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Interdisciplinary data-constrained 3-D potential field modelling with



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Thterdisciplinary data integration







3D Structural Models:

Hessen (Freymark et al. 2015)

Hessen3D (Arndt et al. 2011)

GeORG (GeORG-Projektteam 2013a)

Baden-Württemberg (Nitsch & Zedler 2009, Rupf & Nitsch 2008)

Central European Basin System (Maystrenko & Scheck-Wenderoth 2013)

Molasse Basin (Przybycin et al. 2015a)

Additional Data:

2D Surface and Thickness Maps (Boigk & Schöneich 1972, Bachmann et al. 1987, Mechie 2007, Amante & Eakins 2009, NAGRA 2012)

Seismic Reflection Profiles

(Brun et al. 1992, Finckh et al. 1984, Lüschen et al. 1987, Meissner & Bortfeld 1990, Oncken 1998, Oncken et al. 1999)

Seismic Refraction Profiles

(Blundell et al. 1992, Gajewski et al. 1987, Glahn et al. 1993, Maurer & Ansorge 1992, Mueller et al. 1973)

Wells / Temperature Data

(Bär 2012, Bonté et al. 2010, Carré 2011, Guillou-Frottier et al. 2011, Kohl et al. 2003, Le Masne et al. 1991, LGRB 2010, Vernoux & Lambert 1993)

Upper Rhine Graben

Freymark, J. K. (2019). Implications of the 3D structural and density configuration for the thermal and hydraulic fields of the Upper Rhine Graben (Doctoral dissertation, Universitätsbibliothek der RWTH Aachen).

Data: geology, seismic images, wells, 3D models, thickness maps etc.



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Thteractive gravity modelling



Pavlis, N.K., Holmes, S.A., Kenyon, S.C., Factor, J.K., 2012. The development and evaluation of the Earth Gravitational Model 2008 (EGM2008). Journal of Geophysical Research: Solid Earth 117, B04406. https://doi.org/10.1029/2011JB008916

Freymark, J., Sippel, J., Scheck-Wenderoth, M., Bär, K., Stiller, M., Fritsche, J.-G., et al. (2017). The deep thermal field of the Upper Rhine Graben. Tectonophysics 694, 114–129. 10.1016/j.tecto.2016.11.013



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Interdisciplinary data-constrained 3-D potential field modelling with IGMAS+



TGMAS+: Interactive Gravity and Magnetic Application System





No-cost license upon request



Cross-platform Implementation in Java



Time Machine Timeline-based project management



Performance Hardware-accelerated parallel calculations



Wide User Community Hundreds of users world-wide



Global Visualization NASA WorldWind Plugin

Long History

Interactivity

User-friendly graphical interface

(cc)

Customization Big variety of themes

Over 40 years of development

Since 2019: in GFZ Potsdam **German Research Centre for Geosciences** https://www.gfz-potsdam.de/igmas

Key publication:

Götze, H. J., & Lahmeyer, B. (1988). Application of three-dimensional interactive modeling in gravity and magnetics. Geophysics, 53(8), 1096-1108.

Schmidt, S., Anikiev, D., Götze, H. J., Gomez Garcia, A., Gomez Dacal, M. L., Meeßen, C., Plonka, C., Rodriguez Piceda, C., Spooner, C., & Scheck-Wenderoth, M. (2020, May). IGMAS+-a tool for interdisciplinary 3D potential field modelling of complex geological structures. In EGU General Assembly Conference Abstracts (p. 8383).







Applications: Southern Central Andes



Related vEGU21 abstract: EGU21-5214

GFZ Interdisciplinary data-constrained 3-D potential field modelling with IGMAS+ D. Anikiev et al. **EGU** General Assembly 2021 5

(†)

Applications: Caribbean plate

Location of the model region (magenta box) and interpretation region (black box).



Gómez-García, Ángela María, et al. "The preserved plume of the Caribbean Large Igneous Plateau revealed by 3D data-integrative models." Solid Earth 12.1 (2021): 275-298.

Related vEGU21 abstract: EGU21-10188

GFZ Interdisciplinary data-constrained 3-D potential field modelling with IGMAS+ D. Anikiev et al.







Applications: Alpine domain



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References



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Anikiev, D., Götze, H.-J., Bott, J., Gómez-García, A. M., Gomez Dacal, M. L., Meeßen, C., Spooner, C., Rodriguez Piceda, C., Plonka, C., Schmidt, S., and Scheck-Wenderoth, M.: Interdisciplinary data-constrained 3-D potential field modelling with IGMAS+, EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-2964, https://doi.org/10.5194/egusphere-egu21-2964, 2021.

Freymark, J., Sippel, J., Scheck-Wenderoth, M., Bär, K., Stiller, M., Fritsche, J.-G., et al. (2017). The deep thermal field of the Upper Rhine Graben. Tectonophysics 694, 114–129. <u>https://doi.org/10.1016/j.tecto.2016.11.013</u>

Freymark, J. K. (2019). Implications of the 3D structural and density configuration for the thermal and hydraulic fields of the Upper Rhine Graben (Doctoral dissertation, Universitätsbibliothek der RWTH Aachen).

Götze, H. J., & Lahmeyer, B. (1988). Application of three-dimensional interactive modeling in gravity and magnetics. Geophysics, 53(8), 1096-1108.

Gómez-García, A. M., Le Breton, E., Scheck-Wenderoth, M., Monsalve, G., and Anikiev, D.: The preserved plume conduits of the Caribbean Large Igneous Plateau and their relation with the Galápagos hotspot back to 90 Ma, EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-10188, https://doi.org/10.5194/egusphere-egu21-10188, 2021.

Gómez-García, Ángela María, et al. "The preserved plume of the Caribbean Large Igneous Plateau revealed by 3D data-integrative models." Solid Earth 12.1 (2021): 275-298.

Kumar, A., Spooner, C., Scheck-Wenderoth, M., and Cacace, M.: How seismicity relates to lithospheric heterogeneity in the Alps, EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-11552, <u>https://doi.org/10.5194/egusphere-egu21-11552</u>, 2021.

Pavlis, N.K., Holmes, S.A., Kenyon, S.C., Factor, J.K., 2012. The development and evaluation of the Earth Gravitational Model 2008 (EGM2008). Journal of Geophysical Research: Solid Earth 117, B04406. <u>https://doi.org/10.1029/2011JB008916</u>

Rodriguez Piceda, C., Scheck Wenderoth, M., Gomez Dacal, M. *et al.* Lithospheric density structure of the southern Central Andes constrained by 3D data-integrative gravity modelling. *Int J Earth Sci (Geol Rundsch)* (2020). <u>https://doi.org/10.1007/s00531-020-01962-1</u>

Rodriguez Piceda, C., Scheck-Wenderoth, M., Bott, J., Gomez Dacal, M. L., Pons, M., Prezzi, C., and Strecker, M.: Unravelling the thermal state of the southern Central Andes and its controlling factors, EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-5214, <u>https://doi.org/10.5194/egusphere-egu21-5214</u>, 2021.

Schmidt, S., Anikiev, D., Götze, H.-J., Gomez Garcia, Å., Gomez Dacal, M. L., Meeßen, C., Plonka, C., Rodriguez Piceda, C., Spooner, C., and Scheck-Wenderoth, M.: IGMAS+ – a tool for interdisciplinary 3D potential field modelling of complex geological structures., EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-8383, https://doi.org/10.5194/egusphere-egu2020-8383, 2020

Spooner, C., Scheck-Wenderoth, M., Götze, H.-J., Ebbing, J., Hetényi, G., and the AlpArray Working Group: Density distribution across the Alpine lithosphere constrained by 3-D gravity modelling and relation to seismicity and deformation, Solid Earth, 10, 2073–2088, <u>https://doi.org/10.5194/se-10-2073-2019</u>, 2019.





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