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Research interests

Dr. Qian's research focuses on the physics, dynamics, and electrodynamics of the ionosphere, thermosphere, and mesosphere (ITM), with an emphasis on understanding their variability and coupling processes. This includes investigations of space weather and space climate, as well as the coupling between the lower and upper atmosphere. She has extensive experience in numerical modeling and has worked with several state-of-the-art models, including the Thermosphere-Ionosphere Electrodynamics General Circulation Model (TIE-GCM), the Thermosphere-Ionosphere-Mesosphere Electrodynamics General Circulation Model (TIME-GCM), and the Whole Atmosphere Community Climate Model with thermosphere and ionosphere extension (WACCM-X).

Qualifications

Physics, MS, Chinese Academy of Sciences
Physics, BS, Nanjing University
Physics, PhD, Pennsylvania State University-Main Campus
Computer and Information Science, MS, Pennsylvania State University-Main Campus

Employment

Senior Scientist

Geospace Frontiers
University Corporation for Atmospheric Research
Oct 1 2002 → present

Research outputs

Statistical Study of Geoeffective Fe XV 28.4 nm Emission Bursts and Their Influence on Ionospheric Total Electron Content During the Late Phase of Solar Flares
Bekker, S. Z., O'Hare, A. N., Grotzinger, H. J., Hayes, L. A., Janitzek, N., Kerr, G. S., Milligan, R. O., Qian, L. & Watanabe, K., Jul 2026, In: Journal of Geophysical Research: Space Physics. 131, 7, e2026JA035779.

Sudden Ionospheric Disturbances Generated by Solar Flares—Not so Sudden?

Maletckii, B., Astafyeva, E., Pedatella, N. M. & Qian, L., Apr 16 2026, In: Geophysical Research Letters. 53, 7, e2025GL120816.

Revealing Flare Energetics and Dynamics with SDO EVE Solar Extreme Ultraviolet Spectral Irradiance Observations

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Impact of Solar Irradiance on Storm-Time Thermospheric Mass Density Response

Zhang, S., Qian, L., Pedatella, N., Sutton, E., Peterson, N. & Berger, T., Mar 28 2026, In: Geophysical Research Letters. 53, 6, e2025GL120471.

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Quantifying Ionospheric and Thermospheric Day-to-Day Variability Due To the Upward Propagating Migrating Diurnal and Semidiurnal Tides

Hu, T., Qian, L., Pedatella, N. M., Wang, W. & Gan, Q., Feb 2026, In: Journal of Geophysical Research: Space Physics. 131, 2, e2025JA034805.

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Wu, K., Qian, L., Xiao, F., Liu, S., Luo, J., Cai, X. & Shi, G., Oct 2025, In: Journal of Geophysical Research: Space Physics. 130, 10, e2025JA034385.

The Long-Term Trend of Thermospheric Compositions From Whole Atmospheric Simulation and Satellite Observation

Hsu, C. T., Wang, W., Qian, L., Aa, E., McInerney, J. M., Zhang, S. R., Zhang, Y., Newheart, A. & Lin, D., Oct 2025, In: Journal of Geophysical Research: Space Physics. 130, 10, e2025JA034285.

The NCAR-TIEGCM Version 3.0

Wu, H., Wang, W., Pham, K. H., Lin, D., Rao, N., Wiltberger, M. J., Lu, G., Wu, Q., Liu, H., Qian, L., Hsu, C. T., Pedatella, N. M., Vila-Pérez, J., McInerney, J. M., Richmond, A. D., Burns, A. G., Solomon, S. C., Maute, A., Sutton, E. K. & Lu, X. & 4 others, Cai, X., Sheng, C., Wang, J. C. & Yue, J., Sep 2025, In: Journal of Geophysical Research: Space Physics. 130, 9, e2025JA034219.

Formation of the Ionospheric G-Condition Following the 2017 Great American Eclipse

Chakraborty, S., Qian, L., Mrak, S., Mabie, J., Goncharenko, L., McInerney, J. M. & Bullett, T., Aug 2025, In: Earth and Space Science. 12, 8, e2024EA004007.

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Li, Q. H., He, M., Wang, W., Zhang, S. R., Qian, L., Aa, E. & Wang, D., Jun 16 2025, In: Geophysical Research Letters. 52, 11, e2025GL115318.

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Quantifying Geomagnetic Activity's Contribution to the Global E-Region Electron Density's Day-To-Day Variability Using Spire Radio Occultation Observations

Salinas, C. C. J. H., Wu, D. L. & Qian, L., Feb 16 2025, In: Geophysical Research Letters. 52, 3, e2024GL112874.

The Formation Mechanism of Merged EIA During a Storm on 4 November 2021

Wu, K., Qian, L., Wang, W., Cai, X. & McInerney, J. M., Jan 2025, In: Journal of Geophysical Research: Space Physics. 130, 1, e2024JA032896.

Equinox Transitions of Thermosphere O/N₂ and Meridional Circulation in the Northern Hemisphere as Observed by NASA's GOLD and ICON Missions

Gan, Q., Qian, L., Pedatella, N. M. & Eastes, R. W., Dec 28 2024, In: Geophysical Research Letters. 51, 24, e2024GL111810.

Global Distribution of Ionospheric Topside Diffusive Flux and Midlatitude Electron Density Enhancement in Winter Nighttime

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Pedatella, N. M., Wu, K., Qian, L. & Gan, Q., Dec 2024, In: Journal of Geophysical Research: Space Physics. 129, 12, e2024JA032855.

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Liu, X., Liu, J., Chen, J., Qian, L., Chamberlin, P. C., Chen, Y., Kong, X. & Li, S., Oct 1 2024, In: Astrophysical Journal Letters. 974, 1, L19.

Development of the Ionospheric E-Region Prompt Radio Occultation Based Electron Density (E-PROBED) Model

Salinas, C. C. J. H., Wu, D. L., Swarnalingam, N., Emmons, D. & Qian, L., Sep 2024, In: Space Weather. 22, 9, e2024SW004037.

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Yuan, T., Pena, M., Hsu, C. T. & Qian, L., Aug 28 2024, In: Journal of Geophysical Research: Atmospheres. 129, 16, e2024JD041422.

Interactions between MSTIDs and Ionospheric Irregularities in the Equatorial Region Observed on 13–14 May 2013

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Liu, J., Qian, L., Wang, W., Pham, K., Kong, X., Chen, Y., Liu, W., Liu, L. & Liu, X., Mar 1 2024, In: Astrophysical Journal Letters. 963, 1, L8.

Climate Change in the Thermosphere and Ionosphere From the Early Twentieth Century to Early Twenty-First Century Simulated by the Whole Atmosphere Community Climate Model—eXtended

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Thermospheric Responses to the 3 and 4 November 2021 Geomagnetic Storm During the Main and Recovery Phases as Observed by NASA's GOLD and ICON Missions

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Investigation of Different $\Sigma O/N_2$ Variations Observed by GOLD During a Minor Geomagnetic Storm From 2 to 4 August 2021

Cai, X., Wang, W., Eastes, R. W., Qian, L., Correia, J. & McClintock, W. E., Jan 2024, In: Journal of Geophysical Research: Space Physics. 129, 1, e2023JA031782.

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Connor, H. K., Jung, J., Qian, L., Sutton, E. K., Cucho-Padin, G., Crow, M. & Lee, S. Y., 2024, In: Frontiers in Astronomy and Space Sciences. 11, 1421196.

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Wang, J. C., Yue, J., Wang, W., Qian, L., Jones, M. & Wang, N., Nov 2023, In: Journal of Geophysical Research: Space Physics. 128, 11, e2023JA031684.

Intensification and Weakening of Equatorial Plasma Bubble Development Observed by GOLD During Different Phases of a Geomagnetic Storm

Amadi, B. C., Qian, L., de Paula, E. R., McInerney, J. M., Kherani, E. A., Santos, A. M. & Sanchez, S. A., Oct 2023, In: Journal of Geophysical Research: Space Physics. 128, 10, e2022JA031262.

Significant Mid- and Low-Latitude Ionospheric Disturbances Characterized by Dynamic EIA, EPBs, and SED Variations During the 13–14 March 2022 Geomagnetic Storm

Aa, E., Zhang, S. R., Erickson, P. J., Wang, W., Qian, L., Cai, X., Coster, A. J. & Goncharenko, L. P., Aug 2023, In: Journal of Geophysical Research: Space Physics. 128, 8, e2023JA031375.

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Cai, X., Wang, W., Eastes, R. W., Qian, L., Pedatella, N. M., Aa, E., Zhang, S., Coster, A., Daniell, R. E. & McClintock, W. E., May 28 2023, In: Geophysical Research Letters. 50, 10, e2023GL102994.

Hemispheric Asymmetry of the Annual and Semiannual Variation of Thermospheric Composition

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Investigation of the Southern Hemisphere Mid-High Latitude Thermospheric $\Sigma O/N_2$ Responses to the Space-X Storm

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Impacts of Ionospheric Conductance on Magnetosphere-Ionosphere Coupling

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Seasonality of the Migrating Semidiurnal Tide in the Tropical Upper Mesosphere and Lower Thermosphere and Its Thermodynamic and Momentum Budget

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Pronounced Suppression and X-Pattern Merging of Equatorial Ionization Anomalies After the 2022 Tonga Volcano Eruption

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Activities

Seasonal Changes in the Thermosphere from WACCM-X Future 21st Century Projections

McInerney, J. (Speaker), Nossal, S. M. (Speaker) & Qian, L. (Speaker)

Jun 25 2025

•NCAR/HAO John W. Firor Publication Award – 2024, 2012 •NASA Silver Achievement Medal (GOLD Science Team) – 2022 •UCAR Scientific and Technical Advancement Award – 2016 •Walter O. Roberts Scientific and Technical Advancement Award – 2015 •NASA Group Achievement Award (TIMED/SEE Science Team) – 2011 •Editors' Citation for Excellence in Refereeing – Space Weather, 2012

Projects

Collaborative Research: CEDAR--Upper Atmospheric Hydrogen Variability on Timescales from Dusk-Dawn to Multidecadal

Qian, L. (PI)

National Science Foundation

03/1/21 → 03/31/26

THERMOSPHERE-IONOSPHERE RESPONSE TO VARIABILITY OF SOLAR X-RAY AND EUV RADIATION DURING SOLAR FLARES

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05/5/09 → 05/4/13

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