

# Curriculum vitae with track record – Geir Evensen

## Personal information

*Family name, First name:* Evensen, Geir  
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*Sex:* Male  
*Nationality:* Norwegian  
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<http://EnKF.nersc.no> <http://github.com/geirev>

## Education

1992	PhD/Dr.Scient: Disputation date 28.11.1992 Department of Mathematics, University in Bergen
1989	Master/Cand Scient: Applied Mathematics (Plasma Dynamics) Department of Mathematics, University in Bergen

## Positions – current and previous positions

2004– 2018–	Nansen Environmental and Remote Sensing Center (NERSC): Research Director II Norwegian Research Center (NORCE): Chief Scientist
1989–1992	Research Council of Norway: personal PhD grant
1993–1995	Research Council of Norway: personal Postdoc grant
1995–2003	Nansen Environmental and Remote Sensing Center: Research Director
2003–2016	Statoil (and Norsk Hydro): Project leader in R&D and technology implementation
2016–2018	International Research Institute of Stavanger: Chief Scientist

## Project management experience

1999–2001	DIADEM (EC FP4 MAST-II), 4 international partner institutes
2001–2003	TOPAZ (EC FP5), 5 international partner institutes
2004–2008	Initiator MERSEA (Marine Environment and Security for the European Area), EC FP6 Integrated project, total budget 24 MEuro, 50 partners
2003–2016	R&D and operational implementation Fast Model Update, Hydro, Statoil
2011–2013	EVITA-EnKF, Research Council of Norway (RCN), budget 2 MEuro, 6 partner
2014–2018	NORDFORSK Center of Excellence EMBLA on data assimilation, 9 Nordic partners
2018–2021	Petromaks–2 DIGIRES (Decision-Driven Big Data and Analytics for the Digital Subsurface), 7 industry partners

## Supervision of graduate students and research fellows

1995–2017	External supervision of 2 master students and 9 PhD students connected to UiB
1995–2017	Supervisor of postdocs and senior scientists in EU projects, at Nansen Center and in Statoil.

## Fellowships and awards

1996–2002	Professor II, Department of Mathematics, University in Bergen (at age 32).
2000–2000	Professeur associé de 2 <sup>ième</sup> catégorie at École Nationale Supérieure des Mines de Paris
2020	<b>Winner of the Norwegian Petroleum Directorate's IOR-price</b>

## Teaching activities

1995–1995	Teaching Vector and Tensor analysis, Department of Mathematics, University in Bergen
1995–2017	Teaching data assimilation methods at summer schools in Norway, France, UK, Japan
2015	Teaching at <i>4th Summer School on Data Assimilation and its applications</i> , Brasov, Romania
2016	Organizing and teaching at the summer school: “Crash Course on Data Assimilation” Bergen
2017	Teaching data assimilation methods, Department of Mathematics, University in Bergen
2018	Organizing and teaching at the summer school: “Crash Course on Data Assimilation” Bergen
2019	Teaching at <i>6th Summer School on Data Assimilation and its applications</i> , Romania
2019	Teaching data assimilation methods, Universidad del Norte y Universidad EAFIT, Colombia
2020	Teaching at <i>American Institute of Mathematics Summer School on Dynamics, Data and the COVID 19 Pandemic</i> .

## Organization of scientific meetings

2017–2022	Co-organizer of the International EnKF Workshop, Norway
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## Invited talks

2015	Aspects théoriques de l’assimilation de données d’ensemble pour le système terre, France
2016	Final ISAPP symposium: Smart Wells and Smart Fields: Past, Present and Future, Holland
2017	IPAM: Data Assimilation, Uncertainty Reduction, ... for Subsurface Flow, UCLA (US)
2017	Invited presentation at INRS–ETE Quebec University, Canada, 11 July, 2017
2018	Invited presentation at DAAG 2018, Vancouver, Canada, April 10–13
2018	Invited presentation at US–EnKF workshop, Montreal, Canada, May 7–10
2018	Invited presentation at University of Reading, Oct 31, Reading, UK.
2019	Keynote speaker at 7th International Symposium on Data Assimilation (ISDA 2019), Japan
2019	CRM Workshop on Data Assimilation: Methodology and Applications, Montreal, Canada
2019	Invited presentation at University of Potsdam, Germany.
2019	1st International Workshop on Data Assimilation for Decision Making, Colombia
2020	<a href="#">Using the power of data assimilation to model the COVID-19 pandemic</a> , ECMWF
2020	Invited presentation at Workshop on ensemble-based 4D seismic history matching The National IOR Centre of Norway
2021	Invited presentation at Kolloquium für Atmosphäre und Klima, ETH Zürich, Using the power of data assimilation to model the COVID-19 pandemic

## Commissions of Trust

→ 2003	Member of EuroGOOS (European Global Ocean Observing System).
→ 2003	Member of GODAE (Global Ocean Data Assimilation Experiment).
2009–2015	Member of the Program Board for eVita, The Research Council of Norway

## Track-record

<b>Total number of publications:</b>	> 80
<b>Monographs/edited books:</b>	2
<b>My h-index:</b>	41
<b>Total number of citations:</b>	> 25 500
<b>Highlight:</b>	I won the <a href="#">Norwegian Petroleum Directorate’s IOR-price</a> in 2020.
<b>Ranking:</b>	I am number 6789 (20 in Norway) on the Stanford list of the worlds 2% (204000) top scientists independent of field <a href="https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3">https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3</a>

I have 30 years of experience within research and R&D project management related to data assimilation in ocean and weather forecasting and petroleum technology.

I have published **the two most cited methodological publications on data assimilation** (Evensen, 1994, 2003) with more than 5443 and 4235 citations on Google Scholar. I have published a **book on data assimilation** (Evensen, 2009b) cited more than 2958 times (Google scholar), which is **translated into Chinese** by Springer Beijing. **In 2022 I have published another data-assimilation book:** (Evensen et al., 2022).

These two papers together with my book on data assimilation have led to **a paradigm shift in the research and operational use of data assimilation in the Earth Sciences.**

- I invented **Ensemble Kalman Filter (EnKF)** which is the method of choice for assimilation of observations in dynamical models in most disciplines within the Earth Sciences, and EnKF is increasingly used in operational weather forecasting systems at the international meteorological services.
- I invented **Ensemble Smoother (ES)** for history matching of petroleum-reservoir models which is now commercialized by Emerson–Roxar and ResOptima, and variants of ES have become the most used methods for history matching in the reservoir engineering community.
- I invented **Fast Model Update (FMU)**, which is an ensemble-based work flow for reservoir modeling and management. FMU connects geophysics, geological modeling and reservoir simulation in an automated multidisciplinary and integrated modeling work flow. FMU allows for the use of multiple realizations and Ensemble Smoother for conditioning the work flow on dynamical data. FMU is now in operational use in Equinor and commercialized by companies such as Emerson–Roxar (The Big-Loop™ Solution) and ResOptima (ResX). FMU is a game changer in the petroleum industry and defines how future reservoir characterization will be done.

I have coordinated international research projects on the development of data-assimilation methodologies and systems. I have given numerous invited presentations at conferences and different universities in Europe, USA, Canada, Colombia, and Japan. I am regularly reviewing research papers and proposals from international journals and funding agencies. I have initiated and managed several projects from an initial idea to operational implementation within ocean forecasting and history matching of petroleum reservoir models.

**Work experience at Nansen Center June 1989–present:** I worked with a development of data-assimilation methods for use in oceanography and meteorology and as department and project manager. I was responsible for approximately 10 researchers working in my team, and I managed several R&D projects mainly funded by the European Commission, the Norwegian and Nordic Research councils, and major oil companies including Statoil and BP. At the Nansen Center some of my achievements are:

- Development of ensemble data-assimilation methods (EnKF, EnKS, ES) and their introduction to the scientific community and further implementation of operational services.
- Development of the TOPAZ ocean-forecasting system currently being run operationally at the Norwegian Meteorological Institute.
- Coordination of two European Commission projects DIADEM and TOPAZ and initiation and development of the European Commission sixth-framework project MERSEA.
- Project manager of the ongoing Nordforsk EMBLA Center of Excellence on data assimilation.

**Work experience at Statoil (and Norsk Hydro) June 2003–March 2016:** I started as an R&D project manager and researcher at Norsk Hydro Research Center in Bergen in June 2003, where I was responsible for managing research related to history matching and model updating. In this position, I implemented an operational Ensemble Kalman Filter for history matching of reservoir-simulation models and contributed to introducing ensemble methods in the international petroleum-research community.

Statoil acquired Hydro in 2007, and I continued in Statoil R&D as a project manager for a large portfolio of research projects within sub-surface reservoir characterization. In this position, I initiated the development of Fast Model Update. From 2012 I managed a project on broad implementation of FMU for operational use in Statoil. I completed the FMU implementation project during summer 2015, and FMU has since then defined the standard way of working in Statoil.

At Statoil, my achievements include:

- I introduced ensemble methods to the petroleum community for history matching of reservoir models.
- Invention, development and broad implementation of Fast Model Update as the standard way of modeling reservoirs in Statoil.
- Fast Model Update is now being implemented outside Statoil and defines the next generation modeling technology in the petroleum industry.

The period at Statoil may be considered as a researcher career break. My role evolved into managing and leading the further development of Fast Model Update, as an internal technology in Statoil, and there were limitations on what I could publish. My motivation was to develop ensemble-based work flows for reservoir characterization all the way till operational use, and with that, I succeeded. On the other hand, while at Statoil, I kept a secondary position at the Nansen Center where I supervised students and initiated and managed research projects (e.g., eVITA–EnKF funded by the Norwegian Research Council 2011–2013) and the EMBLA Nordic center of excellence in data assimilation (2014–2018). I also managed to complete two editions of my Springer book while at Statoil, and I authored and co-authored 23 publications during this period. I believe that my stay at Statoil has strengthened and widened my competence by learning another discipline and also by gaining additional management experience. The work with FMU also won me the [Norwegian Petroleum Directorate's IOR-price](#) in 2020.

Since April 2016, I am fully back in academia working as a chief scientist at NORCE, and continuing with a secondary position at the Nansen Center.

### Some selected publications

- Carrassi, A., M. Bocquet, L. Bertino, and G. Evensen. Data Assimilation in the geosciences: An overview on methods, issues and perspectives. *Wires Climate Change*, 9(5):50, 2018. doi:[10.1002/wcc.535](#).
- Chang, Y. and G. Evensen. An ensemble-based decision workflow for reservoir management. *Journal of Petroleum Science and Engineering*, 2022. doi:[10.1016/j.petrol.2022.110858](#).
- Evensen, G. Sequential data assimilation with a nonlinear quasi-geostrophic model using Monte Carlo methods to forecast error statistics. *J. Geophys. Res.*, 99(C5):10,143–10,162, 1994. doi:[10.1029/94JC00572](#).
- Evensen, G. The ensemble Kalman filter: Theoretical formulation and practical implementation. *Ocean Dynamics*, 53: 343–367, 2003. doi:[10.1007/s10236-003-0036-9](#).
- Evensen, G. The ensemble Kalman filter for combined state and parameter estimation. *IEEE Control Systems Magazine*, 29(3):83–104, 2009a. doi:[10.1109/MCS.2009.932223](#).
- Evensen, G. *Data Assimilation: The Ensemble Kalman Filter*. Springer, 2nd edition, 2009b. doi:[10.1007/978-3-642-03711-5](#).
- Evensen, G. Analysis of iterative ensemble smoothers for solving inverse problems. *Computat Geosci*, 22(3):885–908, 2018. doi:[10.1007/s10596-018-9731-y](#).
- Evensen, G. Accounting for model errors in iterative ensemble smoothers. *Computat Geosci*, 23(4):761–775, 2019. doi:[10.1007/s10596-019-9819-z](#).
- Evensen, G. Formulating the history matching problem with consistent error statistics. *Computat Geosci*, 25:945–970, 2021. doi:[10.1007/s10596-021-10032-7](#).
- Evensen, G. and K. S. Eikrem. Strategies for conditioning reservoir models on rate data using ensemble smoothers. *Computat Geosci*, 22(5):1251–1270, 2018. doi:[10.1007/s10596-018-9750-8](#).
- Evensen, G., P. N. Raanes, A. S. Stordal, and J. Hove. Efficient implementation of an iterative ensemble smoother for data assimilation and reservoir history matching. *Frontiers in Applied Mathematics and Statistics*, 5:47, 2019. doi:[10.3389/fams.2019.00047](#).
- Evensen, G., J. Amezcua, M. Bocquet, A. Carrassi, A. Farchi, A. Fowler, P. L. Houtekamer, C. K. Jones, R. J. de Moraes, M. Pulido, C. Sampson, and F. C. Vossepoel. An international initiative of predicting the sars-cov-2 pandemic using ensemble data assimilation. *Foundations of Data Science*, page 65, 2020. doi:[10.3934/fods.2021001](#).
- Evensen, G., F. C. Vossepoel, and P. J. Van Leeuwen. *Data Assimilation Fundamentals: A Unified formulation for State and Parameter Estimation*. Springer, 2022. ISBN 978-3-030-96708-6. doi:[10.1007/978-3-030-96709-3](#). Open access.
- Raanes, P. N., A. S. Stordal, and G. Evensen. Revising the stochastic iterative ensemble smoother. *Nonlin. Processes Geophys*, 26:325–338, 2019. doi:[10.5194/npg-2019-10](#).