PSHA input model documentation for Australia (AUS)

GEM Hazard Team

Version history

Table 1 summarises version history for the AUS input model, named according to the versioning system described here, and indicating which version was used in each of the global maps produced since 2018. Refer to the GEM Products Page for information on which model versions are available for various use cases. The changelog describes the changes between consecutive versions and are additive for all versions with the same model year.

Table 1 – *Version history for the AUS input model.*

Version	2018.1	2019.1	2022.1	2023.1	Changelog
v2018.0.0	X				New version of the model released by Geoscience Australia in 2018.
v2018.1.0				X	Mmin extended to M4 for crustal distributed seismicity. Source ids updated to use syntax supported by disaggregation by source calculator.

The following text describes v2018.1.0.

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1 Summary

The Global Hazard Mosaic coverage of the Australian continent uses the 2018 model of Geoscience Australia (*Allen et al., 2018*a and *Allen et al., 2018*b), with input from greater seismology community in Australia, as an update to the 2012 national model. The model was originally implemented in the OpenQuake (OQ) engine format, and only the computed sites grid was modified by the GEM Secretariat.

2 Tectonic overview

Most of the Australian continent is stable, and seismicity is relatively infrequent though intraplate earthquakes do occur and may be damaging.

The major exception to this is in far northern Australia, where the continental crust is colliding with the microcontinents of Indonesia, particularly in Papua New Guinea. For more information on this region, see Indonesia. Australian territory may also be affected by the interaction of the Australian and Pacific plates to the east in New Zealand.

3 Basic Datasets

Please refer to *Allen et al., 2018a* and *Allen et al., 2018b*.

4 Hazard Model

4.1 Seismic Source Characterisation

The development of the Australian source model is explained by *Griffin and Davies, 2018*, and the results are summarized by *Allen et al.* (*2018*a). A logic tree combining 20 source models from various contributors (all open access, peer-reviewed, and with national coverage) accounts for some epistemic uncertainty; a panel of experts assigned the weighting for each model. Additional epistemic uncertainty was accounted for during the model parameterization.

Together, the source models include:

- large, background **area sources**
- smaller, regional **area sources**
- seismotectonic sources consiting of both **complex faults** and **area sources**, and
- smoothed seismicity modelled as **point sources**

4.2 Ground Motion Characterisation

Non_cratonic	**Weight**
ChiouYoungs2014	0.13
Allen2012	0.208
AtkinsonBoore2006	0.138
SomervilleEtAl2009NonCratonic	0.205
BooreEtAl2014	0.166
ChiouYoungs2008	0.153
Cratonic	**Weight**
ZhaoEtAl2006Asc	0.146
ChiouYoungs2014	0.085
Allen2012	0.192
AtkinsonBoore2006	0.125
SomervilleEtAl2009YilgarnCraton	0.228
BooreEtAl2014	0.106
AtkinsonBoore2006Modified2011	0.118
Subduction	**Weight**
Allen2012	0.104
AtkinsonBoore2006	0.139
SomervilleEtAl2009NonCratonic	0.099
AtkinsonBoore2003SSlab	0.141
BooreEtAl2014	0.125
AbrahamsonEtAl2015SSlab	0.222
AtkinsonBoore2006Modified2011	0.17

Table 2 *– GMPEs used in the AUS model.*

5 Results

Hazard curves were computed with the OQ engine for the following:

- Intensity measure types (IMTs): peak ground acceleration (PGA) and spectral acceleration (SA) at 0.2s, 0.3s, 0.6s, 1.0s, and 2s
- reference site conditions with shear wave velocity in the upper 30 meters (Vs30) of 760-800 m/s, as well as for Vs30 derived from a topography proxy (Allen and Wald, 2009)

Hazard maps were generated for each reference site condition-IMT pair for 10% and 2% probabilities of exceedance (POEs) in 50 yrs. Additionally, disaggregation by magnitude, distance, and epsilon was computed for the following cities: Perth, Canberra and Darwin. The results were produced as csv files and bar plots for each of the following combinations:

- hazard levels for 10% and 2% POE in 50 yrs

- PGA and SA at 0.2s, 0.3s, 0.6s, and 1.0s
- Vs30=800 m/s

All calculations used a ground motion sigma truncation of 5. Results were computed for sites with 6 km spacing

Visit the GEM Interactive Viewer to explore the Global Seismic Hazard Map values (PGA for Vs30=800 m/s, 10% poe in 50 years). For a comprehensive set of hazard and risk results, see the GEM Products Page.

6 References

Allen, T. I., and Wald, D. J., 2009, On the use of high-resolution topographic data as a proxy for seismic site conditions $Vs30$, Bulletin of the Seismological Society of America, 99, no. 2A, 935-943

Allen, T., J. Griffin, M. Leonard, D. Clark, and H. Ghasemi (2018a). The 2018 National Seismic Hazard Assessment for Australia: model overview, Geoscience Australia Record 2018/27, Canberra, doi: 10.11636/Record.2018.027.

Allen, T. I., J. Griffin, and D. Clark (2018b). The 2018 National Seismic Hazard Assessment for Australia: model input files, Geoscience Australia Record 2018/32, Canberra, doi: 10.11636/Record.2018.032.

Griffin, J., & Davies, G. Earthquake sources of the Australian plate margin, Geoscience Australia Record 2018/31, Canberra, doi: 10.11636/Record.2018.031.

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