Luan da Fonseca Santos

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Summary

I am an applied mathematician and currently a Postdoctoral Researcher at Princeton University working with the FV3 team at the Geophysical Fluid Dynamics Laboratory. My research focuses on developing, analyzing, and implementing numerical methods for solving partial differential equations in global atmospheric modeling.

Research interests

- Finite-volume and finite-difference methods for geophysical fluid dynamics on the sphere.
- Cubed-sphere and spherical Voronoi grids, locally refined grids, grid imprinting mitigation.

Education

University of São Paulo São Paulo, SP, Brazil

Ph.D. in Applied Mathematics *03/2020 - 05/2024*

M. Sc. in Applied Mathematics *03/2018 - 03/2020*

Bachelor's degree with honors in Applied Mathematics (GPA: 9.3/10) *02/2014 - 12/2017*

- Supervisor for all degrees: Pedro da Silva Peixoto
- Ph.D. thesis: Analysis of finite-volume advection schemes on cubed-sphere grids and an accurate alternative for divergent winds.

Research visits

- September 2023 - Princeton University - Atmospheric & Oceanic Sciences Program.

Experience

Princeton University and Geophysical Fluid Dynamics Laboratory Princeton, NJ, USA

Postdoctoral Researcher Associate *06/2024 - Present*

- Implementing and evaluating specific enhancements to FV3's numerical algorithms to advance the accuracy and efficiency of FV3-based weather and climate models. Supervisors: Lucas Harris and Joseph Mouallem.

Institute of Mathematics and Statistics, University of São Paulo São Paulo, SP, Brazil

Graduate Researcher Student *03/2018 - 05/2024*

- Numerical methods for PDEs, finite-volume/difference schemes for the advection, classical and moist shallow-water equations on the sphere, locally refined Voronoi grids, cubed-sphere grids. With financial support from São Paulo Research Foundation (FAPESP), grant numbers 17/25191-4, 20/10280-4.

Undergraduate Researcher Student *06/2017- 12/2017*

- Worked on the implementation of algorithms for generating topography-based, locally refined spherical Voronoi grids on the sphere. Funded by FAPESP, grant number 17/11542-0.

Teaching Assistant

- Grad courses: 1^{st} sem/2019, 1^{st} sem/2020 and 1^{st} sem/2021 - MAP5729 - Introduction to Numerical Analysis.
- Undergrad courses:
  - 2^{nd} sem/2019 - MAP2320 - Numerical methods for PDEs.
  - 2^{nd} sem/2018 - MAP0214 - Numerical Calculus with Applications to Physics.
  - 1^{st} sem/2017 - MAC0427 - Non-linear Optimization.

Publication list

- Luan F. Santos, Joseph Mouallem, Pedro S. Peixoto (2024). Analysis of finite-volume transport schemes on cubed-sphere grids and an accurate scheme for divergent winds, Journal of Computational Physics.
- Luan F. Santos and Pedro S. Peixoto (2021). Topography based local spherical Voronoi grid refinement on classical and moist shallow-water finite volume models, Geosci. Model Dev. Discuss.

Presentations and participation at events

- **2024**: Poster Presentation at *AGU24*, Washington D.C., USA: *Assessment of Finite-Volume Transport Schemes on Cubed-Sphere Grids and an Accurate Alternative for Divergent Winds.*
- **2023**: Talk at the *FV3 group meeting*, GFDL/NOAA, Princeton, USA: *Enhancing accuracy of FV3 finite-volume operators.*
- **2021**: Participation in the ESCAPE2/Fondazione Alessandro Volta Summer school program - *Towards exascale computing for numerical weather prediction, Lake Como School of Advanced Studies (online).*
- **2021**: Talk at *PDEs on the sphere 2021*, Offenbach, Germany (online): *Topography based local spherical Voronoi grid refinement on classical and moist shallow-water finite volume models.*
- **2019**: Participation in the *Winter School in Atmospheric Numerical Modeling at CPTEC (Center for Weather Forecasting and Climate Studies), Cachoeira Paulista, SP, Brazil.*
- **2019**: Poster Presentation at *PDEs on the sphere 2019*, Montréal, Québec, Canada: *Topography based local refinement in spherical Voronoi grids.*

Referee Activities

- Meteorological Applications (2024).

Technical Skills

- Programming languages: Fortran, Python, C, and Matlab.
- Experience with parallel programming using OpenMP and MPI.
- General software and tools: Linux environment, Bash scripts, Git, remote servers, Vim, LaTeX.

Links

- Personal webpage: https://luanfs.github.io/
- Google scholar: https://scholar.google.com/citations?user=D-uXvM0AAAAJ&hl=en
- ORCID: https://orcid.org/0000-0001-9084-6170

Additional Information

- Citizenship: Brazilian.
- Languages: Portuguese (native) and English (advanced).