New Retrieval Methods for Precipitation Latent Heat Profiles and Its Application to Precipitation Research over the Qinghai-Xizang Plateau

Rui Li[1#, *], Yan Zhou[1#], Hongwei Zhao[1], Chun Zhao[1], Peng Zhang[2,3], Lin Chen[3], Qiong Wu [3], Yanluan Lin[4], Yunfei Fu[1], Yu Wang [1], Renjun Zhou[1], Lei Zhong [1], Xuanye Xu[1]

[1] School of Earth and Space Sciences, Joint Laboratory of Fengyun Remote Sensing, University of Science and Technology of China, Hefei, China.

[2] Key Laboratory of Environment Characteristics and Effects for Near-space, Beijing, China.

[3] Meteorological Observation Center, China Meteorological Administration, Beijing, China.

[4] Ministry of Education Key Laboratory for Earth System Modeling, Center for Earth System Science, and Joint Center for Global Change Studies (JCGCS), Tsinghua University, Beijing, China.

# Equal contributions to this work

* Correspondence to rli7@ustc.edu.cn

Satellite retrieval of precipitation latent heat profiles and scientific applications of the corresponding products have long been among the major challenges and core scientific objectives of key missions including TRMM, GPM, and FY-3G. This presentation introduces a method for retrieving global precipitation latent heat profiles from GPM, using the vertical gradient of precipitation profiles observed by spaceborne precipitation radar as the primary input, with both physical retrieval and convolutional neural network (CNN) retrieval employed. The characteristics of the retrieved products are analyzed, including comparisons and evaluations against CSH and SLH products (Li et al., 2019; Zhao et al., 2024).

The presentation also reports applications of these products to investigating the dominant controls on precipitation over the southern slopes of the Qinghai-Xizang Plateau. From the perspective of precipitation latent heat, the results clearly reveal the decisive roles of topographic effects (including mechanical lifting and surface sensible heating) and large-scale circulations associated with the South Asian monsoon in different seasons over the southern slopes (Zhou et al., 2026).

These studies demonstrate the great potential and encouraging progress of artificial intelligence methods in the satellite retrieval of precipitation latent heat. They also highlight the irreplaceable and unique perspective that precipitation latent heat provides for research on cloud microphysics and cloud dynamics. The latent heat retrieval method presented in this talk has been operationally applied to the FY-3G satellite mission.

[1] Li, R.*, Shao, W., Guo, J., Fu, Y., Liu, G., Wang, Y., & Li, W. (2019). A simplified algorithm to estimate latent heating rate using vertical rainfall profiles over the Tibetan Plateau. Journal of Geophysical Research: Atmospheres, 124. https://doi.org/10.1029/2018JD029297

[2] Zhao, H., Yang, S., Wu, Q., Chen, L., Zhang, P., & Li, R.* (2024). Optimizing satellite-based latent heating rate profiling using a convolutional neural network heating (CNNH) algorithm. IEEE Transactions on Geoscience and Remote Sensing, 62, 1-15. https://doi.org/10.1109/TGRS.2024.3466952

[3] Zhou, Y., Li, R.*, Zhao, H., Zhao, C., Zhang, P., Chen, L., Wu, Q., Lin, Y., Fu, Y., Wang, Y., Zhou, R., Zhong, L., & Xu, X. (2026). Satellite latent heating retrievals uncover a seasonal terrain-monsoon seesaw in southern Tibetan Plateau rainfall. npj Climate and Atmospheric Science. (Officially accepted)