ANALYSIS SPECTRAL AND FOCAL MECHANISM OF LIKELY NUCLEAR EXPLOSION IN NORTH KOREA JANUARY 2016

BMKG

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ABSTRACT

Characters from the initial impulse wave signals coming from the explosion is compression or trending upward in the early phase of the earthquake is recorded while the earthquake wave signal has an initial impulse can vary the compression or dilation (trending down) depending position relative to the source of the earthquake station. In the case of North Korea's nuclear test in 2016. When viewed from this characteristic, it is clear that the recording of seismic waves on January 6, 2016 at 01:30:01 UTC about coming from the explosion. However unique seismograph recordings of a nuclear test in 2016 have recorded a large surface waves. It can be seen visually on the waveform, the spectral waveform and spectrogram. It is quite interesting because it is contrary to the opinion that the explosion would not result if surface waves or surface waves will not be too big. Especially Rayleigh surface waves (ground roll) can be formed by the explosion of dynamite on reflection seismic for exploration. Shift or slip allowed formed as a consequence of North Korea's nuclear test in 2016, the static displacement is the key why surface waves are formed by quite big.

DATA

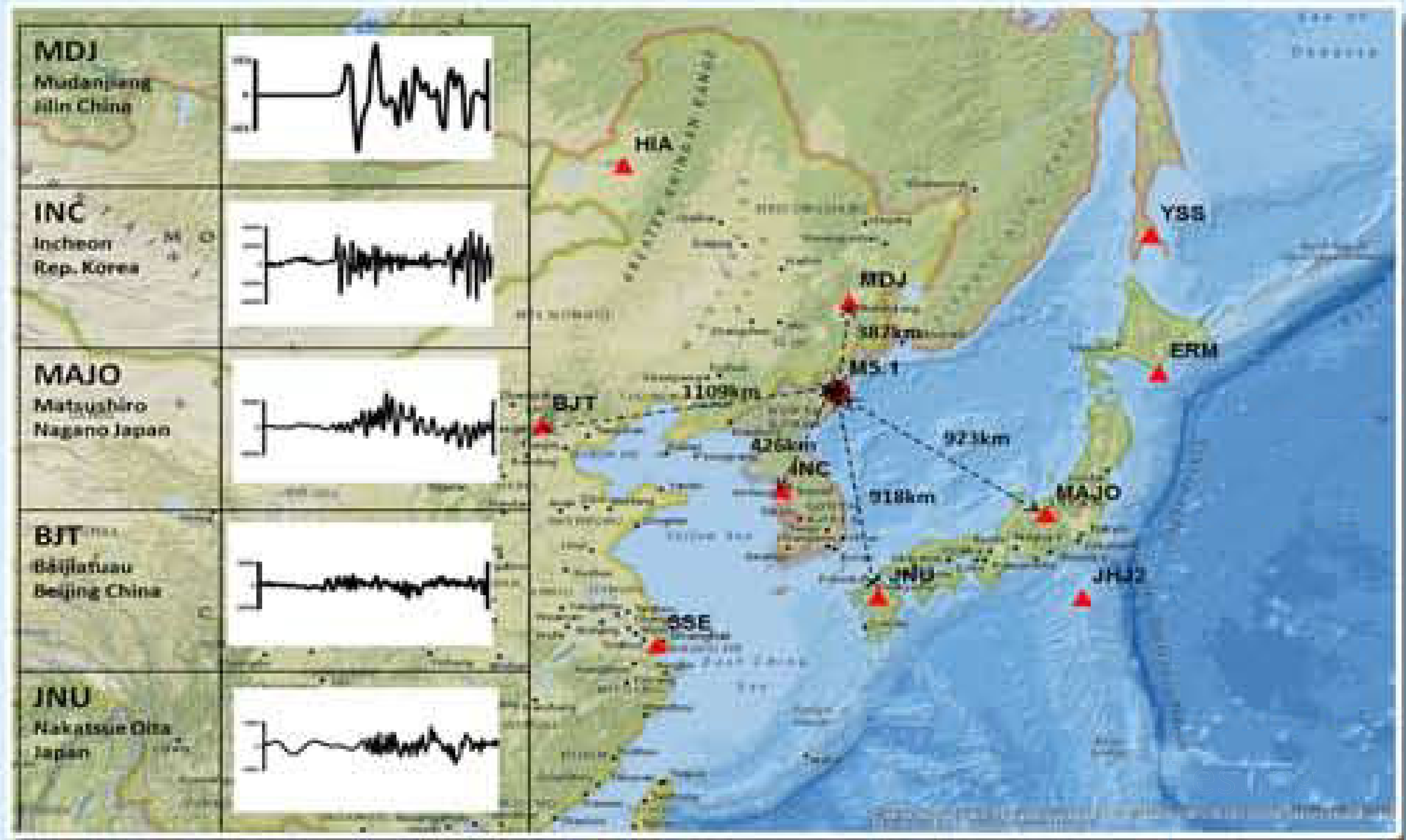

Figure 1. (DATA)
Sample of the record of first motion of P-wave of nuclear explosion recorded by MDJ (China), INC (Korea), PSI, LEM and SIJI seismic station in Indonesia. Epicenter of the explosion of the suspected nuclear test in North Korea (red circle), seismic station (red triangle). Underground of nuclear explosion can be detected because when rocks rupture in a quake or during the explosion - very strong forces rapidly act inside the Earth. This leads to intensive shaking of the rocks around the hypocenter, which generates elastic waves. This wave can travel thousands of miles and are detected by sensitive seismometers. For example

SEISMIC MOMENT TENSOR

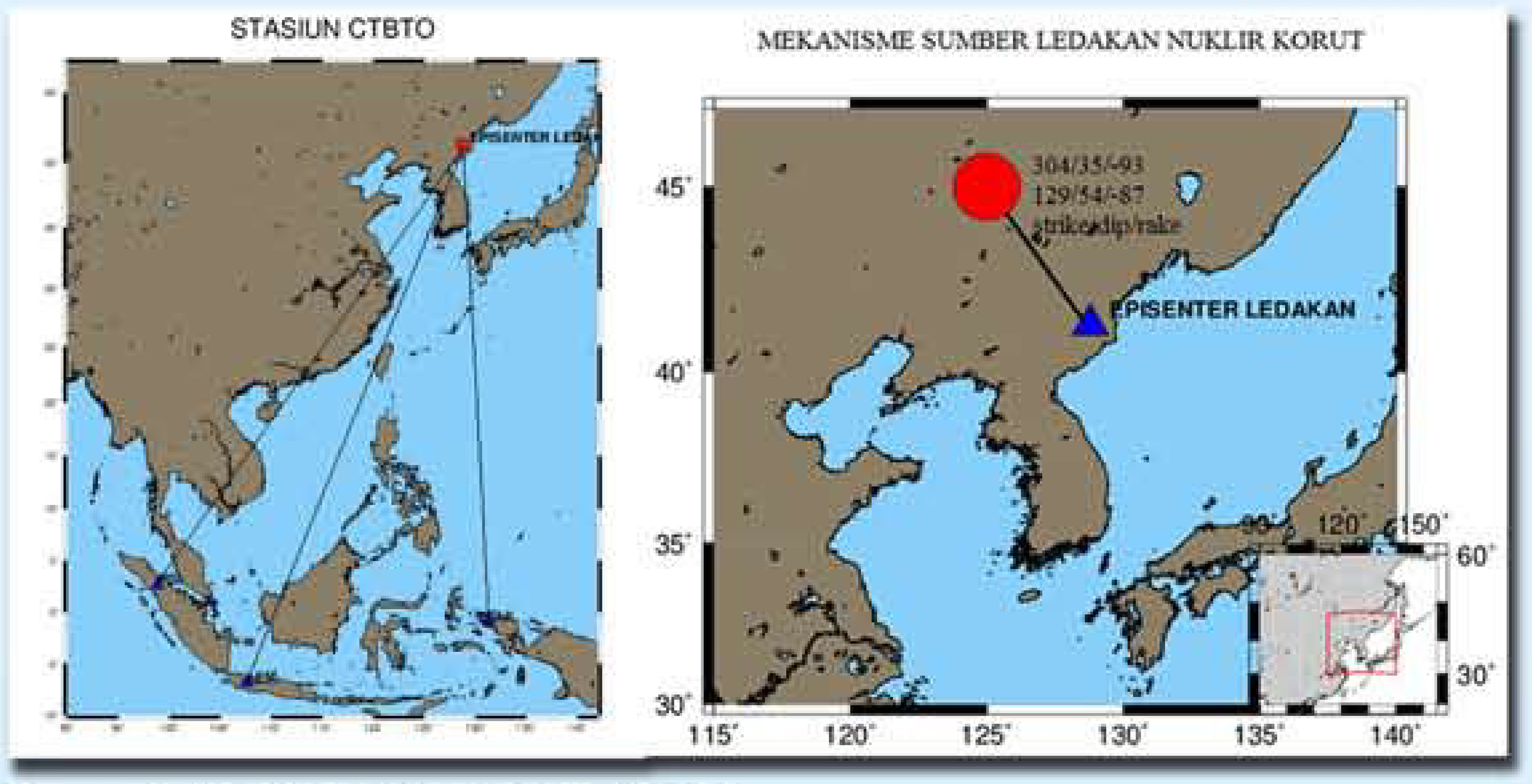

Figure 2. (SEISMIC MOMENT TENSOR)
Left Figure show epicenter of sucpected nuclear explosion in North Korea 2016 used in this study dan three CTBTO's seismic station in Indonesia (PSI, LEM, and SAJI). Right Figure, A second way to distinguish between the origins of the elastic waves is to analyze the data collected by many stations in what is source mechanism or known as a "Moment Tensor Solution." By performing this computation, seismologists trace the elastic waves back to their origin. That not only the precise hypocenter location of the focus, but also shows the mechanism of the forces initially shaking the rocks. During an earthquake, rock breaks in a shear fracture, which results in the rapid sideways movement of two flanks of a fault. In an explosion, however, the origin is indeed a point, from which elastic pressure waves travel concentrically outward. Moment Tensor Solution for the most recent North Korean test (2016) is shown in figure.
Seismic focal mechanism of the waveform inversion of the nuclear explosion. In the case of an underground nuclear explosion, the seismic moment tensor is isotopic, this is an important part to discriminating between earthquakes and explosions.

CONCLUSIONS

There are two differences between an earthquakes and an explosions. Firstly, waveform of an earthquake generates strong S-Waves, but waveform nuclear explosion lack most of these waves. Nuclear explosion North Korea (2016) show clearly existance of Raylegh wave in recorded seismic waveform. This phenomena can be cause by existing of tunel wavel or standing wave of the wurface wave. Seismic focal mechanism of the nuclear explosion show that the seismic moment tensor is isotopic, this is an important part to discriminating between earthquakes and explosions.

SPECTRAL ANALYSIS

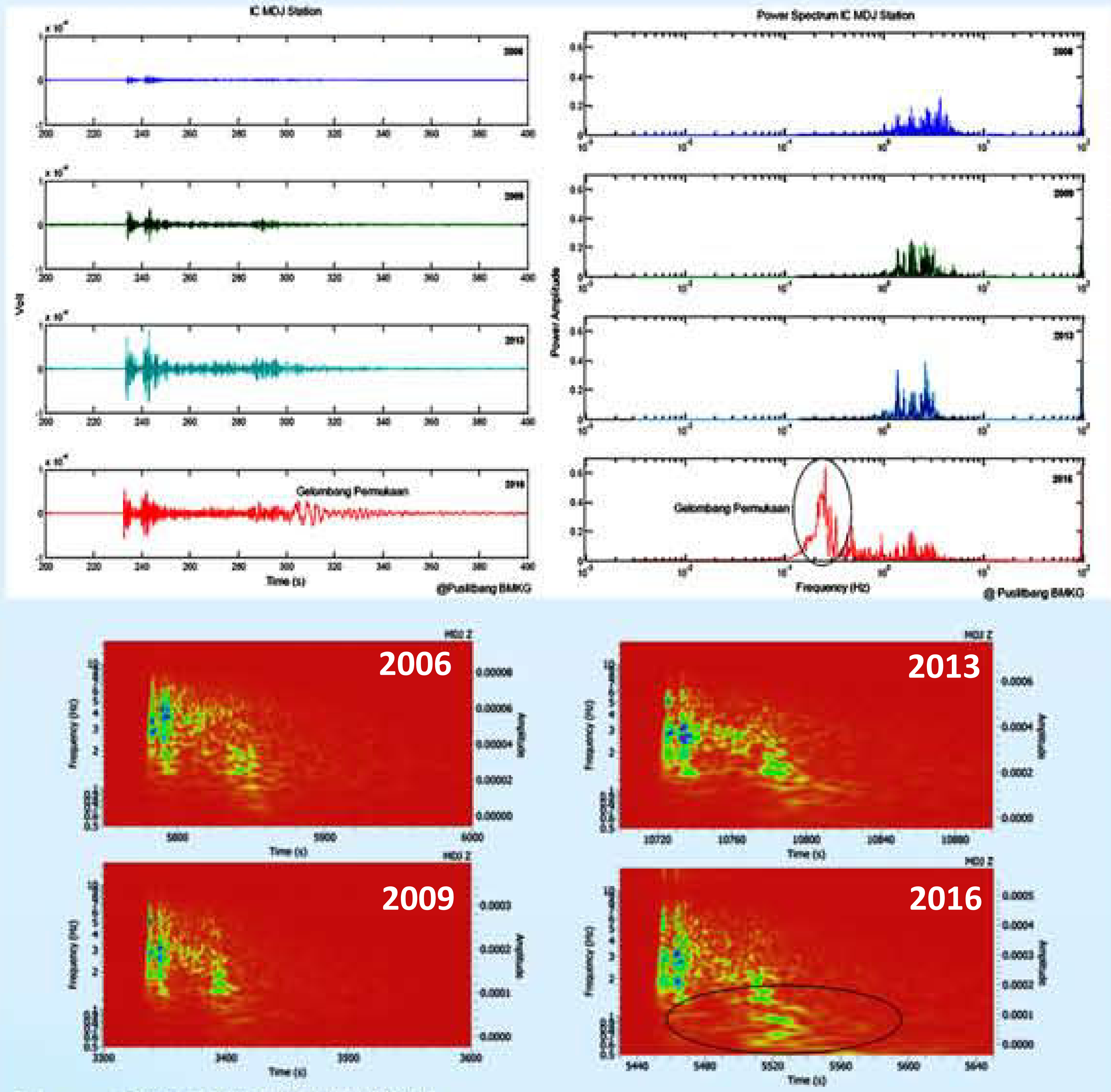

Figure 3 (SPECTRAL ANALYSIS)
Left, waveform of suspected nuclear explosion in North Korea in 2006 (blue), 2009 (green), 2013 (light blue), and 2016 (red), respectively. Center, spectral of each seismic waveform. Right, Spectogram of the seismic waveform of nuclear explosion in 2006, 2009, 2013, and 2016, respectively. There are two differences between the seismograms of natural tectonic earthquakes and those of explosions. Firstly, the waveforms look very different, an earthquake generates strong S-Waves, but the seismograms of underground nuclear test lack most of these waves. Instead, the P- (or primary or pressure) waves dominate the seismogram from the detonation of an atomic bomb below ground, but we can look clearly existance of Raylegh wave in recorded seismic waveform. This phenomena can be cause by existing of tunel wavel or standing wave of the Surface wave.

REFERENCES

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