Eva Marques

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Summary

My research is mainly driven by the assessment of urban heat impact on human health through spatio-temporal Bayesian inference.

Experience

Postdoctoral fellow June 2023 – Present
National Institute of Environmental Health Sciences (NIEHS) *Durham, North Carolina, USA*
Supervisor: Kyle Messier (NIEHS, North Carolina, USA)

- Heat stress exposure mapping at high resolution to assess the impact of heat on human health. Aim to improve the detection of urban heat island compared to existing products. Use of geostatistical methods, including a Bayesian hierarchical model, to harness opportunistic data effectively while managing its inherent uncertainty.
- SET group project: PM2.5 daily prediction across the United States
- Collaborative programming and reproducible, open science with the development of several R packages tested with testthat, soon available on Github and documented through packagedown.

Postdoctoral fellow May 2023 – June 2023
Centre National de Recherches Météorologiques (CNRM) *Toulouse, France*
Supervisor: Valéry Masson (CNRM, Toulouse, France)

- Completion of phD work and publication preparation of final results

Predoctoral research scientist November 2018 – November 2019
Centre National de Recherches Météorologiques (CNRM) *Toulouse, France*
Supervisor: Valéry Masson (CNRM, Toulouse, France)
Funded by the Continental automotive company

- Setup of a measurement campaign to evaluate connected vehicle thermometers quality compared to professional weather stations
- Exploratory analysis, cleaning and ordinary kriging of crowdsourced data from connected vehicles

Intern in deeplearning for tuna fishery governance January 2018 – July 2018
Collecte Localisation Satellite (CLS) *Toulouse, France*
Supervisors: Maxime Lalire, Olivier Titaud, Philippe Gaspar (CLS, Toulouse, France)

- Deep learning to infer tuna spatial distribution in Atlantic ocean
- Collaborative development of `pyfishml` library (not opensource) in python with the help of git
- Python development with `scikitlearn`, `tensorflow`, `keras`

Intern in statistical analysis of massive educational data June 2017 – September 2017
Université du Québec à Montréal (UQAM) *Montreal, Canada*
Supervisor: Marie-Jean Meurs (UQAM, Montréal, Canada)

- Data mining with R
- First research experience in an international team

Education

PhD thesis in geostatistics for urban climatology November 2019 - January 2023

Centre National de Recherches Météorologiques (Météo-France and CNRS) *Toulouse, France*

Supervisors: Valéry Masson (CNRM, Toulouse, France), Philippe Naveau (LSCE, Paris, France) and Olivier Mestre (Météo-France, Toulouse, France)

Funded by the Occitanie region and Météo-France

- Understanding of urban climatology processes, especially urban heat island
- Exploration of the potential of crowdsourced massive datasets: one from connected vehicles of PSA car manufacturer and the other from personal weather stations from the Netatmo company
- Developping spatio-temporal hierarchical Bayesian model with two likelihoods, one for each data source
- Achieving hourly fine resolution maps of urban heat island

Master's degree in applied mathematics (option: statistical modelling) September 2013 - July 2018

Institut National des Sciences Appliquées (INSA) *Toulouse, France*

- Strong background in applied mathematics, descriptive, exploratory and inferential statistics, machine learning, deep learning, Markov Chain Monte Carlo, timeseries, high dimensional statistics
- Inter-school machine learning competition: 2nd position out of 53 teams.

Publications

[In prep.]: Multiple likelihoods hierarchical Bayesian model to reach high spatial and temporal resolution maps of urban heat island from crowdsourced observations.

Crétat, J., Richard, Y., Pohl, B., Emery, J., Dudek, J., Roy, D., Pergaud, J., Rega, M., Poupelin, M., Joly, D., Thévenin, T., **E. Marquès**, and Masson, V. (2023). Impact of topography and land cover on air temperature space-time variability in an urban environment with contrasted topography (dijon, france, 2014–2021). *Theoretical and Applied Climatology*

E. Marquès, Masson, V., Naveau, P., Mestre, O., Dubreuil, V., and Richard, Y. (2022). Urban heat island estimation from crowdsensing thermometers embedded in personal cars. *Bulletin of the American Meteorological Society*, 103(4):E1098 – E1113

Gardes, T., Schoetter, R., Hidalgo, J., Long, N., **E. Marquès**, and Masson, V. (2020). Statistical prediction of the nocturnal urban heat island intensity based on urban morphology and geographical factors - an investigation based on numerical model results for a large ensemble of french cities. *Science of The Total Environment*, 737:139253

Scientific interactions

Conference talks and poster presentations

- Marquès, E. and Messier, K. (2024). *Heat stress exposure mapping at high resolution with the help of crowdsourced personal weather stations.* Durham, NC, USA. NIEHS Science Day. [Poster]
- Marquès, E., Masson, V., Naveau, P., and Mestre, O. (2023). *High resolution and hourly mapping of UHI from citizen weather stations and connected vehicles.* Sydney, Australia. International Conference on Urban Climatology. [Presentation (presenter: Valéry Masson)]
- Marquès, E., Masson, V., Naveau, P., and Mestre, O. (2022c). *Urban heat island observation from the fusion of connected vehicle and personal weather station measurements.* Online event. International Association for Urban Climate. [Poster]
- Marquès, E., Masson, V., Naveau, P., and Mestre, O. (2022a). *Urban heat island estimation from crowdsensing thermometers embedded in personal cars.* Toulouse, France. 35ème colloque annuel de l'Association Internationale de Climatologie. [Paper presentation]
- Marquès, E., Masson, V., Naveau, P., and Mestre, O. (2022b). *Urban heat island estimation from crowdsensing thermometers embedded in personal cars.* Vienna, Austria. European Geoscience Union general assembly. [Paper presentation]
- Marquès, E., Masson, V., Naveau, P., and Mestre, O. (2021). *Urban heat island estimation from crowdsensing thermometers.* Fontainebleau, France. Journées de la géostatistique du reséau Risques, Extrêmes et Statistique Spatio-TEmporelle (RESSTE). [Poster]

Course attendances

- Apptainer Training : Containers for HPC, provided by David Godlove (Solutions Architect CIQ), Durham, NC, USA (August 2023)
- Data assimilation, C.E.R.F.A.C.S, Toulouse, France (June 2022)
- VALPRED workshop on statistics for validation of forecasting and relative topics. (October 2021) Aussois, France
- Urban climatology, Ecole Nationale de la Météorologie, Toulouse, France (2019)

Teaching

Mathematics basics for scientific bachelor's degree 2 semesters (128h in total) in 2020 - 2021

Institut National des Sciences Appliquées *Toulouse, France*

- Analysis (integral computation methods, Taylor expansions, equivalents) and linear algebra (linear systems, matrix computing, vector spaces, ordinary differential equations, linear applications)
- Distance teaching during the first year *(COVID pandemics)*
- Evaluation by competence in continuous assessment
- Very enriching relationship with educative team and with students

Sharing science with the public

Press communication

- Scientific American, Berkowitz, R. (2022, July 1). *How Connected Cars Can Map Urban Heat Islands* [Press release].
- Les Echos Innovateurs, Henno, J. (2022, April 20). *Les voitures connectées au service de la météo* [Press release].
- Le Mensuel de Rennes, Joly, J. (2022, March). *Climat à Rennes: quand votre voiture prend la température* [Press release].

Outreaching activities

- **Scimatch for middle school, NC Science Festival** [in prep.]: creation and animation of a game "In the shoes of an urban climatology researcher" with two classes of 5th and 6th grade, Siler City, NC, USA.
- **Facilitator at Climate Fresk**: animation of a game that gives the scientific keys to understand the mechanisms of climate change. Information is extracted from the IPCC reports.
- **Fête de la science**: design of a 7 meters frieze on urban heat island in collaboration with the association Instant Science (displayed throughout October in front of Quai des Savoirs, Toulouse, France). Preparation and animation of a public stand about urban climatology research at Toulouse innovante et durable festival, Toulouse, France
- **Rencontres Exploreur**: interventions in schools to present the profession of researcher or to explain what is concretely the artificial intelligence.

Skills

Programming

- R libraries: descriptive and exploratory analysis (`ggplot2`), geostatistics (`terra`, `stars`, `sf`, `sftime`, `gstat`, `geoR`, `lubridate`, `mapview`, `leaflet`), spatio-temporal Bayesian modeling (`INLA`), processing of large databases and parallel computation (`foreach`, `data.table`)
- Python: machine learning (`scikitlearn`), in particular deeplearning (`tensorflow`, `keras`), parallel computing (`multiprocessing`)
- Unix Shell

Geographical Information Systems

- QGIS software
- NetCDF data format

Open, shareable, and reproducible science

- Collaborative programming: git, jupyter notebook (for teaching)
- R package development: `styler`, `lintr`, `testthat`, `targets`, `pkgdown`
- Text editor: LaTeX, Office and Microsoft suites
- Image editing: Gimp, Inkscape

Languages

- French (native speaker)
- English (professional working proficiency)
- Spanish (intermediate)

Referees

Dr. Kyle Messier (+1) 984-287-3215
Researcher in environmental exposure and toxicology, NIEHS *kyle.messier@nih.gov*

Dr. Valéry Masson (+33) 561 079 464
Urban climatology researcher, CNRM *valery.masson@meteo.fr*

Dr. Philippe Naveau (+33) 169 084 158
Researcher in statistical climatology and hydrology, LSCE *philippe.naveau@lsce.ipsl.fr*

Pr. Béatrice Laurent-Bonneau (+33) 561 559 326
Professor of mathematics, INSA *beatrice.laurent@insa-toulouse.fr*