## Assessment for a large earthquake occurrence on the northern side of the focal region of the 2011 off-Tohoku mega-thrust earthquake

\*Kazuyoshi Nanjo<sup>1</sup>, Kazuki Miyaoka<sup>2</sup>, Akio Yoshida<sup>3</sup>

1. University of Shizuoka, 2. Japan Meteorological Agency, 3. Shizuoka University

Eight years have passed since the occurrence of the 2011 off-Tohoku mega-thrust earthquake (off-Tohoku earthquake). Seismic activity in the central part of the focal region has settled down. However, magnitude (M) 5 to 6 earthquakes occur occasionally along the coast and inland areas of Tohoku and Kanto. Therefore, it can be said that seismic activity in a wide area is still in a higher level than that before the off-Tohoku earthquake.

Soon after the off-Tohoku earthquake, it was worried that a large earthquake might occur in the northern or southern adjacent regions, for it is not rare that a mega-thrust earthquake was succeeded by an occurrence of another large shock within several years. Last year, Matsu' ura (2018) warned impendence of a large earthquake occurrence in east-off Hokkaido, based on analysis of seismicity changes as well as historical records about great earthquake occurrence in the concerned area. Here, we report results of a detailed investigation about changes in the seismicity and the *b* value in the sea area on the northern side of the focal region of the east-off Tohoku earthquake.

Based on a *b* value analysis using data in three years after the off-Tohoku earthquake, Tormann et al. (2015) inferred that stress level in the focal region had already returned to the state before the earthquake, and presented an idea that a large earthquake may not repeat at an interval of a characteristic period, but rather occur at random. On the other hand, Nanjo and Yoshida (2017) showed, by re-analyzing data of a longer time period, that such a feature of the notable lowering of the *b* value as was observed before the off-Tohoku earthquake in the large-slip area was not seen. However, it was found that the *b* value in the northern adjacent area, far-east off Aomori Prefecture, is notably low. The area covers the focal region of the 1994 far-off Sanriku earthquake partly and extends further north. Further, it was seen that seismicity there has been decreasing in recent years.

Based on seismicity in the study region covering from off Aomori Prefecture to east-off Hokkaido, we found, in this study, spatiotemporal variability in *b* value. In particular, the 2003 *M*8.0 Tokachi earthquake did not show a transition of *b* value to normal levels but further lowered *b* value and expanded zones of low *b* values. The result obtained here is consistent with that by our previous work (Nanjo and Yoshida, 2017). From these observations, we think that a large earthquake may occur in the northern adjacent area of the focal region of the off-Tohoku earthquake in the near future.

Seismicity along the coast of Tohoku on the down-dip side of the coupling region is still high. A seismic quiescence as well as lowering of the *b* value is often observed before occurrence of an  $M5^{-}6$ -class earthquake in the area around their foci. Although effectiveness of the observation of seismic quiescence and lowering of the *b* value in the prediction of a large-earthquake occurrence is still a problem under debate, we would like to propose here that extent of the low-*b* value area and the *b* value at the center of the area may be useful indices in evaluating results of the *b* value analysis. This is an analogy of a typhoon where their magnitude and intensity are evaluated by an extent of the storm area and air pressure at the central point. We expect further that imminence of a large earthquake occurrence may be assessed by noting tendency of the lowering of the *b* value.

Keywords: 2011 off-Tohoku mega-thrust earthquake, b value , seismicity