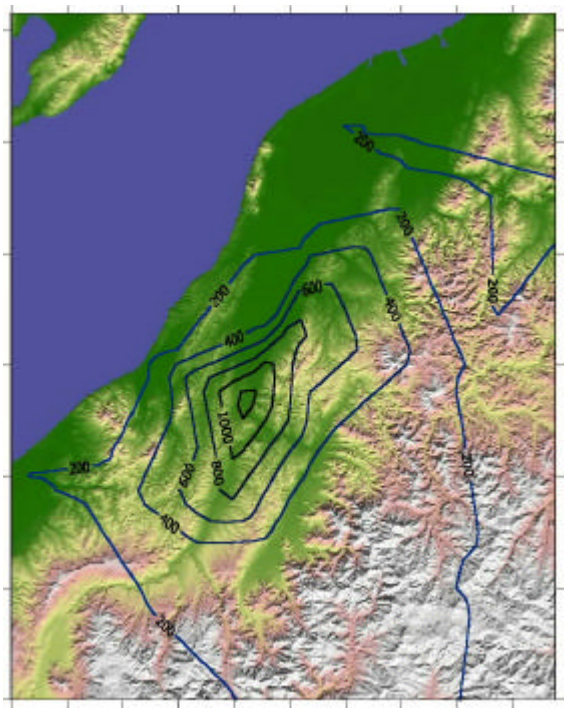


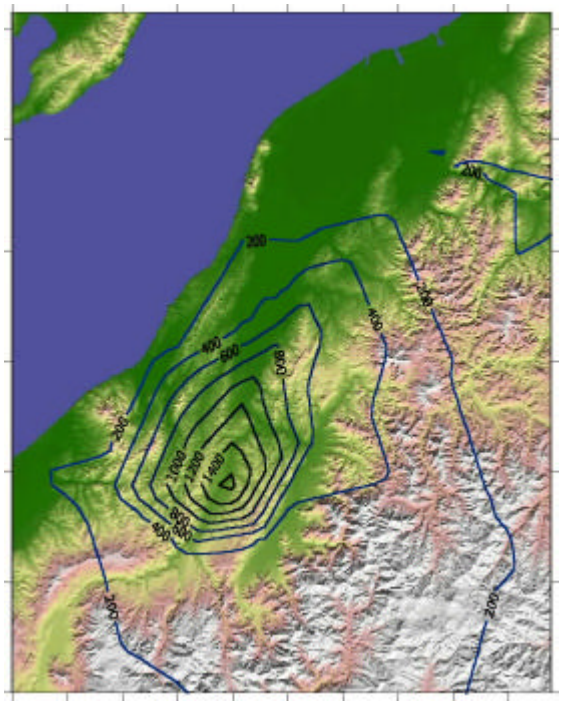
Figure 7.3: Acceleration and velocity records for Tokamachi station (K-Net)



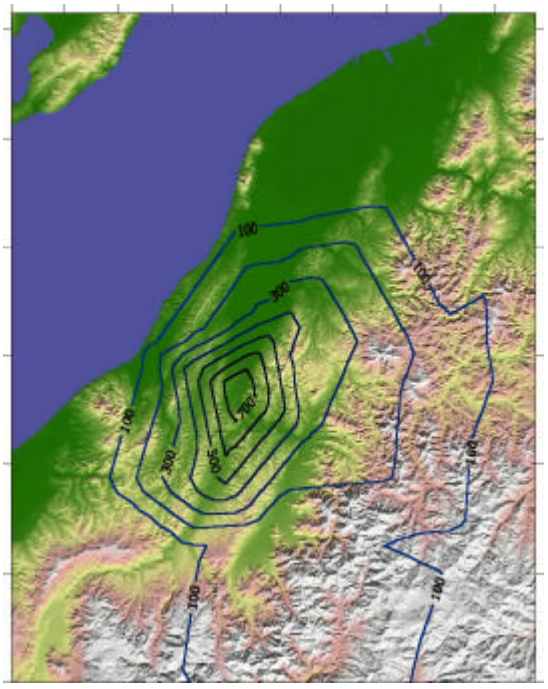
(a) Absolute maximum acceleration



(b) EW maximum acceleration



(c) NS maximum acceleration



(c) UD maximum acceleration

Figure 7.4: Contours of absolute and EW, NS and UD components of maximum ground accelerations

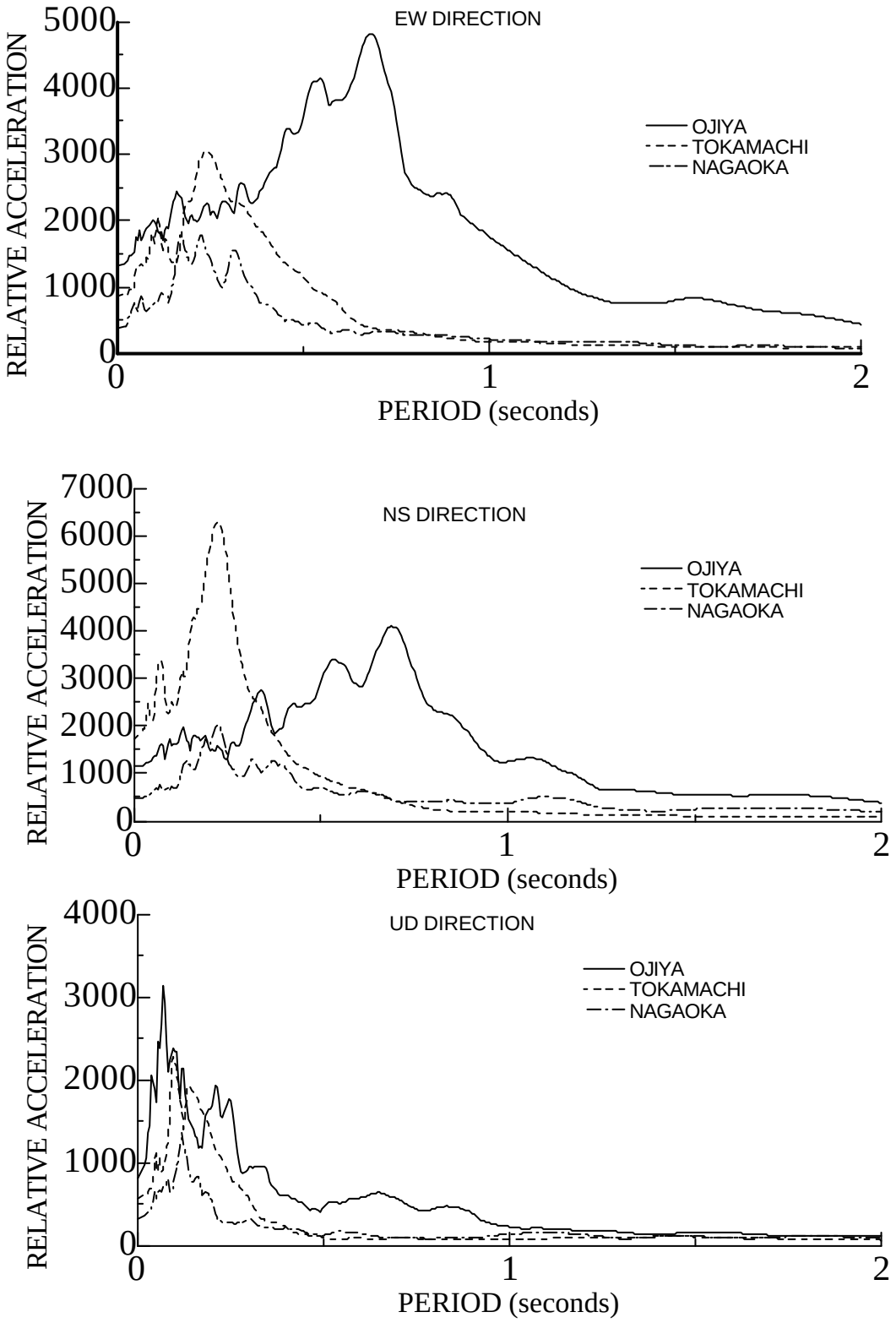


Figure 7.5: Response acceleration spectra for Ojiya, Tokamachi and Nagaoka stations