Novel Tsunami and Flooding Protection Barrier (TFB) for Coastal Cities

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Abstract

Tsunami hazard can be prevented when the pressure waves from earthquakes and landslides are reflected by a stable vertical barrier in the sea before the catastrophic high Tsunami waves near the coast are formed. Building of such deep walls of 20m to 30m depth by conventional submarine technology is difficult and expensive. In this lecture the principle and the erection of submarine walls by relatively simple efficient and economic technologies will be described. These are based on lowering high-strength steel fences with horizontal anchors, or two parallel steel fences with distance holders, and attached concrete foundation into the sea (after dredging a deep sea-bed) and fixing the fences with rocks or rubble deposited from top with additional supply of concrete. Barriers parallel to the coastline are preferably built as empty triangular cylinder with attached concrete foundation - of 300m to more than 1km length- on land/in the harbour, transported by floatation to the intended site (in advance prepared by dredging), and then filled with rocks, concrete, grout, sand. These barriers extend 8m to 10m above sea level and have concrete walls on top to protect a concrete service road. The top concrete walls are protected against storm surges by replaceable surge stoppers (parapets). The oncoming waves are doubled in height and reflected at the vertical wall (from computer simulation). Also the maximum expected load from tsunami pressure wave of 7 tons per m^2 has been found numerically by H. Oumeraci and H. ElSafti at Technical University Braunschweig.

The barriers protect threatened cities and coastlines against tsunami waves and against highest waves from tropical storms, but also against oil spill and other contamination from the ocean and thus protect flora, fauna and beaches. Channels, gates and sluices allow navigation.
A specific application is proposed for the Fukushima radioactive water and waste problem.

The construction costs can partially be compensated with **dump for waste** from large coastal cities followed by **land reclamation** between barrier and coast, by **pumped hydroelectric energy storage** between large sea reservoirs and nearby elevated artificial lakes formed by excavating the required rocks, or by **large-scale fish farming - combined with renewable tidal energy for fresh sea water -** in the reservoir between barrier and coast. This submarine architecture may also be used for building **reliable dikes and for roads into the sea.** Patents have been granted so far in Europe, Japan, China, New Zealand, Singapore.

History of TFB

The author had enjoyed many visits to Japan including collaboration, support for his research, and as visiting scholar/professor. Also he had received the Dr. of Engineering from Tohoku University, Sendai, Japan. After a successful career in crystal technology (see www.hans-scheel.ch) and retirement he was shocked by the Tohoku tsunami catastrophe 2011 and then studied tsunami books and literature. He discovered the possibility to prevent flooding by a submerged vertical barrier which reflects tsunami impulse waves and storm waves. This was then presented in lectures at international conferences and in publications. The collaboration about computer simulation of the hydrodynamics and of the load onto the tsunami-flooding-barriers with the Technical University Braunschweig/Germany, Department of Hydromechanics and Coastal Engineering, was published and presented at the IXth PIANC-COPEDEC Conference October 17 to 21, 2016 in Rio de Janeiro, Brazil.

Biography

Hans J. Scheel, Swiss citizen, chemical background, has worked 25 years in universities in Switzerland, Brazil (as full professor) and Italy and 21 years in chemical, electronic and machine industries in Germany, Switzerland and USA. After retirement from Swiss Federal Institute of Technology (ETH) he was visiting professor/invited scholar at Osaka and Tohoku Universities, Japan and at Shandong University, China. His Accelerated Crucible Rotation Technique ACRT is worldwide applied and demonstrated the importance of forced convection in crystal production, in contrast to the early concept of reduced convection and microgravity. He was co-organizer of European and International Conferences and organized four International Workshops on Crystal Technology between 1998 and 2008. He has given 150+ international invited lectures, is the author of 140 technical publications and patents and co-author and editor of seven books in the field of crystal technology and coastal engineering.

For his inventions and achievements he received the Dr.(DSc) of Engineering from Tohoku University Japan (1995), was elected member of the Russian Academy of Engineering Sciences (1996), and got awards from Swiss (1972), British (2000) and Korean (2001) Crystal Growth Associations and from IBM (1972,1975,1982). In March 2017 he received the biannual DGKK-Preis 2017 for life achievements at the German-Swiss Conference on Crystal Growth in Freiburg/Germany. After retirement he got involved in education of crystal technologists for energy, since the Tohoku Tsunami March 11, 2011 in Tsunami-Flooding-Barriers and Dikes, and since 2016 in efficient economic deposits for radioactive waste. In 2017 Hans Scheel started the company General Protection Engineering GmbH with several projects. www.general-protection-engineering.ch

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