

# Luan da Fonseca Santos

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## SUMMARY

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I am an applied mathematician and currently a Postdoctoral Researcher Associate at Princeton University's Geophysical Fluid Dynamics Laboratory. I hold a PhD degree in Applied Mathematics from the University of São Paulo. My primary research area focuses on advancing numerical techniques for global atmospheric models, specifically the dynamical core development.

## EXPERIENCE

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### Postdoctoral Researcher Associate

Princeton, NJ, USA

*Atmospheric and Oceanic Sciences Program, Princeton University*

*July 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: Dr. Lucas Harris and Dr. Joseph Mouallem.
- Working at the U.S. National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory (NOAA-GFDL) with the FV3 team.

### Graduate Research Student

São Paulo, SP, Brazil

*Institute of Mathematics and Statistics, University of São Paulo*

*March 2018 - May 2024*

- Developed topography-based locally refined grids for South America for the NCAR MPAS model. Implemented a moist shallow-water model to assess these grids, resulting in a paper published in an international peer-reviewed journal.
- Developed and implemented an enhanced transport scheme for the NOAA-GFDL FV3 model with minimal additional computational overhead, resulting in a paper submitted for revision.
- Participated in a two-week research visit to the Atmospheric and Oceanic Sciences Program at Princeton University and the Geophysical Fluid Dynamics Laboratory (hosts: Dr. Joseph Mouallem and Dr. Lucas Harris), where I gave a talk to the FV3 team.

### Teaching Assistant

São Paulo, SP, Brazil

*University of São Paulo*

*2017 - 2021*

- Grad courses:
  - 1<sup>st</sup> sem/2019, 1<sup>st</sup> sem/2020 and 1<sup>st</sup> sem/2021 - MAP5729 - Introduction to Numerical Analysis (Institute of Mathematics and Statistics).
- Undergrad courses:
  - 2<sup>nd</sup> sem/2019 - MAP2320 - Numerical methods for PDEs (Institute of Mathematics and Statistics).
  - 2<sup>nd</sup> sem/2018 - MAP0214 - Numerical Calculus with Applications to Physics (Institute of Astronomy, Geophysics and Atmospheric Sciences).
  - 1<sup>st</sup> sem/2017 - MAC0427 - Non-linear Optimization (Institute of Mathematics and Statistics).

### Undergraduate Researcher Student

São Paulo, SP, Brazil

*Institute of Mathematics and Statistics, University of São Paulo*

*July 2017- December 2017*

- Worked on the implementation of algorithms for generating topography-based, locally refined Voronoi grids on the sphere. Funded by the São Paulo Research Foundation (FAPESP), grant number 17/11542-0.

### Part-time Computer Lab Monitor

São Paulo, SP, Brazil

*Institute of Astronomy, Geophysics and Atmospheric Sciences, University of São Paulo*

*January 2015 - July 2016*

- Ensured smooth operation of computer lab hardware and software, providing technical support to students and resolving any issues promptly.

## EDUCATION

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### Institute of Mathematics and Statistics, University of São Paulo

São Paulo, SP, Brazil

*Ph.D. in Applied Mathematics*

*March 2020 - May 2024*

- Thesis title: Analysis of finite-volume advection schemes on cubed-sphere grids and an accurate alternative for divergent winds. Supervisor: Dr. Pedro Peixoto.
- With financial support from São Paulo Research Foundation (FAPESP), grant 20/10280-4 and CAPES.

### Institute of Mathematics and Statistics, University of São Paulo

São Paulo, SP, Brazil

*M. Sc. in Applied Mathematics*

*March 2018 - March 2020*

- Dissertation title: Analysis of mimetic finite volume schemes on classical and moist shallow water models considering topography based local refinement in spherical Voronoi grids. Supervisor: Dr. Pedro Peixoto.
- With financial support from São Paulo Research Foundation (FAPESP), grant 17/25191-4.

### Institute of Mathematics and Statistics, University of São Paulo

São Paulo, SP, Brazil

*B. Sc. in Applied Mathematics (GPA: 9.3/10)*

*2014 - 2017*

- Undergraduate thesis: Local refinement and interpolation in spherical icosahedral grids. Supervisor: Dr. Pedro Peixoto.
- Honorable mention for outstanding performance in the Applied Mathematics B.Sc. program.

## PUBLICATION LIST

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- Luan F. Santos and Pedro S. Peixoto (2024). Analysis of finite-volume transport schemes on cubed-sphere grids and an accurate scheme for divergent winds, **In review**, Preprint: <http://dx.doi.org/10.2139/ssrn.4866660>.
- 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.*, <https://doi.org/10.5194/gmd-14-6919-2021>.

## REFeree ACTIVITIES

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- Meteorological Applications (2024).

## PRESENTATIONS AND PARTICIPATION AT EVENTS

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- **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*.

## LINKS

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- 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>

## TECHNICAL SKILLS

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- Programming languages: Fortran, Python (NumPy, SciPy, Matplotlib, Cartopy), C, and Matlab.
- Experience with parallel programming using OpenMP and MPI.
- General software and tools: Linux environment, Bash scripts, Git, remote servers, SSH, Tmux, Vim, L<sup>A</sup>T<sub>E</sub>X.

## ADDITIONAL INFORMATION

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- Date of birth: August 7, 1993.
- Citizenship: Brazilian.
- Gender: Male.
- Marital status: Married.
- Languages: Portuguese (native) and English (advanced).