

Curriculum Vitae: Jérôme E. Barré

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EDUCATION

- 2009-2012** - **PhD** thesis on satellite data assimilation. CNRM (Centre National de Recherches Meteorologiques) Météo France.
Thesis title: *“Data assimilation studies in a chemistry transport model using limb and nadir satellite geometries”*.
- Winter 2009 : Data assimilations courses at the University Joseph Fourier, Grenoble, France with professors E. Blayo, E. Cosme and A. Vidard.
 - Summer 2011: NCAS climate modelling summer school, Cambridge, United-Kingdom
- 2007-2009** - **Msc** Ocean, Atmosphere and Climate Sciences: specialisation in remote sensing. University of Pierre et Marie Curie-Paris VI.
Thesis title: *“3-D analysis of carbon dioxide fields: comparisons between ACE-FTS measurements and a tracer model outputs.”*
- 2005-2007** - Licence (equivalent of **Bsc**) of applied physics in earth science. University of Pierre et Marie Curie-Paris VI.

EMPLOYMENT & EXPERIENCE

- 2014-Present** -**Project Scientist I**: NCAR (National Center for Atmospheric Research): Data assimilation research for atmospheric composition and air-quality
- **KORUS-AQ field campaign** : May-June 2016, Daily chemical forecasting.
- 2013-2014** - **Post Doctoral Fellow**: (NCAR) CESM CAM-Chem data assimilation and Observing Simulation System Experiment. Implementing the DART assimilation scheme for CAM-Chem. Developing an observation simulator for a geosynchronous satellite constellation.
- **Research Interests**: Global scale atmospheric tropospheric modelling. Integrating measurements meteorological and chemical measurements into the CESM CAM-Chem model. Assessing the impact of future satellite missions for air quality.
- **SEAC4RS field campaign** : August 2014, Daily chemical forecasting.
- 2009-2012** - **PhD Candidate**: at CNRM (Centre National de Recherches Météorologiques) Météo France. Chemical data assimilation experiments at regional scale and global scale.
- **Research Interests**: UTLS chemistry and dynamics. Stratospheric and tropospheric data assimilation two remote sensing viewing geometries. Effects on the model horizontal resolution on UTLS chemistry and dynamics.
- Spr./Sum. 2009** - **Research Assistant**: LMD (Laboratoire de Météorologie Dynamique), CNRS, IPSL. 3D analysis of atmospheric carbon dioxide fields: comparisons between ACE-FTS retrievals and the FLEXPART model.
- Spr./Sum. 2008** - **Research Assitant**: LOCEAN (Laboratoire d’Océanographie et du Climat : Expérimentation et Approches Numériques), CNRS, IPSL. Study of coastal waves in the tropical East-Atlantic ocean with satellite data TOPEX/POSEIDON and JASON.

PRINCIPAL SCIENTIFIC ACCOMPLISHMENTS

Strong experience in satellite data assimilation for atmospheric chemistry. Understanding in remote sensing and global/regional atmospheric modeling. Assessing the model errors using data assimilation techniques and try to find the causes of model misrepresentations. Assessing data assimilation sub-optimality and envisioning novel techniques and algorithms in order to enhance atmospheric composition predictability and forecasting skills.

- Co-develops a box model data assimilation system (with Univ. Munich) to understand interaction between data assimilation and non-linear effects of gas-phase chemistry. The goal of this project is to design and envision new data assimilation methods for atmospheric chemistry (and highly non-linear systems in general) but also for educational and community purpose.
- Lead the effort of implementing an operational global forecasting system using CAM-Chem DART, for field campaign deployment. CAM-Chem DART successfully provided chemical forecast during the KORUS-AQ campaign.
- Use a novel computational method to simulate a constellation of geosynchronous satellites (located over North America, Europe and Eastern Asia) for monitoring air quality and atmospheric composition. Observing System Simulation Experiment (OSSE) with the CAM-Chem DART data assimilation system have been performed in order to evaluate the impacts of a potential geosynchronous constellation for atmospheric composition and air quality.
- Lead the effort to implement the DART assimilation scheme for chemistry into the CESM CAM-Chem model. This work focuses on adding chemical data assimilation to the current CESM/DART assimilation system. Multi-variate data assimilation scheme is applied which can take into account meteorological and chemical variables. The data assimilation system has been developed for MOPITT and IASI observations as well as MODIS AOD. Designed a novel ensemble emission/source inversion methodology for CO, organic carbon and black carbon and applicable to other tracers.
- Assimilate stratospheric ozone profiles from MLS (Microwave Limb Sounder) into the MOCAGE Chemistry Transport Model (CTM) to study Stratosphere-Troposphere Exchange (STE) and characterize systematic model errors on the UTLS ozone (O_3). Use MLS stratospheric O_3 profiles and IASI tropospheric O_3 columns to improve the O_3 fields in the stratosphere and troposphere. Investigation of the total ozone column variability shows that UTLS ozone plays an important role. Using CO and O_3 data assimilation to diagnose properties of the UTLS.

COMPUTER SCIENCE SKILLS

Strong experience with running and developing massively parallel codes such as forecasting systems for earth system models (NCAR CESM-DART, WRF-Chem, MOCAGE-PALM)

Ability to develop and deliver code in a constrained time schedule : operational forecasting tools, model development and improvement, pre and post processing analysis

Languages :

Very strong experience in Fortran, Python, Shellscript (bash,tcsh,ksh,sh). Developing codes daily in those languages since 2012.

Good knowledge of C++, IDL, Matlab, Javascript, html

Perfect knowledge of the Unix/Linux environment

REFERENCES

- David P. Edwards Laboratory Director ACOM, NCAR, USA
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- Vincent-Henri Peuch Head of Atmospheric Composition Division, ECMWF, UK
vincent-henri.peuch@ecmwf.int
- William A. Lahoz Senior Scientist at NILU, Norway
william.a.lahoz@nilu.no
- Arlindo Da Silva Research Meteorologist, NASA Goddard Space Flight Center, USA
arlindo.m.dasilva@nasa.gov

WRITTEN PUBLICATIONS

- 2017** **Barré, J.**, Eckl, M., Knote, C.,: Background Error Analysis Testbed with BOX models (BEATBOX): Application to chemical mechanisms, *Geoscientific Model Development, In preparation*.
- Edwards, D., **Barré, J.**, Worden, H.,: Quantifying fire emissions and associated aerosols species using assimilation of satellite carbon monoxide retrievals: the Washington fires case study, *J. Geophys. Res. Atmos.*, In preparation.
- B. Gaubert, H. M. Worden, A. F. J. Arellano, L. K. Emmons, S. Tilmes, **J. Barré**, S. Martinez Alonso, F. Vitt, J. L. Anderson, F. Alkemade, S. Houweling and D. P. Edwards: Chemical feedback from decreasing carbon monoxide emissions, submitted to *Geophysical Research Letters*.
- 2016** Gaubert, B., A. Arellano, **J. Barré**, et al.: Toward a chemical reanalysis in a coupled chemistry-climate model: An evaluation of MOPITT CO assimilation and its impact on tropospheric composition, *J. Geophys. Res. Atmos.*, 121, 7310–7343, doi:10.1002/2016JD024863.
- Barré, J.**, et al., (2016): On the feasibility of monitoring carbon monoxide in the lower troposphere from a constellation of northern hemisphere geostationary satellites: Global scale assimilation experiments (Part II). *Atmospheric Environment*, 140, 188-201, doi:10.1016/j.atmosenv.2016.06.001.
- 2015** **Barré, J.**, et al. (2015), Assessing the impacts of assimilating IASI and MOPITT CO retrievals using CESM-CAM-chem and DART, *J. Geophys. Res. Atmos.*, 120, doi:10.1002/2015JD023467.
- Descombes, G., T.D. Auligné, F. Vandenberghe, D.M. Barker, and **J. Barré**, 2015: Generalized background error covariance matrix model (GEN_BE v2.0). *Geoscientific Model Development*, 8, 669-696, DOI: 10.5194/gmd-8-669-2015.
- Barré, J.**, D. Edwards, H. Worden, A. Da Silva, W. Lahoz: On the feasibility of monitoring Carbon Monoxide in the lower troposphere from a constellation of Northern Hemisphere geostationary satellites. (Part 1), *Atmospheric Environment* doi:10.1016/j.atmosenv.2015.04.069, 2015

- 2014** El Amraoui, L., J.L. Attié, P. Ricaud, W.A. Lahoz, A. Piacentini, V.H. Peuch, J.X. Warner, R. Abida, **J. Barré**, and R. Zbinden, 2014: Tropospheric CO vertical profiles deduced from total columns using data assimilation: Methodology and validation. *Atmospheric Measurement Techniques*, 7, 3035-3057, DOI: 10.5194/amt-7-3035-2014.
- G. Foret, M. Eremenko, J. Cuesta, P. Sellitto, **J. Barré**, B. Gaubert, A. Coman, G. Dufour, and M. Beekmann: Ozone pollution: What can we see from space? A case study, *J. Geophys. Res. Atmos.*, 119, 8476–8499, doi:10.1002/2013JD021340.
- Barré, J.**, Peuch, V.-H., Lahoz, W. A., Attié, J.-L., Josse, B., Piacentini, A., Eremenko, M., Dufour, G., Nedelec, P., von Clarmann, T. and El Amraoui, L. (2014), Combined data assimilation of ozone tropospheric columns and stratospheric profiles in a high-resolution CTM. *Q.J.R. Meteorol. Soc.*. doi: 10.1002/qj.2176
- 2013** **Barré, J.**, El Amraoui, L., Ricaud, P., Lahoz, W. A., Attié, J.-L., Peuch, V.-H., Josse, B., and Marécal, V.: Diagnosing the transition layer at extra-tropical latitudes using MLS O₃ and MOPITT CO analyses, *Atmos. Chem. Phys.*, 13, 7225-7240, doi:10.5194/acp-13-7225-2013, 2013.
- 2012** **Barré, J.**, Peuch, V.-H., Attié, J.-L., El Amraoui, L., Lahoz, W. A., Josse, B., Claeysman, M., and Nédélec, P.: Stratosphere-troposphere ozone exchange from high resolution MLS ozone analyses, *Atmos. Chem. Phys.*, 12, 6129-6144, doi:10.5194/acp-12-6129-2012, 2012
- 2011** Claeysman, M.; Attie, J.L.; Peuch, V.H.; El Amraoui, L.; Lahoz, W.A.; Josse, B.; Joly, M.; **Barré, J.**; Ricaud, P.; Massart, S.; Piacentini, A.; Clarmann, T.von; Höpfner, M.; Orphal, J.; Flaud, J.M.; Edwards, D.P.: A thermal infrared instrument onboard a geostationary platform for CO and O₃ measurements in the lowermost troposphere: observing system simulation experiments (OSSE). *Atmospheric Measurement Techniques*, 4(2011) S.1637-1661 doi:10.5194/amt-4-1637-2011.

ORAL PUBLICATIONS & CONFERENCES

- 2017** **J. Barré** et al.: Quantifying fire emissions and associated aerosols species using assimilation of satellite carbon monoxide retrievals., AMS Meeting, Seattle WA, USA, Jan 2017
- 2016** **J. Barré** et al.: Quantifying fire emissions and associated aerosols species using assimilation of satellite carbon monoxide retrievals., AGU Fall Meeting, San Fransisco CA, USA, Dec 2016
- J. Barré** et al.: The atmospheric composition satellite constellation for air quality and climate science. Second OSSE workshop, ECMWF, UK, Nov 2016
- J. Barré** et al.: On inferring the unobserved chemical state of the atmosphere: box model experiments, 14th IGAC confrence, Breckenridge CO, USA, Sept 2016
- 2015** **J. Barré**: Chemical data assimilation for atmospheric composition and climate science, NCAR seminar, Dec 2015, Boulder CO. USA
- J. Barré** et al.: Carbon Monoxide Data Assimilation for Atmospheric Composition and

Climate Science: Evaluating Performance with Current and Future Observations, AGU Fall Meeting, San Francisco CA, USA, 2015.

J. Barré et al.: Carbon monoxide data assimilation for atmospheric composition and climate science: Evaluating performance with Observing System Simulation Experiments, EUMETSAT 2015 conference, Sept 2015, Toulouse France

J. Barré et al.: Carbon monoxide data assimilation for atmospheric composition and climate science: Evaluating performance with current and future observations, ECMWF seminars, Sept 2015, Reading, United Kingdom

J. Barré et al.: Carbon monoxide data assimilation for atmospheric composition and climate science: Evaluating performance with current and future observations, LATMOS-IPSL seminars, Sept 2015, Paris, France

J. Barré et al.: Overview of chemical data assimilation activities in CAM-Chem DART, 20th Annual CESM Workshop, 15-18 June 2015, Breckenridge Colorado.

2014

J. Barré, D. P. Edwards, H. M. Worden, A. F. Arellano, B. Gaubert, J. L. Anderson, A. P. Mizzi, W. A. Lahoz: The atmospheric composition geostationary satellite constellation for air quality and climate science: Evaluating performance with Observation System Simulation Experiments: AGU Fall Meeting, San Francisco CA, USA, 2014.

J. Barré, D. P. Edwards, A. F. Arellano, B. Gaubert, H. M. Worden, J. L. Anderson, A. P. Mizzi: Assessment of IASI CO and MOPITT CO Data Assimilation in CAM-Chem: AGU Fall Meeting, San Francisco CA, USA, 2014.

J. Barré et al., Observing Simulation System Experiments: A Geostationary Constellation for Atmospheric Chemistry, GMAO seminars, August 2014, Greenbelt, MD, USA

J. Barré et al., (Keynote) Multivariate chemical data assimilation and chemistry - dynamics interactions: WOSC Conference, August 2014, Montreal Québec, Canada

J. Barré et al., Multivariate chemical data assimilation and chemistry-meteorology interactions, Annual CESM workshop, June 2014, Breckenridge CO, USA

J. Barré, A. Arellano, K. Raeder, N. Collins: Chemical data assimilation in CAM-Chem, CESM Chemistry Climate Working Group, 10-11 February 2014, NCAR, Boulder CO, USA

2013

J. Barré, H. Worden, D. Edwards, A. Arellano, W. Lahoz: Monitoring lowermost tropospheric carbon monoxide from a geostationary constellation: observation simulations. AGU Fall Meeting, San Francisco CA, USA, 2013.

2012

PhD Defense: Data assimilation studies in a chemistry transport model using limb and nadir geometries.

J. Barré et al.,: Combined data assimilation of ozone tropospheric columns and stratospheric profiles in a regional CTM. ADOMOCA II workshop, Les Lecques, France, September 2012.

J. Barré, V.-H. Peuch, J.-L. Attié, L. El Amraoui, W. A. Lahoz, M. Eremenko, G.

Dufour, B. Josse, A. Piacentini, P. Nedelec, and T. von Clarmann : Combined data assimilation of ozone tropospheric columns and stratospheric profiles in a regional CTM. EUMETSAT satellite conference, Sopot, Poland, September 2012.

2011

Barré, J., et al.,: Stratosphere-troposphere ozone exchange from high resolution MLS ozone analyses ADOMOCA Iworkshop, Les lecques, France, October 2011.

Barré, J., Peuch, V.-H., Attié, J.-L., El Amraoui, L., Lahoz, W. A., Josse, B., Claeysman, M., and Nédélec, P.: Stratosphere-troposphere ozone exchange from high resolution MLS ozone analyses, AGU, San Fransisco CA, USA, 2011.