



## **TRIDEC Cloud – a Web-based Platform for Tsunami Early Warning tested with NEAMWave14 Scenarios**

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In times of cloud computing and ubiquitous computing the use of concepts and paradigms introduced by information and communications technology (ICT) have to be considered even for early warning systems (EWS). Based on the experiences and the knowledge gained in research projects new technologies are exploited to implement a cloud-based and web-based platform – the TRIDEC Cloud – to open up new prospects for EWS. The platform in its current version addresses tsunami early warning and mitigation. It merges several complementary external and in-house cloud-based services for instant tsunami propagation calculations and automated background computation with graphics processing units (GPU), for web-mapping of hazard specific geospatial data, and for serving relevant functionality to handle, share, and communicate threat specific information in a collaborative and distributed environment.

The TRIDEC Cloud can be accessed in two different modes, the monitoring mode and the exercise-and-training mode. The monitoring mode provides important functionality required to act in a real event. So far, the monitoring mode integrates historic and real-time sea level data and latest earthquake information. The integration of sources is supported by a simple and secure interface. The exercise and training mode enables training and exercises with virtual scenarios. This mode disconnects real world systems and connects with a virtual environment that receives virtual earthquake information and virtual sea level data re-played by a scenario player. Thus operators and other stakeholders are able to train skills and prepare for real events and large exercises.

The GFZ German Research Centre for Geosciences (GFZ), the Kandilli Observatory and Earthquake Research Institute (KOERI), and the Portuguese Institute for the Sea and Atmosphere (IPMA) have used the opportunity provided by NEAMWave14 to test the TRIDEC Cloud as a collaborative activity based on previous partnership and commitments at the European scale. The TRIDEC Cloud has not been involved officially in Part B of the NEAMWave14 scenarios. However, the scenarios have been used by GFZ, KOERI, and IPMA for testing in exercise runs on October 27-28, 2014. Additionally, the Greek NEAMWave14 scenario has been tested in an exercise run by GFZ only on October 29, 2014 (see ICG/NEAMTWS-XI/13).

The exercise runs demonstrated that operators in warning centres and stakeholders of other involved parties just need a standard web browser to access a full-fledged TEWS. The integration of GPU accelerated tsunami simulation computations have been an integral part to foster early warning with on-demand tsunami predictions based on actual source parameters. Thus tsunami travel times, estimated times of arrival and estimated wave heights are available immediately for visualization and for further analysis and processing. The generation of warning messages is based on internationally agreed message structures and includes static and dynamic information based on earthquake information, instant computations of tsunami simulations, and actual measurements. Generated messages are served for review, modification, and addressing in one simple form for dissemination via Cloud Messages, Shared Maps, e-mail, FTP/GTS, SMS, and FAX. Cloud Messages and Shared Maps are complementary channels and integrate interactive event and simulation data. Thus recipients are enabled to interact dynamically with a map and diagrams beyond traditional text information.