Numerical study of the amplification mechanism of the meteo-tsunami originating off the western coast of Kyushu

*Katsutoshi Fukuzawa[1], Toshiyuki Hibiya[1]

1. Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo

A meteo-tsunami is generated by a travelling atmospheric pressure disturbance and is characterized by a rapid sea level rise with a period of several tens of minutes in the coastal areas. In Japan, meteo-tsunamis are frequently observed along the western coast of Kyushu during winter-spring and are called “Abiki”.

In shallow seas such as continental shelf areas, a propagating shallow water wave can be amplified through a resonant coupling to the atmospheric pressure disturbance traveling with nearly the same speed (“the first resonance”). The shallow water wave then enters local coastal areas while being further amplified by “geometrical resonance” effects (“the second resonance”). To predict the meteo-tsunami, therefore, it is essential to clarify the amplification mechanism of the shallow water wave, especially through “the second resonance” effect, in addition to draw the information about the atmospheric pressure disturbance causing “the first resonance” from the synoptic scale atmospheric data.

In this study, we investigate the amplification processes of the meteo-tsunami in Makurazaki Bay that occurred in 2004. The sea level variations in Makurazaki Bay are reproduced well using a barotropic numerical model in which an atmospheric pressure disturbance with a width of about 300 km is assumed to propagate east-southeastward with a constant speed of 31 m/s over the East China Sea. On the continental shelf of the East China Sea, the shallow water wave is amplified through “the first resonance” effect. Then, the shallow water wave propagates further eastward and enters the continental shelf running west to east off Makurazaki Bay. It is shown that the existence of Mt. Kaimon, located at the eastern end of this continental shelf plays an essential role in “the second resonance”; the reflection of shallow water waves from Mt. Kaimon causes the excitation of the eigen-oscillation on this continental shelf, which resonantly intensifies the eigen-oscillation in Makurazaki Bay.

Keywords: Meteo-tsunami, Western coast of Kyushu, Amplification mechanism

