An advanced Synchronization Monitoring Atmospheric Corrector （ASMAC）with onboard atmospheric parameter calculation

Yadong Hu[1,2], Mengfan Li[1,2], Xiao Liu[1,2], Xiangjing Wang[1,2], Pingping Yao[1,2], Gaojun Chi[1,2], Zhuoran Li[1,2]

1Anhui Institute of Optics and Fine Mechanics, HFIPS, CAS, Hefei, Anhui 230031, China

2Key Laboratory of Optical Calibration and Characterization of CAS, Hefei, Anhui 230031, China

With the development of fast atmospheric parameter retrieval algorithms and onboard computing technology, it is now possible to perform real-time onboard atmospheric parameter calculations. The Anhui Institute of Optics and Mechanics at the Chinese Academy of Sciences has developed an advanced atmospheric corrector load called the Atmospheric Sensor with Onboard Atmospheric Calculation (ASMAC) to meet the needs of remote sensing technology development. ASMAC is composed of a multispectral polarized atmospheric detection body and an onboard processor capable of real-time atmospheric parameter calculations. To perform atmospheric correction, ASMAC uses the Light Estimator Including Polarization, Surface Inhomogeneities, and Clouds (LEIPSIC) 3D radiative transfer code based on backward Monte Carlo. This allows for highly accurate atmospheric correction in real-time.

Continuous development of quantitative remote sensing and the continuous improvement of quantitative applications of hyperspectral satellite remote sensing in agricultural yield estimation, mineral exploration, and ocean color remote sensing have put forward higher requirements for the ability to correct atmospheric impacts. The detection main body of ASMAC adopts the split aperture multispectral polarization detection technology, with 10 detection bands and a coverage of 0.49 μ m ~1.61 μ m. Including four narrow band bands of oxygen A and oxygen B for high information detection of the aerosol layer; In order to reduce the probability of being affected by clouds and improve the efficiency of atmospheric parameter detection, the instantaneous field of view of the undersatellite point is ≤ 3km. The accuracy of polarization measurement directly affects the accuracy of atmospheric parameter detection and retrieval. The measurement index of polarization accuracy is Dolp err ≤ 0.007. When Dolp=0.2, the absolute uncertainty of radiation measurement in all wavebands is<0.05.

With the development of fast atmospheric parameter retrieval algorithms and onboard computing technology, real-time onboard atmospheric parameter calculation has become possible. The retrieval results include: AOD, CWV, etc. The fast atmospheric parameter inversion method includes a fast radiation transfer method and a lookup table method, which will run in a computing unit composed of a heterogeneous framework based on a combination of FPGA and CPU. The CPU unit is responsible for observation geometry and auxiliary data processing, while the high-performance FPGA is responsible for running the fast atmospheric parameter inversion algorithm.

ASMAC can be used for quantitative requirements of remote sensing of the earth's surface, such as high resolution and high spectral imagery, effectively reducing the impact of atmospheric aerosols, water vapor, and other factors。