Enhancing Hyperspectral Remote Sensing Data Quality: Real-Time On-Orbit Atmospheric Correction with Advanced Synchronization Monitoring Atmospheric Corrector (ASMAC)

Gaojun Chi[a,b*], Yadong Hu[a], Xiangjing Wang[a], Zhuoran Li[a], Yan Ma[c], Zhenwei Qiu[a],and Jin Hong[a,b]

[a]*Anhui Institute of Optics and Fine Mechanics, Hefei Institutes of Physical Science, Chinese Academy of Sciences, Hefei 230031, China/P. R. China*
[b]*University of Science and Technology of China, Hefei 230026, China/P. R. China*
[c]*Aerospace Information Research Institute, Chinese Academy of Sciences, Beijing 100101, China*

[*]*Presenting author (chigaojun@mail.ustc.edu.cn)*

Hyperspectral remote sensing technology plays a crucial role in land cover classification and environmental monitoring. However, the quality of hyperspectral data is often compromised by atmospheric effects. Traditional atmospheric correction methods are typically performed on the ground, leading to lengthy data processing cycles and poor real-time capabilities.[1] This study proposes a novel approach to address this challenge. The utilization of the Advanced Synchronization Monitoring Atmospheric Corrector (ASMAC) for real-time on-orbit atmospheric correction is proposed as a means of enhancing the quality of hyperspectral remote sensing data. In contrast to previous SMAC payloads [2], ASMAC is capable of synchronous measurement of atmospheric parameter information, as well as on-orbit computation of atmospheric parameters and atmospheric correction. The system employs a split-aperture multispectral polarized atmospheric detection system and an onboard real-time computing processor to accurately calculate atmospheric parameters such as aerosol optical depth (AOD) and columnar water vapor (CWV). The ASMAC instrument covers 10 spectral bands, including four narrowband bands that are specifically designed for the detection of aerosol layer height using oxygen A and oxygen B. To mitigate the effects of cloud, ASMAC restricts the instantaneous field of view of the ground point to a maximum of 3 km. This study also introduces the working principles and design strategies of ASMAC and evaluates its advantages and challenges in real-time on-orbit atmospheric correction. The results demonstrate that ASMAC is capable of accurately and in real-time generating atmospheric and correction parameters that align with the spatiotemporal characteristics of hyperspectral images. This capability offers new avenues for real-time tactical decision making.

References

[1] Bue B. D., Thompson D. R., Eastwood M., et al. 2015: Real-Time Atmospheric Correction of AVIRIS-NG Imagery. *IEEE Trans. Geosci. Remote Sens.* **53(12)**, 6419-6428.
[2] Li Z., Hou W., Qiu Z., et al. 2021: Preliminary On-Orbit Performance Test of the First Polarimetric Synchroni-zation Monitoring Atmospheric Corrector (SMAC) On-Board High-Spatial Resolution Satellite Gao Fen Duo Mo (GFDM). *IEEE Trans. Geosci. Remote Sens.* **60**, 1-14.

Preferred mode of presentation: Oral/Poster