

# Our Efforts in Earthquake and Tsunami and Disaster

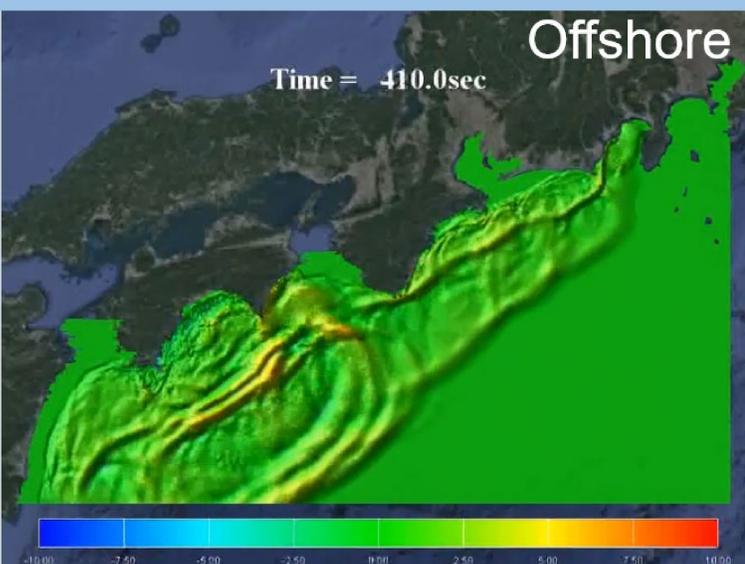
## Earthquake and Tsunami Simulation and Visualization of Disaster Risks

In Japan, triggered by the Great East Japan Earthquake in 2011, it has become clear that there are limits to the mitigation of human damage through hardware measures against natural disasters, and the importance of soft measures has been recognised again.

As a soft measure to protect residents from frequent natural disasters, Japanese municipalities have prepared and released hazard maps. In recent years, however, for the purpose of ensuring a correct understanding of natural disasters and raising awareness of disaster prevention, instead of the conventional static hazard maps as printed materials, dynamic hazard maps that can understand the progress of disasters are also prepared and released. Especially, it is very important for simulations to evaluate and examine disaster prevention and mitigation measures, from the viewpoint of disaster prevention education and consensus formation, to be easily communicated to residents.

We integrate tsunami simulations and evacuation simulations to conduct simulated experiences in immersive spaces utilizing xR technology called VR (virtual reality)/AR (augmented reality)/MR (complex reality), which can be experienced with smart devices, etc.

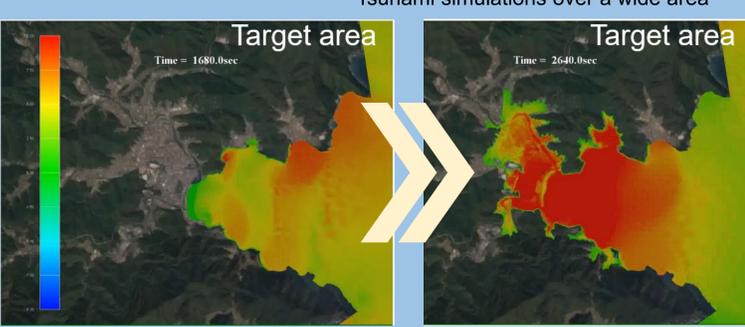
### Tsunami Simulation



Time = 410.0sec

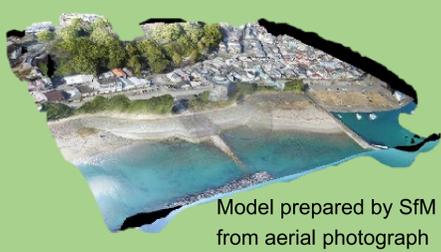
Offshore

Tsunami simulations over a wide area

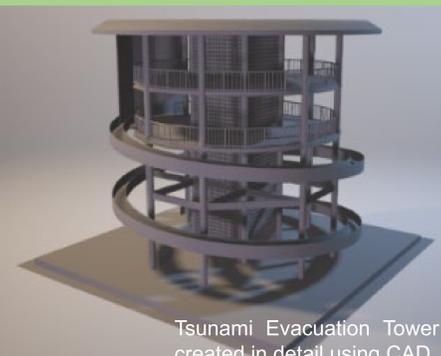


Tsunami simulation in the target area

### Digital city model



Model prepared by SfM from aerial photograph

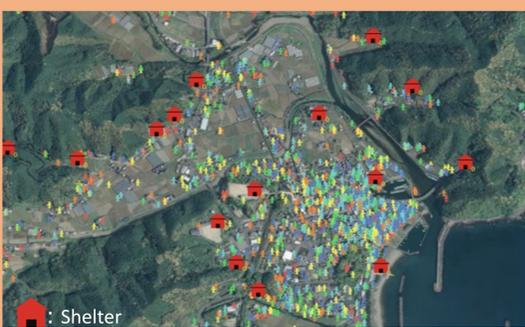


Tsunami Evacuation Tower created in detail using CAD



Model based on actual towns

### Evacuation Simulation



Evacuation simulation (evacuees are colored by age)

Speed by Age

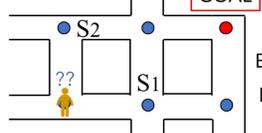
AGE	-14	15-34	35-54	55-64	65-74	75-84	85-
M	1.33	1.47	1.39	1.41	1.32	1.04	0.50
F	1.29	1.44	1.36	1.46	1.48	1.32	0.62

(m/s)

Judgement of refugee's route

$$S = \frac{a}{s^\alpha} - \frac{b}{z^\beta} - \frac{c}{w^\gamma} - \frac{d}{t^\delta}$$

Utility      Distance from evacuation      elevation      Distance from Water's front      majority synchoring bias



Each node has Each S  
If S1 > S2, Refugee Move to S1

Integrate Digital city model and Tsunami simulation result into VR

Create 3D walking Fig.

Integrate evacuation simulation result into VR

Create scripts

Output to VR devices



The use of smart devices, mainly smartphones and tablet head-mounted displays, makes it possible to experience seismic tsunami simulations and evacuation simulation results.

