Preprocessing and Data Filtering*:

Input: Lat/Lon; L1B data; OMI geometry; \( \text{O}_3 \) VCDs

Processing:
- Calculate ozone residuals at 313/314 & 314/315 nm
- Data filtering; PCA on remaining pixels (PCA Step 1)
- Further Data filtering; PCA on remaining pixels (PCA Step 2)
- Spectral fitting w leading PCs; compare residuals w \( \text{SO}_2 \) cross sections

Output: Flags for pixels containing large volcanic \( \text{SO}_2 \)
- Principal Components (PCs)

PCA and Initial VCD Estimate:

Input: Pre-computed, fixed Jacobians for PBL \( \text{SO}_2 \)

Processing:
- Least squares fitting
- Updated PCs
- PCA for pixels with relatively small initial \( \text{SO}_2 \) (PCA Steps 3−5)

Output: Initial estimates of \( \text{SO}_2 \) VCDs

AMF and Final VCD Estimate:

Input: Jacobian Lookup Tables; GEOS \textit{a priori} profiles

Processing:
- AMF/Jacobian calculation for each OMI pixel

Output: Final estimates of \( \text{SO}_2 \) SCDs and VCDs

*Each OMI row is processed separately.