

# Hans Chen

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Chalmers University of Technology  
Department of Space, Earth and Environment  
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## EDUCATION

- 2018 **Ph.D. in Meteorology and Atmospheric Science**, Department of Meteorology and Atmospheric Science, The Pennsylvania State University, University Park, Pennsylvania  
Dissertation: Toward improved regional estimates of carbon dioxide sources and sinks through coupled carbon-atmospheric data assimilation  
Advisor: Fuqing Zhang | Co-advisors: Richard B. Alley and Thomas Lauvaux
- 2012 **M.S. in Atmospheric Sciences, Oceanography and Climate**, Department of Meteorology, Stockholm University, Stockholm, Sweden  
Thesis: The Barents Oscillation and its impact on the Arctic climate  
Advisor: Heiner Körnich | Co-advisor: Qiong Zhang
- 2010 **B.S. in Meteorology**, Department of Meteorology, Stockholm University, Stockholm, Sweden  
Thesis: Local impact of soot on surface temperature in India and Sweden  
Advisor: Annica Ekman | Co-advisor: Henning Rodhe

## EMPLOYMENT

- 2023–present **Assistant Professor**, Department of Space, Earth and Environment, Chalmers University of Technology, Gothenburg, Sweden
- 2020–2022 **Researcher**, Department of Physical Geography and Ecosystem Science, Lund University, Lund, Sweden
- 2018–2020 **Postdoctoral Fellow**, Department of Physical Geography and Ecosystem Science, Lund University, Lund, Sweden

## AWARDS AND HONORS

- 2020 **NASA Group Achievement Award**, NASA Langley Research Center  
For exceptional scientific achievements of the ACT-America Earth Venture Suborbital mission
- 2020 **Stiftelsen Landshövding Per Westlings Minnesfond**, Lund University
- 2018 **Outstanding Student Paper Award**, American Meteorological Society, 20th Conference on Atmospheric Chemistry
- 2016 **Öfverdirektör Elis Sidenbladhs Fond**, Royal Swedish Academy of Sciences
- 2016 **Top 5 Most Highly Cited Papers 2014–2016 in Environmental Development**, Environmental Development, Elsevier
- 2014 **Hans Neuberger Award**, The Pennsylvania State University  
For excellent teaching of meteorology

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## COMMISSIONS OF TRUST

2021–present **Deputy** in the Copernicus CO2 General Assembly

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## RESEARCH GRANTS

- 2022 **Co-Investigator**, National Strategic Research Program BECC (Biodiversity and Ecosystem services in a Changing Climate), research grant  
The impact of warming-induced summer vegetation drought on the vegetation greening, tree growth and carbon fluxes in Sweden
- 2022–2025 **Principal Investigator**, Swedish National Space Agency, Call 2021-C, career grant  
Monitoring anthropogenic carbon dioxide emissions from space
- 2022–2025 **Principal Investigator**, Formas, Research projects for early-career researchers, career grant (declined)  
Improved monitoring of carbon dioxide emissions in Scandinavia using satellite and ground-based observations
- 2021–2024 **Principal Investigator**, Stiftelsen för internationalisering av högre utbildning och forskning, Joint China–Sweden Mobility, mobility grant  
High-resolution carbon cycle data assimilation with multiple satellite observations

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## PEER-REVIEWED PUBLICATIONS

\* indicates corresponding author(s)

- 2022 Wang X., Y. Ran\*, Y. Pang, D. Chen, B. Su, R. Chen, X. Li, **H. W. Chen**, M. Yang, X. Gou, M. T. Jorgenson, J. Aalto, R. Li, X. Peng, T. Wu, G. D. Clow, G. Wan, X. Wu, and D. Luo (2022): Contrasting characteristics, changes, and linkages of permafrost between the Arctic and the Third Pole. *Earth-Science Reviews*, **230**, 104042, doi:10.1016/j.earscirev.2022.104042.
- 2022 Kaminski, T., M. Scholze, P. Rayner, S. Houweling, M. Voßbeck, J. Silver, S. Lama, M. Buchwitz, M. Reuter, W. Knorr, **H. W. Chen**, G. Kuhlmann, D. Brunner, S. Dellaert, H. A. C. Denier van der Gon, I. Super, A. Löscher, and Y. Meijer (2022): Assessing the constraint of atmospheric CO<sub>2</sub> and NO<sub>2</sub> measurements from space on city-scale fossil fuel CO<sub>2</sub> emissions in a data assimilation system. *Frontiers in Remote Sensing*, **3**, 887456. doi: 10.3389/frsen.2022.887456.
- 2022 Fang, M., X. Li\*, **H. W. Chen**\*, and D. Chen (2022): Arctic amplification modulated by Atlantic Multidecadal Oscillation and greenhouse forcing on multidecadal to century scales. *Nature Communications*, **13**, 1865, doi:10.1038/s41467-022-29523-x.
- 2022 Cai, Z., Q. You\*, **H. W. Chen**, R. Zhang\*, D. Chen, J. Chen, S. Kang, J. Cohen (2022): Amplified wintertime Barents Sea warming linked to intensified Barents Oscillation. *Environmental Research Letters*, **17**, 044068, doi:10.1088/1748-9326/ac5bb3.
- 2022 Tang, R., B. He\*, **H. W. Chen**, D. Chen, Y. Chen\*, Y. H. Fu, W. Yuan, B. Li, Z. Li, L. Guo, X. Hao, and L. Sun (2022): Increasing terrestrial ecosystem carbon release in response to autumn cooling and warming. *Nature Climate Change*, **12**, 380–385, doi:10.1038/s41558-022-01304-w.

- 2022 Kaminski, T.\*, M. Scholze, P. Rayner, M. Voßbeck, M. Buchwitz, M. Reuter, W. Knorr, **H. Chen**, A. Agusti-Panareda, A. Löscher, and Y. Meijer (2022): Assimilation of atmospheric CO<sub>2</sub> observations from space can support national CO<sub>2</sub> emission inventories. *Environmental Research Letters*, **17**, 014015, doi:10.1088/1748-9326/ac3cea.
- 2021 Bin, H.\*, C. Chen, S. Lin, W. Yuan\*, **H. W. Chen**, D. Chen, Y. Zhang, L. Guo, X. Zhao, X. Liu, Z. Zhong, R. Wang, and R. Tang (2021): Worldwide impacts of atmospheric vapor pressure deficit on the interannual variability of terrestrial carbon sinks. *National Science Review*, doi:10.1093/nsr/nwab150.
- 2021 Cai, Z., Q. You\*, F. Wu, **H. W. Chen**, D. Chen, and J. Cohen (2021): Arctic warming revealed by multiple CMIP6 models: Evaluation of historical simulations and quantification of future projection uncertainties. *Journal of Climate*, **34(12)**, 4871–4892. doi:10.1175/JCLI-D-20-0791.1.
- 2021 Lai, H.-W., **H. W. Chen**, J. Kukulies, T. Ou, and D. Chen\* (2021): Regionalization of seasonal precipitation over the Tibetan Plateau and associated large-scale atmospheric systems. *Journal of Climate*, **34(7)**, 2635–2651. doi:10.1175/JCLI-D-20-0521.1.
- 2020 Cohen, J.\*, X. Zhang, J. Francis, T. Jung, R. Kwok, J. Overland, T. Ballinger, U. S. Bhatt, **H. W. Chen**, D. Coumou, S. Feldstein, D. Handorf, G. Henderson, M. Ionita, M. Kretschmer, F. Laliberte, S. Lee, H. W. Linderholm, W. Maslowski, Y. Peings, K. Pfeiffer, I. Rigor, T. Semmler, J. Stroeve, P. C. Taylor, S. Vavrus, T. Vihma, S. Wang, M. Wendisch, Y. Wu, and J. Yoon (2020): Divergent consensus on the influence of Arctic amplification on mid-latitude severe winter weather. *Nature Climate Change*, **10**, 20–29. doi:10.1038/s41558-019-0662-y.
- 2019 **Chen, H. W.**, L. N. Zhang, F. Zhang\*, K. J. Davis, T. Lauvaux, S. Pal, B. Gaudet, and J. P. DiGangi (2019): Evaluation of regional CO<sub>2</sub> mole fractions in the ECMWF CAMS real-time atmospheric analysis and NOAA CarbonTracker Near-Real Time reanalysis with airborne observations from ACT-America field campaigns. *Journal of Geophysical Research–Atmospheres*, **124**, 8119–8133. doi:10.1029/2018JD029992.
- 2019 **Chen, H. W.**, F. Zhang\*, T. Lauvaux, K. J. Davis, S. Feng, M. P. Butler, and R. B. Alley (2019): Characterization of regional-scale CO<sub>2</sub> transport uncertainties in an ensemble with flow-dependent transport errors. *Geophysical Research Letters*, **46**, 4049–4058. doi:10.1029/2018GL081341.
- 2016 **Chen, H. W.\***, R. B. Alley, and F. Zhang (2016): Interannual Arctic sea ice variability and associated winter weather patterns: A regional perspective for 1979–2014. *Journal of Geophysical Research–Atmospheres*. **121**, 14,433–14,455, doi:10.1002/2016JD024769.
- 2016 **Chen, H. W.\***, F. Zhang, and R. B. Alley (2016): The robustness of midlatitude weather pattern changes due to Arctic sea ice loss. *Journal of Climate*, **29**, 7831–7849, doi:10.1175/JCLI-D-16-0167.1.
- 2013 **Chen, H. W.**, Q. Zhang, H. Körnich, and D. Chen\* (2013): A robust mode of climate variability in the Arctic: The Barents Oscillation. *Geophysical Research Letters*, **40**, 2856–2861, doi:10.1002/grl.50551.
- 2013 Chen, D.\* and **H. W. Chen** (2013): Using the Köppen classification to quantify climate variation and change: An example for 1901–2010. *Environmental Development*, **6**, 69–79, doi:10.1016/j.envdev.2013.03.007.

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## SUBMITTED MANUSCRIPTS

- 2023 Zhong, Z., B. He, Y.-P. Wang, **H. W. Chen**, D. Chen, Y. H. Fu, Y. Chen, L. Guo, Y. Deng, L. Huang, W. Yuan, X. Hao, R. Tang, H. Liu, L. Sun, X. Xie, and Y. Zhang: Disentangling the effects of vapor pressure deficit on terrestrial ecosystem productivity.
- 2023 **Chen, H. W.**, F. Zhang, T. Lauvaux, M. Scholze, K. J. Davis, and R. B. Alley: Regional CO<sub>2</sub> inversion through ensemble-based simultaneous state and parameter estimation: TRACE framework and controlled experiments.
- 2023 Cai, Z., Q. You, **H. W. Chen**, R. Zhang, Z. Zuo, G. Dai, D. Chen, and J. Cohen: Underestimation of Barents Sea warming simulations is tied to poleward moisture transport.
- 2023 Yan, X., Z. Zang, **H. W. Chen**, Y. Jiang, Y. Chen, B. He, T. Nakajima, J. Kim, and C. Zuo: Filling the knowledge gap of atmospheric pollution over unmeasured regions by applying deep learning to satellite data.
- 2023 Song, Y., G. Zhou, **H. W. Chen**, Y. Li, J. Liu, J. Tian, L. Chen, Z. He, G. Wang, J. Xu, and D. Chen: Warming has different effects on quality of rice gain over different climate regions in China.
- 2023 Wang, S., B. He, **H. W. Chen**, D. Chen, Y. Chen, W. Yuan, F. Shi, J. Duan, W. Wu, T. Chen, L. Guo, Z. Zhong, W. Duan, Z. Li, W. Jiang, L. Huang, X. Hao,, R. Tang, H. Liu, Y. Zhang, and X. Xie: Fire carbon emissions over Equatorial Asia suppressed by shortened dry seasons.
- 2023 You, Q., Z. Cai, **H. W. Chen**, R. Zhang, Z. Zuo, G. Dai, D. Chen, J. Cohen, O. Zolina, and S. K. Gulev: Interdecadal variability of the Warm Arctic–Cold Eurasia pattern linked to the Barents Oscillation.
- 2023 Yan, X., C. Zuo, Z. Li, **H. W. Chen**, Y. Jiang, B. He, H. Liu, J. Chen, and W. Shi: Cooperative simultaneous inversion of PM<sub>2.5</sub> and ozone.
- 2023 Wu, M., Y. Ran, W. Zhang, **H. W. Chen**, M. J. Lara, D. Chen, B. Elberling, X. Li, Y. Yi, S. Wang, T. Tagesson, H. Wang, Z. Zhang, X. Xing, H. Croft, W. Ju, F. Jiang: Contrasting tundra responses to atmospheric and soil moisture in the world’s permafrost regions.

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## OTHER PUBLICATIONS

- 2020 Scholze, M., **H. Chen**, T. Kaminski, and M. Voßbeck (2020): Inversion strategy based on joint QND assessments. *CHE Consortium*.
- 2018 **Chen, H.** and M. Scholze (2018): Progress in characterizing uncertainty for fossil fuel emissions. *CHE Consortium*.
- 2018 Ying, Y., X. Chen, Y. Zhang, M. Minamide, R. Nystrom, **H. Chen**, J. Poterjoy, C. Melhauser, Y. Weng, Z. Meng, A. Aksoy, and F. Zhang (2018): PSU WRF EnKF/4DVar hybrid regional data assimilation system: Technical notes.

- 2018 Cohen, J., X. Zhang, J. Francis, T. Jung, R. Kwok, J. Overland, P. C. Tayler, S. Lee, F. Laliberte, S. Feldstein, W. Maslowski, G. Henderson, J. Stroeve, D. Coumou, D. Handorf, T. Semmler, T. Ballinger, M. Hell, M. Kretschmer, S. Vavrus, M. Wang, S. Wang, Y. Wu, T. Vihma, U. Bhatt, M. Ionita, H. Linderholm, I. Rigor, C. Routson, D. Singh, M. Wendisch, D. Smith, J. Screen, J. Yoon, Y. Peings, **H. Chen**, and R. Blackport (2018): Arctic change and possible influence on mid-latitude climate and weather: a US CLIVAR White Paper. *U.S. CLIVAR White Paper 2018-1*, 41 pp. doi:10.5065/D6TH8KGW.

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## INVITED TALKS

- 2022 Ensemble-based simultaneous state and parameter estimation for monitoring greenhouse gas emissions and removals, *2nd International Association of Meteorological Education and Sciences Annual Conference and the 9th COAA International Conference on Atmosphere, Ocean, and Climate Change*
- 2021 Monitoring anthropogenic carbon dioxide emissions from space, *Swedish Space Researchers 2022*
- 2021 Assessing the uncertainty in top-down greenhouse gas emissions estimates, *Asia Oceania Geosciences Society Virtual 18th Annual Meeting*
- 2020 Coupled carbon-atmospheric data assimilation through ensemble-based simultaneous state and parameter estimation, *Fuqing Zhang Symposium* (canceled due to Covid-19)
- 2018 Monitoring Earth's carbon cycle and human fossil fuel emissions with the help of advanced data assimilation methods, *Second ADAPT Symposium on Advanced Understanding, Monitoring and Prediction of Weather, Climate and Environmental systems*
- 2018 Constraining surface carbon dioxide fluxes using advanced data assimilation techniques, *98th American Meteorological Society Annual Meeting*
- 2016 Nonlinear atmospheric response to Arctic sea-ice loss under different sea ice scenarios, *ADAPT Symposium on Advanced Assimilation and Uncertainty Quantification in BigData Research for Weather, Climate and Earth System Monitoring and Prediction*

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## TEACHING EXPERIENCE

- 2019–present **Lund University**
- Supervisor for Bachelor's thesis (Spring 2022)
  - Co-instructor
    - The Climate System (Spring 2022)
    - Theory and Methods of Physical Geography (Fall 2019–2022, Fall 2020 online)

- 2013–2017 **The Pennsylvania State University**
- **Course head and main instructor**  
Introduction to Programming Techniques for Meteorology (Spring 2015)
  - **Co-instructor**  
Applications of Computers to Meteorology (Fall 2013)
  - **Co-advisor for research project** (Summer 2017)
  - **Teaching assistant**  
Synoptic Meteorology Laboratory (Fall 2015)  
Applications of Computers to Meteorology (Fall 2014, Spring 2014)  
Introduction to Programming Techniques for Meteorology (Spring 2013)

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## OUTREACH

- 2022 **Radio interview for Sveriges Radio, Vetenskapsradion Klotet**, about how satellites can reveal greenhouse gas emissions
- 2021 **Interview for the Extrakt online magazine**, about using satellite observations to track anthropogenic CO<sub>2</sub> emissions
- 2021 **Interview for the European Environment Agency COINS project**, about monitoring CO<sub>2</sub> emissions on city scales using top-down and inverse approaches
- **Research websites**, over 245,000 views and 93,000 unique visitors since 2013 (example: <http://hanschen.org/koppen>)

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## SERVICE TO PROFESSION

- 2022–present **Young Editorial Member** for Advances in Climate Change Research (IF=4.7 in 2022)
- 2022–present **Guest Editor** for Remote Sensing (IF=5.4 in 2022)
- 2020–2021 **Organizer of department seminar series**, Department of Physical Geography and Ecosystem Science, Lund University, Lund, Sweden
- **Reviewer** for the following journals:  
Nature Climate Change, Atmospheric Chemistry and Physics, Geophysical Research Letters, Journal of Geophysical Research–Atmospheres, Climate Dynamics

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## NON-ACADEMIC WORK

- 2008 **Computer programmer**, IVL Swedish Environmental Research Institute, Gothenburg, Sweden

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## OTHER RELEVANT EXPERIENCES

- 2016 **NCAR Advanced Study Program Summer Colloquium**, Advances in Air Quality Analysis and Prediction: The Interaction of Science and Policy, National Center for Atmospheric Research, Colorado

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## COMPUTER SKILLS

OS	Linux, Unix, Windows, macOS	Graphics	Adobe Photoshop, Inkscape
Programming	Python, Fortran, C++, C	Typography	L <sup>A</sup> T <sub>E</sub> X
Numerical	MATLAB, Mathematica	Office suites	Microsoft Office, LibreOffice
Shell script	Bash, Z shell	Other	Git, regular expressions, HTML, CSS

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## LANGUAGES

Native	<b>Swedish</b>
Fluent	<b>English</b>
Mother tongue	<b>Mandarin</b> , fluent speaking, basic reading and writing
Basic	<b>German</b>

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## SELECTED PRESENTATIONS

- 2022 Monitoring greenhouse gas emissions and removals using satellites, *Swedish Climate Symposium 2022*, Oral
- 2021 Data assimilation and simultaneous state–parameter estimation for CO<sub>2</sub> inversion, *Pufendorf inverse modeling workshop*, Oral
- 2021 Arctic–midlatitude linkages: why is it still controversial? *Arctic workshop: Multi-disciplinary perspectives on a changing Arctic*, Online Oral
- 2021 Assessment of radiocarbon observations for constraining fossil fuel emissions in a comprehensive Carbon Cycle Fossil Fuel Data Assimilation System, *EGU General Assembly 2021*, Online Oral
- 2019 Potential benefit of <sup>14</sup>CO<sub>2</sub> observations in CO<sub>2</sub> inversions quantified using the coupled Carbon Cycle Fossil Fuel Data Assimilation System, *IG3IS–Transcom workshop 2019*, Poster
- 2018 Arctic–mid latitude linkages: Lessons learned and future coordinated modeling experiments, *8th Third Pole Environment Workshop*, Oral
- 2018 Characterizing CO<sub>2</sub> transport errors for regional inversions using a coupled carbon–atmospheric data assimilation system, *AGU Fall Meeting 2018*, Poster
- 2018 A joint regional carbon–atmosphere inversion system with explicit treatment of transport uncertainties, *IG3IS–Transcom workshop 2018*, Poster
- 2018 Progress toward estimating surface carbon dioxide fluxes at the regional scale using an augmented ensemble Kalman filter, *98th American Meteorological Society Annual Meeting*, Poster
- 2018 Constraining regional-scale CO<sub>2</sub> fluxes using a coupled meteorological-carbon ensemble Kalman filter, *8th EnKF Data Assimilation Workshop*, Oral
- 2016 Predictability of mid-latitude extreme weather changes in response to Arctic sea ice loss, *96th American Meteorological Society Annual Meeting*, Poster