# Christophe Baehr

天下莫柔弱於水。而攻堅强者，莫之能勝

- Météo-France/CNRS Research Scientist - CNRM/GAME URA1357
- Associated member of the Mathematical Institute of Toulouse

- Associated Editor "American Journal of Algorithms and Computing"


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- University Education:
    - Ph D. Applied Mathematics, Toulouse III (2008)
    - Master of Science, Applied Mathematics, option Probability, Toulouse III (2004)
    - B. Sc in Pure Mathematics, Paris VI (1996)

- Positions:
    - Research Scientist in Data Processing Meteorological and Turbulence measurements and Meteorological Data Assimilation (2003-)
    - Engineer in Data Processing for Meteorological and Turbulence Experiments (2001-2003)
    - Librarian at the Météo-France Research Centre (1999-2001)
    - Forecaster in Météo-France Aviation forecast centre (1991-1999)

- Teaching:
    - Lectures in Master degree of Ecology, Toulouse III : Time series, deterministic and random ( 2005 - )
    - Lectures in Engineer Degree of National Meteorological School : Data Processing (2008-)
    - Lectures in Master degree of Ecology, Toulouse III : Introduction to Scilab software (2006-)
    - Lectures in Master degree of Ecology, Toulouse III : Introduction to LaTeX (2010-)
    - Lectures in Master degree of Ecology, Toulouse III : Introduction to Time series ( 2005-2009)
    - Lecture for Météo-France Aviation Professional Degree : Dynamics of Signal (2009)

- Research Interest:

  - Applied Probability, Stochastic Algorithm.
  - Non-linear filtering, interacting particle approximation.
  - Kalman filters family.
  - Interacting Multi-Model Filtering.
  - Data processing, Fourier and Wavelet Analysis.
  - Atmospheric Turbulence and dynamical meteorology.
  - Data Assimilation for Geophysical fields.
  - Design of Algorithms to include Met Information in Aircraft Navigation Predictors.

- Scientific publications:

- **C. Baehr**, (2013) : Variational Particle Approximation for imperfect models. In prep

- M. Teurlai, R. Huy, B. Cazelles, R. Duboz, **C. Baehr** and S. Vong (2012): Can Human Movements Explain Heterogeneous Propagation of Dengue Fever in Cambodia? PLOS Neglected Tropical Diseases 6(12): e1957. doi:10.1371/journal.pntd.0001957.

- M. Lei and **C. Baehr** (2012): Unscented and Ensemble Transform-based Variational Filter. PhysicaD : Nonlinear phenomena 246 (1) 1-14 (2013)  DOI : 10.1016/j.physd.2012.11.006

- **C. Baehr**, C. Beigbeder,  F. Couvreux, A. Dabas and B. Piguet (2012): Retrieval of the turbulent and backscattering properties using a non-linear filtering technique applied to Doppler LIDAR observation. Submitted to J. Ocean Atm. Tech.

- M. Lei, Z. Jing, S. Hu and **C. Baehr** (2012): Iteration and SUT-based Variational Optimization Filter.  Submitted to IEEE Transactions on Signal Processing

- L. Rottner and **C. Baehr** (2012): Particle filters for turbulent parameters estimation from moving sensors. Submitted to J. Ocean Atm. Tech.

- F. Suzat, **C. Baehr** and A. Dabas (2011) : A fast atmospheric turbulent parameters estimation using particle filtering. Application to LIDAR observations. J. Phys. Conf. Ser. Vol 318-7 doi:10.1088/1742-6596/318/7/072019

- S. Rémy, O.Pannekoucke, T. Bergot and **C. Baehr** (2011): Adaptation of a particle filtering method for data assimilation in a 1D numerical model used for fog forecasting . Quarterly Journal of Royal Meteorological Society DOI: 10.1002/qj.915

- **C. Baehr** (2010) : Nonlinear filtering for observations on a random vector field along a random path. Application to atmospheric turbulent velocities, ESAIM: M2AN 44 (5) 921-945 (2010) DOI: 10.1051/m2an/2010047

- O. Pannekoucke and **C. Baehr** (2010) : Kalman filters family in geoscience and beyond chapter in Kalman Filtering. J.M. Gomez Ed. Nova Science Publishers, 2010

- **C. Baehr** and O. Pannekoucke (2010) : Some issues and results on the EnKF and particle filters for meteorological models. Chapter in Chaotic Systems: Theory and Applications, 27-34. DOI No: 10.1142/9789814299725_0004. C. H. Skiadas and I. Dimotikalis Ed. World Scientific, 2010

- M. Lei, **C. Baehr** and P. Del Moral (2010) : Fisher Information Matrix-based Nonlinear System Conversion for State Estimation. IEEE transaction on Control and Automation, 06/2010, 837-841, DOI No: 10.1109/ICCA.2010.5524066.

- M. Lei, P. Del Moral and **C. Baehr** (2010) : Error analysis of approximated PCRLBs for nonlinear dynamics. IEEE transaction on Control and Automation 06/2010, 1988-1993, DOI No: 10.1109/ICCA.2010.5524070.

- **C. Baehr** (2009) : Stochastic modeling and filtering of discrete measurements for a turbulent field. application to measurements of atmospheric wind. Int. Journal Modern Phys. B, 23 (28-29), 5424-5433, DOI No: 10.1142/S0217979209063742

- **C. Baehr** (2008) : Probabilistic models for atmospheric turbulence to filter measurements with particle approximations PhD. Thesis

- **C. Baehr** et al. (1999) : Dynamical Characterization of the FASTEX cyclogenesis cases. Quarterly Journal of the Royal Meteorological Society 125(561): 3469

- **C. Baehr** et al (1999) : Effects of a low-level precursor and frontal stability on cyclogenesis during FASTEX IOP17. Quarterly Journal of the Royal Meteorological Society 125(561): 3415

All the papers are available on http://www.math.univ-toulouse.fr/~baehr/

- Research Management :

    - Member of the Météo-France Research centre GAME scientific committee.
    - Member of the SESAR WP4.7.1, WP 4.7.2, WP 11.2.1 and WP 11.2.2 project management.

- Member of the ANR and Research projects :

    - ANR Research Projects 2009-2011 PREVASSEMBLE; Forecasting and Data assimilation. Subject : Particle Filter in Geosciences Applications with Pr Pierre Del Moral
    - SESAR Joint Undertaking 2009-2016 : SESAR J.U., Meteo-France affiliate of the DGAC/DSNA/DTI ; Work Package 4.7.1 , 4.7.2. 11.2.1

and 11.2.2 : New algorithms and stochastic estimators for the weather environment in the optimization of the commercial aircraft trajectory prediction problem
- EUROCAE WG-85 4D-Navigation working group

- International conferences Board:
    - "International Conference on Ensemble Methods in Geophysical Sciences 2012", 12-16 November 2012 - Scientific Committee + board management.
    - "International Society for Ecological Modelling Conference 2013", 25-30 October 2013, Scientific Committee + Board Management.

- Supervision of researchers fixed term contract:

    - Dr Ming Lei hired with the ANR PREVASSEMBLE funds on « Particle Filter in Geosciences Applications », October 2009 - September 2011
    - Dr Nolwen Huet hired by SESAR funds on « New algorithms and stochastic estimators for the weather environment in the optimization of the commercial aircraft trajectory prediction problem», June 2010 - April 2012.

- PhD students:

    - Antoine Campi « Reconstruction of backscattering and turbulent media using a combination of Doppler and Aerosol LIDAR», October 2012 –
    - Lucie Rottner « Submesh assimilation for non-hydrostatic models of turbulent parameters estimated by particle filtering from Doppler LIDAR observations», October 2012 –
    - Cécile Ichard « Aircraft trajectory optimization in random meteorological fields», October 2012 –

- Tutoring:

    - Master Mathematical Engineering, Univ. Toulouse III, March-Sept 2012, Cécile Ichard: «State of the art in aircraft trajectories optimization in random meteorological medium»

    - Master Research in Ocean and Atmosphere Univ. Toulouse III, Feb-July 2012, Lucie Rottner: «Turbulence parameters learning using non-linear filtering for moving sensors».

    - Master Research in Applied Mathematics, Univ. Toulouse III, Feb-July 2012, Younes Farouj: «Lagrangian methods for turbulent flows».

- Master Research in Physics and Science for Engineering, Orleans University, July-November 2011, Julien Mansion : «Atmospheric Boundary Layer modelling. Stochastic methods for PIV».

- Master Research in Applied Mathematics, Toulouse III university, February-July 2010 , Florian Suzat : « Estimation of the atmospheric turbulent parameters using a Lidar Doppler with interacting particle systems».

- Master Research in Ecology BioStatistics and Modelling Toulouse III University, February-July, Magali Teurlai : « Data Analysis of the Dengue survey in Cambodia from 2002 to 2008: Spatial-temporal study of the disease in the country »

- INSA Engineer School, 4th yrs project:

  - Claire Beigbeder : « Stochastic Algorithms to learn atmospheric turbulence parameters with a Doppler LIDAR», July-September 2011.
  - Florian Faucher : « Theoretical study and Modelling of the wedging of noisy, fast and drifting instrumental measurements with stable measurements perturbed with Poissonian noises », June-September 2009.
  - Laurent Vezard : « A stochastic Lagrangian Model for humid atmosphere», June-September 2009.

- INSA Engineer School, 3rd yrs project:

  - Celia Martinez: « Meteorological Ensemble forecast weighting using air traffic prediction scores», July-September 2012.

- Météo-France Engineer School, Modeling Engineer 2nd yrs project,
  - Lucie Rottner, Mickael Zamo and Hugo Merzisen, January-February 2011, « Evaluation of the possible links between high-resolution deterministic forecast errors and low-resolution ensemble forecast spreading for some meteorological models »
  - Florian Suzat, Niels Oger and Robin Locatelli, January-February 2009,  « Adaptative Data Assimilation using Ensemble Kalman Filter and particle Filters »

- Workshop Organizations:

- Workshop Organizer 2010. 5th cross-meeting Met/AppliedMath : Air traffic modeling and meteorology (sponsorship SMAI + DSNA/DTI) March 08-09th 2010, Météo-France Toulouse.
- Workshop Organizer 2009. 4th cross-meeting Met/AppliedMath (sponsorship SMAI + IMT) March 25th 2009 at University Toulouse III March 26th at Météo-France Toulouse.
- Workshop Organizer 2008. 3rd cross-meeting Met/AppliedMath: Extreme Events + Ensemble Kalman Filter, September 18-19th 2008, Météo-France Toulouse .
- Workshop Organizer 2007. 2nd cross-meeting Met/AppliedMath: Particle Methods in Fluid Mechanics, March 16th 2007, Météo-France Toulouse.
- Workshop Organizer 2006. 1st cross-meeting Met/AppliedMath: PDF methods for fluids dynamics, March 06th 2006, Météo-France Toulouse .

- Last Invited Conferences:

- Chinese Academy of Fisheries Sciences, Pearl River Institute for Fisheries Sciences, Guangzhou, December 09-18th 2011 **C. Baehr** : An example of Wavelet Analysis : relationship between water temperature and phytoplankton.

- Workshop EUROCAE WG85. Madrid (Spain) Septembre 28th 2011 **C. Baehr**, Some studies about the impact of ICAO Met data format.

- Workshop ENAC/DSNA February 17th 2011, **C. Baehr**, Introduction to the meteorological engineering and its application to aeronautics.

- PREVASSEMBLE workshop - ENS/LMD Paris, September 8-9th 2010 **C. Baehr** : Non-linear stochastic filtering and its particle approximation in a geophysical context.

- Data assimilation LEFE/ASSIM workshop - INRIA Paris, December 2009. **C. Baehr** : Non-linear stochastic filtering and its particle approximation for meteorological models.

- 2nd Chaotic Modeling and Simulation International Conference - Chania Crete, Greece June 2009, **C. Baehr** and O. Pannekoucke : Some issues and results on the EnKF and particle filters for meteorological models.

- Météo-SMAI-IMT workshop March 25th 2009, **C. Baehr** : Particle Filters and turbulence. Filtering with high dimensional problems.

- Probability Seminar. Toulouse Mathematical Institute, September 2008. **C. Baehr** : Probabilistic models for atmospheric turbulence to filter measurements with particle approximations