



Overview and Update of the AeroCom Volcanic SO₂ Emission Inventory

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Outline

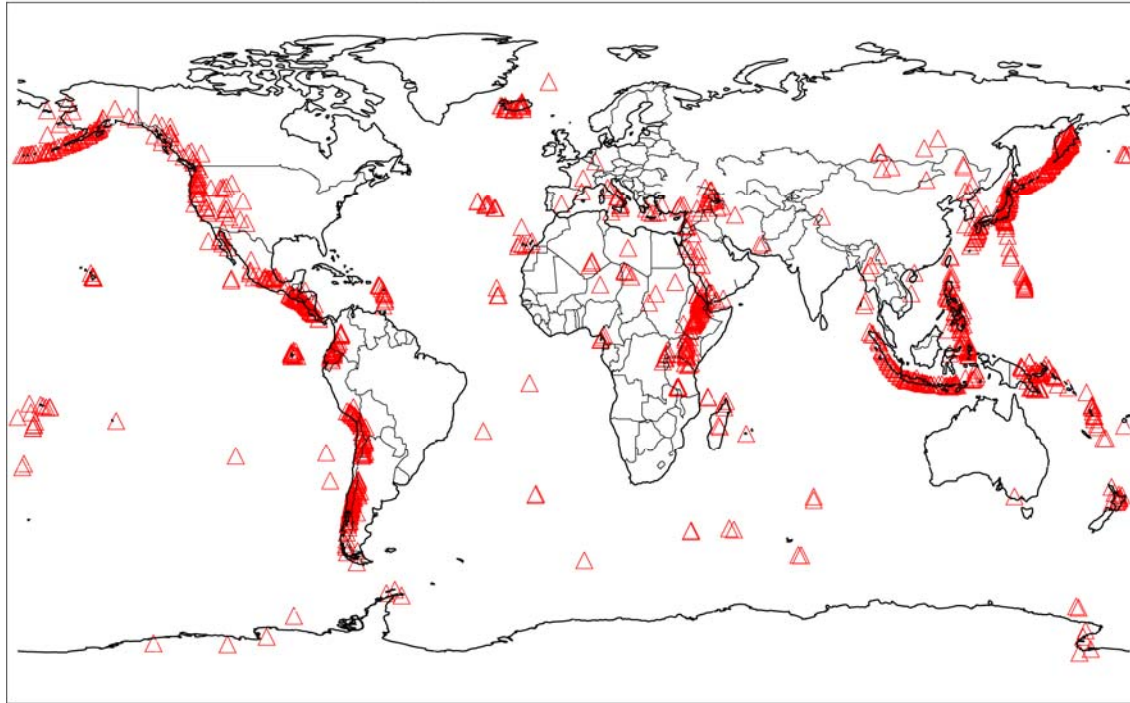
- General Features
- Methodology
- Recent Modifications
- Discussion of some details of the dataset

General Features

- Daily SO₂ emissions and plume heights for 1167 volcanoes from 1-1-1979 to 31-12-2009
- Emissions due to explosive and effusive eruptions as well as silent degassing taken into account
- Eruption data including the VEI is from the Smithsonian's Global Volcanism Program (GVP)

Distribution of Volcanoes

Emitting Volcanoes 1979-2009



- Mostly located along arcs of subduction zones
 - More frequent, violent and short-lived eruptions
- Fewer hot spot and rift volcanoes
 - Longer lasting eruptions, more effusive

Methodology

- All volcanoes with historic subaerial eruptions in GVP are included
- For eruptive episodes, GVP provides dates and the VEI.
 - First approximation of SO₂ and plume height by the VEI/VSI
- SO₂ amount iteratively refined for individual eruptions by satellite (e.g. TOMS, OMI) and COSPEC observations, and more detailed analyses from publications
- Plume height also refined for individual cases by observations listed in the Bulletin of the Global Volcanism Network (BGVN), and analyses in the literature
- For some eruptions with known Lava and/or Tephra volumes, the SO₂ is estimated from these amounts
- Data for quasi-continuously erupting volcanoes is from Andres & Kasgnoc (1998)
- Silent degassing estimates for non-eruptive periods are based on Berresheim & Jaeschke (1983) and Stoiber et al. (1987)

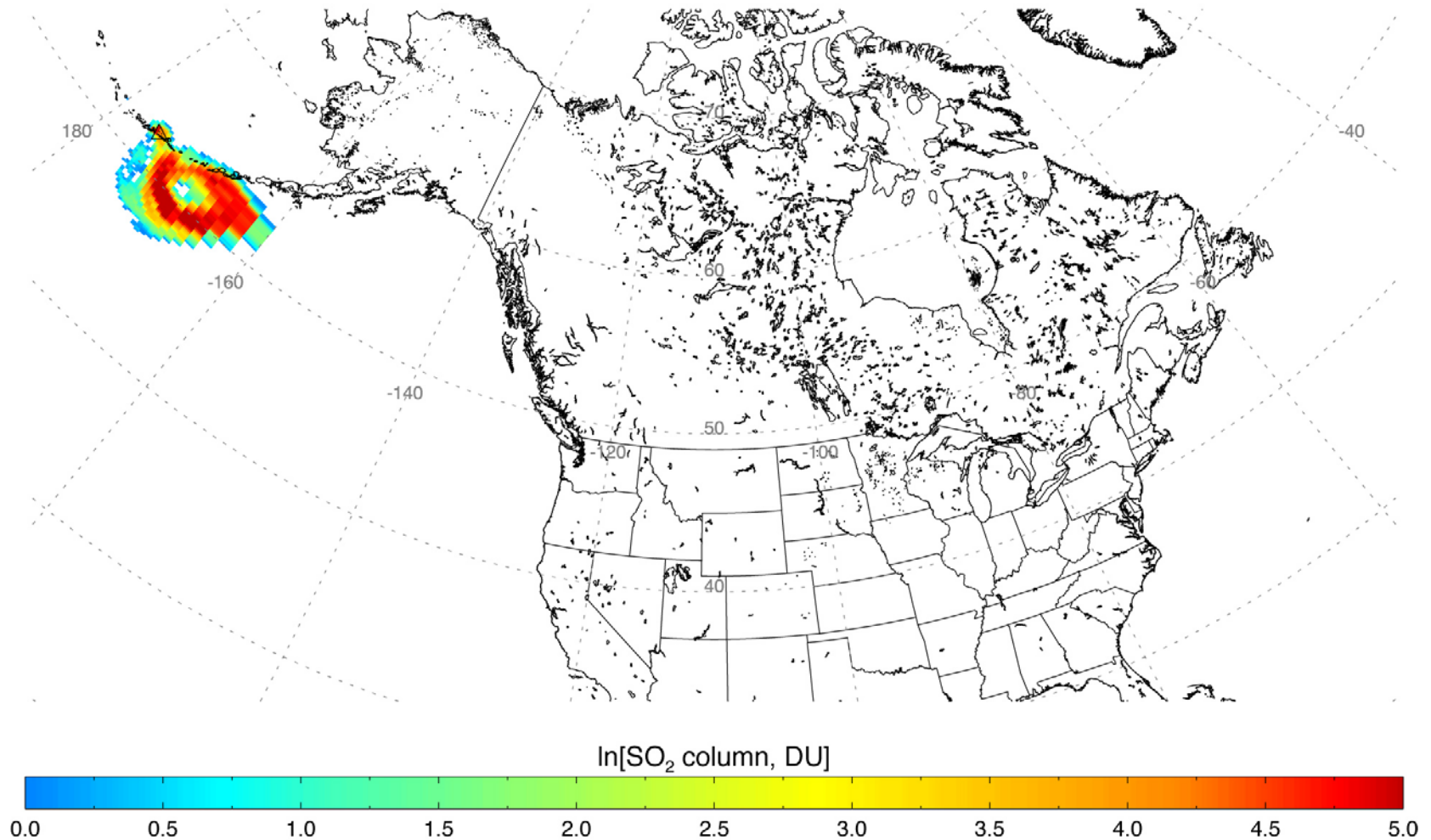
Recent Changes

- Added eruptions for 2008 and 2009
- Ingested OMI data for several eruptions, e.g.:
 - Kasatochi (2008), Nyamuragira (2006), Okmok (2008), Redoubt (2009), Sarychev Peak (2009)
- Changed plume height for Pinatubo and El Chichon to 25 km
- Added some plume heights from BVGN reports
- Fixed a code bug

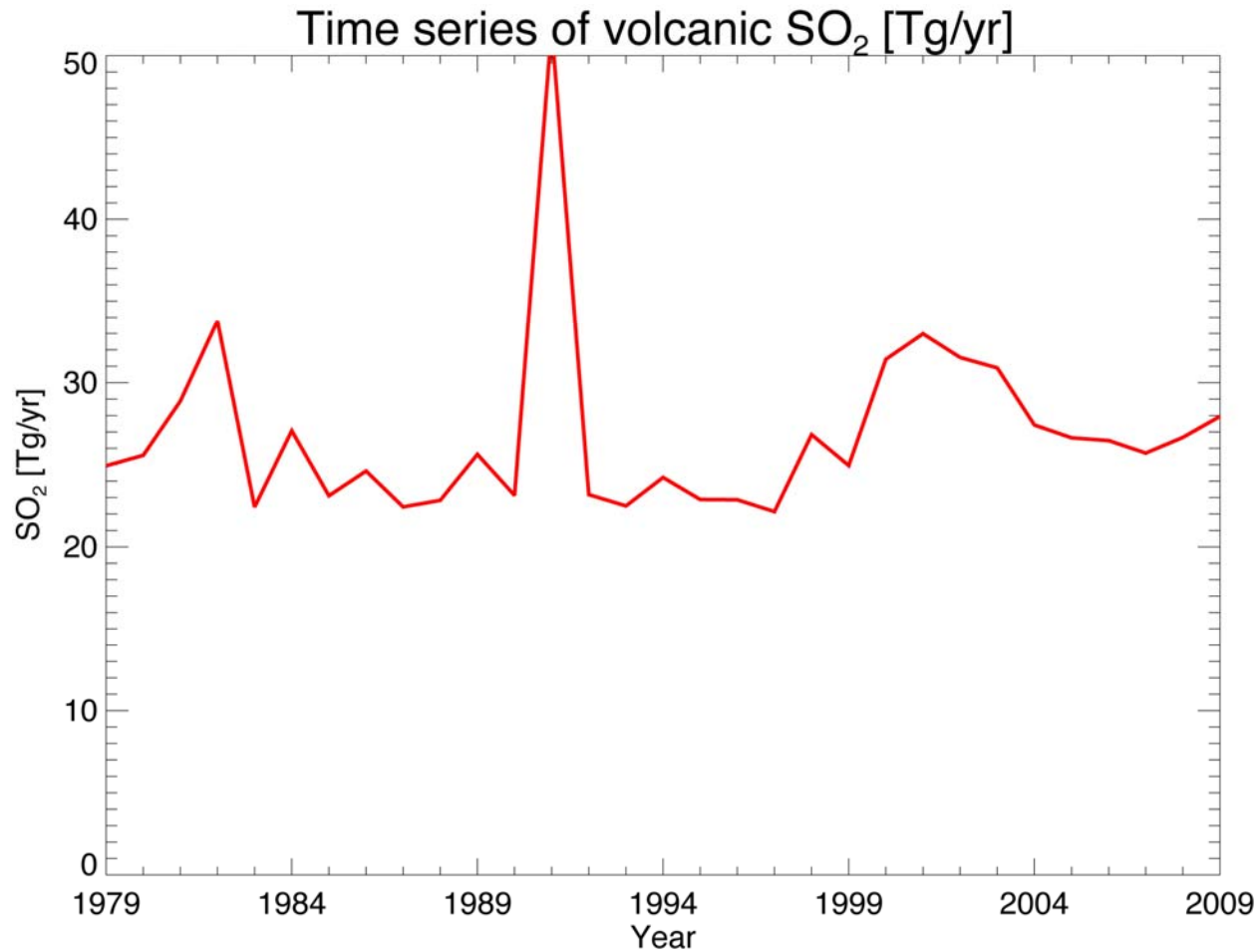
Example from OMI - Kasatochi

Aura/OMI - 08/09/2008 00:56-01:03 UT - Orbit 21636

SO₂ mass: 882.092 kt; Area: 641791 km²; SO₂ max: 246.15 DU at lon: -171.85 lat: 50.32 ; 01:02UTC



Total SO₂ per Year

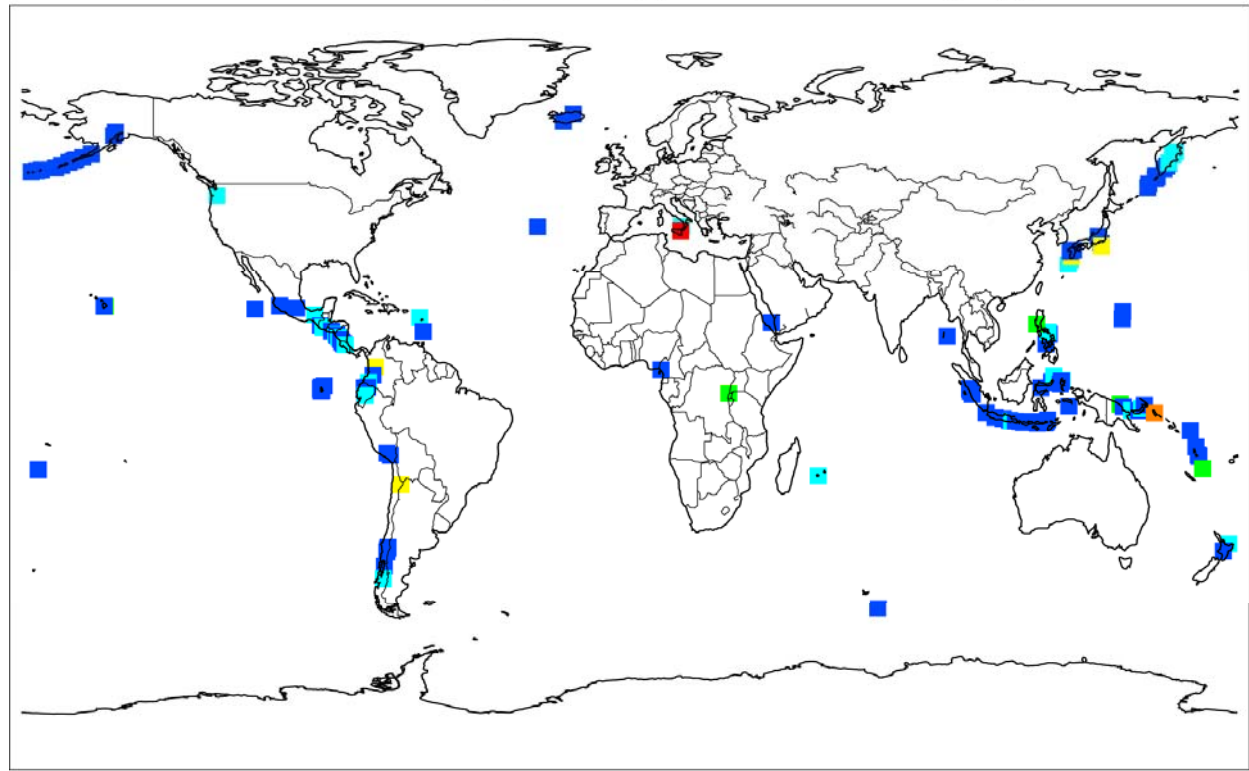


	Minimum	Maximum	Average	Median
Total SO ₂ /year	22 Tg	52 Tg	27 Tg	26 Tg

About 11-13 Tg/year from silent degassing included

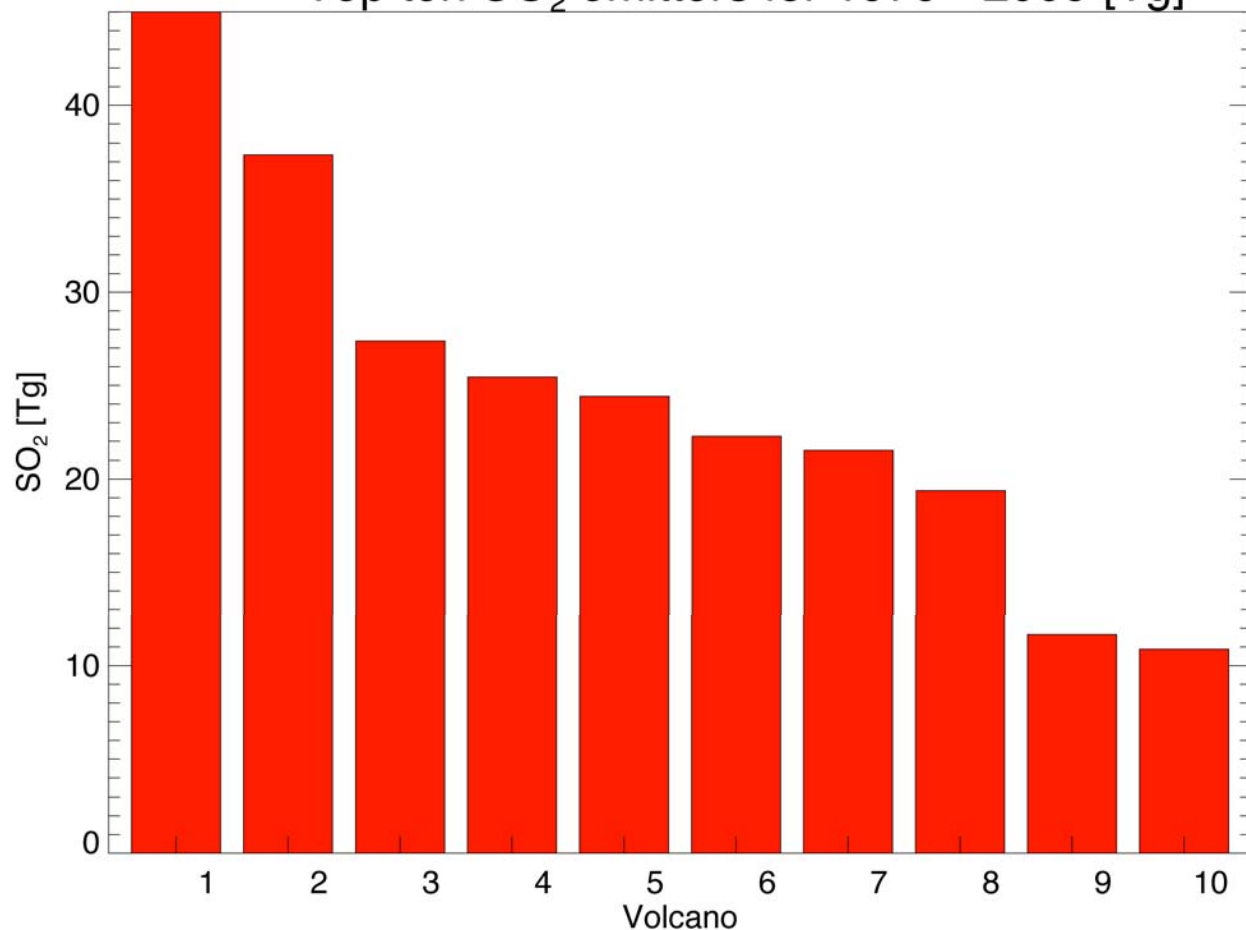
Total SO₂ per Volcano

Emitted SO₂ during 1979-2009 [Tg]



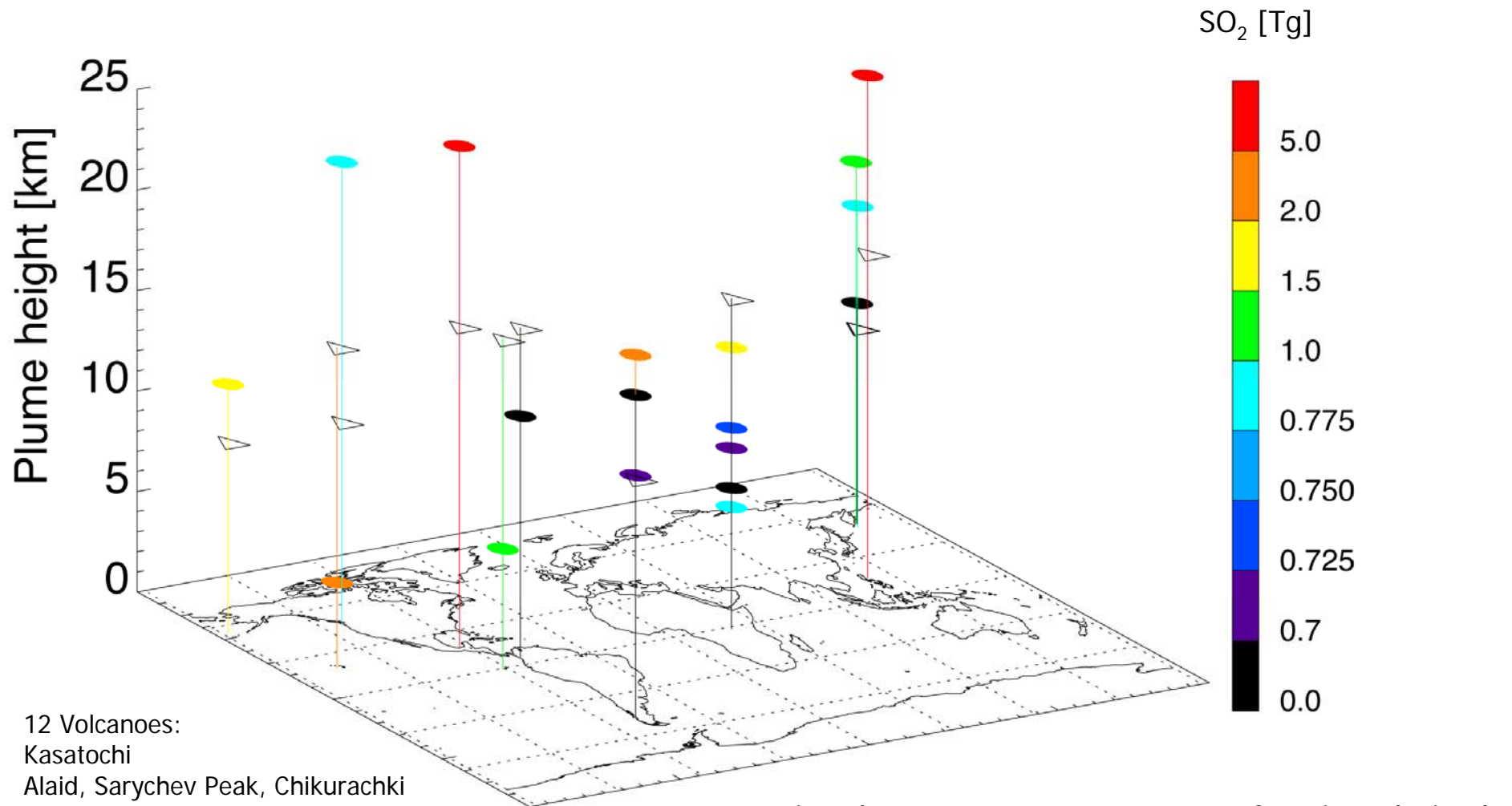
Strongest Emitters

Top ten SO₂ emitters for 1979 - 2009 [Tg]



- 1: Etna
- 2: Bagana
- 3: Lascar
- 4: Miyake-jima
- 5: Nyamuragira
- 6: Nevado del Ruiz
- 7: Sakura-jima
- 8: Pinatubo
- 9: Kilauea
- 10: Manam

Largest 20 Explosive Eruptions



12 Volcanoes:

Kasatochi

Alaid, Sarychev Peak, Chikurachki

St. Helens

Mauna Loa, El Chichon, Sierra Negra, Nevado del Ruiz

Nyamuragira, Pinatubo

Cerro Hudson

Some Open Issues

- Observed top plume height not necessarily corresponding to top SO₂ injection height
- Effects of buoyancy and in-plume removal
- How to use plume height from inventory in models (current recommendation: injection into top 1/3 of the plume)
- Inclusion of other species? Ash might be of interest. Other species?
- Suggestions? Questions?