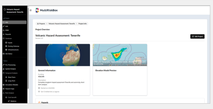
VolcanBox: Comprehensive Risk Analysis Platform

Introduction to VolcanBox

VolcanBox (MRB) is an advanced web-based platform designed to analyze, visualize, and manage multi-hazard risks across geographic regions. Built by CSIC-NRAMS, it combines sophisticated modeling, spatial analysis, and decision support tools to help organizations understand and reduce disaster risk.

Platform dashboard



Project workspace

Dataset Upload & Management Tools

VolcanBox provides powerful tools to manage and process different types of datasets. The platform handles various data formats and sources, allowing users to prepare their data for analysis, simulation, and risk assessment workflows. The application supports multiple dataset types including geospatial data, infrastructure information, hazard maps, exposure data, and vulnerability assessments.

Once uploaded, datasets go through processing steps to ensure quality and compatibility. VolcanBox offers intuitive tools for data import, validation, transformation, and preprocessing. Beyond basic dataset management, the platform includes specialized tools for creating and managing zones, allowing users to define geographic boundaries, classify areas by risk level, or organize spatial data into meaningful regions for analysis.

Dataset import tools

Data processing

Zone management

Foundation for Advanced Analysis

The datasets prepared through these upload and management tools become the foundation for all downstream analysis. Whether conducting long-term trend assessments, running simulation models, or performing hazard mapping, the quality and organization of your datasets directly impacts the accuracy and usefulness of your results.

Simulation Models & Risk Scenario Testing

VolcanBox enables users to run sophisticated simulation models to understand how different hazards impact their areas of interest. These simulations help organizations forecast risk scenarios, test intervention strategies, and make data-driven decisions for disaster risk reduction. The platform supports complex modeling workflows that incorporate multiple data sources and hazard types.

Simulation results visualization

The simulation environment allows users to define different scenarios and test how infrastructure, populations, and assets would be affected under various risk conditions. Results are visualized on interactive maps and through detailed charts, making it easy to understand the spatial distribution and severity of potential impacts. This capability is critical for emergency planning, insurance risk assessment, and long-term resilience strategies.

Multi-hazard scenario modeling

VolcanBox currently includes simulation models for a comprehensive range of hazards: lava flows, pyroclastic density currents, ash fall, lahars, ballistic projectiles, landslides, and peak ground acceleration. This diverse modeling capability allows organizations to assess multiple hazard types within a single platform, facilitating integrated multi-hazard risk management.

Simulation setup and parameters

Hazard Maps & Risk Visualization

VolcanBox synthesizes simulation results and analysis data into comprehensive hazard maps. These maps provide clear visual representations of where and how hazards could impact specific regions, combining multiple risk factors into unified layers that stakeholders can easily understand and use for planning.

Hazard map layers and visualization

Multi-hazard risk assessment maps

The maps integrate results from simulations with underlying exposure and vulnerability data, creating actionable intelligence for decision-makers. Users can customize map layers, adjust thresholds, and export results for use in reports, emergency planning documents, or stakeholder presentations. This visual representation of risk is essential for communicating complex analysis to non-technical audiences and supporting informed policy decisions.

Temporal Analysis: Short-Term Monitoring & Long-Term Scenarios

VolcanBox includes temporal analysis capabilities that support both rapid interpretation of evolving volcanic unrest and broader probabilistic planning. In the short-term workflow, users can structure bulletins, compare recent observations with reference episodes, inspect probability curves, and review heatmaps that summarize how monitoring variables evolve over time. This makes it easier to track changing conditions and communicate near-real-time assessments during unrest episodes.

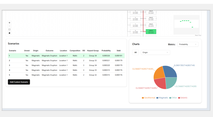
For longer horizons, VolcanBox leverages historical hazard event data to identify patterns and trends over extended periods. By analyzing past events, the platform applies Bayesian statistical methods to develop decision trees that help predict the most probable future scenarios. Together, short-term monitoring and long-term scenario analysis connect operational awareness with strategic planning.

Short-term bulletin-based assessment workflow

Heatmap view for short-term probability tracking

Comparative charts linking short-term indicators with scenarios

Historical data analysis and trend identification



Probabilistic scenario forecasting

Users can explore different time horizons and understand both immediate changes in monitored indicators and long-term shifts in hazard frequency and intensity. The Bayesian framework incorporates uncertainty, allowing decision-makers to see not just the most likely scenarios, but also the range of possibilities and their associated probabilities. This combination is invaluable for operational decision support, infrastructure planning, insurance assessments, climate adaptation strategies, and identifying areas where risk may be increasing or decreasing over time.

Coming Soon: Advanced Decision Support & Monitoring

VolcanBox is continuously evolving to provide even more comprehensive risk analysis and decision-making capabilities. Current development lines include stronger real-time monitoring integrations, cost-benefit decision models (both qualitative and Bayesian quantitative) to help evaluate intervention strategies, enhanced vulnerability assessments that integrate social, economic, and physical indicators, and an integrated monitoring and early warning system providing real-time hazard tracking and automated alerts. These developments reflect our commitment to making VolcanBox an indispensable tool for disaster risk reduction, climate adaptation, and building more resilient communities worldwide.