Victor BOUSSANGE

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

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 Zürich, Switzerland   ℹ Born 1995 (age 26) | France Citizen

I am a researcher with interest in complex systems, mathematical modeling and scientific machine learning. My Ph.D aims at better understanding the drivers behind diversification processes in biological and economic systems. I conduct my investigations with mathematical models capturing eco-evolutionary dynamics. In parallel, I develop machine learning methods to empower these models and obtain an agreement with empirical data. I believe that the combination of mechanistic models and machine learning provides a powerful approach to better understand and forecast the dynamics of real ecosystems and economies. This is crucial for policy-makers to take the right decisions, in the face of potentially important ecosystem changes and accelerating threats.

🏛 EDUCATION

September 2022 (expected) September 2018	**Ph.D in Environmental Sciences, SWISS FEDERAL INSTITUTE FOR FOREST, SNOW AND LANDSCAPE (WSL), Switzerland** Title : *"Diversification in Complex Adaptive Systems : from biological populations to economic sectors"* > Part I : *"Neutral and adaptive diversification in spatial graphs"* > Part II : *"Scientific Machine Learning with applications to eco-evolutionary modeling"* > Part III : *"Econobiology : understanding economic dynamics with biological models"* `eco-evolutionary modeling` `graphs` `partial differential equations` `Scientific Machine Learning` `GPU computing`
June 2017 September 2016	**Full year academic exchange, UNIVERSITY OF NEW SOUTH WALES (UNSW SYDNEY), Australia** `computational methods for finance` `electrical energy` `chemical reaction engineering`
June 2017 February 2017	**Master thesis in theoretical geomechanics, UNSW SYDNEY	CSIRO, Australia** > Title : *"Numerical continuation and bifurcation analysis for unconventional geomechanics"* > Supervisor : Thomas Poulet (CSIRO Australia) `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

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`

📖 Publications

Preprints	❯ Boussange, V. & Pellissier, L.,*Topology and habitat assortativity drive neutral and adaptive diversification in spatial graphs*, [bioRxiv] (2021), 25 pages. Revision requested from Communications Biology.
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.
Works in progress	❯ Boussange, V., Becker, S., Jentzen, A., Pellissier, L., *Deep learning approximations for non-local nonlinear PDEs with Neumann boundary conditions*.
	❯ Boussange, V., Sornette, D., Pellissier, L., *Eco-evolutionary dynamics in economic systems*.
	❯ Boussange, V., Vilimelis-Aceituno, P., Pellissier, L., *Interpretable Machine Learning for forecasting dynamical processes in ecosystems*.
	❯ Boussange, V., Becker, S., Rackauckas, C., Pellissier, L., `HighDimPDE.jl` : *A Julia package for solving high dimensional, non-local, nonlinear PDEs*.

📡 Talks

November 2021	StAMBio seminar, St Andrews, UK.*Numerical approximations of solutions of highly dimensional, non-local nonlinear PDEs*.
October 2021	Conference on Complex Systems, Lyon, France. *Graph topology and habitat assortativity drive phenotypic differentiation in an eco-evolutionary model*.
October 2021	ECBC, Amsterdam, Netherlands. *Using graph-based metrics to assess the effect of landscape topography on diversification*.
September 2021	International Conference on Computational Methods in Systems Biology, Bordeaux, France. *Solving non-local nonlinear Partial Differential Equations in high dimensions with HighDimPDE.jl*.
April 2021	Mathematical Population Dynamics, Ecology and Evolution, CIRM Marseille, France. *Responses of neutral and adaptive diversity to complex geographic population structure*.

💻 Softwares

HighDimPDE.jl   2021
○ github.com/vboussange/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
DiffEqFlux.jl, CUDA.jl, Flux.jl, LightGraphs.jl.

</> Programming

Programming languages	Julia, **Python**, **C++**, Java, Matlab, R, Bash, VBA
Libraries	Flux.jl, DifferentialEquations.jl, DiffEqFlux.jl, CUDA.jl, LightGraphs.jl, TensorFlow, ArchGDAL, matplotlib

🎓 Teaching and Mentoring

December 2020 September 2020	**701-3001-00L Environmental Systems Data Science**, ETH Zürich, D-USYS, Switzerland Undergraduate course. In charge of the unit *Supervised Deep Learning - Application*.
June 2020 April 2020	**262-0100-00L Lab rotation**, ETH Zürich, D-BSSE, Switzerland Supervision of Cecilia Valenzuela Agui in the frame of her MS in *Computational Biology and Bioinformatics*.
December 2020 September 2020	**Taste of research internship**, Polytech Nice-Sophia, France 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. **Major achievements** : Graubünden Haute Route, 6 days, group leader, 2021 | Hausstock 3158m, S ridge, 38° / D, 2021 | Stucklistock 3313m, S ridge, 40° / D, 2021.

> Alpinism. **Major achievements** : Spaghetti tour, 6 days, group leader, AD, 2021 | Mönch 4017m, Normal route, AD, 2020 | Piz Palü 3882m, traverse W-E from Rifugi dals Chamuotschs-Fortezza, PD 2c, 2020.

> Rock climbing, alpine climbing. **Major achievements** : Sewenstock 2820m, "Amarone", 10 pitches, 7 pitches in 6a+, 2021 | Hannibalturm 2920m, "Conquest of Paradise", 6 pitches, 6b, 2020 | Brüggler, "Sonntagweg", 7 pitches, 6a+, 2020.

> Enduro mountainbiking, bikepacking. **Major achievements** : "From the first to the last droplet of the Rhone river", Furkapass to Marseille, 11 days, group leader, 2018-2020 | Tour du Mont Blanc, 5 days, group leader, 2019.

> Surfing.

❝ References

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Dr. Thomas Poulet
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