

理工学研究所

国際交流・公開研究セミナー

Prof. Kwok Fai Cheung(米国, ハワイ大学)が来日される機会に, 地震による津波シミュレーションにおけるモデリング手法の最近の進歩についてご講演をお願いしました. 是非ご参集ください.

題 目 : Nonhydrostatic Modeling of Tsunamis from Earthquake
Rupture to Coastal Impacts
講演者 : Prof. Kwok Fai Cheung
(University of Hawaii at Manoa , USA)
日 時 : 2025年 11月 28日(金) 15:10 - 16:50
場 所 : 中央大学 キャンパス 2号館 3階 2308 号室

アブストラクト:

The last decade has seen the rapid emergence of nonhydrostatic modeling as an advanced tool for studies of tsunami processes and source mechanisms. Inclusion of depth-averaged vertical velocity and nonhydrostatic pressure in the nonlinear shallow-water equations enables description of long-wave dynamics in quasi three-dimensional flows. The governing equations involve first-order derivatives, but retain higher-order properties, as in the Boussinesq-type approach. The commonly-used staggered finite difference scheme continues to provide the surface elevation and horizontal velocity, which in turn are updated by the nonhydrostatic pressure evaluated from a Poisson-type equation. In addition to having dispersion properties complementary to the governing equations, the numerical framework allows implementation of time-varying seafloor excitation from earthquake rupture, a shock-capturing scheme for discontinuous flows, and a multilevel two-way nested grid system for dispersive and shock waves. A series of numerical and laboratory benchmarks as well as a case study of the 2011 Tohoku tsunami illustrate the model capabilities in describing tsunami generation, dispersion, shoaling, bore formation, and separation driven currents with high precision. These capabilities have an important role in resolving effects of detailed earthquake rupture patterns and providing accurate tsunami impact predictions with implications for warning guidance, hazard assessment, and seismological research.

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