The 11 November 2018 monotonic event near Mayotte island, east Africa observed by the Iranian broadband seismic stations

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The 11 November 2018 Mayotte event was first introduced in the media by Maya Wei-Haas (2018) on National Geographic Magazine as a strange earthquake of which seismic waves were recorded by instruments around the world, but unusually nobody felt them. The Mayotte event in the absence of body waves caused long-period surface waves traveling around the globe. Tono Research Institute of Earthquake Science recorded the data with the broadband seismometer (STS-1) and gravimeter (gPhone) installed in Mizunami (Murakami et al., 2019). The records by Iranian broadband stations clearly showed the long period seismic signals around 10 (UTC) on November 11, 2018. We studied records by 28 stations (Figure 1) distributed throughout the country. Among them, 26 stations were operated by National Center of Broadband Seismic Network of Iran, while two other stations were operated by the Ferdowsi University of Mashhad. Since the frequency content of Fourier amplitude spectra appeared the signal of the surface waves as a peak around 0.06 Hz, we applied a bandpass filter of 0.05-0.07 Hz to the waveform data. To separate Rayleigh from love in surface waves, the filtered horizontal components were rotated to the radial and transverse components based on an assumed epicenter location at the latitude of 12.7S and longitude of 45.4E degrees. The stations considered as an array and the investigation was carried out in two ways. First, the position of each station was taken as the reference point of the array coordinate, and arrival delay times at the other stations relative to the reference were calculated. The phase velocity and the back-azimuth of each station were estimated through the least-square regression method. The estimated back azimuths were within 13 degrees from the back azimuths from the assumed epicenter. The average phase velocity for Rayleigh (Figure 2a) and Love phases (Figure 2b) are calculated as 3.31 and 2.97 km/sec, respectively. Second, we applied semblance analysis to six stations (red triangles in Fugure 1) with the shortest spacing distances. However, the distance between the adjacent stations relative to the signal wavelength was not enough short to prevent spatial aliasing. Nevertheless, the interesting was that the semblance results were different for radial and transverse components.

(References)

Maya Wei-Haas (2018) Strange waves rippled around the world, and nobody knows why, National Geographic, published November 28, 2018.

Murakami O., Tanaka T., and Asai Y. (2019) Observation of the extremely monotonic seismic waves generated on November 11, 2018 at the Tono Research Institute of Earthquake Science, Report of the Tono Research Institute of Earthquake Science, Seq. No.42, 17-22 (in Japanese).

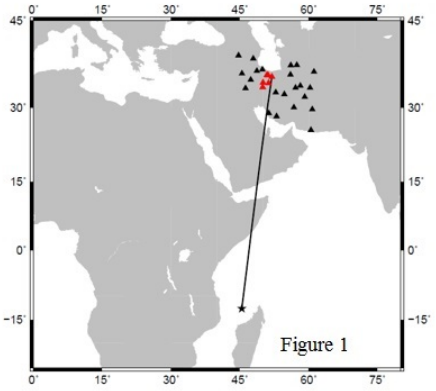

Figure 1: The broadband stations that recorded the 2018 November 11 Mayotte event are shown with triangles. The red triangles show the stations used in the semblance analysis. The assumed epicenter is indicated by a star, and the line shows the great circle connecting the epicenter and the semblance array.

Figure 2a: Filtered seismograms of the radial component recorded at the stations used in the semblance analysis with the start time at 09:50:0 (UTC).

Figure 2b: Filtered seismograms of the transverse component recorded at the stations used in the semblance analysis with the start time at 09:50:0 (UTC).