

EGU24-14673, updated on 14 Jan 2025

<https://doi.org/10.5194/egusphere-egu24-14673>

EGU General Assembly 2024

© Author(s) 2025. This work is distributed under the Creative Commons Attribution 4.0 License.



Tsunami Digital Twin – Concept, Progress, and Application to the 2024 Noto Peninsula Earthquake Tsunami Disaster, Japan

Shunichi Koshimura, Bruno Adriano, Erick Mas, Shohei Nagata, and Yuriko Takeda

Tohku University, International Research Institute of Disaster Science, Sendai, Japan (koshimura@irides.tohoku.ac.jp)

The digital twin is recognized as digital copies of the physical world's objects stored in digital(cyber) space and utilized to simulate the sequences and consequences of target phenomena. Users can fully view the target through real-time feedback by incorporating the physical world's data into the digital twin. Given the importance of the digital twin, the authors propose "Tsunami Digital Twin (TDT)" as a new paradigm in tsunami science and engineering to enhance tsunami disaster resilience.

The components of TDT are the transformation from "Data" to "Information" by integrating sensing, monitoring, and simulation; "Interpretation" of data and information; and "Inference" by using available data and information to draw conclusions and consequences and decide policies and responses for social resilience. Fusing these components is the key to gaining knowledge and insight for optimal solutions in the physical world.

In the session, the authors focus on two functionalities of TDT: Real-time tsunami modeling and forecast capability and Dynamic exposure estimation to verify through the 2024 Noto Peninsula Earthquake Tsunami Disaster.

The rapid tsunami hazard assessment by real-time tsunami modeling implied that severe impacts were expected around Noto Peninsula (Shika to Nanao), and the directivity of tsunami energy was also toward the Japan sea coasts, especially Joetsu city, Niigata Prefecture. We also found that the specific bathymetric features (continental shelf of Noto Peninsula) are responsible for high tsunamis in Suzu city.

The exposure analysis was performed using Mobile Spatial Statistics (the population estimates using mobile phone data) to elucidate population change after the earthquake by elevation (tsunami affected or not).