

# Curriculum Vitae

Jonathan Demaeyer

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## Personal Information

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**Last name, First name** Demaeyer, Jonathan

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**Google Scholar** <https://scholar.google.be/citations?user=UMtLu4cAAAAJ>

**ResearchGate** [https://www.researchgate.net/profile/Jonathan\\_Demaeyer](https://www.researchgate.net/profile/Jonathan_Demaeyer)

**Languages** French (mother tongue), English (fluent), Dutch (intermediate).

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## Positions and education

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### Current Position

- **EUMETNET Postdoctoral fellow** (Royal Meteorological Institute of Belgium)  
Apr 2019-present

### Previous Positions

- **Research System Engineer** (Sony Depthsensing Solution) Mar 2018–Mar 2019
- **Postdoctoral fellow** (Royal Meteorological Institute of Belgium) Feb 2014–Feb 2018
- **Full time teaching assistant** (Université Libre de Bruxelles, Physics) 2007–2013

### Education

- **M.Sc. in Physics** (Université Libre de Bruxelles) 2001–2006  
Thesis: Approche symplectique pour l'étude des applications bruitées  
Advisor: Pierre Gaspard
  - **PhD in Physics** (Université Libre de Bruxelles) 2007–2013  
Thesis: Escape rate theory for noisy dynamical systems  
Advisor: Pierre Gaspard
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### Selected oral presentations

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- Online presentations at EGU 2020 and 2021
- Invited seminar on stochastic subgrid scale parameterization at the Institute for Atmospheric Dynamics and Climate, Uni-Frankfurt, January 2018.

- Presentation at the Workshop Stochastic modeling of subgrid scale processes: From theory to practice, Royal Meteorological Institute of Belgium, Brussels, 2017.
- Presentation of the model MAOOAM at 30 Years of Nonlinear Dynamics in Geosciences, Rhodos, July 2016.
- Presentation of model MAOOAM at EGU 2016, Vienna.

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## Complete list of publications

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### Journal articles

1. Demaeyer, J., Penny, S. G., and Vannitsem, S (2022). Identifying efficient ensemble perturbations for initializing subseasonal-to-seasonal prediction. *Journal of Advances in Modeling Earth Systems*, e2021MS002828 [[link](#)].
2. Vannitsem, S., Bremnes, J. B., Demaeyer, J., Evans, G. R., Flowerdew, J., Hemri, S., ... and Ylhaisi, J. (2021). Statistical Postprocessing for Weather Forecasts: Review, Challenges, and Avenues in a Big Data World. *Bulletin of the American Meteorological Society*, **102**(3), E681-E699 [[link](#)].
3. Vannitsem, S., Demaeyer, J., and Ghil, M. (2021). Extratropical low-frequency variability with ENSO forcing: A reduced-order coupled model study. *Journal of Advances in Modeling Earth Systems*, **13**, e2021MS002530 [[link](#)].
4. Demaeyer, J., De Cruz, L., and Vannitsem, S. (2020). qgs: A flexible Python framework of reduced-order multiscale climate models. *Journal of Open Source Software*, **5**(56), 2597 [[link](#)].
5. Demaeyer, J. and Vannitsem, S. (2020). Correcting for Model Changes in Statistical Post-Processing – An approach based on Response Theory. *Nonlinear Processes in Geophysics Discussion*, **27**, 307-327 [[link](#)].
6. Demaeyer, J. and Vannitsem, S. (2018). Comparison of stochastic parameterizations in the framework of a coupled ocean–atmosphere model. *Nonlinear Processes in Geophysics*, **25**(3), 605-631 [[link](#)].
7. De Cruz, L., Schubert, S., Demaeyer, J., Lucarini, V. and Vannitsem, S. (2018). Exploring the Lyapunov instability properties of high-dimensional atmospheric and climate models. *Nonlinear Processes in Geophysics*, **25**(2), 387-412 [[link](#)].
8. Demaeyer, J. and Vannitsem, S. (2017). Stochastic parametrization of subgrid-scale processes in coupled ocean–atmosphere systems: benefits and limitations of response theory. *Quarterly Journal of the Royal Meteorological Society*, **143**(703), 881-896 [[link](#)].
9. De Cruz, L., Demaeyer, J. and Vannitsem, S. (2016). The Modular Arbitrary-Order Ocean-Atmosphere Model: MAOOAM v1. 0, *Geoscientific Model Development*, **9**, 2793–2808 [[link](#)].
10. Vannitsem, S., Demaeyer, J., De Cruz, L., and Ghil, M. (2015). Low-frequency variability and heat transport in a low-order nonlinear coupled ocean–atmosphere model. *Physica D: Nonlinear Phenomena*, **309**, 71-85 [[link](#)].
11. Demaeyer, J. and Gaspard, P. (2013). A trace formula for activated escape in noisy maps. *Journal of Statistical Mechanics: Theory and Experiment*, **2013**(10), P10026 [[link](#)].
12. Demaeyer, J. and Gaspard, P. (2009). Noise-induced escape from bifurcating attractors: Symplectic approach in the weak-noise limit. *Physical Review E*, **80**(3), 031147 [[link](#)].

## Book chapters

1. Carrassi, A., Bocquet, M., Demaeyer, J., Grudzien, C., Raanes, P., and Vannitsem, S. (2022). Data assimilation for chaotic dynamics. In *Data Assimilation for Atmospheric, Oceanic and Hydrologic Applications (Vol. IV)* (pp. 1-42). Springer International Publishing, Switzerland [[link](#)].
2. Demaeyer, J. and Vannitsem, S. (2018). Stochastic Parameterization of Subgrid-Scale Processes: A Review of Recent Physically Based Approaches. In *Advances in Nonlinear Geosciences* (pp. 55-85). Springer, Cham [[link](#)].

## Thesis

1. Demaeyer, J. (2013). Escape rate theory for noisy dynamical systems. Université Libre de Bruxelles. [[link](#)]

## Newsletter articles

1. Demaeyer, J., Vannitsem, S. and Van Schaeybroeck, B. (2021). Statistical post-processing of ensemble forecasts at the Belgian met service, *ECMWF Newsletter No. 166*, 21–25 [[link](#)].
2. Vannitsem, S. and Demaeyer, J. (2020). Statistical postprocessing of ECMWF forecasts at the Belgian met service, *ECMWF Newsletter No. 164*, 4–5 [[link](#)].

## Project Report

1. Vannitsem, S., Crucifix, M., Termonia, P., Nicolis, C., Demaeyer, J. and Mitsui, T. Improving the representation and prediction of climate processes through stochastic parameterization schemes. Belspo [[link](#)].

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## Projects portfolio

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### Past projects

**STOCHLIM** Project on the parameterization of subgrid scale variability in a hierarchy of models. Several articles were published during this 4-years project.

### Ongoing

**RMI operational postprocessing** Operational postprocessing ECMWF ensemble forecasts at station points and on the grid, with the Member-By-Member method. Service provided to the RMI Weather Office on a daily basis.

**EUMETNET postprocessing benchmark** Benchmark of postprocessing methods on the ECMWF Weather Cloud with collaborators from many European National Meteorological services. Related to Vannitsem et al. (2021) (see list of publications above).

**Critical Earth project** Supervision Oisín Hamilton (grad student) working on how climate change could affect atmospheric blocking and the low-frequency variability in the atmosphere.

**RMI Seamless prediction program** Providing scientific guidance for the medium range blending of forecasts.

## In preparation

**PEREN-FMB** - in collaboration with Zied Ben Bouallègue (ECMWF). Postprocessing and Estimating the REpresentativeNess errors in the Forecast Models over Belgium: a project to make model agnostic postprocessing of weather forecasts over Belgium by analyzing and sampling the representativeness errors. Bottom-up project to go from research to operational applications, including the statistical upscaling of rainfall to cover river's catchment area.

**DestinE** European project on high-resolution resolving of extreme events. Manager of a Task in the Postprocessing work package.

**E-TREND** Providing scientific guidance on Member-By-Member postprocessing of wind forecasts on this project on renewable energy in Belgium.

**NOAA** in collaboration with Stephen G. Penny (NOAA/SoFaR ocean). Identifying efficient perturbations for initializing subseasonal-to-seasonal ensemble forecasts with the [Unified Forecast System](#).

**DERISC** promoted by Stéphane Vannitsem and Rafiq Hamdi (RMI), and by Michel Bechtold and Gabriëlle De Lannoy (KU Leuven). Project on coupled land-atmosphere data assimilation.

## National and International collaborations

**Francesco Ragone - RMI and UCLouvain** Ongoing study on the predictability of extremes with rare events algorithms/statistics.

**Henk Dijkstra - Utrecht University** Ongoing work on the eddy memory kernel in quasi-geostrophic baroclinic model (qgs model).

**Alberto Carrassi (UBologna) and Stephen G. Penny (NOAA)** Collaboration on data assimilation methods, in particular for the subseasonal-to-decadal forecast range.

## Teaching

**During PhD** (2007-2013), at Université Libre de Bruxelles:

- **General physics** 1<sup>st</sup> year exercises on Newtonian mechanics and electricity & magnetism.
- **Manager of the laboratories of physics** for the Faculty of Pharmacy: scheduling, staffing, organization of the examinations, edition of the laboratory handouts and teaching of the introductory courses.
- **Museum** Demonstrations at the Museum of Physics of ULB, the Experimentarium.

## Ongoing co-supervision

- Tarik Kalai, M.Sc. in Engineering (Université Libre de Bruxelles)  
Subject: Machine learning and postprocessing
- Oisín Hamilton, PhD student (University of Louvain-la-Neuve), Critical Earth project  
Subject: Typing point in geophysical dynamical systems  
Co-supervision with Stéphane Vannitsem (RMI, co-supervisor) and Michel Crucifix (UCL, co-supervisor).

## Past co-supervision

- Maxime Geerinck, B.Sc. in Engineering (University of Antwerpen) 2021-2022  
 Subject: Machine learning and postprocessing  
 Co-supervision with Joris Van Den Bergh (RMI) and Siegfried Mercelis (UAntwerpen).
  - Sébastien Verkercke, M.Sc. in Physics (Université Libre de Bruxelles) 2019-2020  
 Thesis: *Variabilité et prévisibilité de la dynamique atmosphérique extratropicale sous l'influence du phénomène ENSO*  
 Co-supervision with Stéphane Vannitsem (RMI, supervisor).
  - Arthur Moraux, M.Sc. in Physics (Université Libre de Bruxelles) 2016-2017  
 Thesis: *Ocean-atmosphere coupled model with low-frequency variability of minimal dimension*  
 Co-supervision with Stéphane Vannitsem (RMI, supervisor). Arthur is now doing his PhD at the institute and the VUB.
  - Several internships at Master and Bachelor levels 2015-Now
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## Professional activities

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### Training

- **Mathematics of Climate** (LMS Research School – University Reading) 2019
- **Fundamental Aspects of Turbulent Flows in Climate Dynamics** (Les Houches Summer School) 2017
- **Predictability and ocean-atmosphere ensemble forecasting** (ECMWF) 2015

### Editorial work

- Referee for Geoscientific Model Development (GMD), EGU sphere, Journal of Advances in Modeling Earth Systems (JAMES), Quarterly Journal of the Royal Meteorological Society (QJRMS) and Journal of Statistical Physics .

### Organization of scientific events

- EUMETNET Post-Processing Workshop December 2019
- EUMETNET Post-Processing Benchmark Kick-Off Workshop December 2021

### Other Services

- ULB: Scientific Corps member of the council (2008-2013) and bureau (2009-2013) of the Physics Department.
- Treasurer of La Scientothèque ASBL (2013-2022), a non-profit organization of ULB for the promotion of sciences to the young people.

### Programming languages and tools

- **Language:** Python, Jupyter, Fortran, Lua
- **Models:** MAOOAM, QGS, PLASIM (GCM)
- **Framework:** HPC, ECMWF toolchain, Docker
- **Data:** NetCDF, Grib, zarr, pandas, xarray, iris
- **General:** bash, git, make,  $\LaTeX$ , html, css

### Code development

- MAOOAM model <https://github.com/Climdyn/MAOOAM>
- qgs model <https://github.com/Climdyn/qgs>
- Pythie post-processing package <https://github.com/Climdyn/pythie>

### Dataset management

- EUMETNET postprocessing benchmark dataset  
<https://github.com/Climdyn/climetlab-eumetnet-postprocessing-benchmark>