Research progress of atmospheric aerosol and cloud Characteristics based on remote sensing of dual-polarization satellite payloads of China

Xiaobing Sun[a*], Rufang Ti[a], Yizhe Fan[b] Han Wang[c] and Haixiao Yu[a]

[a]*Anhui Institute of Optics and Fine Mechanics, Hefei Institutes of Physical Science(HFIPS), Chinese Academy of Sciences, 350 Shushanhu Rd., 230031 Hefei, P.R.China*
[b]*Henan Polytechnic University, 2001 Shiji Rd., 454000 Jiaozuo, P.R.China*
[c]*China University of Mining Technology, 1 University Rd., 221116 Xuzhou, P.R.China*

[*]*Presenting author (xbsun@aiofm.ac.cn)*

Due to the polarization sensitivity of atmospheric scattering radiation, optical polarization remote sensing technology has been gradually applied in Earth's atmospheric exploration. Many types satellite polarization payloads have been launched in the world, and their in-orbit observation data products can be applied to the research fields of meteorology, climate, environmental protection and atmospheric science, and etc. Considering the configuration characteristics of the polarization payload in orbit, two kinds of satellite-borne detection systems with polarization wide-field imaging and polarization scanning imaging, namely Directional Polarization Camera (DPC) and Particulate Observation Scanning Polarimeter (POSP), have been developed by Anhui Institute of Optics and Fine Mechanics, Hefei Institutes of Physical Science (HFIPS), Chinese Academy of Sciences, and have been successfully launched several times. Based on the on-orbit observations of atmospheric polarized radiation by DPC and POSP, we analyze the characteristics of aerosols and clouds, and obtain the relevant research results [1].

In this talk, we summarize the recent developments of our research team on the optical and microphysical properties of atmospheric aerosols and clouds based on polarized radiation detection. We have completed several aerial polarization detection flight experiments to verify the polarization radiation detection accuracy of the developed instrument and the effectiveness of aerosol polarization inversion. In particular, the primary aerosol models and distribution characteristics over China are studied, the information content of satellite atmospheric polarized radiation observation is discussed, and the method of surface-atmosphere decoupling by using the detection data of short-wave infrared polarization band is investigated. On this basis, the representative research results of atmospheric aerosol and cloud characteristic parameters of our team are presented, and the related validation results of product accuracy are introduced. These results are as follows: the retrieval results of aerosol optical depth based on the combination of intensity and polarization information from satellite detection, the analysis of cloud polarization characteristics in the strong convective weather, the analysis of polarization characteristics of clouds over ice and snow surface observed by dual-polarization payloads, and the study of water cloud droplet size distribution based on the dynamic adjustment of multi-angle polarized radiation information [2,3,4].

References

[1] Xiaobing SUN, Maoxin SONG, Yang WU, *et al*., 2022: Analysis of the atmospheric multi-angle polarimetric radiometer for aerial remote sensing and its test experiments. *Optics and Precision Engineering*. **30**(22):2847-2859.

[2] Yizhe Fan, Xiaobing Sun, Honglian Huang, *et al*., 2021: The primary aerosol models and distribution characteristics over China based on the AERONET data. *Journal of Quantitative Spectroscopy & Radiative Transfer*. **275**, 107888.

[3] Yizhe Fan, Xiaobing Sun, Rufang Ti, *et al*., 2023: Aerosol Retrieval Study from a Particulate Observing Scanning Polarimeter Onboard Gao-Fen 5B without Prior Surface Knowledge, Based on the Optimal Estimation Method. *Remote Sens*. **15**, 385.

[4] Ying Fang, Xiaobing Sun, Rufang Ti, *et al*., 2023: Cloud detection algorithm over Ice-Snow Based on Polarization Sensor of Gaofen-5(02) Satellite. *Acta Optica Sinica*. **43**(24): 2428004.

Preferred mode of presentation: Invited