Atmospheric correction method and application of satellite hyperspectral data: A case study in mineral resource monitoring

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A. Introduction

Hyperspectral sensors have become indispensable tools in remote sensing applications, playing a pivotal role in precision agriculture, mineral alteration mapping, land cover classification, and autonomous satellite wildfire detection. Their high spectral resolution and comprehensive spectral information about ground objects underscore their significance. However, despite the wealth of hyperspectral data sources, challenges in data processing have impeded their quantitative application on the Earth's surface. Atmospheric correction, a critical procedure for deriving surface reflectance that accurately captures surface properties, is essential to overcoming these challenges.

Aims: The study aims to propose an atmospheric correction method of satellite hyperspectral data and perform application in mineral resource monitoring.

B. Methods

Atmospheric correction based on radiative transfer model.

TOA Reflectance ρ^* → RTM → Surface Reflectance ρ_s

Atmospheric parameters T,σ, ρ_{Path}

Aerosol Optical Depth(AOD) | Perceptible Water Vapor(PWV)

Inversion of the atmospheric parameters.

ρ^*: Apparent reflectance T: Gas transmittance
ρ_s: Surface reflectance σ: Hemispheric albedo
ρ_{Path}: Atmospheric path radiation

C. Results

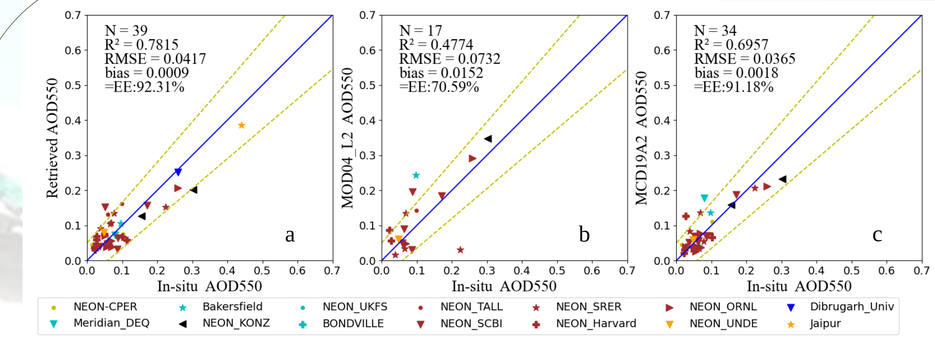

Fig.1. Validation results of AOD (a), MOD04_L2 (b) and MCD19A2.

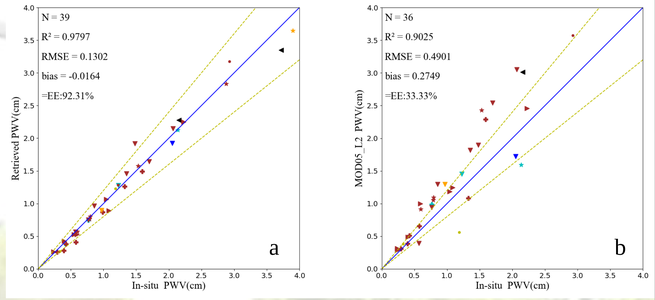

Fig.2. Validation results of PWV retrievals (a) and MOD05_L2 (b).

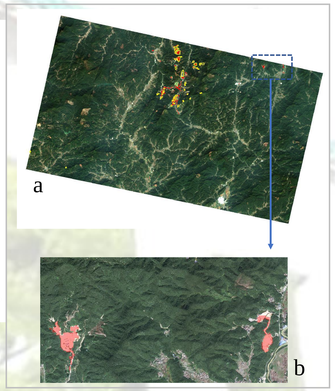

Fig.4. Through comparison with mining rights maps, more than 80% of mining area maps are successfully identified (a). Moreover, it facilitates the monitoring of unauthorized mining activities (b).

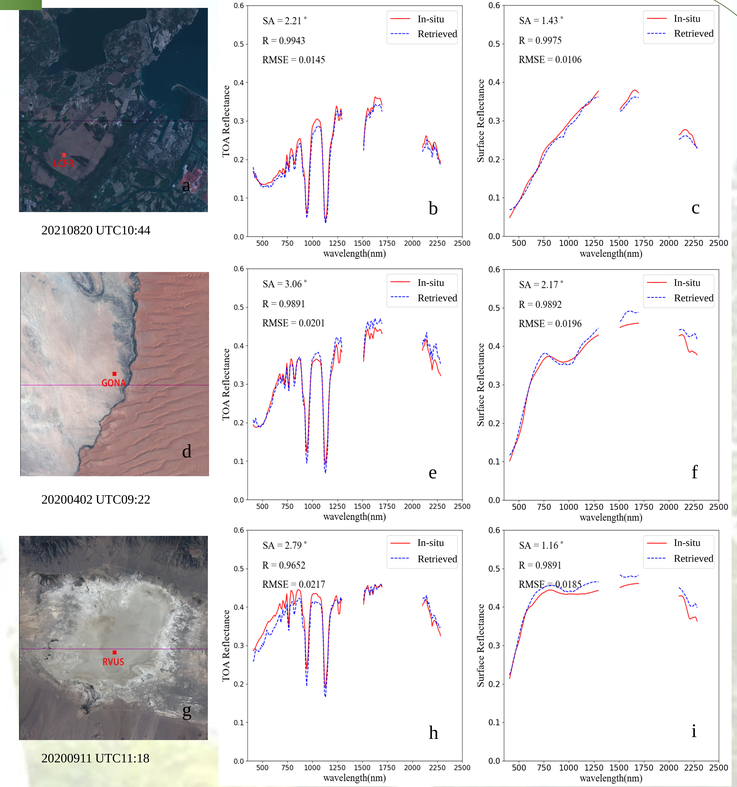

Fig.3. Comparison of TOA and surface reflectance on LCFR, GONA and RVUS sites.

D. Conclusions

- The retrieved AOD and PWV retrievals exhibit excellent consistency with ground measurements and are reliable for utilizing as input of atmospheric correction.
- The result of atmospheric correction, surface reflectance, is highly accurate when compared with in-situ measurements.
- The resulting surface reflectance spectral curve is utilized to identify mineral areas and achieves high accuracy.