

Sammy Metref

Postdoctoral Researcher
at CIMA/CONICET-UBA/CNRS,
Intendente Güiraldes 2160 – Ciudad Universitaria – Pabellón II – 2do. piso.

Nationality: French

Date of birth: 09/05/87

Email: sammy.metref@cima.fcen.uba.ar

Summary

I have been working for more than 6 years in different mathematical and physical fields using data assimilation (cryptography, climatology, oceanography). These experiences have allowed me to acquire a fine expertise in data assimilation and geosciences. I have also been teaching Mathematics and Computational Engineering for 3 years at the License degree of the Université Joseph Fourier. My current field of research is aimed at using data assimilation in order to detect and attribute causal events in climatological systems.

Education

Doctor of Philosophy (Ph.D.) - Applied Mathematics to geophysics, **2012 - 2015** *Université de Grenoble Alpes*

Master 2 (Research) - Atmospheric and oceanic dynamics, **2012** *Université Pierre et Marie Curie (Paris VI)*

Master of Engineering (M.Eng.) - Mathematical Engineering and Computing, **2012** *Ecole nationale des Ponts et Chaussées*

Master 1 - Applied mathematics - Specialization : Scientific Calculus, **2009** *Université Paul Sabatier (Toulouse III)*

License - *Fundamental Mathematics*, **2008** *Université Paul Sabatier (Toulouse III)*

Skills & Expertise

Scientific : Data assimilation, Probability, Geosciences, Numerical analysis, Statistics

Numerical : Ferret , C , C++ , Fortran , Matlab , Python , LaTeX

Languages : French (native), English (fluent), Spanish (fluent)

Experiences

Research: January 2016 – actual position (1 year and 9 months) **DADA: Climate change detection and attribution using data assimilation**

Internship at CIMA/CONICET-UBA/CNRS (Argentina) supervised by **A. Hannart**.

How can observations be used to best evidence the influence on climate of human activities, among other forcings ? Purely statistical methods of detection and attribution were designed to answer this question which is of high societal relevance when it comes to adaptation and mitigation policy. The DADA project proposes a new paradigm using data assimilation (DA) methods and the DA probabilistic framework to approach that issue.

Research and teaching: October 2012 – December 2015 (3 years 3 months) **Non Gaussian Data Assimilation Comparison applied to marine biogeochemistry**

PhD candidate – SANGOMA Project at MEOM Team/LGGE – CNRS (France) supervised by **E. Cosme** and **P. Brasseur**.

The PhD project aims at developing and testing advanced data assimilation methods based on the use of ensembles, with emphasis on non-Gaussian methods. By the use of complex ensemble evaluation scores, the behavior of various data assimilation methods is assessed in a coupled dynamical-biogeochemical context.

Research: March 2012 - July 2012 (5 months) *4D-Var ensemble data assimilation method*
Internship at LMD - ENS Ulm (France) supervised by O.Talagrand and M.Jardak.

Comparison between classic data assimilation methods (4D-Var, EnKF ...) and a new 4D-Var ensemble data assimilation method created and studied by O.Talagrand and M.Jardak (LMD). Experiments were conducted on a Spherical Shallow Water model and on a Korteweg de Vries model.

Research: September 2010 - July 2011 (11 months) *Weak constraint in variational data assimilation*

Internship at ESCER - UQAM (Canada) supervised by P.Gauthier.

Comparison of primal (4D-Var) and dual (4D-PSAS) variational approaches in a weak constraint data assimilation problem. Work based on [Courtier, 1997] theoretically proving the equivalence in between primal and dual approaches.

Research: May 2009 – July 2009 (3 months) *Cryptography using data assimilation*

Internship at LATTIS – INSA Toulouse (France) supervised by L.Cot.

Comparison of Least Squares methods and Kalman Filters controlling parameters in chaotic cryptography. The goal was to retrieve two parameters and the initial condition of chaotic series observing a final 2-variable state vector.

Publications

[1] Metref, S., Cosme, E., Snyder, C., and Brasseur, P., ***A non-gaussian analysis scheme using rank histograms for ensemble data assimilation.*** Nonlin. Processes Geophys., 21 :869–885, 2014.

[2] Metref, S., Hannart, A., Ruiz, J., Bocquet M., Carrassi A. and Ghil, M., ***Estimating model evidence using ensemble-based data assimilation with localization - The model selection problem.*** Quarterly Journal of Meteorological Sciences, submitted.

[3] Metref, S., Hannart, A., Ruiz, J., Bocquet M. and Carrassi A., ***Climate change attribution using local contextual model evidence estimation.*** In prep.

Major oral communications

7th WMO symposium: *Data assimilation in geosciences, Florianopolis (Brasil), 2017 Attribution of climatic events using a data assimilation-based formulation of model evidence*, Metref S., Hannart A., Ruiz J., Bocquet M., Carrassi A. and Ghil M.

10th EnKF Workshop – IRIS, Bergen (Norway), 2017 *Estimating model evidence using ensemble-based data assimilation with localization*, Metref S., Hannart A., Ruiz J., Bocquet M., Carrassi A. and Ghil M.

EnDA International Workshop: *Ensemble data assimilation, Les Houches (Fr), 2015 Ensemble data assimilation in a marine biogeochemical system with a focus on non-Gaussianity*, Metref S., Cosme E., Brasseur P., Brankart J.-M. and Gregorio S.

Colloque National d'Assimilation: *Data assimilation, Toulouse (Fr), 2015 Evaluation de filtres stochastiques pour l'assimilation non-Gaussienne dans un modele couple dynamique-biogeochimie marine en mer Ligurę* Metref S., Cosme E., Brasseur P., Brankart J.-M. et Gregorio S.

6th WMO symposium: *Data assimilation in geosciences, Washington (USA), 2012 A non-Gaussian analysis scheme using rank histograms for ensemble data assimilation*, Metref S., Cosme E., Snyder C. and Brasseur P.

Teachings

2014-2015 : 71.75h

- *Mathématiques Outils Pour Les Sciences De L'Ingénierie*(GDMAT116) – TD – L1

- *Mathématiques Outils Pour Les Sciences De L'Ingénieur* (GDMAT116) – Cours-TD – L1

2013-2014 : 76.5h

- *Mathématiques Outils Pour Les Sciences De L'Ingénieur* (GDMAT116) – TD – L1

- *Mathématiques Outils Pour Les Sciences De L'Ingénieur* (GDMAT116) – Cours-TD – L1

2012-2013 : 48.25h

- *Algèbre Linéaire Et Géométrie Élémentaire* (GDMAT112) – Cours-TD – L1

- *Mathématiques Pour L'Ingénieur* (GDMAT113) – Cours-TD – L1

- *Découverte Des Mathématiques Appliquées* (GDMAT120) – TPI – L1

Measurement campaigns

MoorSPICE (USA/France), 1-month cruise in the Salomon sea, in charge of oxygen measurements and treatments, **2014**

MOOSE (France), 10-day cruise in the Golfe du Lion, in charge of chemical measurements, **2012**

Other trainings

- *Initiation à l'esprit critique et Zététique Session ZTT-14*, 3 days, **2015**

- *Atmospheric and oceanographic numerical modeling* (Grenoble), 1 week, **2014**

- *Didactique générale dans l'enseignement supérieur* (DIDAC), 2 days, **2014**

- *From chaos to complexity*, 3 days, **2014**

- *Introduction to data assimilation - Winter School* (Grenoble), 1 week, **2013**

- *Mise en page - article, document professionnel* (MEPA), 3 days, **2013**

- *Mémoires et pseudo-sciences : quand les sciences se mettent en scène* (SM), 3 days, **2013**

- *Mise en page - poster* (MEPP), 1 day, **2013**

- *L'évaluation de nos enseignements* (EVAL ENS), 1 day, **2013**

- *Introduction au métier d'Enseignant Chercheur* (Stage résidentiel d'Autrans), 3 days, **2012**

References

Alexis Hannart,

Chercheur senior – OURANOS, Montréal, Canada

alexis.hannart@ouranos.ca

Marc Bocquet,

Directeur de recherche – CNRS, CEREA- Ecole Nationale des Ponts et Chaussées France

bocquet@cerea.enpc.fr

Emmanuel Cosme,

Maître de conférence – Université Joseph Fourier, Laboratoire de Glaciologie et Géophysique de l'Environnement- Equipe MEOM, France emmanuel.cosme@lgge.obs.ujf-grenoble.fr

Olivier Talagrand,

Directeur de recherche émérite – CNRS, Laboratoire de Méétéorologie Dynamique – Ecole Normale Supérieure d'Ulme France talagrand@lmd.fr

Pierre Gauthier,

Chercheur senior – Université du Québec à Montréal, Laboratoire ESCER, Canada

gauthier.pierre@uqam.ca