Geophysical Research Abstracts
Vol. 20, EGU2018-13917, 2018
EGU General Assembly 2018

Conditions for deriving air quality information from satellite data

Roland Stirnberg and Jan Cermak
Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research (roland.stirnberg@kit.edu)

This contribution presents an approach to map urban air quality using passive-sensor satellite data.
Air pollution is inherently a spatial phenomenon: airborne transport of substances yields a multi-source mixture of pollutants at any given location, at and beyond source regions like cities. Thus, satellite data may provide information on the distribution of pollutants relative to geophysical parameters pertaining to surface and atmospheric states. We develop a method to estimate spatial patterns of street-level particulate matter (PM) concentrations based on satellite-retrieved aerosol optical depth (AOD). AOD data is obtained based on the Multi-Angle Implementation of Atmospheric Correction (MAIAC) algorithm applied on data from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument.
The relationship between vertically integrated AOD and PM at street level is modulated by variability in geophysical conditions. Hence, we focus on the detection of sets of conditions that allow a reliable analysis of street-level air pollution based on satellite-derived AOD. AOD and ground-based (PM) measurements are paired with explicit consideration of geophysical parameters such as boundary layer height, relative humidity, wind speed, wind direction, temperature and land surface cover. AOD and PM are linked via a normalization approach, in which the parameters for each month per year are ranked individually from highest to lowest value. This allows us to easily compare associated AOD and PM data pairs and to investigate the governing factors of the relationship between these parameters.
First results indicate that planetary boundary layer height and relative humidity exert the strongest influence on the correlation of AOD and PM, the magnitude and type of the influence changing with season. We conclude that conditions often associated with high air pollution, e.g. stable inversion situations not perturbed by high wind speeds may be particularly suited for satellite-based analysis. Based on our spatial estimates of street-level air quality, we ultimately aim to obtain a better understanding of pollution event patterns and their development in time and space, relative to urban topography and surface cover.