

基于中国三颗类似 EMI 载荷的 SO₂ 总量反演及产品比较研究

摘要：基于中国已发射 GF5(01A)、DQ1 和 GF5(02)卫星上三颗类似 EMI 载荷观测数据，经过光谱重定标、云判识、DOAS 斜柱、AMF 垂直柱转换等步骤后，反演获得大气中 SO₂ 总量。以夏威夷火山喷发为研究对象，开展 GF5(01A)、DQ1 和 GF5(02)卫星上三颗类似 EMI 载荷 SO₂ 总量产品的比较。从时空分布上看，GF5(01A)、GF5(02)星和 DQ1 EMI 载荷 SO₂ 产品都能明显监测到火山喷发产生的高浓度 SO₂ 气团以及扩散影响范围。高浓度 SO₂ 气团在西北风的影响下，扩散至墨西哥、美国东部沿海等区域，且浓度逐渐降低。GF5(02)星和 DQ1 EMI 载荷组网可实现一天两次的全球 SO₂ 监测，为大气环境和气候变化监测提供了有力的数据支撑。定量精度上，从 2022 年 12 月 01 日夏威夷火山单日监测结果上看，超过 90%的像元相对偏差在±5%以内，火山喷发及扩散区域近 5 万的像元相关系数在 0.73 左右。

Retrieval and comparison of SO₂ total column from three Chinese satellites with EMI-like instruments

Abstract: Based on the observation data of three similar EMI loads on GF5(01A), DQ1 and GF5(02) satellites launched by China, the total amount of SO₂ in the atmosphere is obtained after processes such as spectral calibration, cloud identification, DOAS slant column retrieval, and AMF vertical column conversion. Taking the Hawaiian volcanic eruption as case study, SO₂ columns from three similar EMI on GF5(01A), DQ1 and GF5(02) satellites was compared. As for spatial and temporal distribution, all three satellites demonstrate the ability to detect high concentrations of SO₂ plumes generated by the volcanic eruption, along with the corresponding dispersion patterns. Influenced by northwest winds, these high-concentration SO₂ plumes disperse into regions such as Mexico and the eastern coastal areas of the United States, gradually decreasing in concentration. The satellite network formed by GF5(02) and DQ1 with EMI sensors

enables twice-daily global monitoring of SO₂, providing data support for the atmospheric environmental and climate change monitoring. In terms of quantitative accuracy, from the single-day monitoring results of the Hawaiian volcano on December 1, 2022, the relative deviation of more than 90% of the pixels is within $\pm 5\%$, and the correlation coefficient of nearly 50,000 pixels in the volcanic eruption and diffusion area is about 0.73.

Keywords: SO₂ Retrieval, GF5 EMI, Volcanic Eruption