The Leibniz-Institute of Atmospheric Physics in Kühlungsborn, Germany (IAP) installed a new powerful VHF radar on the North-Norwegian island Andøya (69.30N, 16.04E) in 2009/2010. The new Middle Atmosphere Alomar Radar System (MAARSY) replaces the existing ALWIN radar which has been in continuous operation on Andøya for more than 10 years. MAARSY is a monostatic radar operated at 53.5MHz with an active phased array antenna consisting of 433 Yagi antennas each connected to its own transceiver with independent control of frequency, phase and power of the transmitted signal. This arrangement provides a very high flexibility of beam forming and beam steering and allows classical beam swinging operation as well as experiments with simultaneous multiple beams and the use of modern interferometric applications for improved studies of the Arctic atmosphere from the troposphere up to the lower thermosphere with high spatial-temporal resolution. The installation of the antenna array was completed in August 2009. The radar control and data acquisition hardware as well as an initial expansion stage of 196 transceiver modules was installed in spring 2010, upgraded to 343 transceiver modules in December 2010 and is scheduled to be completed to full operation in spring 2011. Beside standard observations of tropospheric winds and Polar Mesosphere Summer Echoes, the first multi-beam experiments using up to 91 beams quasi-simultaneously in the mesosphere have been carried out using the different expansion stages of the system in summer and winter 2010. These results provide a first insight into the horizontal variability of Polar Mesosphere Summer and Winter Echoes in an area of about 80 km by 80 km with time resolutions between 3 and 9 minutes.