15 Years of Global $PM_{2.5}$ Estimates from Satellite

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Chronic exposure to fine particulate matter ($PM_{2.5}$) is globally responsible for millions of premature deaths each year. Unfortunately, many regions with both the highest population and highest $PM_{2.5}$ contain the least amount of *in situ* monitoring. Satellite retrievals of Aerosol Optical Depth (AOD), however, provide insight into total aerosol columns over these regions and globally, yet AOD may not be indicative of $PM_{2.5}$ near the surface. Chemical transport models have been shown as an effective way to quantitatively relate AOD to $PM_{2.5}$, allowing the production of global $PM_{2.5}$ estimates including regions that are not measured on the ground.

We produce and combine three different global $PM_{2.5}$ datasets based on this technique, creating annual $PM_{2.5}$ estimates from 1998 to 2012. First, $PM_{2.5}$ is estimated using the operational AOD retrievals from the MODIS and MISR instruments for 2001 to 2006. Second, optimal estimation techniques are used to produce MODIS-based $PM_{2.5}$ estimates for 2004 to 2010. Lastly, we use SeaWiFS and MISR AOD retrievals to represent annual variation in $PM_{2.5}$ from 1998 to 2012, and combine all three datasets together.

We will demonstrate that significant agreement is found between the combined satellite-derived $PM_{2.5}$ estimates and *in situ* observations over North America and Europe. Global comparisons will also be discussed. Global $PM_{2.5}$ exposure will be explored as well as trends over the past 15 years. These results show that global $PM_{2.5}$ concentrations over this period have generally decreased in regions of low exposure, while concurrently increasing in regions of high exposure.