Alban Farchi

Ingénieur des Ponts, des Eaux et des Forêts.
Research fellow in data assimilation.

Experience

2019–   **Research fellow** in mathematics applied to geosciences (data assimilation),
CEREA (atmospheric environment centre), École des Ponts ParisTech, Champs-sur-Marne, France.
- Collaboration with ECMWF (starting 2020).
  - Main objective: model error correction with neural networks.
  - Development of hybrid data assimilation / machine learning methods to train the network from sparse and noisy observations.
  - Development of a new weak-constraint 4D-Var variant to train neural networks online.
  - Implementation in the Object-Oriented Prediction System (OOPS) used at ECMWF for operational data assimilation, using a newly developed neural network library in Fortran: `github.com/cerea-daml/fnn`.
  - Proof of concept with low-order models: 3 articles published.
  - Application to operational weather forecast with the Integrated Forecasting System (IFS) developed at ECMWF (work in progress).
- Co-supervision of a PhD student (2019-2022).
  - Development of ensemble data assimilation methods for online neural network training.
  - Development of neural network architecture for model error correction in an advanced quasi geostrophic model.
  - 1 article published, 1 article in preparation.
- Participation to the Argonaut, CoCO2, and Lock'Air projects (starting 2021).
  - Argonaut is a funded by the ANR (french national reasearch agency), Lock'Air is funded by ADEME (french institute), and CoCO2 is funded by the EU (H2020 call).
  - Use inverse modelling and machine learning to monitor pollutant emissions from space.
  - Development of new metrics for pollutant plume inversion at high resolution.
  - Development of neural networks for CO_2 plume detection and segmentation.
  - Co-supervision of two post-doctoral research fellows.
  - 2 articles published, 1 in review, 2 in preparation.
- Participation to the SASIP project (starting 2021).
  - SASIP is funded by the Schmidt Futures fundation (VESRI call).
  - Development of hybrid data assimilation and machine learning methods for the emulation of Sea Ice dynamics.
  - Co-supervision of one post-doctoral research fellows and one phd student.
  - 1 article published, 1 in review, 1 in preparation.

2016–2019   **PhD student** in mathematics applied to geosciences (data assimilation),
CEREA (atmospheric environment centre), École des Ponts ParisTech, Champs-sur-Marne, France.
- Theoretical research about localisation in ensemble data assimilation.
- Supervisor: Prof. Marc Bocquet.
- Localisation in the particle filter:
  - Review of the literature related to localisation and the particle filter.
  - New implementations of local particle filtering, using optimal transport approaches.
  - Systematic comparison of local particle filter algorithms with low- and medium-order models.
  - Application to a realistic chemical-transport model at continental scale.
- Covariance localisation in the ensemble Kalman filter:
  - Study about the efficiency and consistency of covariance localisation.
  - Application to the assimilation of satellite radiances in low-order models.
- 3 articles published.
- oral presentations in several national and international conferences.

Education

2016 – 2019	**PhD** in mathematics applied to geosciences (data assimilation), Supervisor: Prof. Marc Bocquet, Title of the thesis: On the localisation of ensemble data assimilation methods, *École des Ponts ParisTech*, *Université Paris-Est*, Champs-sur-Marne, France.
2015 – 2016	**Mastère spécialisé**, public policy for sustainable development, IPEF background, *École des Ponts ParisTech*, *Agro ParisTech*, Paris.
2014 – 2015	**Masters** in Ocean, Atmosphere, Climate and Space Observation, valedictorian, *Université Pierre et Marie Curie*, Paris.
2011 – 2014	**Engineering degree**, major in fundamental physics and mathematics, *École polytechnique*, Palaiseau.

Skills

Programming	C/C++, Python, Fortran, Java, Caml.
Operating Systems	OSX, Linux.
Languages	French (native), English (fluent), German.

International conferences

July 2023	**CRiSM Workshop** (Warwick, United Kingdom), oral presentation [invited].
June 2023	**SIAM conference** (Bergen, Norway), oral presentation [invited].
March 2023	**Workshop on math. approaches of data assim.** (Banff, Canada), oral pres. [invited].
November 2022	**ECMWF-ESA Workshop on Machine Learning**, oral presentation.
May 2022	**EGU General Assembly**, oral presentation.
November 2021	**ECMWF-ESA Workshop on Machine Learning**, oral presentation.
September 2021	**WCRP-WWRP Symposium on Data Assimilation and Reanalysis**, oral presentation.
June 2021	**International Conference on Computational Science**, oral presentation.
April 2021	**EGU General Assembly**, oral presentation.
April 2021	**ECMWF Workshop for Member and Co-operating States**, oral presentation.
October 2020	**ECMWF-ESA Workshop on Machine Learning**, poster.
November 2019	**International workshop at Institut Henri Poincaré** (Paris, France), oral presentation.
June 2019	**International EnKF meeting** (Voss, Norway), oral presentation.
April 2019	**EGU General Assembly** (Vienna, Austria), oral presentation.
May 2018	**International EnKF meeting** (Bergen, Norway), oral presentation.
April 2018	**EGU General Assembly** (Vienna, Austria), oral presentation.
October 2017	**Memorial Symposium** in the legacy of Prof. Anna Trevisan (Bologna, Italy), oral presentation.