Aura OMI observations of global SO$_2$ and NO$_2$ pollution from 2005 to 2013

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18 September 2014
Key improvements in OMI NO\textsubscript{2} and SO\textsubscript{2}

• **Significant improvements in retrieval quality** –
  – Improved spectral fitting of OMI NO\textsubscript{2} removes 20%- 40% of the stratospheric biases with other satellite measurements. **New NO\textsubscript{2} version planned for release next year**
  – New PCA SO\textsubscript{2} algorithm uses full spectral content from OMI, reduces noise by half and removes biases (artifacts)
  – **New Version 2 OMI SO\textsubscript{2} dataset will be released this fall**

• **Maximal data continuity between instruments** –
  – Both OMI NO\textsubscript{2} and SO\textsubscript{2} algorithms can benefit new missions: SNPP/ OMPS, TROPOMI, GEMS and TEMPO
  – no need to develop instrument-specific radiance data correction schemes

• **Maximal sensitivity** -
  – PCA SO\textsubscript{2} detection limit for point sources is half the current PBL algorithm

• **Flexibility** –
  – PCA SO\textsubscript{2} fitting window can be easily adjusted to optimize sensitivity under different conditions: from small anthropogenic signals to largest volcanic plumes.
  – NO\textsubscript{2} fitting window can be expanded to UV wavelengths (OMPS)
Regional trends in OMI new SO$_2$ and NO$_2$ : 2005-2013
OMI SO$_2$ and NO$_2$ time series

- SZA < 70°
- Cross-track CCD rows 6-23 (excluding row anomaly for all years);
- Snow-free observations (according to the IMS data* product);
- SCD-O$_3$<1500 DU, VCD_SO$_2$<15 DU
- Additional volcanic filtering: all days removed which, over that region and considering all years, had a daily 99.9$^{th}$ percentile value greater than $X$,
  - where $X$=5 DU for Eastern North America,
    8 DU for Eastern Europe and India,
    10 DU for China –
these thresholds are obtained using the 99.9 percentile daily regional time series.
For consistency removed the same volcanic days in NO$_2$ product

Eastern Europe

2005-2007

SO$_2$

2011-2013

Etna Volcano

Maritsa Iztok (Bulgaria)
Eastern Europe: Time series for Maritsa Iztok

SO₂

2005

2013

Change from 2005 [%]
India

SO$_2$

2005-2007

2011-2013

Power plants / smelter

Vertical Column Density [DU]

0.5 1 1.5

SO$_2$

Chhattisgarh

Pronunciation: chuht-tihs-guhr

Change in SO$_2$ [%]

Year

2005 2006 2007 2008 2009 2010 2011 2012 2013

0 20 40 60 80 100
2005-2007

India

2011-2013

$\text{NO}_2$

Power plants / smelter

Chhattisgarh

Pronunciation: chuht-tihs-guhr

Chhaterasgarh

Pronunciation: chuht-tihs-guhr

Change in trop. NO$_2$ [%]

Vertical Column Density [10$^{15}$ cm$^{-2}$]
Time series: India (Chhattisgarh)

SO\textsubscript{2}
Eastern China: Time series

SO$_2$

NO$_2$

Change in SO$_2$ [%]

Change in trop. NO$_2$ [%]
Summary

Eastern USA

Eastern Europe (Maritsa Iztok, Bulgaria)

India (Chhattisgarh)

Eastern Asia (Eastern China)