Multi-static and Multi-frequency observations of meteors combining specular and forward scatter radars

G. Stober (1), J.L. Chau (1), and **C. Schult** (1)
(1) Leibniz Institute of Atmospheric Physics, Rostock University, Kuehlungsborn, Germany (schult@iap-kborn.de)

Meteoroids entering the Earths atmosphere are heated and decelerated due to the impinging air molecules. Some particles have enough kinetic energy to reach the vaporization temperature forming an ambipolar plasma trail along its flight path through the atmosphere. This ablated meteoric material is mostly deposited in the mesosphere/lower thermosphere (MLT) and provides an essential ingredient for the formation of noctilucent clouds or polar mesospheric summer echoes.

In January 2014 we started a novel development to improve the existing specular meteor observations by introducing the Multi-static Multi-frequency Agile Radar for Investigation of the Atmosphere (MMARIA) concept. Therefore we revisited an old idea of forward scatter meteor systems as shown in Figure 1. The forward scatter systems are synchronized with a 1PPS disciplined rubidium to ensure that we can measure the correct propagation distance from the transmitter to the passive transceiver. The receiver station employs a receiving array of 5 antennas in Jones configuration to determine the angle of arrival of the forward scattered signal. Further, the receiver station is coherent to the transmitter, which allows in combination with the synchronization to measure a precise Doppler velocity.

Using the same transmitter as monostatic meteor radars, the MMARIA network is able to detect a much higher number of meteor events. The increased Bragg wavelength for the forward scatter systems extends the observation ceiling to higher altitudes. Further we are able to enhance our atmospheric observations. The multi-static measurements are suitable to obtain horizontally resolved wind field at the MLT.

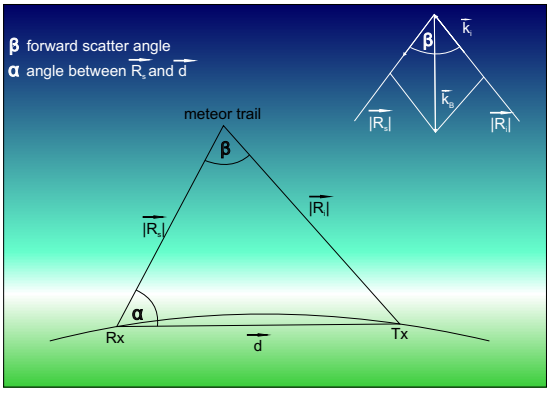

Figure 1: Schematic view of the MMARIA concept.

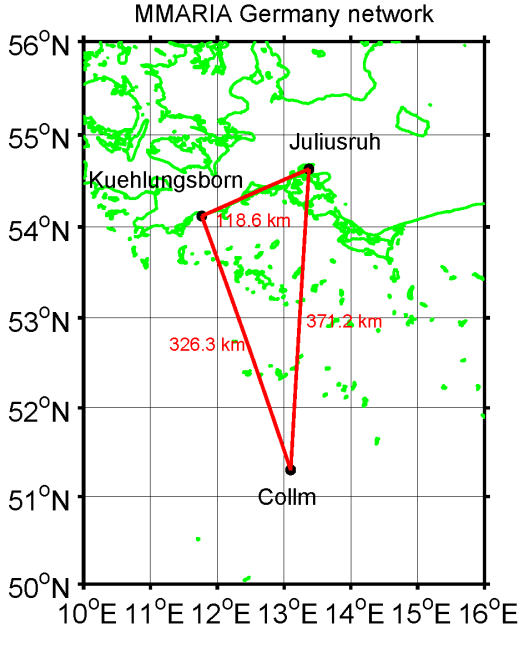

Figure 2: Current stage of the MMARIA network in Germany. We operate with two active meteor radars at Juliusurh and Collm and three passive systems in Juliusruh and a dual frequency system in Kuehlungsborn.

References

[1] G. Stober und J. L. Chau, A multistatic and multifrequency novel approach for specular meteor radars to improve wind measurements in the MLT region, Radio Sci., 431-442, doi:10.1002/2014RS005591, 2015.