

Zhibin Sun

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Research interests:

- Application and development of data assimilation algorithms to Earth dynamical systems
- Large-scale numerical simulations of nonlinear dynamic systems

Research experience:

- Developing and implementing an ensemble-based data assimilation framework for geomagnetic and dynamo communities.
- Developing and implementing innovative assimilation algorithms for NASA's first geomagnetic data assimilation system
- Participated in the development of NASA's next generation of comprehensive geomagnetic field model (CM5)
- Developed and implemented an EnOI-based data assimilation algorithm for Princeton Ocean Model (POM)
- Used the improved POM for regional modeling of Gulf of Mexico, and Mid-Atlantic Bight
- Developed data assimilation algorithms for multi-source satellite data analysis, and implemented the algorithms to calibrate AIRS (satellite) CO data by utilizing TES (satellite) CO data
- Based on the least-squares with linear inequality constraints method, developed a new algorithm to implement fully constrained linear spectral mixture analysis in remote sensing.

Research skills:

Extensive knowledge of data assimilation theories and algorithm development
Many years of experience in parallel computation
Many years of experience in large-scale numerical computation

Computing skills:

Fortran 77/90, C/C++, MPI, Matlab, Unix/Linux

Education:

PhD Aug, 2007 University of Maryland, Baltimore County, Applied Mathematics
Advisors: Dr. Weijia Kuang, Dr. Andrew Tangborn & Dr. Matthias K. Gobbert

Dissertation: "Geomagnetic Data Assimilation Using Ensemble Methods to Estimate Forecast Error Covariance"

MS May, 2004 University of Maryland, Baltimore County, Applied Mathematics
MS Jun, 2000 Central South University, China, Applied Mathematics
BS Jun, 1997 Central South University, China, Applied Mathematics

Employment History:

Research Scientist	Colorado State University	Apr, 2014 to present
Research Scientist	Universities Space Research Association	July, 2011 to Aug, 2013
Visiting Research Associate	Goddard Earth Sciences and Technology Center, University of Maryland, Baltimore County	Apr, 2010 to Jun, 2011
Postdoctoral Research Associate	Atmospheric and Oceanic Sciences Program, Princeton University	Mar, 2008 to Mar, 2010
Postdoctoral Researcher	Joint Center for Earth Systems Technology, University of Maryland, Baltimore County	Sep, 2007 to Feb, 2008
Research Assistant	Joint Center for Earth Systems Technology, University of Maryland, Baltimore County	Jan, 2004 to Aug, 2007
Teaching Assistant	Department of Mathematics and Statistics, University of Maryland, Baltimore County	Aug, 2002 to Dec, 2003
Lecturer	School of Computer Engineering and Science, Shanghai University, China	July, 2000 to Jun, 2002

Publications:

1. Sun, Z. and W. Kuang, An ensemble algorithm based component for geomagnetic data assimilation, *Terrestrial, Atmospheric and Oceanic Sciences*. (accepted)
2. Warner, J. X., Yang, R., Wei, Z., Carminati, F., Tangborn, A., Sun, Z., Lahoz, W., Attié, J.-L., El Amraoui, L., and Duncan, B.: Global carbon monoxide products from combined AIRS, TES and MLS measurements on A-train satellites, *Atmos. Chem. Phys.*, 14, 103-114, doi:10.5194/acp-14-103-2014, 2014
3. Sun, Z., L.-Y. Oey and Y.-H. Zhou, Skill-Assessments of Statistical and Ensemble Kalman-Filter Data Assimilative Analyses using Surface and Deep Observations in the Gulf of Mexico, *Frontiers of Earth Science*, 7, 271-281, doi:10.1007/s11707-013-0377-8, 2013
4. Zhou, Y.-H., Mayhew, G., Sun, Z., Xu, X., Zou, F. and Wright, F. A. (2013), Space-time clustering and the permutation moments of quadratic forms. *Stat.* doi: 10.1002/sta4.37

5. L.-Y. Oey, Y.-L. Chang, Z.-B. Sun and X.-H. Lin, Topocautics, *Ocean Modelling*, 29, 277-286, 2009
6. Tangborn, A., R. Cooper, S. Pawson and Z. Sun, Chemical Source Inversion Using Assimilated Constituent Observations in an Idealized Two-dimensional System, *Monthly Weather Review*, 137, 3013-3025, 2009
7. Kuang, W., A. Tangborn, W. Jiang, D. Liu, Z. Sun, J. Bloxham and Z. Wei, MoSST_DAS: the first generation geomagnetic data assimilation framework, *Communications in Computational Physics*, 3, 85-108, 2008
8. Sun, Z., A. Tangborn and W. Kuang, Data Assimilation in a Sparsely Observed MHD System, *Nonlinear Processes in Geophysics*, 14, 1-12, 2007
9. Kuang, W., Z. Sun, A. Tangborn, D. Liu, W. Jiang, Constructing numerical geodynamo with surface observations: a geomagnetic data assimilation approach, in *Proceedings of the First SWARM International Science Meeting* (ESA, WPP-261), 2006
10. Sun, Z., C.-I. Chang, H. Ren, JO Jensen, A least-squares approach to fully constrained linear spectral mixture analysis using linear inequality constraints, *Proceedings of SPIE*, 5159, 349, 2004

Conference and Seminar Presentations:

2012 CIG Geodynamo Developer Meeting

Title: *Enabling CIG geomagnetic data assimilation: Algorithm, Framework and Implementation*

Authors: Kuang, W; Sun, Z; Jiang, W & Tangborn, A

Oct 8-10, 2012,
Boulder, CO

2011 AGU Fall Meeting

Title: *Magnetic fields of the solar system: A comparative planetology toolkit*

Authors: Joseph B Nicholas, Michael E Purucker, Catherine L Johnson, Terence J Sabaka1, Nils Olsen, Zhibin Sun, Manar Al Asad, Brian Jay Anderson, Haje Korth, James A Slavin, Igor I Alexeev, Elena Semenovna Belenkaya, Roger J Phillips, Sean C Solomon, Robert J Lillis, Benoit Langlais, Reka Moldovan Winslow, Christopher T Russell, Michele Karen Dougherty, Maria T Zuber

Dec 5 - 9, 2011,
San Francisco, CA

2007 AGU Fall Meeting

Title: *Application of Ensemble Techniques in Geomagnetic Data Assimilation*

Authors: Sun, Z; Tangborn, A & Kuang, W

Dec 10 - 14, 2007,
San Francisco, CA

NASA/GMAO Seminar at NASA/GSFC (invited talk)

Title: *Geomagnetic data Assimilation*

Oct 25, 2007,
Greenbelt, MD

Differential Equations Seminar at University of Maryland, Baltimore County (invited seminar)

Title: *Geomagnetic data Assimilation*

Apr 9, 2007,
Baltimore, MD

2006 AGU Fall Meeting

Title: *Geomagnetic Data Assimilation (talk)*

Authors: Sun, Z; Tangborn, A & Kuang, W

Dec 11 - 15, 2006,
San Francisco, CA

10th Symposium of SEDI

July 9 -14, 2006,

1. Title: *Error Covariances Derived from MoSST Core Dynamics Model* Prague, Czech Republic
 Authors: Zhibin Sun, Andrew Tangborn, Weijia Kuang, Don Liu & Weiyuan Jiang
2. Title: *MoSST_{DAS}: The First Generation Geomagnetic Data Assimilation Framework*
 Authors: Weijia Kuang, Andrew Tangborn, Weiyuan Jiang, Don Liu & Zhibin Sun
- 2006 Joint Assembly Meeting** May 23 - 26, 2005, Baltimore, MD
1. Title: *Geomagnetic Data Assimilation in MoSST Core Model*
 Authors: Sun, Z; Tangborn, A & Kuang, W
2. Title: *Observing System Simulation Experiments in Geomagnetic Data Assimilation*
 Authors: Liu, D; Kuang, W; Tangborn, A; Sun, Z; Jiang, W & Bloxham, J
- First Swarm International Science Meeting** May 3 - 5, 2006, Nantes, France
 Title: *Geomagnetic Data Assimilation with MoSST Core Model*
 Authors: Z. Sun, A. Tangborn, W. Kuang & W. Jiang
- 2005 AGU Fall Meeting** Dec 5 - 9, 2005, San Francisco, CA
1. Title: *Geomagnetic Data Assimilation Using Ensemble Error Covariance Estimation*
 Authors: Sun, Z; Tangborn, A; Kuang, W; Liu, D & Jiang, W
2. Title: *Scalable Numerical Dynamo Model Developed as a Component of Geomagnetic Data Assimilation Framework*
 Authors: Jiang, W; Kuang, W; Sun, Z; Liu, D & Tangborn, A
3. Title: *Studies of Synthetic Observation Data Assimilation into Geodynamo Solutions: Understanding the Effects of Rayleigh Number and Changes in Solution Error Due to Data Assimilation*
 Authors: Liu, D; Kuang, W; Tangborn, A; Sun, Z; Jiang, W & Bloxham, J
4. Title: *Development of Geomagnetic Data Assimilation Framework: the Challenges and Progress*
 Authors: Kuang, W; Tangborn, A; Sun, Z; Liu, D; Jiang, W; Sabaka, T & Bloxham, J
- 2005 Joint Assembly Meeting** May 23 - 27, 2005, New Orleans, LA
 Title: *Ensemble Calculation of Error Covariances in the MoSST Core Dynamics Model*
 Authors: Sun, Z; Liu, D; Jiang, W; Tangborn, A & Kuang, W
- 2004 AGU Fall Meeting** Dec 13 - 17, 2004, San Francisco, CA
 Title: *Geomagnetic Data Assimilation: A Method for Determining Error Covariances*
 Authors: Sun, Z; Don, L; Tangborn, A & Kuang, W

Workshop:

- Summer Workshop on Application of Remotely Sensed Observations July 23 - Aug 10, 2007

in Data Assimilation

Summer School on Fusing Geophysical Models with Data

The Twentieth Annual Workshop on Mathematical Problems in
Industry

The First Annual Graduate Student Mathematical Modeling Camp

University of Maryland,
College Park

Jun 13 - 17, 2005,
Boulder, CO

Jun 21 - 25, 2004,
Univ. of Delaware, DE

Jun 15 - 18, 2004,
Rensselaer Polytechnic
Institute, NY