

New Seismic Hazard Research Capabilities and Software Improvements in OpenSHA v26.8

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1. Background

OpenSHA (<https://opensha.org>) is an open-source, Java-based platform for Seismic Hazard Analysis (SHA). It provides a framework for implementing earthquake rupture forecasts (ERFs) and combining them with ground-motion models to compute hazard curves, maps, and related products while exploring epistemic uncertainties.

We've expanded the platform with new velocity models and rupture forecasts, while overhauling the infrastructure to make updating apps and importing the OpenSHA library much easier.

2. New Earthquake Rupture Forecasts (ERFs)

Puerto Rico and the U.S. Virgin Islands (PRVI): Full production support has been added for PRVI Earthquake Rupture Forecasts (ERFs) and their corresponding Intensity Measure Relationships (IMRs).

National Seismic Hazard Model (NSHM23): Production support is now integrated for the Western United States (WUS) Revisions 1 and 2, ensuring hazard calculations align with the latest USGS modeling standards. Revision 2 was primarily updated to reclassify stable continental gridded seismicity in the Intermountain West as 2/3 active crustal and 1/3 stable continental.

Enhanced UI Data: The ERF Parameter Editor has been updated to include surface comprehensive model information directly within the graphical interface.

Version Comparison: Users can now easily view the differences between specific model versions (e.g., comparing NSHM23 Rev 1 against Rev 2) prior to executing hazard calculations, ensuring greater clarity in version selection. (See Fig 1.)

3. Mapping IMRs to Tectonic Regions

Added support for assigning multiple Intensity Measure Relationships (IMRs) to different Tectonic Region Types (TRTs) within a single ERF. (See Fig 2.)

Supported ERFs: This is primarily available for comprehensive, multi-region models like the NSHM23 (CONUS) and PRVI models.

Scientific Impact: Different tectonic environments attenuate seismic waves very differently. This feature allows researchers to map specific ground motion models to their appropriate tectonic settings within the same hazard calculation. For example, you can now apply one IMR for Active Shallow Crust (like California) and a different one for Stable Shallow Crust (like the Eastern US) or a Subduction zone. The hazard engine will automatically apply the correct ground motion physics to each rupture in a single run.

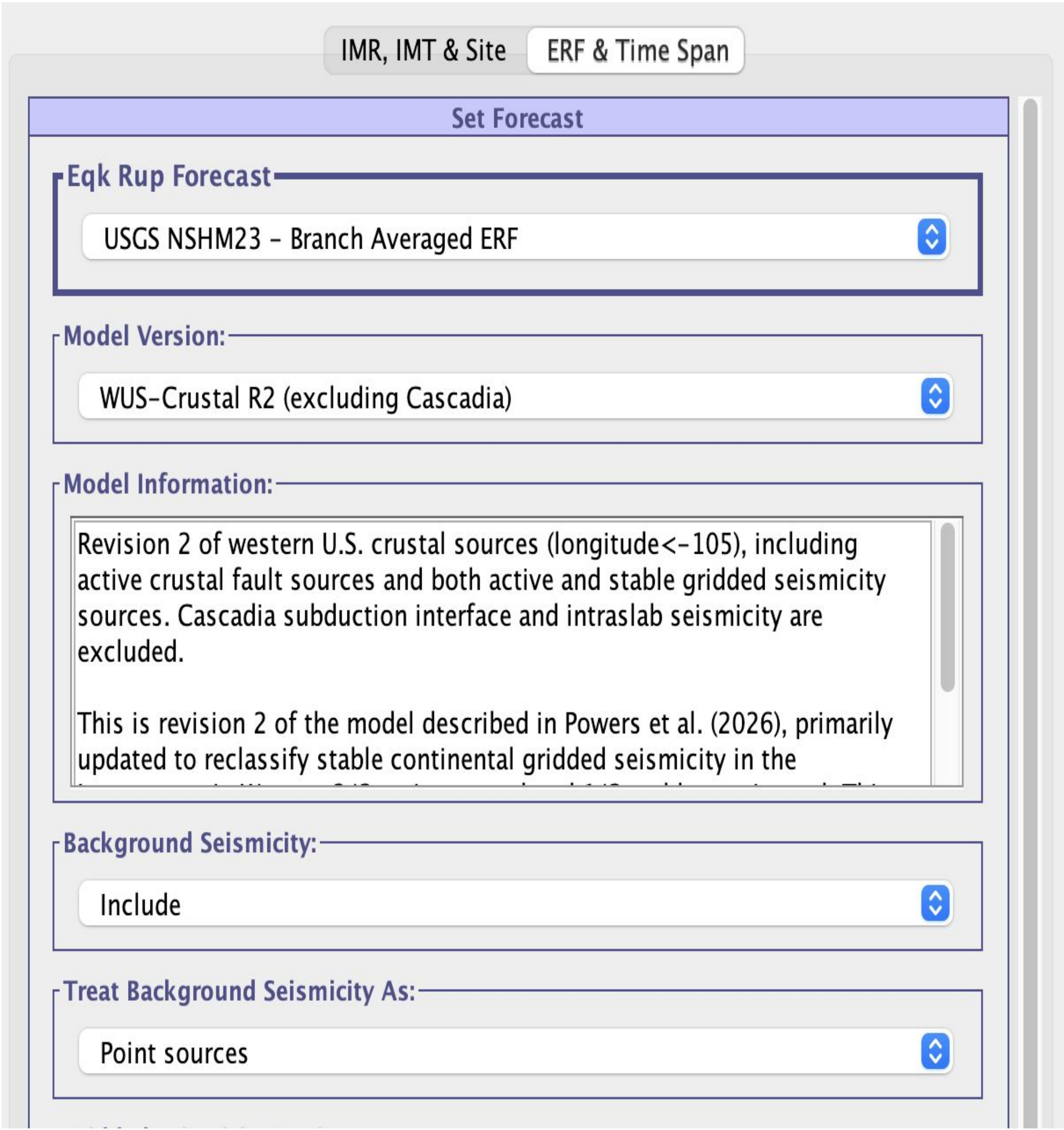


Fig 1. Can now select from multiple variants of the USGS NSHM23 ERF (HazardCurveApp Screenshot)

4. New Site Data Provider

Implemented brand new Site Data Providers that integrate data directly from the USGS Conterminous United States (CONUS) National Seismic Hazard Models (2023 and 2018).

The new providers automatically supply essential regional metrics, specifically basin depth and sediment thickness data, seamlessly integrating them into hazard maps and calculations.

New release v26.8 improvements for Seismic Hazard Analysis

- Updates to USGS NSHM23 (Western United States)
- USGS NSHM25 Puerto Rico and Virgin Islands ERF
- Seamless automatic updates for OpenSHA apps

5. Automatic Updates

Seamless Upgrades: Engineered a new subsystem that automatically checks for newer stable releases when launching OpenSHA desktop applications.

User-Centric Prompts: Upon detecting an outdated JAR, users are presented with the latest release notes and given the option to "Download Now," "Skip," or "Remind Me Later" (defers for 7 days). (See Fig 3.)

Academic & Training Support: To prevent version mismatch during workshops or research projects, the update subsystem can be completely disabled globally via a local configuration file.

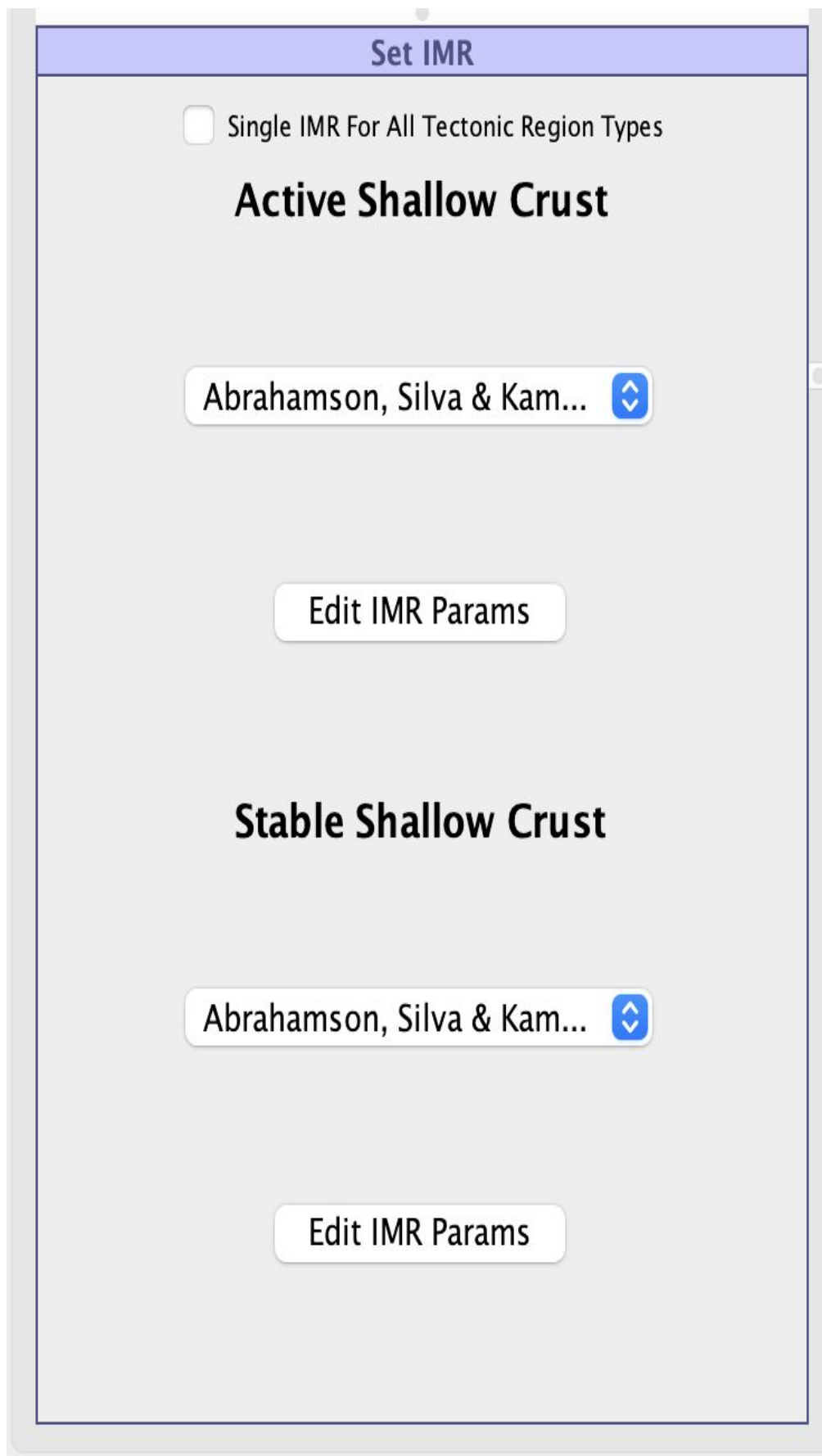


Fig 2. IMRs available for each TRT

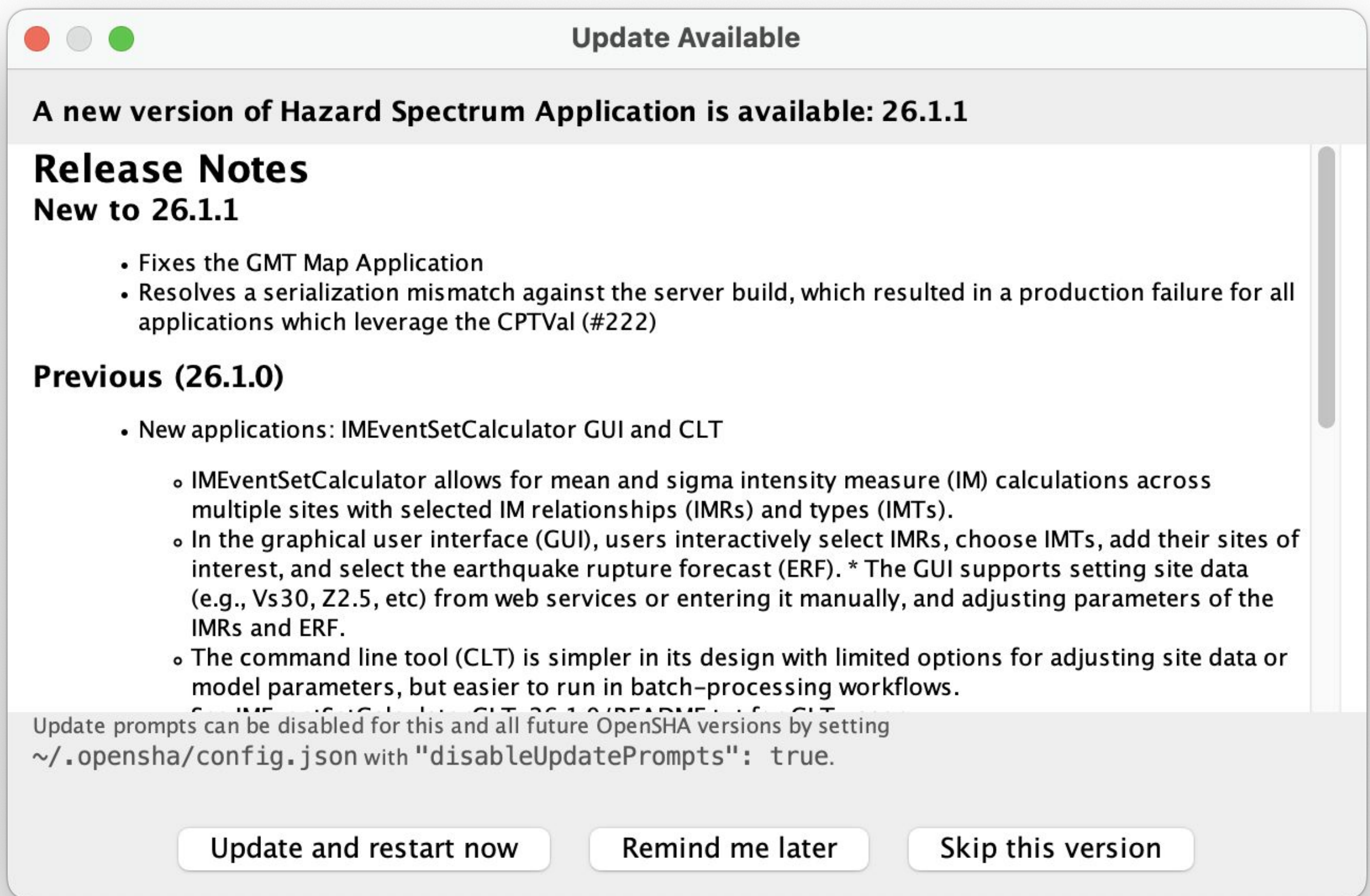
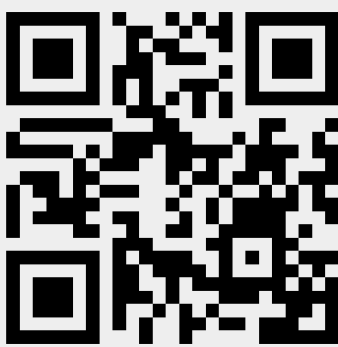


Fig 3. Automatic Update Prompt

6. Acknowledgements

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Try it out: Scan the QR code on the left or navigate to the following link in a web browser to access the code as well as documentation for installing and using OpenSHA applications.

<https://opensha.org>

