

Estimating SO₂ emissions from a large point source using 10 year OMI SO₂ observations: Afsin Elbistan Power Plant

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SO₂ pollution has still been a problem for parts of Turkey, especially regions with large scale coal power plants. In this study, 10 year Ozone Monitoring Instrument (OMI) SO₂ observations are used for estimating SO₂ emissions from large point sources in Turkey. We aim to estimate SO₂ emissions from coal power plants where no online monitoring is available and improve the emissions given in current emission inventories with these top-down estimates. High-resolution yearly averaged maps are created on a domain over large point sources by oversampling SO₂ columns for each grid for the years 2005-2014. This method reduced the noise and resulted in a better signal from large point sources and it was used for coal power plants in U.S and India, previously. The SO₂ signal over selected power plants are observed with this method, and the spatiotemporal changes of SO₂ signal are analyzed. With the assumption that OMI SO₂ observations are correlating with emissions, long-term OMI SO₂ observation averages can be used to estimate emission levels of significant point sources. Two-dimensional Gaussian function is used for explaining the relationships between OMI SO₂ observations and emissions.

Afsin Elbistan Power Plant, which is the largest capacity coal power plant in Turkey, is investigated in detail as a case study. The satellite scans within 50 km of the power plant are selected and averaged over a 2 x 2 km² gridded domain by smoothing method for 2005-2014. The yearly averages of OMI SO₂ are calculated to investigate the magnitude and the impact area of the SO₂ emissions of the power plant. A significant increase in OMI SO₂ observations over Afsin Elbistan from 2005 to 2009 was observed (over 2 times) possibly due to the capacity increase from 1715 to 2795 MW in 2006. Comparison between the yearly gross electricity production of the plant and OMI SO₂ observations indicated consistency until 2009, but OMI SO₂ observations indicated a rapid increase while gross electricity production is decreasing in 2011-2012. This result could be due to the change in the quality of the coal used or issues in SO₂ removal technologies and will be investigated in detail here.