

# SPATIO-TEMPORAL CHARACTERIZATION OF AEROSOLS THROUGH ACTIVE USE OF DATA FROM MULTIPLE SENSORS

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## ABSTRACT:

One of the main challenges of current climate research is providing Earth-wide characterization of Aerosol Optical Depth (AOD), which indicates the amount of depletion that a beam of radiation undergoes as it passes through the atmosphere. Here, a comprehensive overview will be presented of our ongoing data mining based study aimed at better understanding of spatio-temporal distribution of AOD by taking advantage of measurements collected from multiple ground and satellite-based sensors. In contrast to domain-driven methods for AOD retrieval (prediction from satellite observations), our approach is completely data-driven. This statistical method consists of training a nonlinear regression model to predict AOD using the satellite observations as inputs where the targets are obtained from a network of unevenly distributed ground-based sites over the world. Challenges and our proposed solutions to be discussed here in context of global scale AOD estimation include (i) training such a statistical predictor for robust performance across multiple accuracy measures; (ii) AOD regression from mixed-distribution spatio-temporal data; (iii) uncertainty analysis of AOD estimation, (iv) active selection of sites for ground based observations, (v) discovery of major sources of correctable errors in deterministic models, and (vi) using conditional random fields to combine nonlinear regression models and a variety of correlated knowledge sources in a unified and more accurate AOD prediction model. The proposed methods will be illustrated on experiments conducted using two years of global observations obtained by merging satellite data of high spatial resolution (MODIS Level 2 data from NASA's Terra and Aqua satellites) with ground-based observations of high temporal resolution (a remote-sensing network of radiometers called AERONET network). The experiments revealed that the proposed methods result in more accurate AOD retrieval than the baseline statistical and domain-based predictors.

**TOPIC:** Data fusion and data assimilation

**ALTERNATIVE TOPIC:** New earth observation satellites