New $\text{SO}_2$ Product from OMPS

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Outline

• Long-term SO$_2$ EDR
• OMPS: Goals and Algorithms
• Sample OMPS Results and Comparisons with OMI
• Summary
SO$_2$ EDR: Inventory of Emission from Volcanic Eruptions

TOMS & OMI: 1978 - Present
SO$_2$ EDR: Volcanic Degassing & Anthropogenic Emissions

Daily SO$_2$ emissions (kilotons)  
Sept 2004 - Sept 2005

Ecuador/S. Colombia volcanoes

La Oroya copper smelter

Ilo copper smelter

Average SO$_2$ map from OMI
OMPS Nadir Mapper (NM)
SO$_2$ Products Goals

- Continue the long-term sulfur dioxide (SO$_2$) EDR from TOMS and OMI

- Provide near-real-time (NRT) detection and monitoring of volcanic plumes for aviation hazard mitigation
OMPS NM SO$_2$ Processing

**Standard Product:** Spectral Fitting Algorithm
- Retrieve ozone and SO$_2$ simultaneously
- Suitable for quantify full range of SO$_2$

**Near-Real-Time Product:** LF (linear-fit) Algorithm
- Use outputs from operational total ozone processing
- Fast and reliable in detecting volcanic plumes

*Same algorithms used for the corresponding OMI products.*
Sample Results and Comparison: Volcanic Eruption

\[ \text{(SO}_2 \text{ in Upper Troposphere and Lower Stratosphere)} \]
Volcanic Eruption: 2012-05-08
Nyiragongo (DR Congo)

Mass = 14 kT
Max SO₂ = 29 DU
@ lon = 29.23
lat = -1.26
11:30 UTC
Volcanic Eruption: 2012-05-08
Nyiragongo (DR Congo)

Mass = 16 kT
Max SO$_2$ = 12 DU
@ lon = 30.09
lat = -0.96
11:40 UTC
Near-Real-Time OMPS SO₂ Product

Eruption of Kliuchevskoi Volcano (Kamchatka, Eastern Russia) 10/19/2013
SO₂ Over US: validation of OPMS with ground-based measurements
Sample Results and Comparison: Volcanic Degassing

(SO$_2$ in Lower Troposphere)
Volcanic Degassing: 2012-10-04
Kilauea (Hawaii)

Mass = 1.2 kT
Max $SO_2 = 1.9$ DU
@ lon = -155.48
lat = 18.65
23:25 UTC
Volcanic Degassing: 2012-10-04
Kilauea (Hawaii)

Mass = 1.4 kT
Max $SO_2 = 1.7$ DU
@ lon = -155.74
  lat = 18.53
  23:41 UTC
OMPS/NM Sample Results: Anthropogenic Emission

(SO$_2$ in the Boundary Layer and Lower Troposphere)
OMPS SO$_2$ Measurements

SO$_2$ (DU)
OMPS NO$_2$ Measurements

NO$_2$ ($10^{15}$ cm$^{-2}$)
Monitoring of SO$_2$ Plumes: Copahue (Argentina and Chile)

Degassing Volcanoes

Anthropogenic Emission

2012/12/22

SO$_2$ (DU)
Summary

• OMPS NM provides high signal-to-noise ratio UV measurements, stable instrument performance (no degradation detected). Correction needed and developed to reduce stray-light contamination.

• NRT software implemented and tested. OMPS NM provides reliable data for NRT global monitoring of eruptive volcanic plumes.
Summary (continued)

• Good agreements in total loadings between OMPS and OMI for both volcanic degassing and eruption. TOMS and OMI long-term volcanic EDR can be extended with OMPS record.

• We have accomplished high quality retrievals for $\text{SO}_2$ in the boundary layer and lower troposphere. Boundary layer $\text{SO}_2$ EDR from OMI can be extended with OMPS data.