Victor **Boussange**

Engineer in Energy & Environmental Systems
Ph.D in Environmental Sciences

github.com/vboussange
https://vboussange.github.io
+33 6 95 57 52 90 @ victor.boussange@wsl.ch
Zürich, Switzerland Born 1995 (age 29) | France Citizen

Updated as of September 14, 2024.

Education

October 2022 – September 2018 | **Ph.D in Environmental Sciences, Swiss Federal Institute for Forest, Snow and Landscape (WSL | Swiss Federal Institute of Technology Zurich, ETH), Switzerland**
"*Forward and inverse modelling of eco-evolutionary dynamics in ecological and economic systems*". Under the guidance of Prof. Dr. Loïc Pellissier.
eco-evolutionary dynamics | mathematical modeling | scientific machine learning | complex systems

June 2017 – September 2016 | **Full year academic exchange, University of New South Wales (UNSW Sydney), Australia**

June 2017 – February 2017 | **Master thesis in theoretical geomechanics, UNSW Sydney | CSIRO, Australia**
"*Numerical continuation and bifurcation analysis for unconventional geomechanics*". Under the guidance of Dr. Thomas Poulet.
numerical continuation | bifurcation analysis

August 2018 – September 2013 | **B.S./ M.S. in Energy and Environmental Engineering, Institut National Des Sciences Appliquées de Lyon (INSA Lyon), France**
- Two-year undergraduate intensive course in mathematics and physics. Ranking : 21/650 students.
- Three-year undergraduate engineering course in Energy and Environmental Systems, focused on Advanced Energy Systems and Efficiency.

fluid mechanics | thermodynamics | networks and optimisation | energy markets

Professional appointments

May 2025 – March 2024 | **Postdoctoral researcher, Swiss Federal Institute of Technology Zurich (ETHZ) | Swiss Federal Institute for Forest, Snow and Landscape (WSL), Switzerland**
Dynamic Macroecology group, in charge of biodiversity modelling within the Speed2Zero initiative.
novel methods for spatial planning | ecological connectivity assessment | teaching and supervision

February 2024 – October 2023 | **Postdoctoral researcher, Swiss Federal Institute for Forest, Snow and Landscape (WSL), Switzerland**
Dynamic Macroecology group, under the supervision of Dirk Karger.
global change biodiversity | novel methods for conservation | teaching and supervision

April 2023 – November 2022 | **Postdoctoral researcher, Swiss Federal Institute of Technology Zurich (ETHZ) | Swiss Federal Institute for Forest, Snow and Landscape (WSL), Switzerland**
Ecosystems and landscape evolution group, under the supervision of Loïc Pellissier.
inverse modelling | ecological modelling | teaching and supervision

August 2018 – March 2018 | **R&D intern, Compagnie National du Rhône (CNR), France**
Development of an Energy Management System based on various optimisation techniques for optimal production of renewable resources. Applications to EU sponsored projects :
- Jupiter1000 (power-to-gas)
- Move in pure (vehicle-to-grid)
- Marie-Galante island (micro-grid)

software development | mathematical optimisation | energy trading

$ Fundings

August 2024 yDiv Graduate School & Postdoc Program funding for a 3-day workshop, **2,000EUR**.
March 2023 WSL Biodiversity Center Innovative Workshop grant, **10,000CHF**.

Publications

Peer-reviewed

- Alsos, I.G., **Boussange, V.**, Rijal, D.P., Beaulieu, M., Brown, A.G., Herzschuh, U., Svenning, J.C., Pellissier, L., *Using ancient sedimentary DNA to forecast ecosystem trajectories under climate change*. Phil. Trans. R. Soc. B (2024).
- **Boussange, V.**, Becker, S., Jentzen, A., Kuckuck, B., Pellissier, L., *Deep learning approximations for non-local nonlinear PDEs with Neumann boundary conditions*. Partial Differ. Equ. Appl., Paper no. 51, 59 pages (2023). [arXiv]
- Skeels, A., Boschman, L. M., McFadden, I. R., Joyce, E.M., Hagen, O., Jiménez Robles, O., Bach, W., **Boussange, V.**, Keggin, T., Jetz, W., Pellissier, L., *Paleoenvironments shaped the exchange of terrestrial vertebrates across Wallace's Line*. Science 381, 86-92 (2023).
- **Boussange, V.**, *Forward and inverse modelling of eco-evolutionary dynamics in ecological and economic systems*, PhD thesis. ETH Zurich (2022).
- **Boussange, V.** & Pellissier, L., *Eco-evolutionary model on spatial graphs reveals how habitat structure affects phenotypic differentiation*. Commun Biol 5, 668 (2022). [bioRxiv]

Preprints

- Sapienza, F., Bolibar, J., Schäfer, F., Groenke, B., Pal, A., **Boussange, V.**, Heimbach, P., Hooker, G., Pérez, F, Persson, P.O., Rackauckas, C., *Differentiable Programming for Differential Equations : A Review*. [arXiv] (2024), 72 pages. In review at SIAM Review.
- Reji Chacko, M., Albouy, C., Altermatt, F., Casanelles Abella, J., Brändle, M., **Boussange, V.**, Campell, F., Ellis, W. N., Fopp, F., Gossner, M., Ho, H. C., Joss, A., Kipf, P., Neff, F., Petrović, A., Prié, V., Tomanović, Ž., Zimmerli, N., Pellissier, L., `trophiCH` - *a national species-level trophic metaweb of 23k species for Switzerland*. [EcoEvoRxiv] (2024). In review.
- **Boussange, V.**, Vilimelis-Aceituno, P., Pellissier, L., *Partitioning ecological time series to improve process-based models with machine learning* [bioRxiv] (2024), 46 pages. In review at Methods in Ecology and Evolution.
- **Boussange, V.**, Lischke, H., Sornette, D., Pellissier, L., *Processes analogous to ecological interactions and dispersal shape the dynamics of economic activities*. [arXiv] (2023), 23 pages.

Proceedings

- Poulet, T., Alevizos, S., Veveakis, M., **Boussange, V.**, Regenauer-Lieb, K., *Episodic mineralising fluid injection through chemical shear zones*, ASEG Extended Abstracts (2018), 5 pages.

Work in progress

- Poulet, T., **Boussange, V.**, Truttman, S., Veveakis, M., *Chaotic Slow Slip Events in New Zealand from two coupled slip patches : a proof of concept*. In review at Communications Earth & Environment.

- **Boussange, V.**, Karger, D., Malle, J. T., Midolo, D., *A deep species-area relationship model to map the sensitivity of species richness to habitat size*. (in alphabetical order)

Talks

August 2024	3-day workshop organizer and speaker, *Practical introduction to Julia for biodiversity research*, German Centre for Integrative Biodiversity Research (iDiv), Leipzig, Germany
July 2024	Speaker, `PiecewiseInference.jl` : *inverse modelling for complex dynamics*, JuliaCon2024, Eindhoven, Netherlands
January 2024	Speaker, *A scalable machine learning approach to assess the combined effect of habitat loss and climate change on biodiversity*, IBS 2024, Prague, Czech Republic
April 2023	Speaker, `PiecewiseInference.jl` : *a machine learning framework for inverse ecosystem modelling*, EGU 2023, Vienna, Austria
March 2023	2-day workshop organizer and speaker, *Practical introduction to Julia for modelling and data analysis in biodiversity and earth sciences*, WSL biodiversity center, Birmensdorf, Switzerland
February 2023	Invited speaker, *Combining eco-evolutionary theory and machine learning to advance our understanding of living systems*, Seminar at the Laboratoire interdisciplinaire de physique (LiPhy), Grenoble, France
July 2022	Speaker, `HighDimPDE.jl` : *A Julia package for solving high-dimensional PDEs*, JuliaCon2022, online
June 2022	Speaker, *Interpretable machine learning for forecasting dynamical processes in ecosystems*, World Biodiversity Forum, Davos, Switzerland
June 2022	Invited speaker, *Investigating empirical patterns of biodiversity with mechanistic eco-evolutionary models*, Seminar at the Theoretical Ecology and Evolution group, Universität Bern, Switzerland
November 2021	Invited speaker, *Numerical approximations of solutions of highly dimensional, non-local nonlinear PDEs*, StAMBio seminar, St Andrews, UK
October 2021	Speaker, *Graph topology and habitat assortativity drive phenotypic differentiation in an eco-evolutionary model*, Conference on Complex Systems, Lyon, France
October 2021	Speaker, *Using graph-based metrics to assess the effect of landscape topography on diversification*, ECBC, Amsterdam, Netherlands
September 2021	Speaker, *Solving non-local nonlinear Partial Differential Equations in high dimensions with HighDimPDE.jl*, International Conference on Computational Methods in Systems Biology, Bordeaux, France
April 2021	*Responses of neutral and adaptive diversity to complex geographic population structure*, Mathematical Population Dynamics, Ecology and Evolution, CIRM Marseille, France

Softwares

EcoEvoModelZoo.jl 2023

github.com/vboussange/EcoEvoModelZoo.jl documentation

A zoo of eco-evolutionary models with high fitness.

Julia

PiecewiseInference.jl 2022

github.com/vboussange/PiecewiseInference.jl documentation

Suite for parameter inference and model selection with dynamical models characterised by complex dynamics.

Julia

HighDimPDE.jl 2021

github.com/SciML/HighDimPDE.jl documentation

A Julia package that breaks down the curse of dimensionality in solving non local, non linear PDEs.

Julia

EvoId.jl 2019 - 2021

github.com/vboussange/EvoId.jl documentation

Evolutionary individual based modelling, mathematically grounded.

Julia

OptiVPP 2018

confidential

Energy Management System for Virtual Power Plants.

Python GAMS

Open Source contributions

Member of the SciML organisation (open source software for scientific machine learning) with many contributions to core packages, further contributions to CUDA.jl, Flux.jl, LightGraphs.jl.

</> Programming

Programming languages	**Julia**, **Python**, C++, Java, Matlab, R, Bash, Mathematica, VBA, LaTeX
Libraries	Flux.jl, DifferentialEquations.jl, DiffEqFlux.jl, CUDA.jl, LightGraphs.jl, TensorFlow, Keras, ArchGDAL, matplotlib, JAX, xarray, scikit-learn, pytorch

Teaching and Supervision

July 2024	**701-1679-00L Landscape Modelling of Biodiversity : From Global Changes to Conservation, ETH Zürich, D-USYS, Switzerland**
February 2023	Environmental Sciences Master course. Supervising a student group on the proposed project *Modelling the spread dynamics of invasive alien species*.
December 2023	**701-3001-00L Environmental Systems Data Science, ETH Zürich, D-USYS, Switzerland**
September 2023	Undergraduate course. In charge of the unit *Supervised Deep Learning - Application*.
June 2020	**262-0100-00L Lab rotation, ETH Zürich, D-BSSE, Switzerland**
April 2020	Supervision of Cecilia Valenzuela Agui in the frame of her MS in *Computational Biology and Bioinformatics*.
December 2020	**Taste of research internship, Polytech Nice-Sophia, France**
September 2020	Supervision of Nicolas Demolin for his research internship in the frame of his MS in *Applied Mathematics and Modeling*.

Languages

French	●●●●●	Spanish	●●●○○
English	●●●●●	German	●●●○○

Hobbies

- Ski touring, ski mountaineering, alpinism, rock climbing. **Major achievements** : 28/48 Swiss 4000m peaks climbed | From Tromsø to Nordkapp with skis and bicycle, Norway, March 2024 | North-South traverse of the Alps from Innsbruck to Venice with skis and bicycle, March 2023 | Haute Route Chamonix Zermatt, February 2022 | Crossing of the Grisons massif with skis, february 2021.
- Enduro mountainbiking, bikepacking. **Major achievements** : "From the first to the last droplet of the Rhone river", Furkapass to Marseille, 2018-2020 | Tour du Mont Blanc, 2019.
- Sailing. **Major achievements** : Refit of a 36-feet, 40 year-old sailing boat, sailed it from Germany to Norway, May-September 2023.
- Surfing.

Full adventure CV available at https://vboussange.github.io/pages/alpine_cv/.

References

Prof. Dr. Loïc Pellissier
Landscape Ecology, ETH Zürich
@ loic.pellissier@usys.ethz.ch
+41 44 632 32 03

Prof. Dr. Arnulf Jentzen
, University of Münster
@ ajentzen@uni-muenster.de
+49 251 83-33792

Dr. Thomas Poulet
Deep Earth Imaging, CSIRO
@ thomas.poulet@csiro.au