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The determination of the atmospheric aerosol load from space

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The measured top-of-atmosphere (TOA) reflection function (RF) of the atmosphere-Earth system is determined not only by spectral reflective properties of an underlying surface (e.g., vegetation, soil, snow, etc.) but also by the scattering and absorption of solar light by trace gases, aerosols, and clouds. This means that, in principle, properties of the suspended particles and abundances of trace gases can be retrieved from spectral TOA reflectance measurements (e.g., in the visible and near IR). To achieve this, numerous retrieval algorithms have been developed (see, e.g., von Hoyningen-Huene et al., 2003).

This work is aimed to the application of the Bremen AErosol Retrieval algorithm (BAER) (von Hoyningen-Huene et al., 2003) to studies of the aerosol pollution over cities using SeaWiFS imagery. The algorithm was improved recently with respect to the cloud screening procedure. We retrieve the aerosol optical thickness, the spectral exponent, the columnar mass, the number concentration and the effective radius of aerosol particles over Moscow region. Retrievals are based on SeaWiFS measurements of TOA RF in the visible. In particular, we found that the most frequently occurred columnar concentration of particles was 40 particles per squared micrometer with twice as large values in the most polluted areas. The most frequent values of the effective radius of particles were 0.12 micrometers for the scene studied. The derived maps of various aerosol characteristics clearly show the spatial distribution of particulate pollutants over the city. The results of the work are of importance for the improvement of the air quality forecasts using spaceborne observations (Al-Saadi et al., 2005). For example, it is well well-known that the derived aerosol optical thickness highly correlates with the ground particulate matter measurements (Al-Saadi et al, 2005). Such correlations, if properly studied, can be used for the monitoring of the aerosol pollution from space.