

RIESGOS – Multi-risk analysis and information system components for the Andean region

Client II – International partnerships for sustainable innovation

The Andes region is exposed to multiple natural hazards. These include frequent earthquakes and volcanic activity, but also droughts and flooding. The relationships between natural hazards and cascading effects – such as tsunamis caused by earthquakes – often lead to destructive consequences for human lives. The “RIESGOS” collaborative project brings together German, Chilean, Ecuadorian, and Peruvian experts from various disciplines to develop scientific methods for assessing complex multi-risk situations. The results will be turned into a demonstration platform for a multi-risk information system using web services.

Better understanding geo risks

The close proximity to an active subduction zone causes frequent earthquakes and volcanic activity in the Andean region. In addition, droughts and flood events occur regularly, primarily induced by the El Niño phenomenon.

The “RIESGOS” project aims to develop research methods for analyzing complex multi-risk situations and the associated cascading effects in selected regions in Chile, Ecuador, and Peru. Appropriate web services will be developed in order to transfer the scientific findings and results to a modular, flexible demonstrator, which will serve as a multi-risk information system. This will make it possible to share the results with project partners in the selected Andean countries of South America in a targeted manner. Thanks to the use of recognized standards, the partners will also be able to integrate their own services into the demonstrator.



Tsunami warning sign on the Peruvian coast close to the capital city Lima.

The results and developments are to be made available to disaster risk management and civil protection authorities. This information should enable authorities to analyze complex multi-risk scenarios, reduce risks, and improve disaster management.

Different scenarios

“RIESGOS” applies approaches from various disciplines such as geophysics, hydrology, geology, geography, geostatistics, and remote sensing as well as utilizing the existing initiatives and services of the South American partners. Different scenarios are developed for a total of five different natural hazards – earthquakes, landslides, volcanoes, floods, and tsunamis and possible interactions. A wide variety of research is done on exposure to multiple natural hazards. This work ranges from analyzing earth observation data to using innovative techniques for on-site data acquisition with the aim of developing integrated exposure models. In addition to this, the analysis of dynamic vulnerability in the context of multiple natural hazards, including structural, social, and systemic aspects, should produce new models with components dependent on time and space. Cascading effects, which significantly increase risk, are identified and probabilistically modeled.

One of the main goals of the project is to develop a platform for demonstrating a multi-risk information system. A modular system concept will be prepared and developed in close cooperation with the South American project partners. The “RIESGOS” information system concept will be centered around web-based services that enable open and flexible access to decentralized data and computing services. The demonstrator should be able to purposefully combine and manage the individual web services so that a future user can independently explore and evaluate various multi-risk scenarios. A key element of the added value of this modular and interoperable approach is the ability to integrate different web services into existing system environments.

In order to better understand, describe, and quantify multi-risk situations, “RIESGOS” works with case studies in selected pilot regions in Chile, Ecuador, and Peru. These represent realistic multi-risk situations, including cascading effects. Earthquakes, tsunami, and critical infrastructure are investigated in the region of Valparaíso and in Greater Lima. In Quito and the Cotopaxi region, investigations will focus on lahars, landslides, flooding, and critical infrastructure.

Practical application

The “RIESGOS” approach is geared to the needs of potential users and practical applications. Close contact with national and local authorities as well as disaster risk management organizations will be maintained throughout the project to ensure that users’ needs and feedback on interim results are recorded and integrated in the best possible way throughout the development process.

Development of the demonstrator platform will be complemented by initiatives from the German consortium and the South American partners, who will evaluate and test the platform’s usefulness for spatial planning and for risk communication with key stakeholders from science, politics, administration, industry, and society.

As part of the “RIESGOS” project, an analysis will also be carried out of the potential for the services that are developed within the project to be exploited economically.



Volcanic activity is a permanent threat in Cotopaxi National Park.

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Contact

Dr. Elisabeth Schöpfer, DLR e. V.
82234 Weßling, Germany
Phone: +49 8153 28-1508 | E-mail: elisabeth.schoepfer@dlr.de

Project partner

German GeoResearch-Center; Alfred-Wegener-Inst.; TU Munich; 52°North GmbH; geomer GmbH; EOMAP GmbH & Co. KG; plan + risk consult; DIALOGIK gGmbH; Centro de Investigación para la Gestión Integrada del Riesgo de Desastres; Oficina Nacional de Emergencia del Ministerio del Interior; Servicio Hidrográfico y Oceanográfico de Armada de Chile; Instituto Geofísico; Instituto de Investigación Geo-lógico y Energético; Secretaría de Educación Superior, Ciencia, Tecnología e Innovación; Servicio Nacional de Gestión de Riesgos y Emergencias; Centro Nacional de Estimación, Prevención y Reducción del Riesgo de Desastres; Centro Nacional de Planeamiento Estratégico; Centro Peruano-Japonés de Investigaciones Sísmicas y Mitigación de Desastres; Instituto Geofísico del Perú; Instituto Nacional de Defensa Civil et. al.

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