The influence of the Sahara storm on the aerosol optical properties in Lithuania

G. Mordas, V. Ulevicius and N. Prokopciuk

Center for physical sciences and technology, Savanorių 231, LT-02300 Vilnius, Lithuania.
Keywords: Light scattering coefficient, number concentration, long range transport.
Presenting author email: genrik@ftmc.lt

Introduction

Atmospheric aerosol particles have direct and indirect effects on a human health, people life conditions and the global climate. The effects are dependent on aerosol particle physicochemical properties, which are formatted by natural and anthropogenic aerosol sources located in this region. In this study, we assembly ground based measurements, satellite measurements, a modelling of dust distribution and calculations of the backward trajectories with aim to show the effect of the far located (several thousand km) Sahara storm on the aerosol optical properties in Lithuania.

Methods

The ground-based measurements were performed in the in Vilnius city (54°38’36”, 25°10’58”) during July 2012. They give insights into the physical and optical properties of the urban aerosols measuring the aerosol scattering coefficient with the particle size distribution. The aerosol scattering coefficient was measured with the integrating nephelometer TSI 3563 at three wavelength λ=450, 550 and 700 nm. Measurements of the particle number concentration (D_{pa}>0.5μm) and the particle size distribution in the range from 0.5 to 10.0 μm was performed by aerodynamic particle sizer TSI 3321. The ground based measurements was reached by analyse of the air mass backward trajectories HYSPLIT4. That allows selecting the air masses by sectors, which have characterised properties of the aerosol particles. Helpful, it was an investigation of the regional dust distribution by Met Office Unified Model. The Met Office provides quantitative SEVIRI satellite retrievals of the aerosol optical depths (AOD) at 550 nm.

Results

The analyse of the air mass backward trajectories allowed dividing measurement period on several episodes. From 1 to 8 of July, the South-West sector (Mediterranean see, North Africa was dominated. The West sector (Atlantic Ocean, Great Britain, Norway) was observed at 9-24 of July. From 25 to 31, there were continental air mass from Ukraine and Russia. The significant differences were measured in the aerosol particle scattering coefficient and the particle number concentration (D_{pa}>0.5μm). The cleanest air mass came from West sector. The South-West sector was characterised the highest values of the particle number concentration (D_{pa}>0.5μm) and the aerosol scattering coefficient. So, the scattering coefficient was varied from 3.5 to 369 Mm^{-1} during measured period. The clean air mass from Atlantic Ocean had averaged scanning coefficient of 10 Mm^{-1} comparing with 70 Mm^{-1} from Mediterranean see. The highest pick was 369 Mm^{-1} at 3 of July. The averaged Angstram exponent for 450/700nm wavelength pair was 2.0. That is typical for aerosols affected by urban (Vrekoussis *et al*., 2005). However, the Angstram coefficient decreased rapidly at 3 of July, it was 1.4, when the value of the aerosol scattering coefficient and the particle number concentration (D_{pa}>0.5μm) had the highest values (Fig.1) The calculation of the backward trajectories showed that the air masses came from the Nord Africa. In the Sahara desert, it was a storm during several days. The regional dust distribution based on the AOD measurements and dust transport were modeled. The results showed the invasion of the dust polluted air mass from Sahara on the Baltic region (Fig.2). Additionally, the chemical composition of a precipitation indicates increase in calcium which air masses brought from the region of North Africa.

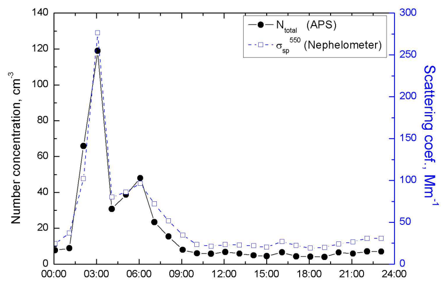

Fig.1. Aerosol scattering coefficient and particle number concentration (D_{pa}>0.5μm) during 3 of July.

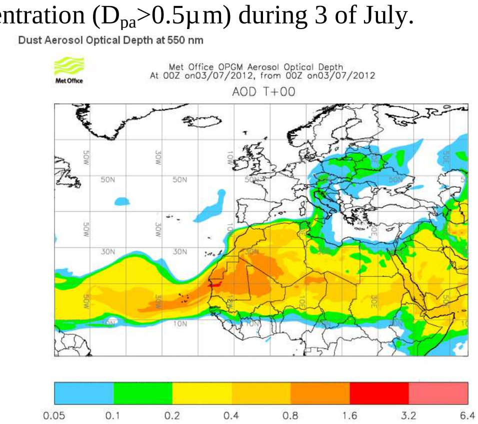

Fig.2. The AOD regional distribution.

This work was supported by the Lithuanian-Swiss cooperation programme “Research and Developing” project AEROLIT (Nr. CH-3-ŠMM-01/08).

Vrekoussis M., Liakakou E., Kocak M., Kubilay N., Oikonomou K., Sciare J., Mihalopoulos N. (2005). *Atm. Env.* **39**, 7083–7094