2022.08.17

The Japanese Approach as the Basis for BBB vision

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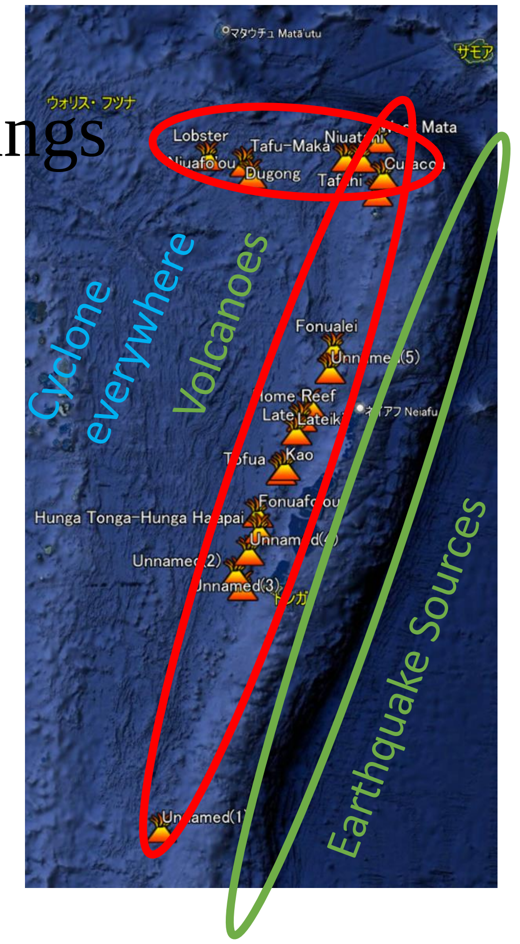
- JICA -

Natural Phenomena to be considered for Tonga

Cyclones → Storm Surge, Strong Wind
Earthquakes → Strong Motion, Tsunami
Volcanic Eruption → Tsunami, Volcanic Ash Fall

- Storm Surge → Coastal Infra.
- Strong Wind → Housing & Buildings
- Strong Motion → Housing & Buildings
- Tsunami → Coastal Infra.
- Volcanic Ash Fall → Livelihood etc.

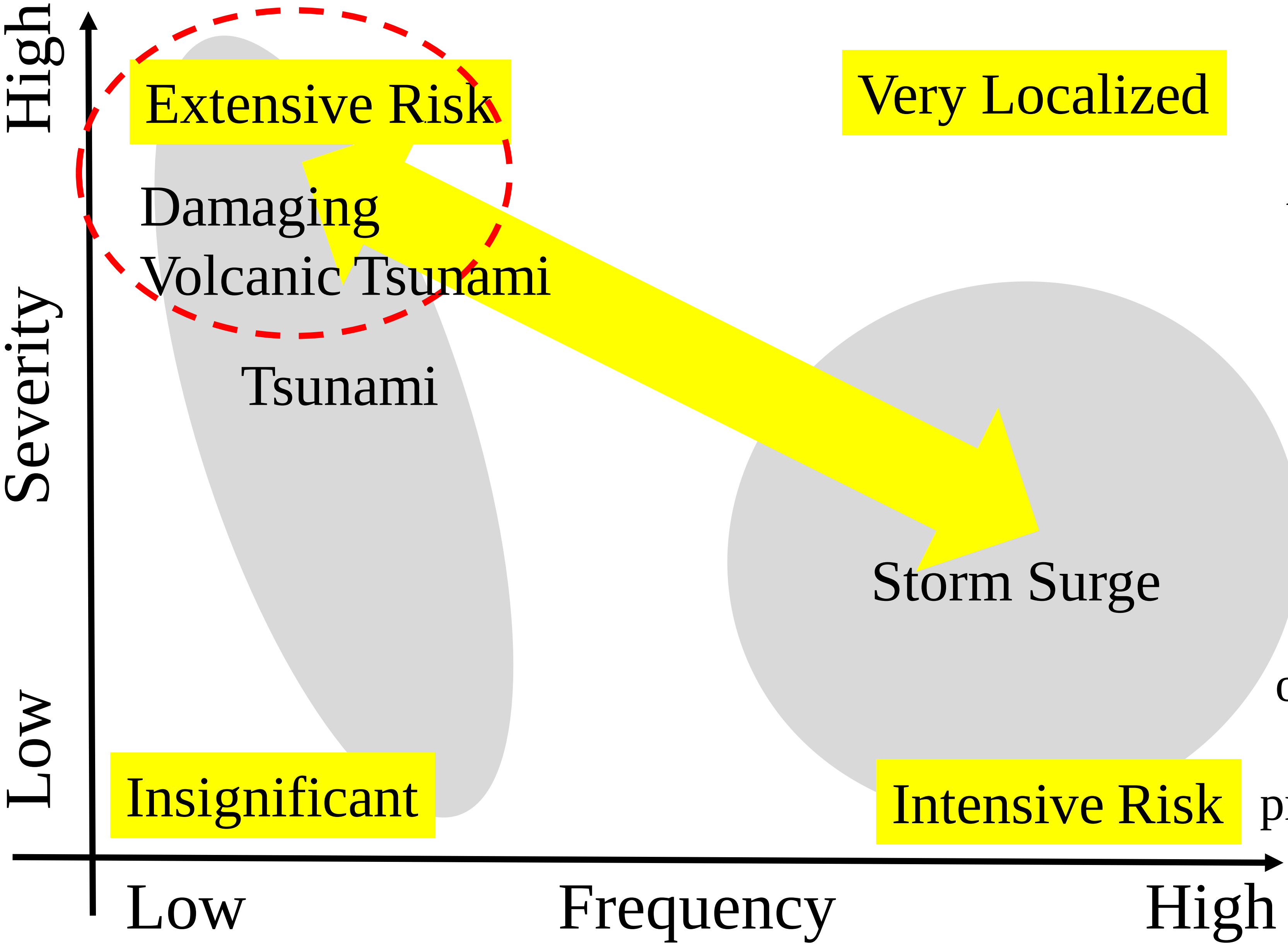
- Coastal Infra. 🡐 Wave Height
- Housing & Buildings
- Livelihood etc.



DRR: <u>Understanding</u> the Natural Phenomena to know Their Hazard & <u>Monitoring</u> Combined with Early Warning System

➔Pre-Disaster Investment & Immediate Response

Cope with low frequency highly severe natural phenomena



Measures for low-frequency highly severe disasters shall be multi-purpose, combined with those for high-frequency normal disasters, and with ordinary infrastructure to maintain social functionalities.

Otherwise, by the time the next low-frequency severe disaster strikes, facilities may be deteriorated, systems and organizations may be obsolete or forgotten, and may not function properly at the time of emergency

In the BBB Vision, the objective is not to return to the state as it was a few days before the disaster, but to start running toward a favorable future of a safe, resilient, and attractive country.

Therefore, it is needed to take structural measures by pre-disaster investment with multi-purpose and multi-protection for resilience of society.

Moreover, we should consider the followings that were opinionated in and after the kick-off meeting 30 May 2022 as an image of the goal and the procedure toward it.

- Inclusiveness and equality especially dialog with communities.
- Quality of life, not quantity.
- Partnership among stakeholders.
- Rebuild a resilient Tonga supporting sustainable and quality economic and social development.
- Planning based on scientific knowledge as well as traditional one.
- Green Infrastructure to reduce natural disaster power.
- Land use planning avoiding development at vulnerable land.

Different approaches for cities, suburbs or rural area like isolated islands

- **In the capital**:
- Government can lead DRR and Development directly by pre-disaster investment for structural measures to where capital & industry are concentrated & accumulated.
- Support whole country including rural area through investment to the bases of the public assistance, i.e., transport, communication, science, technology, education, medical & health care, human resource development etc.
- Contribute to National Economy through investment for promotion of Commerce, Agro-Fish-Food & Information Industry, & Trading.

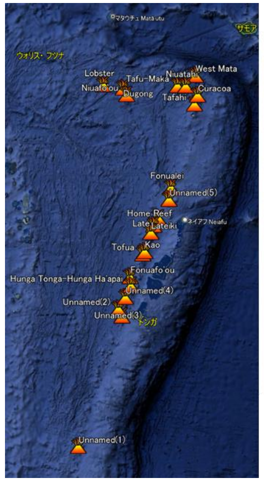
- **In very rural area**:
- Self-help & mutual assistance within communities for DRR, supported by the public assistance, & Self-sustainable Development connected to national economy.
- Due to the scattered distribution of population, however, structural measures of big scale may not be realistic.
- Investment should be done on a selected common key measures which can support the activities of communities for transport, communication, education, medical & health care etc.

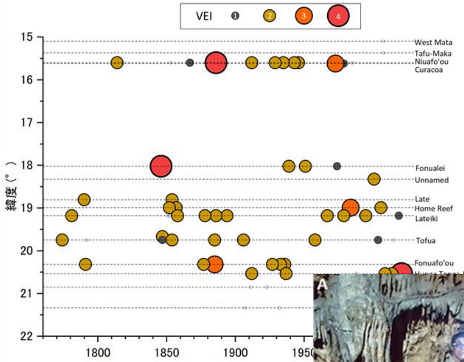
An Extreme ⟷ Wide Variety of reality between two extremes ⟷ Another Extreme

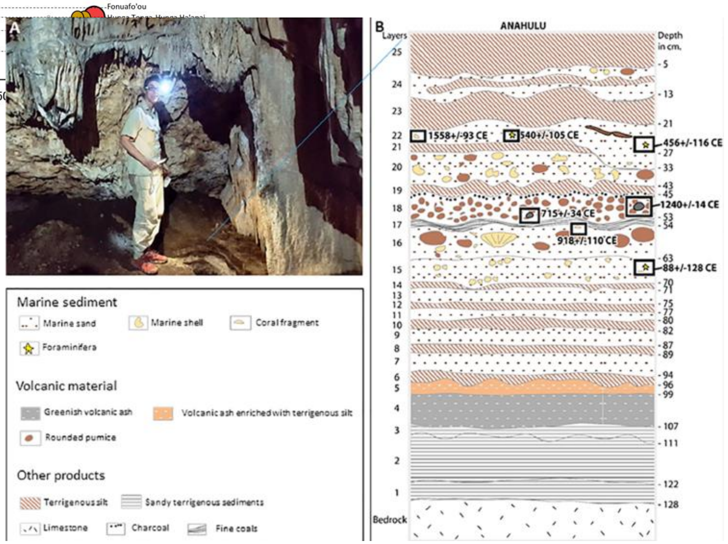
Understanding & Monitoring

Ex: Volcanic Activities

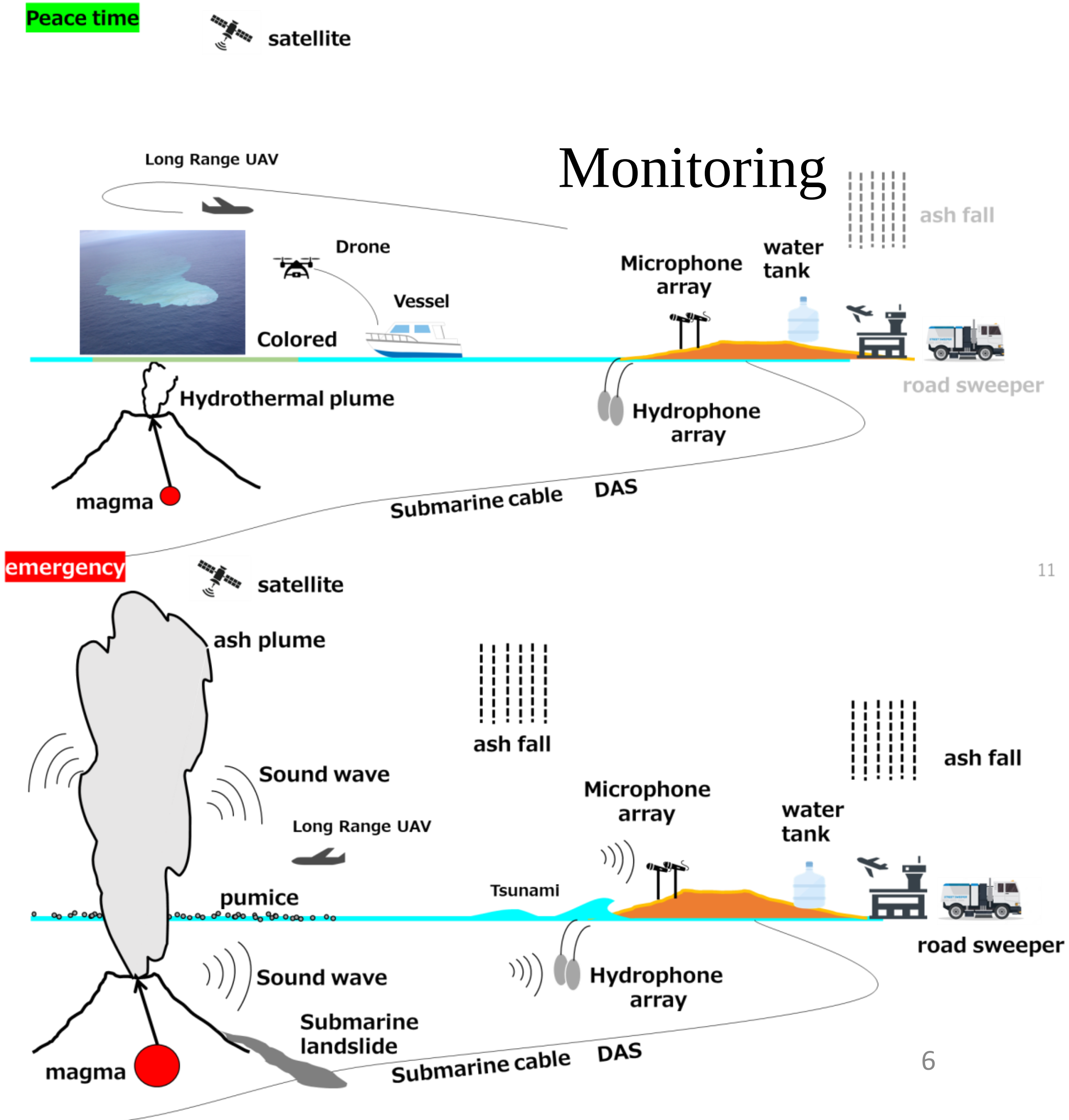
Understanding their history and mechanism for middle and long term estimate.







Lavigne et al.(2021)



Similar for Earthquakes & Cyclones

Progress in Experts Meeting (as of Aug. 15)

Group	Member	Topics	Outputs	Remarks
A	Dr. Nakada, Prof. O'minato, Prof. Ichihara, Prof. Maeno (obs)	Mechanisms of 2022HTHH Eruption & the accompanied phenomena	Detail time series of eruption (especially the first 30 minutes) and possible eruption mechanisms considering gravity currents that caused disconnection of submarine cables. A possibility of DAS (distributed acoustic sensing) technology using the existing submarine cables for monitoring seismicity around HTHH was shown.	**Since the January 2022 eruption was due to a violent interaction of magma with the shallow sea water, leaving deep depression behind, it is unlikely the similar eruption at HTHH recurs on a 100-year time scale.**
B	Prof. Iguchi, Dr. Inoue, Prof. Nogami, Dr. Fujii	Reproducibility of the disasters(ash fall, pyroclastic flow, volcanic blocks, lava flow, gas, mud flow, etc.) caused by eruptions and countermeasure menu and direction for those disasters.	Necessary countermeasures are proposed from the perspective of Build Back Better against various disasters such as ash fall and tsunami, in accordance with the assumption of eruptions that can affect residential areas in Tonga will occur multiple times in 100 years. All Volcanic Disaster Factors must be considered for Niuafo'ou (inhabited island).	**Eruptions affects residential areas in Tonga are judged to occur more than once every 100 years.**
C	Prof. Imamura, Prof. Arikawa, Dr. Inoue, Dr. Kamigaichi, Prof. Chikasada, Prof. Mori, Prof. Maeno (obs)	2022HTHH volcanic tsunami and its influence as tsunami height and its run-up height, its recurrence period and tsunami input level for design structures.	Numerical Simulation of HTHH Volcanic Tsunami to understand the generation, propagation, and run-up. Parametric study on the tsunami source activated by HTHH volcanic eruption for risk evaluation.	**Simulation is ongoing with high-resolution DEM and the digital bathymetry provided by Tonga side.**
D	Prof. Mori, Prof. Arikawa, Prof. Imamura	Storm Surge by Cyclone under the influence of Global Climate Change.	Numerical Simulation of historical storm surges. Preparation of storm surge inundation simulation and data analysis of climate data including cyclones and sea-level rise based on IPCC 6th Assessment Report. Numerical simulation of storm surges to reproduce the historical major events in the recent 60 years. The effect of climate change for coastal inundation will be considered.	**Simulation is ongoing with high-resolution DEM and the digital bathymetry provided by Tonga side.**

Zoomed up

Group	Outputs	Remarks
A	Detail time series of eruption (especially the first 30 minutes) and possible eruption mechanisms considering gravity currents that caused disconnection of submarine cables. A possibility of DAS (distributed acoustic sensing) technology using the existing submarine cables for monitoring seismicity around HTHH was shown.	**Since the January 2022 eruption was due to a violent interaction of magma with the shallow sea water, leaving deep depression behind, it is unlikely the similar eruption at HTHH recurs on a 100-year time scale.**
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Zoomed up

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C	Numerical Simulation of HTHH Volcanic Tsunami to understand the generation, propagation, and run-up. Parametric study on the tsunami source activated by HTHH volcanic eruption for risk evaluation.	**Simulation is ongoing with high-resolution DEM and the digital bathymetry provided by Tonga side.**
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Member of Experts

- A group (Volcanic activity)

Name	Affiliation	Position	Field
Dr. Nakada Setsuya 	National Research Institute for Earth Science and Disaster Resilience	Director-General / Senior Research Fellow	Volcanic Geology
Prof. Ohminato Takao 	Volcano Research Center, ERI, Univ. TOKYO	Professor	Volcanic Physics,Volcanic Seismology
Dr. Ichihara Mie 	Volcano Research Center, ERI, Univ. TOKYO	Associate Professor	Volcanic Physics

- B group (Volcanic Eruption Disaster + Countermeasures)

Name	Affiliation	Position	Field
Prof. Iguchi Masato 	Disaster Prevention Research Institute Kyoto University	Professor	Volcanic Physics
Dr. Inoue Hiroshi 	National Research Institute for Earth Science and Disaster Resilience	Visiting Researcher	Earthquake
Prof. Nogami Kenji 	Volcanic Fluid Research Center, Tokyo Institute of Technology	Professor	Earth Cosmochemistry / Natural Disaster Science
Dr. Fujii Toshitsugu 	Mount Fuji Research Institute, Yamanashi Prefectural Government	Director	Petrology, Magmatology

- C group (Volcanic Tsunami)

Name	Affiliation	Position	Field
Prof. Imamura Fumihiko 	International Research Institute of Disaster Science	Professor	Tsunami Engeering
Prof. Arikawa Taro 	Coastal Engineering Laboratry.Civil and Environmental Engineering, Faculty of Science and Engineering ,Chuo University	Professor	Coastal Hydrology, Coastal Harbor Science
Prof. Mori Nobuhito 	Disaster Prevention Research Institute Kyoto University	Professor	Social Infrastructure Engineering (Meteorological, Coastal disaster)
Dr. Kamigaichi Osamu 	Japan Meteorological Business Support Center	Senior Technician	Earthquake and Tsunami Observation
Dr. Inoue Hiroshi 	National Research Institute for Earth Science and Disaster Resilience	Visiting Researcher	Earthquake
Dr. Chikasada Yamamoto Naotaka 	National Research Institute for Earth Science and Disaster Resilience	Chief Researcher	Non-Seismic Tsunami

- D group (Storm surge caused by cyclone)

Name	Affiliation	Position	Field
Prof. Mori Nobuhito 	Disaster Prevention Research Institute Kyoto University	Professor	Social Infrastructure Engineering (Meteorological, Coastal disaster)
Prof. Arikawa Taro 	Coastal Engineering Laboratry.Civil and Environmental Engineering, Faculty of Science and Engineering ,Chuo University	Professor	Coastal Hydrology, Coastal Harbor Science
Prof. Imamura Fumihiko 	International Research Institute of Disaster Science	Professor	Tsunami Engeering

<u>For infrastructure</u> we set two wave height levels.

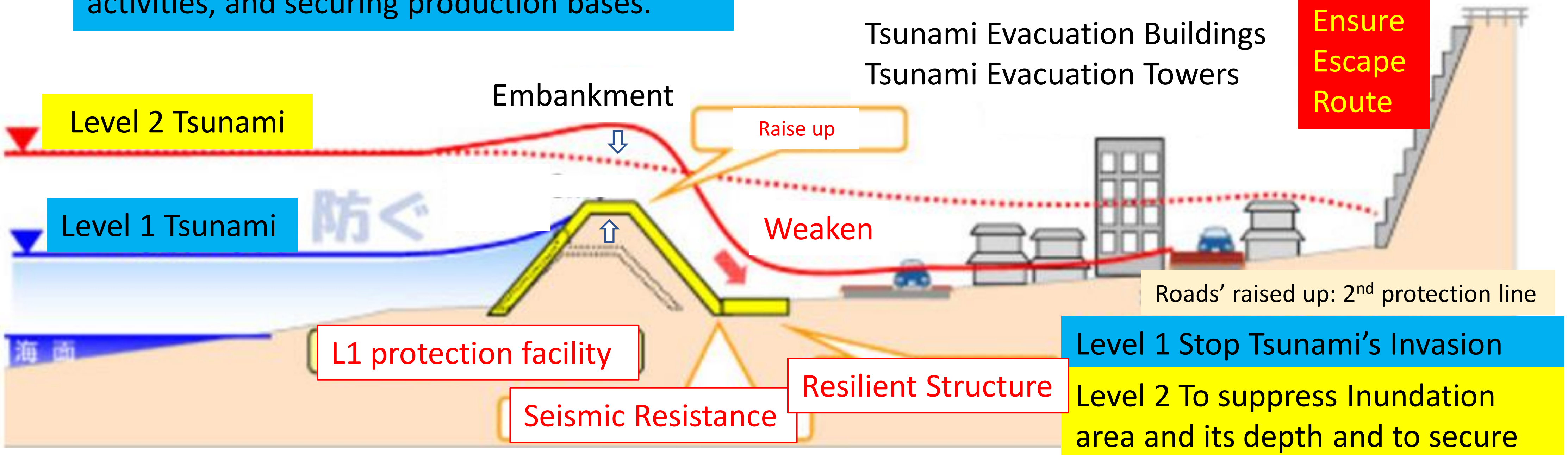
The Principle is the Establishment of Evacuation Measure to safe places

Level 1 Tsunami

Establish Tsunami protection facilities from the perspectives of protecting human lives and property, stabilizing regional economic activities, and securing production bases.

Level 2 Tsunami

Reduce damage by Tsunami protection facilities for Level-1 and promote non-structural measures, mainly evacuation for Tsunamis that exceed Level-1.



Level 1 Stop Tsunami's Invasion

Level 2 To suppress Inundation area and its depth and to secure of evacuation time

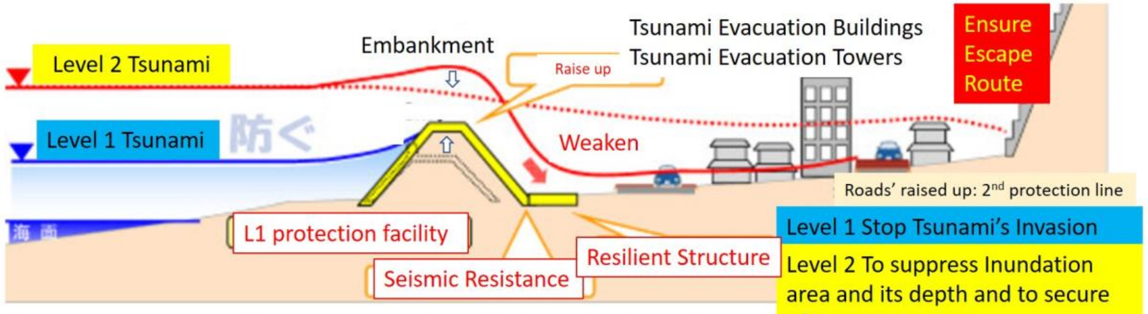
<u>New Concept of Tsunami DRR (Shizuoka Prof.)</u>

It is a controversial issue whether the 2022 HTHH Tsunami can be regarded as Level-1 or not.

Multi-Protection Principle: Serious natural events can occur at any time, although very rare.

+ In such cases, Tsunami overflows and invades. Evacuation is the main counter measure for disaster mitigation as shown already.
+ It is recommended to designate or construct tsunami evacuation bases/ buildings to reduce the number of people who cannot escape from the tsunami due to long evacuation routes.
+ In addition, further individual protective measures are recommended for essential facilities to keep their functionalities and to make the society enough resilient.

➔ "Functional Continuity Guideline for Buildings as Disaster Prevention Bases", e.g., government office buildings including fire stations, police and military bases, hospitals, etc.



New Concept of Tsunami DRR (Shizuoka Prof.)

Functional Continuity Guideline for Buildings as Disaster Management Bases

(2018, MLIT, Japan)

The essential functionalities of the buildings used as disaster management bases must be continued at the time of disaster, i.e., earthquake, tsunami etc. These functionalities are designated in the national/regional disaster management plan/ the business continuity/ contingency plan ➔ No damage that would interfere the essential functionalities.

The guideline recommend:

+ Site: at relatively low hazard site or to minimize risk if already selected.
+ Structure should be designed under a demand severer than usual buildings.
+ Non-structural members (e.g., ceiling, partitioning wall etc.) should be designed to keep buildings' functionalities without major repairs.
+ Equipment should be designed to keep functionalities of buildings without major repairs during the required period. Ensure functionality in response to lifeline disruptions and against water invasion into buildings/ or their premises. For example, electric cables and outlets not close to floor, Electric Generators not in underground floor, etc.

Hazard estimate is necessary for the above mentioned measures and multi-protection principle should be considered.

Emphasis on Disaster Management Planning

- Disaster Management Plan of National Government
- Local Disaster Management Plan of Division & District Offices including stockpile plan, relief plan etc.
- Disaster Management Work Plan (Business Continuity Plan & Business Contingency Plan) for every state and private entities
- The importance of DRR education in these plans is emphasized in terms of sustainable transfer of knowledge, not only in the context of information dissemination but also in capacity development and school education.

Conclusion

- BBB Vision conflicts neither with humanitarian issues nor development issues but can be harmonized with them.
- Scientific understanding of natural hazard, pre-investment and planning underlie BBB Vision.
- Outputs from the expert team have been reported.
- Different approaches are taken depending on the reality of the target area.
- Multi-purpose and multi-protection principles.
- Relatively new topic, “Functional Continuity Guidelines for Buildings as Disaster Management Bases“ for buildings of essential functionalities.
- Baseline survey of JICA for information collection will be completed soon, and the next step has started gradually.
- From now on we’d like to ask your collaboration with the consultant team for JICA’s project forming.