# Gisela Daniela Charó

Intendente Güiraldes 2160 - Ciudad Universitaria - Pabellón II - 2do. piso, (C1428EGA) Buenos Aires - Argentina
gisela.charo@cima.fcen.uba.ar

**RESEARCH INTERESTS**

- Applying topological data analysis and chaos topology to characterise oceanographic and meteorological data.
- Understanding the climate tipping points, a threshold that when exceeded, leads to an abrupt and irreversible change in the climate system, being the characterisation of these points very relevant for the study of climate change.
- Understanding the dynamics of nonlinear complex systems using mathematical tools as topological data analysis and chaos topology.
- Investigating the shape and structure of data to classify dynamical distinguished regions in fluid flows.

**RESEARCH EXPERIENCE**

**Centro de Investigaciones del Mar y la Atmósfera (CIMA)**, Institut Franco-Argentin d'Études sur le Climat et ses Impacts, University of Buenos Aires, Argentina.

- PostDoc — Apr 2020 – present
  - Project: Topological analysis of time series for the study of seasonal climate variability in South America and the Southern Hemisphere.
  - Supervisors: Denisse Sciamarella and Carolina Vera.
  - Focus: Topological data analysis, nonlinear dynamics, climatic time series.

**Laboratoire de Météorologie Dynamique (LMD)**, Paris, France.

- Overseas lab visit. — Jan 2020
  - Project: Topological structure of random attractors.
  - Supervisor: Michael Ghil
  - Focus: Topological data analysis, Lorenz random attractor.

**Institut National de Recherche en Informatique et en Automatique (INRIA)**, Rennes, France.

- Full-time internship at INRIA Fluminance group — Sep 2016 – Nov 2016
  - Project: Identification of Lagrangian coherent structures in stochastic flows.
  - Supervisors: Etienne Mémin and Guillermo Artana
  - Focus: Lagrangian coherent structures, stochastic flows.

**National Weather Service (SMN) – Argentine Naval Hydrographic Service (SHN)**, Buenos Aires, Argentina.

- Full-time internship in Defense Research and Development Program. — Mar 2012 – Oct 2013
  - Project: Applications of last generation numerical models, within the scope of the National Weather Service for weather forecasting. Environmental vulnerability, social and economic impact studies.
  - Supervisor: Estela Collini
  - Focus: Verification of weather forecasts.

**EDUCATION**

**University of Buenos Aires (UBA), Argentina**

- Ph.D, in engineering — Apr 2015 – Mar 2020
  - Thesis title: Analysis of nonstationary separation using streaklines.
  - Honors: *Summa Cum Laude*
  - Advisors: Guillermo Artana and Denisse Sciamarella
  - Focus: Identification of dynamical distinguished Lagrangian regions in flows using topological data analysis.
- Degree in Mathematical Sciences with distinction in Applied Maths (Licenciada en Ciencias Matemáticas). — Aug 2005 – Apr 2013
  - Thesis title: Simulations of Turing patterns using finite elements.
  - Advisor: Gabriel Acosta
  - Focus: Numerical approximation of pattern formation using finite elements.

**PUBLICATIONS**

**JOURNALS**

[7] G.D. Charó, D. Sciamarella, M. Chekroun and M. Ghil, "Noise-driven topological changes in chaotic dynamics,"Chaos: An Interdisciplinary Journal of Nonlinear Science, 31(10), 103115.(2021).

[6] G.D. Charó, G. Artana and D. Sciamarella. "Topological colouring of fluid particles unravels finite-time coherent sets," Journal of Fluid Mechanics, 923.(2021).

[5] Melisa P. Charó , G.D. Charó, Guillermo Aceñolaza and Jose L. Cavallotto D. “Bioerosion on Late Pleistocene (MIS 7 and MIS 5e) marine molluscs A palaeoclimatological and palaeoecological comparison with modern beaches (Río Negro, Argentina),”Acta Geologica Sinica English Edition. (2021)

[4] G.D. Charó, G. Artana and D. Sciamarella, “Topology of dynamical reconstructions from Lagrangian data,” *Physica D: Nonlinear Phenomena*, vol. 405, pp. 132371, (2020).

[3] G.D. Charó, D. Sciamarella, S. Mangiarotti, G. Artana and C. Letellier, “Observability of laminar bidimensional fluid flows seen as autonomous chaotic systems,” *Chaos: An Interdisciplinary Journal of Nonlinear Science*, vol. 29, no. 2, pp. 123126, (2019).

[2] M. P. Charó, J.L Cavalotto,G. Aceñolaza and G.D. Charó, “Bioerosion on marine molluscs of MIS 5e in Faro Segunda Barranca, South of Buenos Aires Province, Argentina,” *Serie Correlación Geológica*, vol. 34, no. 2, pp. 5–2, (2018).

[1] G.D. Charó, E.A. Collini and M.E. Dillon, “La utilización del MET (Model Evaluation Tool) para la verificación de los pronósticos del modelo WRF-ARW/SHN-SMN durante la primavera de 2011,” *Meteorológica*, vol. 39, no. 2, pp. 49–68, (2014).

**CHAPTER OF BOOKS**

[1] M. Alvarez, S. Beratz ,G.D. Charó, R. Elencwajg, M. Maurette, C. Rosito, E. Sosa and A. Stein, “Taller de Matemática Industrial 2012: Mapeo automático y generación de mapas a partir de información de pozos petroleros,” *Cursos y Seminarios de Matemática*, Serie B, Fascículo 8, pp. 45–67, (2014).

[2] G.D. Charó, L. Salvagni,I. Moldasvky, S. Basso Morrow, F. Carrá, C. Rosito and I. Ojea, “Taller de Matemática Industrial 2010: Optimización del Transporte de Caña de Azúcar,” *Cursos y Seminarios de Matemática*, Serie B, Fascículo 6, pp. 3–15, (2010).

**CONFERENCES**

[16] D. Sciamarella,G. D. Charó, M. D. Chekroun, and M. Ghil “Perspectives on Climate Sciences:” in *EGU division: Nonlinear Processes in Geosciences*, held online, Jul 2021.

[15] G. D. Charó, R. Durand, M. D. Chekroun, D. Sciamarella, and M. Ghil “Transfer operators, climate sensitivity and the topology of random attractors,” in *2020 SIAM Mathematics of Planet Earth*, held online, Aug 2020.

[14] M. Ghil, G. D. Charó, D. Sciamarella, and M. D. Chekroun, “The Lorenz convection model’s random attractor (LORA) and its robust topology,” in *22nd European Geosciences Union General Assembly*, held online, May 2020.

[13] M. Ghil , G. D. Charó and D. Sciamarella, “Topological study of the Lorenz convection model’s random attractor (LORA),” in *American Geophysical Union, Fall Meeting 2019*, San Francisco, United States of America, Dec 2019.

[12] D. Sciamarella, G. D. Charó, G. Artana, M. D. Chekroun, and M. Ghil, “Exploring state-space topology in the Geosciences,” in *The Mathematics of Climate and the Environment (CliMathParis)*, Institut Henri Poincaré, Paris, France, Sep 2019.

[11] G. D. Charó, D. Sciamarella, M. D. Chekroun, and M. Ghil , “Topological snapshot analysis of the Lorenz convection model’s random attractor,” in *27th IUPAP International Conference on Statistical Physics StatPhys27*, Buenos Aires, Argentina, Jul 2019.

[10] G. D. Charó, G. Artana, and D. Sciamarella, “Topological classification of Lagrangian geographies,” in *Environmental Fluid Dynamics: Confronting Grand Challenges*, Les Houches, France, Jan 2019.

[9] G. D. Charó, G. Artana, and D. Sciamarella, “Dinámica de las partículas en el doble giro no autónomo,” in *XV Reunión de fluidos y sus aplicaciones*, Buenos Aires, Argentina, Nov 2018.

[8] M. Charó, G. D. Charó, G. Aceñolaza, and J.L. Cavallotto, “Trazas de bioerosión sobre moluscos marinos en playas actuales de Mar del Tuyú (Partido de la Costa, Buenos Aires),” in *X Jornadas Nacionales del Mar*, FCEyN. UBA. Buenos Aires, Argentina, Aug 2018.

[7] G. D. Charó, V. Resseguier, D. Sciamarella, and G.Artana, “Cinemática de la línea de emisión: Una herramienta para el estudio de los patrones del océano,” in *X Jornadas Nacionales del Mar*, FCEyN. UBA. Buenos Aires, Argentina, Aug 2018.

[6] G. D. Charó, G. Artana, and D. Sciamarella, "Identification of Lagrangian coherent sets by topological methods," in *Segundo Encuentro de mujeres matemáticas de Latinoamérica*, Valdivia, Chile, Jan 2018.

[5] G. D. Charó, D. Sciamarella, and G. Artana, "Topological structure of chaotic flows from tracer trajectories," in *LIA Physics and Mechanics of Fluids (FMF/PMF)*, Buenos Aires, Argentina, Nov 2017.

[4] G. D. Charó, G. Artana, and D. Sciamarella, "Identification of Lagrangian coherent structures by topological methods," in *LIA Physics and Mechanics of Fluids (FMF/PMF)*, Buenos Aires, Argentina, Nov 2016.

[3] G. D. Charó, D. Sciamarella, T. Duriez, E. Moreau, N. Bernard, and G. Artana, "Identification of Lagrangian coherent sets by topological methods," in *LIA Physics and Mechanics of Fluids (FMF/PMF)*, Buenos Aires, Argentina, Oct 2015.

[2] G. D. Charó, E. A. Collini, and M. E. Dillon, "Verificación de los pronósticos del modelo WRF-ARW / SMN-SHN utilizando el MET para la primavera del 2011," in *XXVI Reunión Cientifica de la Asociación de Geofísicos y Geodestas (AAGG 2012)*, San Miguel de Tucumán, Argentina, Nov 2012.

[1] G.D. Charó, L. Salvagni,I. Moldasvky, S. Basso Morrow, F. Carrá, C. Rosito and I. Ojea, "Optimizing Transport of Sugar Cane," in *Taller de Matemática Industrial I*, Buenos Aires, Argentina, Mar 2010.

**INVITED TALKS**

[6] G. D. Charó, G. Artana and D. Sciamarella, "Usando la topología para la identificación de la diversidad dinámica en un fluido," in *Coloquios del Departamento de Ciencias de la Atmósfera y los Océanos (DCAO)/ Centro de Investigaciones del Mar y la Atmósfera (CIMA)*, Facultad de Ciencias Exactas y Naturales, Buenos Aires, Argentina, Jul 2020.

[5] G. D. Charó, D. Sciamarella and M. Ghil, "The heritage of Poincaré and the algebraic topology of the Lorenz model's random attractor," in *École Normale Superieure Seminars*, École Normale Superieure, Paris, France, Jan 2020.

[4] G. D. Charó, G. Artana and D. Sciamarella, "Control de separación no estacionaria a través de líneas de emisión," in *Segundo Seminario de Vinculación y Transferencia*, Facultad de Ingeniería, Buenos Aires, Argentina, Oct 2018.

[3] G. D. Charó, G. Artana, and D. Sciamarella, "Topological detection of Lagrangian coherent structures," in *INRIA Fluminance group Seminars*, Rennes, France, Oct 2016.

[2] G. D. Charó and G. Acosta, "Simulations of Turing patterns using finite elements," in *Seminarios de modelado matemático en Biología*, FCEyN, UBA, Buenos Aires, Argentina, Oct 2013.

[1] G. D. Charó and E. Collini, "MET. Tu herramienta de verificación," in *Biblioteca Nacional de Meteorología*, Servicio Meteorológico Nacional, Buenos Aires, Argentina, Dec 2012.

**SCHOLARSHIPS**

- National Scientific and Technical Research Council (CONICET) PostDoctoral scholarship.
  Apr 2020 – Mar 2023
- Scholarship for attending the conference: "Enviromental fluid dynamics: Confronting Grand challenges, École de physique de Les Houches," Les Houches, France.
  Jan 2019
- Scholarship for attending the conference: "Segundo Encuentro de mujeres matemáticas de Latinoamérica," Valdivia, Chile.
  Jan 2018
- National Scientific and Technical Research Council (CONICET) PhD scholarship.
  Apr 2015 – Mar 2020
- University of Buenos Aires (UBA) Science and Technology Division scholarship to begin PhD studies.
  Sep 2014 – Mar 2015
- Defense Research and Development Program Research Initiation Scholarship, PIDDEF N41, National Weather Service (SMN), Naval Hydrographic Service (SHN), Buenos Aires, Argentina.
  Mar 2012 – Oct 2013

**FUNDED RESEARCH PROJECTS**

- OSTST (Science Team Ocean Surface Topography) CNES-EUM Rôle: participant. (SABIO).Length: 2021-2024.
- CLIMATAmSud 25-MATH-01 Climate dYnamics ANalysis from Data (CYAN). Role: participant. Amount per year: 10 keur. Involving: Argentina (Mincyt), Chile (CMM), Uruguay (ANII), France (CNRS-INRIA). Length: 2021-2022.
- LEFE/MANU: Noise-Nonlinearity Interaction in Climate Dynamics (NOISE). Projet à risque. Role: participant. Amount 2021: 14 keur. Length: 2021-2022.
- IEA (International Emerging Actions) CNRS 2020: The effect of South American Dust on atmospheric CO2 changes. Role: participant. Amount per year: 10 keur. Length: 2020-2021.
- MATHAmSud 18-MATH-04 MATHematical Methods for GEOphysical flows (MATH-GEO). Role: participant. Amount per year: 12 keur. Involving: Argentina (Mincyt), Chile (CMM), Uruguay (ANII), France (CNRS-INRIA), Peru (CONCYTEC). Length: 2018-2019.
- ECOS-Sud Argentina 2017 A17A08. Role: participant. Title: Nonparametric Data Assimilation: a data-driven approach. Funding institution: Ministère des Affaires Étrangères / Ministère de l'Enseignement Supérieur et de la Recherche. Length: 2018-2019.

**TEACHING**

- Teaching assistant (Ayudante 1º): Departamento de Matemática, Facultad de Ingeniería, University of Buenos Aires.

  Oct 2014 – present
- Teaching assistant (Ayudante 1º): Departamento de Matemática, Ciclo Básico Común (CBC), University of Buenos Aires.

  May 2021 – present
- Teaching assistant (Ayudante 2º): Departamento de Matemática, Ciclo Básico Común (CBC), University of Buenos Aires.

  Mar 2012 – Apr 2021
- Teaching assistant (Ayudante 2º): Departamento de Matemática, Facultad de Ciencias Exactas y Naturales (FCEyN), University of Buenos Aires.

  Aug 2011 – Aug 2013

**LANGUAGES**

- Spanish: Mother tongue.
- English: Fluent (speaking, reading, writing).
- French: Fluent (speaking, reading, writing).
- Korean: Intermediate (speaking, reading, writing).

**SKILLS**

MATLAB, C++, Mathematica, Microsoft Office, LaTeX.

**REFERENCES**

- **Professor Michael Ghil**
  Distinguished Research Professor, UCLA, Los Angeles, USA.
  Distinguished Professor (emeritus), Ecole Normale Supérieure, Paris, France.
  24 rue Lhomond, 75005, Paris, France.
  ghil@atmos.ucla.edu
- **Dr Denisse Sciamarella**
  Director of UMI 3351, Institut Franco-Argentin d'Études sur le Climat et ses Impacts.
  Intendente Güiraldes 2160, Ciudad Universitaria, Pabellón II - 2do. piso, (C1428EGA) Buenos Aires, Argentina.
  denisse.sciamarella@cima.fcen.uba.ar