Lead Author e-mail: *tymon@iopan.gda.pl*

Title: *Optical properties of Arctic aerosols studied within the framework of the NASA Maritime Aerosol Network*

Tymon Zielinski[1], Tomasz Petelski[1], Przemyslaw Makuch[1], Agata Strzalkowska[1], Anna Rozwadowska[1], Dorota Gutowska[1], Paulina Pakszys[1], Piotr Markuszewski[1], Brent Holben[2], Alexander Smirnov[2]

[1]***Institute of Oceanology Polish Academy of Sciences***

[2]*NASA/Goddard Space Flight Center, USA*

Absorption and scattering of radiation by aerosols directly affect the radiation balance of the Arctic, which is thought to be very sensitive to changes in radiative fluxes. This is due to small amount of solar energy normally absorbed in the polar regions. These regions represent sensitive ecosystems, which are susceptible to even small changes in the local climate. Thus, for a given aerosol distribution, the specific optical properties are enhanced in these regions.

The Arctic studies of aerosol optical properties within the NASA Maritime Aerosol Network program were originated in 2008 during the ARctic EXperiment (AREX) campaigns using the r/vOceaniavessel. Every year the vesselcruises for seven weeks (June-August) in the area of the Arctic between 0 and 14°E and 69 and 79°N. The aerosol studies were conducted using an ensemble of instruments, including laser particle counters, sunphotometers and ozonometers. During the ship studies laser particle counter was placed on a mast of the vessel and moved vertically, which facilitated the determination of the vertical structure of aerosol concentrations and their size distribution at altitudes of up to 20 m a. s. l. Simultaneously, Microtops II sunphotometers provided the aerosol optical thickness data.

The Arctic aerosols in the Spitsbergen area show significant temporal and vertical variability. The results collected during the campaigns can be divided into two groups, the spring data and the summer data. Each winter, cold dense air settles over the Arctic. In the darkness, the Arctic seems to become more and more polluted by a buildup of mid-latitude emissions from fossil fuel combustion, smelting and other industrial processes. Then, in spring, when the light appears, there is a smog-like haze in the Arctic region. The values of aerosol optical thickness, e.g. at 500 nm, exceed 0.1 and they can be as high as 0.35.

In summer the situation differs from that in spring. The main problem in aerosol optical studies is related to cloud coverage over the region. Also the air mass trajectories can vary significantly which also influences the aerosol optical thickness. The summer values at 500 nm can also be high, up to even 0.3 (land origin of air masses) but majority of data are below 0.1, which indicates very clean

air conditions, with very few aerosol particles suspended in it.