

# Probing the Arctic middle atmosphere using the Middle Atmosphere Alomar Radar System

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In 2011 the Leibniz-Institute of Atmospheric Physics in Kühlungsborn completed the installation of the **M**iddle **A**tmosphere **A**lomar **R**adar **S**ystem (MAARSY) on the North-Norwegian island Andøya. MAARSY allows classical beam swinging operation as well as experiments with simultaneous multiple beams and the use of interferometric applications for improved studies of the Arctic atmosphere from the troposphere up to the lower thermosphere with high spatio-temporal resolution. Observations of polar mesosphere echoes have been carried out continuously to study their characteristics and occurrence during summer and winter time. Results from multi-beam experiments conducted during various campaigns to investigate the horizontal structures of mesospheric echoes indicate that the underlying structures and processes reveal a high spatial variability. Sophisticated wind analysis methods such as an extended velocity azimuth display have been applied to retrieve additional parameters from the wind field, e.g. horizontal divergence, vertical velocity, stretching and shearing deformation. High Power Large Aperture radar systems as MAARSY can detect reflections from plasma irregularities around meteoroids called meteor-head echoes. The interferometric capabilities of MAARSY permit the determination of the meteor trajectories within the radar beam with high accuracy. The received data are used to gain information about entry velocities, source radiants, observation heights and other meteoroid parameters. Since September 2013, MAARSY has been operating the full array with circular polarization in both transmission and reception. Although the system has been originally designed for studies of the mesosphere, stratosphere and troposphere regions, its aperture (100 meter diameter) and peak power (800 kW) makes it suitable to try incoherent scatter radar measurements at 50 MHz over polar latitudes. We present a description of new capabilities of MAARSY and show observational results obtained during campaigns over a period of 3 years of operation.

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