

# Depth of seismogenic layer at the 2018 North Osaka and the 2018 Hokkaido Eastern Iburi earthquake sites

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## Background:

Understanding crustal seismogenic layer on faults is important because it enable us to know the maximum size of possible crustal earthquake on the corresponding fault. Depth of the crustal seismogenic layer also gives us the depth of brittle zone because it relates to the rheology of the crust. The cutoff depths where total of 95 % of events occurred within the depth column of each grid, referred to as D95, can be calculated from the past microseismicity. We aimed to verify the index, D95, if it indicates as the deeper limit of the seismogenic layer. Using the microseismicity before mainshocks, we investigated if we could foresee the deeper limit of seismogenic layer before the 2018 North Osaka (2018 Osaka) and the 2018 Hokkaido Eastern Iburi (2018 Iburi) earthquakes occurred.

## Data and Method:

D95 is calculated from the seismicity before each mainshock. We used JUICE catalog (2001-2012) of the event catalog for microseismicity in this study. We calculated D95 from events of M1.5 or greater listed in the JUICE catalog for every grid point of 0.02 degree interval. We only consider when the total number of events within the range of 0.1 degree from the grid point contains 50 events and more.

We also look at the temperature data to see if the estimated depths of 250 degrees (in Celsius), 300 degrees, and 450 degrees correspond to the actual earthquake depth. Using the datasets contain the temperature profile of the depth down to about 300 m and the depth down to about 1000 m from the surface of the earth, we computed the depth at which the crustal temperature reaches 250, 300, 450 degrees (hereafter referred to as D250deg, D300deg, D450deg, respectively).

## Result:

For the 2018 Osaka earthquake site, the relocated hypocenter of the mainshock was 13.7 km in depth. Relocated aftershocks are mainly distributed between 8 and 14 km in depth. D95 along the aftershocks was calculated to be between 13 km to 14 km. The range of D250deg to D450deg was between 10 km and 24 km. D300deg was about 13 km.

For the 2018 Iburi earthquake site, the relocated hypocenter of the mainshock was 35.9 km in depth. Relocated aftershocks are mainly distributed between 25 to 50 km. D95 was estimated to be around 25 km. The range of D250deg and D400deg is between 10 km and 34 km.

## Conclusion/Discussion:

D95 as a seismogenic depth of the 2018 Osaka earthquake site was consistent with the mainshock and aftershock distribution. Conversely, D95 of the 2018 Iburi earthquake was not consistent with an actual event: D95 was about 10 km shallower than the mainshock and about 30 km shallower than the deeper aftershocks. The seismicity on the Ishikari Lowland Eastern edge fault zone (Ishikari Teichi Touen Danso Tai), west from the mainshock site, was used to compute D95 in this study. Therefore, discrepancy in D95 of Iburi earthquake site is due to D95 indicates the seismogenic depth of Ishikari Lowland Eastern edge fault zone but not the fault responsible of the 2018 Ishikari Earthquake.

Keywords: seismogenic depth, North Osaka, Hokkaido Eastern Iburi, Earthquake, heat flow