Multistatic Coded Continuous Wave Meteor Radar

Juha Vierinen[1,2], Jorge L. Chau[2], Ryan Volz[3], Gunter Stober[2], and Nico Pfeffer[2]

(1) University of Tromsø, Norway

(2) IAP Kühlungsborn, Germany

(3) MIT Haystack Observatory, Westford, MA, USA

The concept of a coded continuous wave specular meteor radar (SMR) is described. The radar uses a continuously transmitted pseudorandom phase-modulated waveform, which has several advantages compared to conventional pulsed SMRs. The coding avoids range and Doppler aliasing, which are in some cases problematic with pulsed radars. Continuous transmissions maximize pulse compression gain, allowing operation at lower peak power than a pulsed system. With continuous coding, the temporal and spectral resolution are not dependent on the transmit waveform and they can be fairly flexibly changed after performing a measurement. The low signal-to-noise ratio before pulse compression, combined with independent pseudorandom transmit waveforms, allows multiple geographically separated transmitters to be used in the same frequency band simultaneously without significantly interfering with each other. Because the same frequency band can be used by multiple transmitters, the same interferometric receiver antennas can be used to receive multiple transmitters at the same time. The principles of the signal processing are discussed, in addition to discussion of several practical ways to increase computation speed, and how to optimally detect meteor echoes. Measurements from a campaign performed with a coded continuous wave SMR are shown and compared with two standard pulsed SMR measurements. The type of meteor radar described in this paper would be suited for use in a large-scale multi-static network of meteor radar transmitters and receivers. Such a system would be useful for increasing the number of meteor detections to obtain improved meteor radar data products, such as wind fields. We also give an update on the latest developments of a new funded multi-static meteor radar network that will be built during 2017-2018.