Dr. María Constanza Manassero

Research Scientist in Geophysics –

3D Joint Inversions of Magnetotelluric and Seismic Data

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CAREER SUMMARY

Dr. Manassero graduated with a PhD in Geophysics at Macquarie University, Australia, in April 2020. Her project consisted of the development of new methodologies to help study the deep lithospheric structure and mapping the location of mineral deposits and energy sources within Australia. Her background is in computational and theoretical geophysics and her interests lay within many different geophysical methods. She is particularly interested in the joint inversion of MT data with other geophysical observables (such as seismic and gravity) as it provides key information for imaging the deep and complex lithospheric structure. MT, in particular, has the greatest potential for exploring mineral and energy sources. This potential has led to a considerable investment by the Australian government to acquire MT data across the whole of Australia through the AusLAMP initiative and significant efforts have been made by the geophysical community to develop robust methods of MT data inversion and interpretation. Dr. Manassero's work within this field is remarkably prominent as she has developed a novel and innovative methodology for joint probabilistic inversion of 3D MT and seismic data, which opens up new opportunities for the understanding of the Earth's interior. She is currently working on the application of her methodology for joint probabilistic inversions using the MT data from AusLAMP and the seismic data from AusArray as part of an ARC Linkage Grant with UNSW, Geoscience Australia and several Australian Geological Surveys. This will be a valuable asset for helping advance the field of energy and mining technology.

KEY SKILLS

Magnetotellurics, Seismics & Gravity	**Geophysical Methods**	**Lithosphere Structure**	**Numerical Approximations**
Programming	**Reduced Order Models**	**Probabilistic Inversion**	**Machine Learning**

RELEVANT EXPERIENCE

Post-Doctoral Research Scientist in Geophysics – Macquarie University (MQ)| Oct 2019 – Current| Sydney, Australia
Main research area: Joint Probabilistic Inversion of 3D Magnetotelluric (MT) data with other observables (e.g., seismic, gravity).

- Currently working on joint probabilistic inversion using seismic data and the MT data from AusLAMP initiative to image the lithosphere beneath Australia and helping to identify potential mineral and energy resources at a national scale.
- Working as part of a multi-disciplinary and international team including geologists from MQ and GNS, petrologists from University of Manchester and geodynamicist from University of Twente.
- Leading the MQ node of an Australian Research Council (ARC) Linkage project (Grant LP170100233) with UNSW, Geoscience Australia and several Australian Geological Surveys.
- Part of collaboration projects with researchers from the Barcelona Supercomputing Center, Universidad Complutense de Madrid, Universidad Politecnica de Cataluña, National University of La Plata, and University of Twente.

PhD in Geophysics– Macquarie University | Aug 2016 - Aug 2019- Conferral April 2020 | Sydney, Australia

- Thesis title: "A Reduced Order Approach for Probabilistic Inversions of 3D Magnetotelluric Data"
- The project was part of The Australian Research Council (ARC) Grant DP160103502
- Awarded with International Macquarie University Research Excellence Scholarship (iMQRES)

Key achievements:

- Developed an optimised version of the MT finite element forward code of Zyserman & Santos (2000)
- Developed a novel and efficient RB+MCMC algorithm that combines Reduced Basis methods, full finite element solutions and MCMC strategies to reduce computational times and be able to include 3D MT data into joint probabilistic inversions.
- Designed an efficient parallel-in-parallel structure to combine 3D MT forward computations by frequency with our RB+MCMC algorithm.
- Developed an innovative general framework to include 3D MT data into probabilistic joint inversions for imaging the lithospheric structure of the Earth and mapping potential mineral deposits and energy sources.
- Performed the first joint inversion of 3D MT data and surface-wave dispersion data within a fully probabilistic framework.
- Include gravity data into a 1D joint probabilistic framework (LitMod, Afonso et al, 2013)

TEACHING EXPERIENCE

Dr. Manassero has over 10 years of teaching experience in Geophysics, Mathematics and Engineering at University of La Plata, Argentina and Macquarie University, Australia.

- **Teaching Assistant – Macquarie University** | June 2022- present | Sydney, Australia
  Assistant at 'Engineering Design' class, Macquarie University.

- **Teaching Assistant – Macquarie University** | Apr 2019 | Sydney, Australia
  Assistant at 'The Planet Earth' class, Macquarie University.

- **Teaching Assistant – Macquarie University** | Oct 2018 | Sydney, Australia
  Assistant at 'Earth Dynamics' class, Macquarie University.

- **Teaching Assistant – Macquarie University** | Aug 2017- Sep 2017 | Sydney, Australia
  Assistant at' An introduction to Solid Earth' class, Macquarie University.

- **Teaching Assistant – National University of La Plata** | Dec 2011-Jun 2016 | La Plata, Argentina
  Teaching assistant Position in 'Geomatics', awarded on merits.

- **Teaching Assistant – National University of La Plata** | Oct 2012-Jun 2016 | La Plata, Argentina
  Teaching assistant position in 'Mathematical Analysis', Macquarie University.

TECHNICAL SKILLS

Fortran 90,77	Octave	3D grid	Linux	Microsoft
Matlab	Latex	GMT	Paraview	Illustrator

EDUCATION & COURSES

PhD in Geophysics | Macquarie University | Aug 2016 - Aug 2019-Conferral April 2020 |Sydney, Australia
- Thesis title: "A Reduced Order Approach for Probabilistic Inversions of 3D Magnetotelluric Data"

Geophysicist | National University of La Plata, Argentina - 2015
- Master - Equivalent Degree.
- Thesis title: "Seismic Attenuation around Peteroa Volcano-Central Andes"

Seismic and Electromagnetic Interferometry for Imaging and Monitoring of the Subsurface | Sept 2014 | National University of La Plata
- Dr. Deyan Draganov, Delft University of Technology, The Netherlands
- 15 hours postgraduate course attended

Introduction to the Theory of Poroelasticity | Sept 2014 | National University of La Plata
- Dr. Germán Rubino, University of Lausanne, Switzerland
- 32 hours postgraduate course attended.

Borehole Seismic | Aug 2013-Dec 2013 | National University of La Plata
- Dr. Eduardo Corti. Faculty of Astronomical Sciences and Geophysics La Plata
- 40 hours undergraduate seminar.

Hydrogeophysical Methods for Environmental Studies | June 2013 | National University of La Plata
- Dr. Damien Jougnot, University of Lausanne, Switzerland
- 30 hours postgraduate course

XIV Giambiagi Winter School "Applied and Environmental Geophysics" | July 2012| University of Buenos Aires
- 30 hours postgraduate course

Seismic Waves Propagation. Theory and Numeric Simulation | May 2012| University of Buenos Aires
- Dr. Jose Carcione. ONDAS YPF-UNLP, Buenos Aires (Argentina)
- 21 hours course.

Monitoring Active Volcanoes and Volcanic Risk | July 2011| University of La Plata
- Dr. Jesús Miguel Ibañez Godoy (UGR)- FCAGLP, La Plata (Argentina)
- 25 hours postgraduate course attended.

AWARDS

- **Macquarie University International Research Excellence Scholarship (iMQRES)** | 2016-2019| Sydney, Australia.
  Recognition of academic achievement
- **Training fellowship from the Committee for Scientific Research of Buenos Aires Province (CIC)** | 2013-2015 |
  Argentina National scholarship. Awarded to develop the degree thesis project, due to the excellent academic performance.
- **Educational scholarship for Engineering and Geosciences, Rocca Foundation, Techint** | 2006-2010 | Buenos Aires, Argentina.
  Merit based scholarship given by an external enterprise, awarded to financially support the university studies.
- **Best oral presentation**| Higher Degree Research Presentation Day | Nov 2018 | Sydney, Australia
- **Best poster presentation**| CCFS meeting | Nov 2017 | Cairns, Australia.
- **Distinction Dr Joaquin V Gonzalez** | 2015 | La Plata, Argentina.
  Awarded to the students with the best academic average within the National University of La Plata
- **Travel grant to attend the IASPEI LACSC14** | 2014 | Bogota, Colombia.
  Merit-based travel support awarded to attend the IASPEI LACSC14 Assembly in Bogota

SUPERVISORY EXPERIENCE

- **Dinesh Shrestha** | Master of Science Innovation in Geology and Geophysics | 2020| Macquarie University
  Co-supervisor

MEMBERSHIPS
- **European Geosciences Union (EGU)**
- **American Geophysical Union (AGU)**
- **Australian Society of Exploration Geophysicists (ASEG)**

PUBLICATIONS

- Manassero, M.C., Özaydin S., Afonso J.C, Shea J.J., Kirkby A., Ezad I., Thiel S., Fomin I., and Czarnota K. "Lithospheric structure and melting processes in southeast Australia: new constraints from joint probabilistic inversions of 3D magnetotelluric and seismic data" *Journal of Geophysical Research: Solid Earth* (in review).
- Elías, Matías W., Fabio I. Zyserman, Marina Rosas-Carbajal, and María Constanza Manassero. "Three-dimensional modelling of controlled source electro-magnetic surveys using non-conforming finite element methods." *Geophysical Journal International* 229, no. 2 (2022): 1133-1151.
- Manassero, María Constanza, Juan Carlos Afonso, Fabio Zyserman, Alan Jones, Sergio Zlotnik, and Ilya Fomin. "A Reduced Order Approach for Probabilistic Inversions of 3D Magnetotelluric Data II: Joint Inversion of MT and Surface-Wave Data." *Journal of Geophysical Research: Solid Earth* 126, no. 12 (2021): e2021JB021962.
- Manassero, Maria Constanza, Juan Carlos Afonso, Fabio Zyserman, Sergio Zlotnik, and Ilya Fomin. "A Reduced Order Approach for Probabilistic Inversions of 3D Magnetotelluric Data I: General Formulation." *Geophysical Journal International* 223.3 (2020): 1837-1863.
- Manassero, Maria Constanza. "A reduced order approach for probabilistic inversions of 3D magnetotelluric data." (2019). PhD Thesis
- Manassero, María C., Juan Carlos Afonso, Fabio Zyserman, and Sergio Zlotnik. "Including 3D Magnetotelluric Data into Joint Probabilistic Inversions." In *AGU Fall Meeting 2019*. AGU, 2019
- Casas, J. A., D. Draganov, G. A. Badi, M.C. Manassero, VH Olivera Craig, L. Franco Marín, M. Gómez, and E. Ruigrok. "Seismic interferometry applied to local fracture seismicity recorded at Planchón-Peteroa Volcanic Complex, Argentina-Chile." *Journal of South American Earth Sciences* 92 (2019): 134-144.
- Manassero, M.C., Afonso, J. C., Zyserman, F., Zlotnik, S., Rosas-Carbajal, M., & Thiel, S. 2018. Including magnetotelluric data into multi-observable probabilistic inversion: implications for the physical state and water content of the continental lithosphere. Page 11849 of: EGU General Assembly Conference Abstracts. EGU General Assembly Conference Abstracts, vol. 20.
- J. A. Casas; D. Draganov; M. C. Manassero; M. Gomez; E. Ruigrok; G. A. Badi, 2014. Interferometría Sísmica con Sismos Volcano-Tectónicos Aplicada a Datos del Volcán Peteroa, Argentina. E-ICES 10, 10th Meeting of "International Center For Earth Sciences". Buenos Aires, Argentina. November 2014. CD-ROM, pp. 1709- 1710. ISBN 978-987-1323-39-5
- Manassero, M.C., G.A. Badi, J.A. Casas, M. Gomez, D. Draganov, J. Ruzzante, 2014. Seismic attenuation around Peteroa volcano, Argentina In Proceedings of the "Third Latin-American Congress of Seismology". Bogotá, Colombia. July 23 – 25, 2014. Earth Sciences Research Journal, Earth Sci. Res. J. Vol 18 Special Issue (July 2014), pp 341-342. ISSN 1794-6190
- Casas, J.A., G.A.Badi, M.C.Manassero, E. Ruigrok, M.Gomez, D.Draganov, J.Ruzzante, 2014. Characterization of Seismo-volcanic Activity in Peteroa Volcano, Central Andes Argentina-Chile. In Proceedings of the "Third Latin-American Congress of Seismology". Bogotá, Colombia. July 23 – 25, 2014. Earth Sciences Research Journal, Earth Sci. Res. J. Vol 18 Special Issue (July 2014), pp 335-336. ISSN 1794- 6190.
- Manassero, M.C., G.A. Badi, J.A. Casas, M. Gomez, D. Draganov, J. Ruzzante, 2014. Seismic attenuation around Peteroa Volcano, Mendoza. XIX Argentine Geologic Congress, Córdoba, Argentina, 2-6 June 2014. CD-ROM, pp. 1739-1740.ISBN 978-987-22403-5-6
- Badi, G.A., D. Rojas Arce, M. Maugeri, M.C. Manassero, J.A. Casas, N. Sabbione, J. Ibáñez Godoy,2014. Atenuación sísmica espectral de ondas directas: una nueva metodología, y sus resultados para la región de Nuevo Cuyo. XIX Argentine Geologic Congress, Córdoba, Argentina, 2-6 June 2014. CD-ROM, pp. 1399-1400.ISBN 978- 987-22403-5-6
- Manassero, M.C, V. Graffigna, M. Gende, Un juego de Internet dirigido a la enseñanza de las ciencias de la Tierra. CIENCIA HOY (Science magazine). Vol. 20 20- # 118August- September 2010. ISSN 1666 1666-5171.

PEER REVIEWER- ACADEMIC SERVICE

- Reviewer for Geophysical Prospecting. August 2021
- Reviewer for Geophysical Journal International. September 2021
- Reviewer for Journal of Applied Geophysics. July 2021
- Reviewer for Geophysical Journal International. May 2021
- Reviewer for Journal of Applied Geophysics. January 2021

PRESENTATIONS IN CONFERENCES AND INVITED SEMINARS

Dr. Manassero has delivered several seminars at universities and geoscience organizations and given multiple talks in national and international conferences.

- ASEG FedEx webinar: Including 3D Magnetotelluric Data into Joint Probabilistic Inversions for Imaging the Deep Earth | 27th September 2022. **Invited speaker/seminar**
- Maria Constanza Manassero**,** Sinan Özaydın, Juan Carlos Afonso, Joshua Shea, Alison Kirkby, Ilya Fomin, Karol Czarnota, Alan Jones and Stephan Thiel, " Joint Probabilistic Inversion of 3D Magnetotelluric and Seismic Data in Southeast Australia." | Electromagnetic Induction Workshop (EMIW) 2022, Turkey. September 2022. **Oral presentation**.
- Geoscience Australia webinar: Joint Probabilistic Inversion of 3D Magnetotelluric and Seismic Data in Southeast Australia.| 21st June 2022. **Invited speaker/seminar.**
- Maria Constanza Manassero**,** Juan Carlos Afonso, Alison Kirkby, Alan Jones, Ilya Fomin, and Karol Czarnota" Joint Probabilistic Inversion of 3D Magnetotelluric and Seismic Data in Southeast Australia." | EGU 2022, Vienna Austria. May 2022. **Oral presentation**.
- Maria Constanza Manassero, Juan Carlos Afonso, Alison Kirkby, Alan Jones, Karol Czarnota and Ilya Fomin, "Including 3D Magnetotelluric Data into Joint Probabilistic Inversions for Imagining the Deep Earth" *International Symposium on Deep Exploration and Practices* 2021, Beijing, China. November 2021. **Invited oral presentation.**
- Mtnet webinar: A Reduced Order Approach for Probabilistic Inversions of 3D Magnetotelluric Data | March 2021| **Invited Seminar.**
- Manassero, María Constanza., Juan Carlos Afonso, Fabio Zyserman, and Sergio Zlotnik. "A reduced order approach for joint probabilistic inversions of 3D MT and surface waves data." | AGU Fall Meeting 2020. San Francisco, USA. 2020. **Oral presentation.**
- Manassero, María Constanza., Juan Carlos Afonso, Fabio Zyserman, and Sergio Zlotnik. "Including 3D Magnetotelluric Data into Joint Probabilistic Inversions." | AGU Fall Meeting 2019. San Francisco, USA. 2019. **Poster.**
- Seminar on Probabilistic Inversion of 3D MT Data |Dec 20, 2019, National University of La Plata| **Invited Seminar**
- Manassero, María Constanza., Juan Carlos Afonso, Fabio Zyserman, and Sergio Zlotnik. "Including 3D Magnetotelluric Data into Joint Probabilistic Inversions." | IUGG 2019. Montreal, Canada. **Poster (J.C Afonso presenter)**
- National MT Workshop and AusLAMP SA Release Day |Dec 5, 2018, Adelaide Australia| **Invited Talk**
- Manassero, Maria Constanza, Juan Carlos Afonso, Fabio Zyserman, Sergio Zlotnik, Marina Rosas-Carbajal, and Stephan Thiel. "Including magnetotelluric data into multi-observable probabilistic inversion: implications for the physical state and water content of the continental lithosphere." (2018). | EGU General Assembly 2018. Vienna, Austria. 8-13 April 2018 | **Poster**
- CCFS Whole of Centre Meeting, Cairns Australia | 27 Nov-1 Dec 2017| **Poster**
- Manassero, M.C., G.A. Badi, J.A. Casas, M. Gomez, D. Draganov, J. Ruzzante, 2014. Seismic attenuation around Peteroa volcano, Argentina.III Latinamerican Seismology Congress. IASPEI | Bogotá, 23- 25 July 2014| **Presenter**
- Manassero, M.C., G.A. Badi, J.A. Casas, M. Gomez, D. Draganov, J. Ruzzante, 2014. Seismic attenuation around Peteroa volcano, Argentina.III Latinamerican Seismology Congress. IASPEI| Bogotá, 23- 25 July 2014| **Presenter**
- Manassero, M.C., G.A. Badi, J.A. Casas, M. Gomez, D. Draganov, J. Ruzzante, 2014. Atenuación sísmica en el área del Volcán Peteroa, Mendoza. XIX Argentine Geologic Congress**.** |Córdoba, Argentina, 2- 6 June 2014. | **Presenter**
- Manassero, M. Constanza; Graffigna, Victoria; Gende, Mauricio, 2009. Sistema de Información Geográfico para la divulgación de las ciencias de la Tierra en Argentina. XXIV Scientific Meeting of Argentinean Association of Geophysicists and Geodesists| Argentina, April 14-17 | **Presenter**

LANGUAGES

English (Proficiency)   **Spanish** (Native)   **Swedish** (Beginner)