MULID – ISAC CNR ROME

To properly understand the transport processes of aerosol in the Arctic atmosphere, their influence on the radiative balance and on cloud microphysics, a detailed analysis of their vertical distribution and its daily and interseasonal variation should be accurately determined. Measurements of aerosol burden and thermo dynamical phase inside the Planetary Boundary Layer and in the free troposphere can be achieved by remote sensing technique using a one wavelength (532 nm) two polarizations lidar looking upward from the ground in a range of about 3000 m., with a relative error in estimating the aerosol concentration of 0.01 at 100 m of altitude for a measurement of 1 minute and a vertical resolution of 15 m. Lidar technique is based on laser sources sounding the atmosphere at different range distances from the instrument. The atmosphere backscatters part of the polarized laser light into the instrument. The amount of backscattered light includes two contributions, the Rayleigh scattering proportional to the molecular density and the Mie scattering by particles depending on their nature, their concentration and their size distribution. The particle phase is retrieved by the ratio between the main and the cross-polarized signal at 532 nm (volume depolarization): zero or very low values of depolarization indicate aerosols in liquid phase; ratios around 50 are peculiar of well formed (radius > 1 micron) ice cristals; intermediate values of depolarization indicate mixed phases or amorphous particles. An estimate of the particles characteristics, as size distribution and albedo is also possible.

A semi-automated, one wavelengths (532 nm) micro lidar station (MULID) was present during ASCOS campaign on board the Swedish Icebreaker ODEN in August 2008, in the framework of a collaboration between ISAC- CNR and University of Stockholm with the technical support of CIRES, University of Colorado, and it is aimed at determining vertical structure of aerosols and cloudiness in the troposphere and then provide fundamental information to investigate their role in modulating radiation budget at the surface. The peculiar configuration of the system allows a reconstruction of the aerosol profile from the first few metres from the ground up to the free troposphere, with a relative error in estimating the aerosol backscatter ratio of 0.01 at 100 m of altitude for a measurement of 1 minute and a vertical resolution of 1.75 m. Thanks to its little dimension/weight, power consumption and capability to work unattended for long period in an hard environment, the Italian micro lidar system will contribute to improve instrumentation in remote sites providing information on the vertical structure of the marine PBL on remote sites.

LASER	Nd –YAG diode pulsed Pulse energy 35 μJ (532nm) ν = 1 kHz
TELESCOPE	Cassegrain Telescope: Primary Mirror 200mm diam.
DETECTOR	Phototube 532 nm // Phototube 532 nm $\perp$

Tab.1: MULID on board ASCOS, August 2008

DATA FORMAT:

File name: ASCOS_ddd.txt

Where :
ddd is the day of the year 2008

ASCII files with 20 rows of header and then 4 columns of:

1) Decimal day of year 2008 (1.0 is the 00:00 of January 1th)
2) AMSL (meter) (above the instrument)
3) LOG10 of Polarized backscatter ratio (*10^2)
4) Volume depolarization ratio (*10^2)

Note that all decimal days are the same for each profile; each profile occupies 749 rows. Then the next profile takes up the next 749 rows and so on, until the end of the day in the file. There is only one header per day..

PLOT:
Two sets of plots are attached; plots of polarized backscatter ratio and of volume depolarization ratio. The plots are named:

ASCOS_SCRC_ddd.bmp
ASCOS_DEPOV_ddd.bmp

Where :
ASCOS_SCRC is the Polarized backscatter ratio at 532
ASCOS_DEPOV is the Volume depolarization ratio at 532
ddd is the day of the year 2008