

# Vanderlei C. Oliveira Jr.


*Associate Professor of Geophysics*

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## OVERVIEW

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Associate Professor at the geophysics department of Observatório Nacional, Brazil. Specialist in numerical methods for processing and interpreting potential fields (gravity and magnetic).

## APPOINTMENTS

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**Associate Professor of Geophysics**

2017–

*Observatório Nacional, Rio de Janeiro, Brazil*

**Assistant Professor of Geophysics**

2013–2016

*Observatório Nacional, Rio de Janeiro, Brazil*

## RESEARCH INTERESTS

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- **Equivalent layer technique:** computationally efficient methods for processing and interpreting large potential field data sets.
- **Inversion of gravity and/or magnetic data:** methods to invert gravity and/or magnetic data for the purpose of estimating the position and shape of geological bodies.
- **Magnetization of geological bodies:** methods for estimating the magnetization direction of geological bodies by using land and airborne magnetic data.
- **Magnetization of rock samples:** methods for estimating the magnetization distribution within rock samples by using scanning magnetic microscopy data.
- **Magnetic modeling of geological bodies:** methods for computing the demagnetizing field within geological bodies having high susceptibility.
- **Regional characterization of gravity field:** computationally efficient methods for representing the regional gravity field by combining different data sets.
- **Regional characterization of the crustal magnetic field:** computationally efficient methods for representing the crustal field by combining different data sets.

## EDUCATION

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### PhD Geophysics

Dec/2010 – Jan/2013

*Observatório Nacional, Brazil*

**Title (portuguese):** “Processamento e inversão de dados de campos potenciais: Novas abordagens”

**Title (english):** “Processing and inversion of potential field data: New approaches”

**Advisor:** Dr. Valeria C. F. Barbosa

**Description:** This work presents two new methodologies for processing and interpreting potential field data. The first one is the Polynomial Equivalent Layer, which is a cost-effective method for processing large potential-field data sets via the equivalent-layer technique. The second is a non-linear method for inverting gravity-gradient data to estimate the shape of isolated 3-D geological bodies.

### MSc Geophysics

Mar/2009 – Nov/2010

*Observatório Nacional, Brazil*

**Title (portuguese):** “Inversão gravimétrica radial por camadas para a reconstrução de corpos geológicos 3D”

**Title (english):** “Radial gravity inversion by layers for retrieving 3D geological bodies”

**Advisor:** Dr. Valeria C. F. Barbosa

**Description:** This work presents a gravity-inversion method for estimating the geometry of a 3D source. The subsurface region containing the geologic source is discretized into an ensemble of vertically juxtaposed prisms. By estimating the coordinates of the horizontal section of each prism, the method retrieves a set of polygonal horizontal sections representing depth slices of the 3D gravity source.

### BSc Geophysics

Mar/2004 – Dec/2008

*University of São Paulo, Brazil*

**Title (portuguese):** “Modelagem gravimétrica 3D da borda norte da Bacia do Paraná”

**Title (english):** “3D gravity modelling of the northern border of the Paraná basin”

**Advisor:** Dr. Yara R. Marangoni

**Description:** This work presents a geological model of the northern border of the Paraná basin obtained from gravity data.

## PEER-REVIEWED JOURNAL PAPERS (ORCID)

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- [1] J. Araujo, A. Reis, V. C. Oliveira Jr, A. Santos, C. Luz-Lima, E. Yokoyama, L. Mendoza, J. Pereira, A. Bruno. Characterizing Complex Mineral Structures in Thin Sections of Geological Samples with a Scanning Hall Effect Microscope. *Sensors* **2019**, *19*, 1636.
- [2] D. Takahashi, V. C. Oliveira Jr. Ellipsoids (v1.0): 3-D magnetic modelling of ellipsoidal bodies. *Geoscientific Model Development* **2017**, *10*, 3591–3608.
- [3] F. C. L. Siqueira, V. C. Oliveira Jr., V. C. F. Barbosa. Fast iterative equivalent-layer technique for gravity data processing: A method grounded on excess mass constraint. *GEOPHYSICS* **2017**, *82*, G57–G69.
- [4] A. L. A. Reis, V. C. Oliveira Jr., E. Yokoyama, A. C. Bruno, J. M. B. Pereira. Estimating the magnetization distribution within rectangular rock samples. *Geochemistry, Geophysics, Geosystems* **2016**, *17*, 3350–3374.
- [5] V. Oliveira Jr, D. Sales, V. Barbosa, L. Uieda. Estimation of the total magnetization direction of approximately spherical bodies. *Nonlinear Processes in Geophysics* **2015**, *22*, 215–232.
- [6] L. Uieda, V. C. Oliveira Jr., V. C. F. Barbosa. Geophysical tutorial: Euler deconvolution of potential-field data. *The Leading Edge* **2014**, *33*, 448–450.
- [7] F. F. Melo, V. C. F. Barbosa, L. Uieda, V. C. Oliveira Jr., J. B. C. Silva. Estimating the nature and the horizontal and vertical positions of 3D magnetic sources using Euler deconvolution. *GEOPHYSICS* **2013**, *78*, J87–J98.
- [8] V. C. Oliveira Jr., V. C. Barbosa. 3-D radial gravity gradient inversion. *Geophysical Journal International* **2013**, *195*, 883–902.
- [9] V. C. Oliveira Jr., V. C. F. Barbosa, L. Uieda. Polynomial equivalent layer. *GEOPHYSICS* **2013**, *78*, G1–G13.
- [10] V. C. Oliveira Jr., V. C. F. Barbosa, J. B. C. Silva. Source geometry estimation using the mass excess criterion to constrain 3-D radial inversion of gravity data. *Geophysical Journal International* **2011**, *187*, 754–772.

## LAST PARTICIPATIONS AT INTERNATIONAL CONFERENCES

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- [1] L. B. Vital, C. Foss, V. C. Oliveira Jr., V. C. F. Barbosa, *Magnetic Field Inversion – the cost of freedom*. ASEG Extended Abstracts - AEGC 2019: From Data to Discovery, Australian Society of Exploration Geophysicists (ASEG), Perth, Australia. 1–5, [expanded abstract co-author]. <https://doi.org/10.1080/22020586.2019.12073182>.
- [2] L. S. Piaulino, V. C. F. Barbosa, V. C. Oliveira Jr., *Estimative of the gravity-gradient data from vertical component of gravitational attraction by using the equivalent-layer and fast Fourier transform techniques*. 16th International Congress of the Brazilian Geophysical Society, Brazilian Geophysical Society (SBGf), Rio de Janeiro, Brazil, [expanded abstract co-author]. <https://doi.org/10.22564/16cisbgf2019.235>.
- [3] A. D. Arelaro, V. C. F. Barbosa, V. C. Oliveira Jr., *The sensitivity of ocean-bottom gravimeters at deep waters to mass changes in a synthetic hydrocarbon reservoir*. 16th International Congress of the Brazilian Geophysical Society, Brazilian Geophysical Society (SBGf), Rio de Janeiro, Brazil, [expanded abstract co-author]. <https://doi.org/10.22564/16cisbgf2019.242>.
- [4] S. P. Gonzalez, F. F. Melo, V. C. F. Barbosa, V. C. Oliveira Jr., *Amplitude of the magnetic anomaly vector in low latitudes via equivalent layer*. 16th International Congress of the Brazilian Geophysical Society, Brazilian Geophysical Society (SBGf), Rio de Janeiro, Brazil, [expanded abstract co-author]. <https://doi.org/10.22564/16cisbgf2019.028>.
- [5] L. B. Vital, V. C. Oliveira Jr., V. C. F. Barbosa, *Radial magnetic inversion to retrieve the geometry of 3D sources*. SEG Technical Program Expanded Abstracts 2019, SEG, San Antonio, USA. 1754–1758, [expanded abstract co-author]. <https://library.seg.org/doi/abs/10.1190/segam2019-3215805.1>.
- [6] L. S. Piaulino, F. C. L. Siqueira, V. C. Oliveira Jr., V. C. F. Barbosa, *Estimative of gravity-gradient tensor components via fast iterative equivalent-layer technique*. SEG Technical Program Expanded Abstracts 2019, SEG, San Antonio, USA. 1714–1718, [expanded abstract co-author]. <https://library.seg.org/doi/abs/10.1190/segam2019-3215804.1>.
- [7] A. L. A. Reis, V. C. Oliveira Jr., V. C. F. Barbosa, *Equivalent layer technique for estimating magnetization direction*. SEG Technical Program Expanded Abstracts 2019, SEG, San Antonio, USA. 1769–1773, [expanded abstract co-author]. <https://library.seg.org/doi/abs/10.1190/segam2019-3216745.1>.
- [8] F. F. Melo, S. P. Gonzalez, V. C. F. Barbosa, V. C. Oliveira Jr., *Amplitude of the magnetic anomaly vector for interpretation at low latitudes*. SEG Technical Program Expanded Abstracts 2019, SEG, San Antonio, USA. 1744–1748, [expanded abstract co-author]. <https://library.seg.org/doi/abs/10.1190/segam2019-3215222.1>.
- [9] A. L. A. Reis, V. C. Oliveira Jr., *SED for optimal acquisition design and sensor-to-sample distance applied to scanning magnetic microscopy*. Fifth bi-annual meeting of the LATINMAG, LATINMAG, Querétaro, México, [abstract co-author].
- [10] A. L. A. Reis, V. C. Oliveira Jr., *Impact of the sensor area, acquisition design and position noise on the estimation of the magnetization distribution within a rectangular rock sample*. 2016 AGU Fall Meeting, AGU, San Francisco, USA, [attendee, abstract co-author].

- [11] K. A. T. Hallam, V. C. Oliveira Jr., *Applications of differential operators in geodetic coordinates*. 2016 AGU Fall Meeting, AGU, San Francisco, USA, [attendee, abstract co-author].
- [12] V. C. Oliveira Jr., D. P. Sales, V. C. F. Barbosa, L. Uieda, *Estimating the total magnetization direction of approximately spherical bodies*. 26th IUGG General Assembly - IAGA - A41 Lithospheric Field Modeling, the WDMAM and Tectonic Implications (Div. V) - A41p-280, IUGG, Prague, Czech Republic, [attendee, abstract co-author, poster presenter].
- [13] A. L. A. Reis, V. C. Oliveira Jr., E. Yokoyama, A. C. Bruno, J. M. B. Pereira, *Estimating the magnetization distribution within rectangular rock samples*. 26th IUGG General Assembly - IAGA - A06d-A06d A06/A07 Applied Rock Magnetism (Div. I) / Theoretical and Experimental Rock Magnetism (Div. I) - IUGG-1853, IUGG, Prague, Czech Republic, [attendee, abstract co-author, oral presenter].
- [14] V. C. Oliveira Jr., V. C. F. Barbosa, *3-D Radial Gravity Gradient Inversion Applied to the Interpretation of the Vinton Salt Dome, USA*. 76th EAGE Conference and Exhibition 2014, EAGE, Amsterdam, Netherlands, [attendee, expanded abstract author, oral presenter].
- [15] L. Uieda, V. C. Oliveira Jr., V. C. F. Barbosa, *Modeling the Earth with Fatiando a Terra*. 12th Scientific Computing with Python Conference, SciPy, Austin, USA, [expanded abstract co-author].
- [16] V. C. Oliveira Jr., V. C. F. Barbosa, *Polynomial equivalent layer*. SEG Las Vegas 2012 Annual Meeting, SEG, Las Vegas, USA, [expanded abstract author].
- [17] V. C. Oliveira Jr., V. C. F. Barbosa, *3D Radial inversion of gravity data for estimating the source's geometry* 73rd EAGE Conference and Exhibition incorporating SPE EUROPEC 2011, EAGE, Vienna, Austria, [attendee, expanded abstract author, oral presentation].
- [18] V. C. Oliveira Jr., V. C. F. Barbosa, *Radial gravity inversion constrained by total anomalous mass excess for retrieving 3D bodies*. SEG San Antonio 2011 Annual Meeting, SEG, San Antonio, USA, [expanded abstract author].

## THESES SUPERVISED

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1. [PhD] Title (portuguese): “Modelagem regional do campo de gravidade utilizando pontos de massa em coordenadas geodésicas”, Title (english): “Regional gravity modeling by using point masses in geodetic coordinates”, Student: Kristoffer A. T. Hallam, *Observatório Nacional, Brazil* (2019).
2. [MSc] Title (portuguese): “[Inversão gravimétrica 2D com vínculo isostático](#)”, Title (english): “2D gravity inversion with isostatic constraint”, Student: Barbara Marcela S. Bastos, *Observatório Nacional, Brazil* (2018).
3. [MSc] Title (portuguese): “[Modelagem magnética 3D de corpos elipsoidais](#)”, Title (english): “3D Magnetic modeling of ellipsoidal bodies”, Student: Diego Takahashi, *Observatório Nacional, Brazil* (2017).
4. [MSc] Title (portuguese): “[Inversão magnética 3D para estimar a distribuição de magnetização de uma amostra de rocha](#)”, Title (english): “3D Magnetic inversion to estimate the magnetization distribution of a rectangular rock sample”, Student: André L. A. Reis, *Observatório Nacional, Brazil* (2016).
5. [MSc] Title (portuguese): “[Estimativa do vetor de magnetização total de corpos aproximadamente esféricos](#)”, Title (english): “Estimating the total magnetization vector of approximately spherical bodies”, Student: Daiana P. Sales, *Observatório Nacional, Brazil* (2014).

## THESES CO-SUPERVISED

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1. [MSc] Title (portuguese): “[Investigação geofísica do Alto do Ceará na margem equatorial brasileira – Uma crosta continental ou uma crosta oceânica?](#)”, Title (english): “Geophysical investigation of the Ceará Rise in the brazilian equatorial margin – A continental crust or oceanic crust?”, Student: Victor C. Pereira, *Observatório Nacional, Brazil* (2017).
2. [PhD] Title (portuguese): “[Otimização computacional do método da camada equivalente](#)”, Title (english): “Computational optimization of the equivalent layer method”, Student: Fillipe C. L. Siqueira, *Observatório Nacional, Brazil* (2016).

## CURRENT STUDENTS

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1. Andre L. A. Reis, PhD, main supervisor, expected 2020.
2. Leonardo B. Vital, PhD, main supervisor, expected 2020.
3. Andre D. Arelaro, MSc, co- supervisor, expected 2020.
4. Diego Takahashi, PhD, main supervisor, expected 2021.
5. Shayane P. Gonzalez, PhD, co- supervisor, expected 2021.
6. Larissa S. Piauilino, PhD, co- supervisor, expected 2022.

## TEACHING

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- Graduate course: “Potential-field methods”, Graduate Program in Geophysics, *Observatório Nacional, Brazil*, 2014 – present
- Graduate course: “Computational methods applied to Geophysics”, Graduate Program in Geophysics, *Observatório Nacional, Brazil*, 2014 – present

## PARTICIPATION IN DEPARTMENTAL COMMITTEES

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- Member of the Faculty Staff of the Graduate Program in Geophysics  
Observatório Nacional, 2014 – present
- Head of the Graduate Program in Geophysics Committee  
Observatório Nacional, 2017 – 2018
- Member the Graduate Program in Geophysics Committee  
Observatório Nacional, 2014 – 2018

## FUNDING

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- [Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro \(FAPERJ\)](#), Title (portuguese): “Camada equivalente aplicada à caracterização magnética de feições estruturais em regiões de crosta oceânica próximas ao equador”, Title (english): “Equivalent layer applied to magnetic characterization of structural features on ocean crust at regions close to equator”, ID: E-26/202.729/2018, Research grant: Jovem Cientista do Nosso Estado – JCNE/2018, R\$ 75 600.00, Nov/2018 – Out/2021.
- [Conselho Nacional de Desenvolvimento Científico e Tecnológico \(CNPq\)](#), Title (portuguese): “Camada equivalente aplicada ao processamento de dados magnéticos”, Title (english): “Equivalent layer applied to magnetic data processing”, ID: 308945/2017-4, Research grant: CNPq N° 12/2017 - Bolsas de Produtividade em Pesquisa - PQ, R\$ 39 600.00, Mar/2018 – Feb/2021.
- [Conselho Nacional de Desenvolvimento Científico e Tecnológico \(CNPq\)](#), Title (portuguese): “Estimativa da direção da magnetização total de corpos 3D aproximadamente esféricos”, Title (english): “Estimation of the total magnetization direction of approximately 3D spherical bodies”, ID: 445752/2014-9, Research grant: MCTI/CNPQ/Universal 14/2014, R\$ 20 000.00, Nov/2014 – Nov/2017.
- [Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro \(FAPERJ\)](#), Title (portuguese): “Infraestrutura computacional para a estimação da magnetização de corpos 3D aproximadamente dipolares”, Title (english): “Computational infrastructure for estimating the magnetization direction of approximately dipolar bodies”, ID: E-26/111.152/2014, Research grant: INST - Auxílio Instalação - 2013/2 , R\$ 10 000.00, Jun/2014 – Mar/2016.