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EDUCATION

- 2003 Ph.D. Atmospheric Sciences, Seoul National University, Seoul, South Korea
- 1996 M.S. Atmospheric Sciences, Seoul National University, Seoul, S. Korea
- 1993 B.S. Atmospheric Science Education, Ewha Women's University, Seoul, S. Korea

PROFESSIONAL RECORD

2024-Present: Project Scientist III, NCAR, MMM Laboratory
2020 – 2024: Project Scientist II, NCAR, MMM Laboratory
2011 – 2020: Project Scientist I, NCAR, MMM Laboratory
2006 – 2010: Associate Scientist, NCAR, MMM Laboratory
2003 – 2005: Postdoctoral fellow in COSMIC/UCAR and MMM/NCAR
2000 – 2003: Advanced Study Program graduate fellowship
1999: Graduate visitor to the Constellation Observing System for Meteorology Ionosphere and Climate (COSMIC) program, University Corporation for Atmospheric Research (UCAR)

SCIENTIFIC RESEARCH HIGHLIGHTS

- Main developer of the MPAS-DART interface based on unstructured meshes for Ensemble Kalman Filter (EnKF) data assimilation, serving as a point of contact for the MPAS-DART community
- Main developer of the Incremental Analysis Update (IAU) and the novel 2-stream I/O in MPAS-JEDI
- Leading atmosphere-biochemistry-land coupled data assimilation and forecasting efforts across labs at NSF NCAR
- Leading satellite data assimilation for air quality forecasting
- Model error representation in mesoscale ensemble analysis and forecasting system using stochastic or multi-physics ensemble
- Meso- and convective-scale weather prediction using various numerical models such as MM5, WRF, WRF-Chem, global and regional MPAS models
- In-depth understanding and contributions to advanced data assimilation algorithms including 4-dimensional Variational data assimilation (4D-Var), 3-dimensional Variational data assimilation (3D-Var), Ensemble Kalman Filter (EnKF), and various hybrid techniques, with high proficiency in state-of-the-art data assimilation systems such as WRFDA, GSI, DART and JEDI.

COMMUNITY SERVICE AND AWARDS

- 2024-present: Associate Editor for Monthly Weather Review (ISSN: 0027-0644)
- 2010-present: Point of Contact for the MPAS-DART community support

- 2018: MMM Outstanding Achievement award on “The development of next generation data assimilation system based on the Objective-Oriented Prediction System (OOPS)”.
- 2013-2018: Korea Institute of Atmospheric Prediction Systems (KIAPS) Scientific Advisory Panel
- 2016: The Organizing Committee for the 2018 PyeongChang Olympic & Paralympic Winter Games (hosted by National Institute of Meteorological Sciences (NIMS)/Korea Meteorological Administration (KMA))

PUBLICATIONS

Ha, S. and J. Sun, 2024: Impact of soil moisture updates on temperature forecasting, *Geophys. Res. Lett.* 51, e2024GL110283. <https://doi.org/10.1029/2024GL110283>.

Ha, S., J.-J. Guerrette, I. Hernandez Banos, W. C. Skamarock, and M. G. Duda, 2024: Incremental Analysis Update (IAU) in the Model for Prediction Across Scales coupled with the Joint Effort for Data assimilation Integration (MPAS-JEDI 2.0.0). *Geosci. Model Dev.* [10.5194/gmd-17-4199-2024](https://doi.org/10.5194/gmd-17-4199-2024).

Ha, S., R. Kumar, G. Pfister, Y. Lee, D. Lee, H.-M. Kim, Y.-H. Ryu, 2023: Chemical data assimilation with aqueous chemistry in WRF-Chem coupled with WRFDA (V4.4.1), *Journal of Advances in Modeling Earth Systems (JAMES)*, 16, e2023MS003928, <https://doi.org/10.1029/2023MS003928>

Guerrette, J. J., Liu, Z., Snyder, C., Jung, B.-J., Schwartz, C. S., Ban, J., Vahl, S., Wu, Y., Banos, I. H., Yu, Y. G., **Ha, S.**, Tremolet, Y., Auligne, T., Gas, C., Menetrier, B., Shlyayeva, A., Miesch, M., Herbener, S., Liu, E., Holdaway, D., Johnson, B. T., 2023: Data assimilation for the Model for Prediction Across Scales - Atmosphere with the Joint Effort for Data assimilation Integration (JEDI-MPAS 2.0.0-beta): ensemble of 3D ensemble-variational (En-3DEnVar) assimilations. *Geosci. Model Dev.*, <https://doi.org/10.5194/gmd-2023-54>.

Cho, Y., H.-M. Kim, E.-G. Yang, Y. Lee, J.-B. Lee, **S. Ha**, 2023: Effect of Meteorological Data Assimilation on Regional Air Quality Forecasts over the Korean Peninsula Using WRF-Chem 3DVAR. *J. Meteor. Res.* doi:10.1007/s13351-024-3152-8.

Ha, Soyung, 2022: Implementation of aerosol data assimilation in WRFDA (v4.0.3) for WRF-Chem (v3.9.1) using the RACM/MADE-VBS scheme, *Geosci. Model Dev.*, 15, 1769–1788, <https://doi.org/10.5194/gmd-15-1769-2022>

Ha, S., Z. Liu, W. Sun, Y. Lee, L. Chang, 2020: Improving air quality forecasting with the assimilation of GOCI aerosol optical depth (AOD) retrievals during the KORUS-AQ period. *Atm. Chem. Phys.*, 20, 6015-6036, <https://doi.org/10.5194/acp-20-6015-2020>.

Skamarock, W. C., M. G. Duda, **S. Ha**, S.-H. Park, 2018: Limited-area atmospheric modeling using an unstructured mesh. *Mon. Wea. Rev.*, 146, 3445-3460. [DOI: 10.1175/MWR-D-18-0155.1](https://doi.org/10.1175/MWR-D-18-0155.1)

J. Klemp, W. C. Skamarock, **S. Ha**, 2017: Damping Acoustic modes in compressible Horizontally Explicit Vertically Implicit (HEVI) and Split-Explicit time integration schemes. *Mon. Wea. Rev.*, 146, 1911-1923. DOI:[10.1175/MWR-D-17-0384.1](https://doi.org/10.1175/MWR-D-17-0384.1)

Ha, S., C. Snyder, W. Skamarock, J. Anderson, and N. Collins, 2017: Ensemble Kalman filter data assimilation for the Model for Prediction Across Scales (MPAS). *Mon. Wea. Rev.*, 145, 11, 4673-4692, DOI:[10.1175/MWR-D-17-0145.1](https://doi.org/10.1175/MWR-D-17-0145.1)

Ha, S., J. Berner, and C.M. Snyder, 2015: A comparison of model error representations in mesoscale ensemble data assimilation. *Mon. Wea. Rev.*, 143, 3893-3911, DOI:[10.1175/MWR-D-14-00395.1](https://doi.org/10.1175/MWR-D-14-00395.1)

Berner, J., K. Fossell, **S. Ha**, J. Hacker, and C. M. Snyder, 2015: Increasing the skill of probabilistic forecasts: Understanding performance improvements from model-error representations. *Mon. Wea. Rev.*, 143, 1295-1320, DOI:[10.1175/MWR-D-14-00091.1](https://doi.org/10.1175/MWR-D-14-00091.1)

Ha, S.-Y., and C.M. Snyder, 2014: Influence of surface observations in mesoscale data assimilation using an ensemble Kalman filter. *Mon. Wea. Rev.*, 142, 1489-1508, DOI:[10.1175/MWR-D-13-00108.1](https://doi.org/10.1175/MWR-D-13-00108.1).

Liu, Z., C.S. Schwartz, C.M. Snyder, and **S.-Y. Ha**, 2012: Impact of assimilating AMSU-A radiances on forecasts of 2008 Atlantic tropical cyclones initialized with a limited-area ensemble Kalman filter. *Mon. Wea. Rev.*, 140, 4017-4034.

Berner, J., **S.-Y. Ha**, J.P. Hacker, A. Fournier, and C.M. Snyder, 2011: Model uncertainty in a mesoscale ensemble prediction system: Stochastic versus multiphysics representations. *Mon. Wea. Rev.*, **139**, 1972-1995, DOI:[10.1175/2010MWR3595.1](https://doi.org/10.1175/2010MWR3595.1).

Hacker, J.P., **S.-Y. Ha**, C.M. Snyder, J. Berner, F.A. Eckel, E. Kuchera, M. Pocerlich, S. Rugg, J. Schramm, and X. Wang, 2011: The U.S. Air Force Weather Agency's mesoscale ensemble: Scientific description and performance results. *Tellus Series A: Dynamic Meteorology and Oceanography*, **63**, 625-641, DOI:[10.1111/j.1600-0870.2010.00497.x](https://doi.org/10.1111/j.1600-0870.2010.00497.x).

Hacker, J.P., C. Snyder, **S.-Y. Ha** and M. Pocerlich, 2011: Linear and non-linear response to parameter variations in a mesoscale model. *Tellus*, **63A**, 429-444, DOI:[10.1111/j.1600-0870.2010.00505.x](https://doi.org/10.1111/j.1600-0870.2010.00505.x).

Ha, S. -Y., Y. -H. Kuo, Y. -R. Guo, and G. -H. Lim, 2003: Variational assimilation of slant-path wet delay measurements from a hypothetical ground-based GPS network. Part I: Comparison with precipitable water assimilation. *Mon. Wea. Rev.*, 131, 2635-2655, doi:10.1175/1520-0493(2003)131<2635:VAOSWD>2.0.CO;2.

Ha, S. -Y., Y. -H. Kuo, Y. -R. Guo, C. Rocken, and T. Van Hove, 2002: Comparison of GPS slant wet delay measurements with model simulations during the passage of a squall line. *Geophys. Res. Lett.*, **29**, 2113, doi:10.1029/2002GL015891.