

Education

- 2011 – 2015 **PhD, University of Oxford**, applied mathematics, specifically:
Data Assimilation (DA), i.e. state estimation with big data, focusing on the Ensemble Kalman filter (EnKF): a Bayesian, Monte-Carlo, Gaussian technique. Thesis:
- Proved a remarkable equivalence of two ensemble smoothing algorithms.
 - Developed deterministic error parameterizations suited for the EnKF.
 - Supervised by C. Farmer, I. Moroz (Oxford), and L. Bertino, G. Evensen (Bergen).
 - Examined by Emmanuel Cosme (external) and Andrew Thompson (internal),
 - Recognized as excellent by division board.
- 2009 – 2010 **MSc, University of Oxford**, mathematical modeling and scientific computing.
- Courses: PDEs, Num. analysis, Finite diff. & elem., Optimization, Stat. mech., Func. approx.
 - Thesis: Modeling Biochemical Crowding. ○ Graduated with distinction.
- 2006 – 2009 **BEng, Institut National des Sciences Appliquées (INSA) de Toulouse.**
- Ranked 5/100 2nd year student body, 3/50 in 3rd year.
- 2008 **Exchange semester, Instituto Tecnológico de Buenos Aires.** Average grade: 8/10.

Work

- 2018 – present **Researcher, NORCE.** Continuation of research from PhD and PostDoc.
- Improved the algorithm of an iterative ensemble smoother used in petroleum DA.
 - Derived expression of linear regression as the average analytic derivative.
- 2016 – 2018 **PostDoc, Nansen center.**
- Built academic DA package in Python (github.com/nansencenter/DAPPER).
 - Developed algorithm for the adaptive estimation of a tuning parameter in the EnKF.
- Paris
North Carolina
- 9-month visit to collaborators at École nationale des ponts et chaussées.
 - 2-month visit to collaborators at Chapel Hill, UNC.
- Temporary
- Summer 2014 **Research project, Statoil.**
- Bergen Worked on iterative ensemble smoothers and its code for the ERT package.
- Summer 2012 **Internship, Schlumberger.** Implemented a tracer conversion scheme in the Eclipse reservoir simulator to model biochemical oil reservoir souring.
- Abingdon
- 2011 **Freelance software development.** Built package in Matlab and C++ to solve the Eikonal equation for the propagation of wave fronts in heterogeneous mediums.
- Oslo

Teaching

- 2017 – 2019 **Tutorials on data assimilation (DA) and the EnKF.**
- Timisoara, Stavng.,
Toulouse, Bergen
- Created 15+ hours of theoretical and interactive programming exercises. Taught at
- “DA summer school”
 - UiS
 - Mercator Ocean Institute
 - UiB (2x)
 - Nansen center “crash course”
- 2012 – 2013 **Teaching assistant, maths institute**, undergraduate mathematics.
- Oxford Courses: Viscous flow, Techniques of applied maths, Applied PDEs, Numerical ODEs & PDEs.
- 2007, Oslo **Teacher, Red Cross summer school.** High-school mathematics, 3 weeks.

Leadership

- 2013 **St. Hugh's college.**
- Oxford
- Founded and captained the football team for graduates.
 - Served as IT representative for student body.
- 2005 – 2009 **European Space Camp, Andøya rocket range.**
- Assistant leader with responsibilities: social organization, press liaison, sponsor relations.

Languages

- Human Norwegian (native), English (bilingual), French (fluent), Spanish (fluent).
- Computer Python, Matlab, C, C++, Bash, Vim, Fortran, Java, MS-DOS, Ada.

Publications

- 2019 **Patrick N. Raanes**, Geir Evensen, Andreas Stordal.
Revising the stochastic iterative ensemble smoother.
Nonlinear Processes in Geophysics, In review.
- 2018 **Patrick N. Raanes**, Marc Bocquet, Alberto Carrassi.
Adaptive covariance inflation in the ensemble Kalman filter by Gaussian scale mixtures.
Quarterly Journal of the Royal Meteorological Society, 145(718): 53–75.
- 2016 **Patrick N. Raanes.**
Improvements to ensemble methods for data assimilation in the geosciences.
Thesis, University of Oxford.
- 2015 Marc Bocquet, **Patrick N. Raanes**, and Alexis Hannart.
Expanding the validity of the ensemble Kalman filter without the intrinsic need for inflation.
Nonlinear Processes in Geophysics, 22(6):645-662.
- 2015 **Patrick Nima Raanes.**
On the ensemble Rauch-Tung-Striebel smoother and its equivalence to the ensemble Kalman smoother.
Quarterly Journal of the Royal Meteorological Society, 142(696):1259-1264.
- 2014 **Patrick N. Raanes**, Alberto Carrassi, and Laurent Bertino.
Extending the square root method to account for model noise in the ensemble Kalman filter.
Monthly Weather Review, 143(10):3857-3873.

Seminars

- Florence
2019 ○ **EAGE Petroleum Geostatistics IV.**
Revising the method of ensemble randomized maximum likelihood.
- Voss
Leeds
Toulouse
2019 ○ **EnKF workshop.** *Invited*
○ **modRSW workshop.** *Invited*
○ **Mercator Ocean Institute.**
○ **INP-ENSEEIH (IRIT).** *Invited*
- 2019 EnKF – FAQ.
- Bergen
2018 ○ **DIGIRES project – technical meeting.**
○ **DIGIRES project – steering committee meeting.**
Revising the stochastic iterative ensemble smoother.
- Bergen
2018 ○ **Employee presentation.**
Research overview.
- Boulder (CO)
Durham (NC)
2018 ○ **NCAR seminar.** *Invited*
○ **SAMSI Postdoctoral Fellow seminar.**
Adaptive covariance inflation in the EnKF by Gaussian scale mixtures.
- Chapel Hill (NC)
2018 ○ **SIAM SEAS mini-symposium “Methods of Data Assimilation in Climate”.**
Two failed improvements to the particle filter.
- Reading
Bergen
2017 ○ **Dept. of Meteorology – DARC seminar series.** *Invited*
○ **EnKF workshop.**
Gaussian scale mixtures and adaptive inflation in the EnKF.
- Vienna
Bergen
2016 ○ **EGU general assembly.**
○ **EnKF workshop.**
The ensemble Rauch-Tung-Striebel smoother and its equivalence to the ensemble Kalman smoother.
- Bergen
On-line
Les Houches
2015 ○ **EnKF workshop.**
○ **MCRN joint data assimilation seminar.**
○ **Workshop on theoretical aspects of ensemble data assimilation for the Earth.**
Extending the square root method to account for model noise in the ensemble Kalman filter.
- Oxford
2014 ○ **Applied Dynamical Systems and Inverse Problems seminar.**
The RTS and other ensemble smoother.

- Oxford 2014 ○ **Junior applied maths seminar.**
Introduction to data assimilation.
- Bergen 2013 ○ **EnKF workshop.**
Smoothers: Types and Benchmarks.
- Oxford 2013 ○ **1st year DPhil presentation.**
- Bergen 2013 ○ **Nansen center PhD interview presentation.**
Estimating the Change in Global Sea Levels: Bayesian Methods in Inverse Problems.

Poster presentations

- Bergen 2018 ○ **EnKF workshop.**
- Vienna 2018 ○ **EGU general assembly.**
Adaptive covariance inflation in the EnKF by Gaussian scale mixtures.
- Brest 2017 ○ **Data Science & Environment workshop.**
Gaussian scale mixtures and adaptive inflation in the EnKF.
- Bergen 2016 ○ **NERSC 30 year anniversary.**
Research interests.
- San Francisco 2014 ○ **AGU fall meeting.**
Square root model error incorporation in the EnKF

Study groups

- Oxford 2014 ○ **European study group with industry.**
Gabor Filter Selection and Computational Processing for Emotion Recognition.
- Leiden (NL) 2017 ○ **Emerging Applications of Data Assimilation in the Geosciences**

Awards & scholarships

- 2016 **NERSC Basic Funding grant** for the development of DAPPER. NOK 150'000 awarded.
- 2016 **EGU highlighted article;** the one from 2015 with first author Bocquet.
- 2013 **PhD grant.** PhD salary, awarded by Statoil Petroleum AS.
- 2009 **Janson's grant.** NOK 100'000 awarded for MSc studies.
- 2006 **Physics olympics,** national finalist.
- 2006 **Math olympics,** national finalist.

Professional Associations

Peer reviewing articles for journals:

- Physica D
- Tellus A
- Computational Geosciences
- Frontiers in Applied Mathematics and Statistics
- Advances in Computational Mathematics
- Monthly Weather Review
- Quarterly Journal of the Royal Meteorological Society
- SIAM Uncertainty Quantification
- MDPI Atmosphere

- 2016, 2018, 2019 **European Geophysical Union membership.**
- 2014 **American Geophysical Union membership.**

Summer schools

- Rome 2016 **Earth Observation summer school, *European Space Agency.***
Two weeks working on remote sensing, earth system modeling, and data assimilation.

Romania **Data Assimilation summer school, 3rd edition.**

2013 Two weeks in Cluj, Romania. Taught by experts. Organized by Remus Hanea.

Minnesota **Summer Institute, Fulbright.**

2009 Six weeks at the U. of Minnesota focusing communicating science to policy makers.