# Biomass burning plumes in the vicinity of Moscow as seen by OMI during summer 2010

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## 1. Event Description

Wildfires in the vicinity of Moscow in the summer of 2010 were particularly widespread and damaging. The most intense fires started 26 July and raged until 12 August. The MODIS-based fire count imagery for this period given in ***Figure 1***, illustrates spatial extent of the fires.

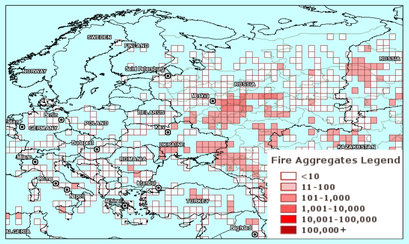


**Figure 1. MODIS fire counts aggregate image for the period 26 Jul – 15 Aug 2010.** The region east of Moscow has the high frequency of fire detections.

**Figure 2.** Photo of a forest fire outside of Moscow (*left*) near the village of Dolginino on 4 Aug 2010 [Artyom Korotayev, AFP/Getty Images]. Resultant smoke and smog *(right)* which plagued Moscow for days-- St. Basil's Cathedral and the Kremlin are seen in the distance through thick smog at the Red Square 6 Aug 2010 [Mikhail Metzel, AP Photo].

Due to stagnant meteorological conditions, plumes of smoke and smog developed and plagued the city of Moscow with poor visibility as can be seen in the photo of Figure 2.

## 2. Meteorological Conditions

Hot, dry conditions set the stage for an above average fire season in the vicinity of Moscow from the end of July through mid-August. Persistent high pressure with accompanying high temperatures, low relative humidity (***Figure 3***) and little wind meant conditions were ideal for the stagnation of smoke plumes.

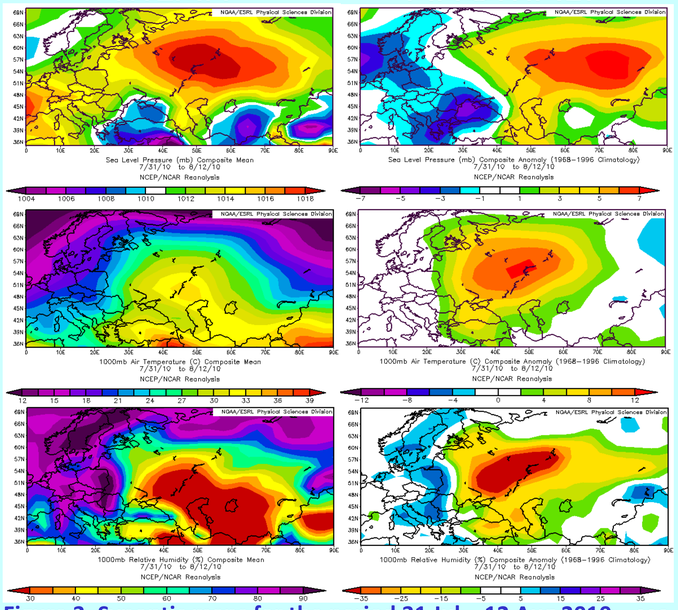


**Figure 3. Synoptic maps for the period 31 Jul – 12 Aug 2010**: sea level pressure (top), air temperature 1000hPa (middle), relative humidity 1000hPa (bottom), where left panels are composite means for the period and right panels are corresponding anomaly fields for the same period.

## 3. Absorbing Aerosol Index (AAI)

The aerosol index is the UV scene color based on a ratio of measured and Rayleigh scattering only reflectance for a given wavelength pair (354/388nm for OMI). The resultant residual value, when positive, indicates the presence of absorbing aerosol (like dust and smoke). The positive AAI values from the OMI OMAERO product are shown in Figure 4. Several days from the event are shown here for early stage, peak of stagnation, and end stage of dissipation.

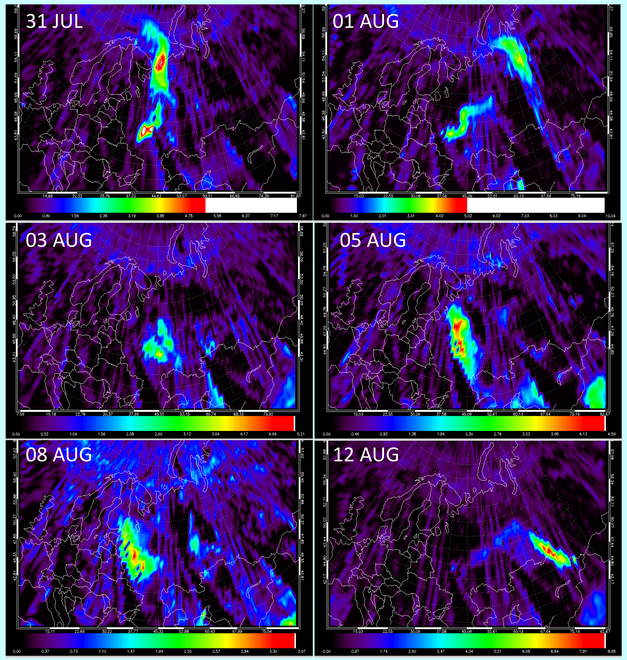


**Figure 4.** OMI OMAERO AAI in the early phase (top), peak stagnation phase (middle), and dissipation phase (bottom).

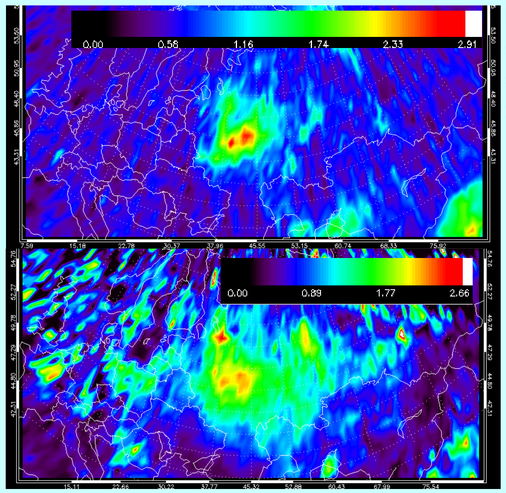


**Figure 5.** OMI OMAERO composite means **AAI** (*top*) and **AOT-483.5nm** (*bottom*) for **01-09 Aug 2010.**

The comparison between AAI and aerosol optical thickness (AOT) at 483.5 nm is shown in Figure 5. Both show similar structure, although the AOT is much noisier due to cloud contamination. AAI depends on AOT, but also aerosol layer height, so these fields are not always correlated.

## 4. Aerosol Optical Thickness (AOT)

The OMAERO AOT shown in Figure 5 (lower panel) can be retrieved for cloud-free scenes and is calculated at 14 different wavelengths in the UV-VIS range of OMI (AOT at 483.5nm shown on this poster). The retrieval uses information from aerosol models and aerosol climatologies.

For comparison MODIS AOT at 550 nm for August 2005 (little boreal burning) and August 2010 are shown in Figure 6 along with OMI AOT.

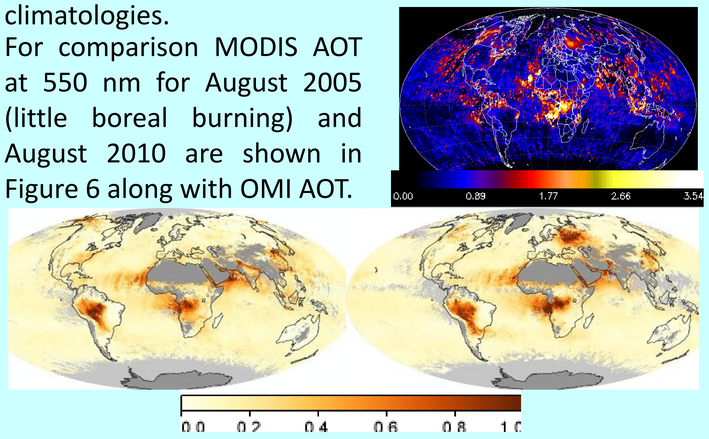


**Figure 6.** OMI AOT composite mean 01-09 Aug 2010 (upper right); MODIS AOT at 550nm monthly average for August 2005 (lower left) and August 2010 (lower right).

## 5. Single scattering albedo (SSA)

The OMAERO SSA is a product of the best aerosol model chosen during the AOT retrieval. SSA is therefore not an independent retrieval variable, and like the AOT is dependent on the aerosol climatologies used as prior information in the retrieval. This can be clearly seen in Figure 7, which is a composite of SSA values for 1-9 Aug 2010, contours follow the aerosol type climatologies, and so it is difficult to observe day-to-day changes in SSA.

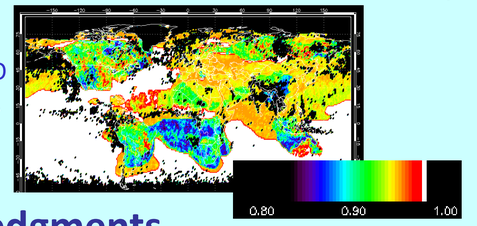


**Figure 7.** OMI OMAERO composite mean of SSA for 01-09 Aug 2010.

## Acknowledgments

MODIS Fire counts in *Figure 1* produced using Univ. of Maryland FIRMS Fire Web Mapper: http://firefly.geog.umd.edu/firemap/;

Photographs in *Figure 2* by Artyom Korotayev, AFP/Getty Images (*left photo*) and Mikhail Metzel, AP Photo (*right photo*);

Synoptic charts in *Figure 3* from NOAA-ESRL: http://www.esrl.noaa.gov/psd/data/composites/day/;

MODIS AOD data in *Figure 6* from: http://earthobservatory.nasa.gov/GlobalMaps/