



Aerosol optical properties in Finland during Russian forest fires in 2010

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Summer 2010 was characterized by intensive forest fires in western part of Russia causing smoke plumes drifting towards west. That produced high turbidity which was observed by breathing difficulties and the decrease of visibility in Finland. Aerosol optical depth (AOD), which gives a columnar measure of light extinction due to aerosol particles, was also recorded to be significantly higher during that time compared with the long-time average. In this study, we report and analyse the Finnish AOD and concurrent in-situ aerosol properties during the Russian forest fires between May and August, 2010. Ground based AOD was measured with Cimel and PFR sun photometers in Helsinki, Hyytiälä, Jokioinen, Kuopio and Sodankylä. Used in-situ aerosol properties were size distribution, total concentration, scattering and absorption coefficients. Connection of high AOD with fire plumes were checked using backward trajectories with meteorological parameters, fire maps as well as MODIS and AATSR satellite data. When available, ceilometer data was used to separate cases of high AOD caused by residual cloud contamination.

There were three clear episodes with high AOD (at 500 nm) caused by the plumes originating from the forest fire areas. First episode started in the middle of May and lasted till the end of the month. During that time, hourly extremes of AOD measured at Kuopio and Jokioinen were 0.3 and 0.6, respectively. The second episode started at the end of June and ended in the middle of July. In Sodankylä, northern Finland, high AOD caused by the plume from the east was observed in July 30th, when an extreme AOD of 0.9 was observed. In Hyytiälä and Kuopio, both located in central Finland, peak values of high AOD measured during that time were 0.3 and 0.6, respectively. AOD at Jokioinen in southern Finland also showed somewhat high values, with a peak observation of 0.3. The third one, most impressive, happened between July 22nd and August 14th. Extreme values during that period were observed on 8th August, with maximum AOD being 1.1 both in Helsinki and Hyytiälä, and 1.5 in Kuopio. In-situ observations, especially the accumulation mode particle concentration, generally followed well the rise of the AOD implying the existence of the dominant part of the aerosols inside the boundary layer.