Ten-year-long Progress from the 2011 Great East Japan Earthquake in Tsunami Monitoring and Coastal Defense in Japan

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ABSTRACT

This paper reviews the ten-year-long progress from the 2011 Great East Japan Earthquake in tsunami monitoring and coastal defense in Japan. For instance, the GPS-mounted buoy system introduced a backup data transmission line while the networks of oceanfloor seismic and water pressure sensors were developed. Researchers focused on the interactions among tsunami flow, seafloor sediment, coastal defense structures, and floating objects. The new design system defined near-100-year-return tsunami and the maximum possible tsunami as Level 1 and 2 Tsunamis, respectively.

KEY WORDS: GPS-mounted buoy system; oceanfloor water pressure sensors; multi physical phenomena model; particle-based model; coastal defense; two-step design tsunami levels; resilient structure.

INTRODUCTION

Japan has been suffering a variety of natural disasters. One of the famous old literatures regarding with Japanese mind on disasters is “Hojoki” by Kamono Chomei in 1212 (An English translation: Moriguchi and Jenkins, 1996). He described the fires, the tornado, the drought, the earthquake, and the tsunami, in 1177–1185, in and around Kyoto, the old capital. Japanese observed the nature carefully and produced paper documents, stone monuments, and art pictures, such as “The Great Wave off Kanagawa” by Katsushika Hokusai. The word “tsunami” means “wave amplifying in ports” in Japanese.

Japanese learn tsunami nature and evacuation from coast, in schools and from their parents. One of the most popular stories is “Inamura no Hi”, meaning “the fire on rice sheaves” (Hamaguchi Goryo Archives Tsunami Educational Center, website). On November 5 in the Japanese lunar calendar, 1854, at Hiro Village, present Hirokawa Town in west Japan, shown in Fig. 1, Mr. Hamaguchi Goryo felt a massive earthquake, saw abnormal change in the sea, and set fire to his rice sheaves on a hill to call villagers from the coast. His action saved many villagers from the tsunami, which is called the 1854 Ansei-Nankai Earthquake Tsunami now, of which epicenter is unknown, but near C. After the tsunami, he casted his property to employ the villagers and construct coastal dike for future disaster prevention. The coastal dike prevented flood in the 1946 Showa-Nankai Earthquake Tsunami, indicated

Figure 1. Major earthquakes and locations referred in this paper.