50 MHz Software Defined Radar for Meteor and Aeronomical Science

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With the rapid emergence of new standards and protocols in wireless communication, many functions of traditional radio receivers are being implemented in software [Mitola, John Wiler and Soncs, 2000; Reed, Prentice Hall Communications Engineering, 002]. These new radio receivers are called software radios since their implementation relies heavily on digital signal processing techniques and require fewer radio frequency components than classic analog radios. Consequently, by utilizing software radio algorithms, it is possible to implement radar receivers at a very low-cost and simultaneously exploit the multiple benefits a digital system offers, such as high dynamic range, perfect coherent quadrature detection, and programmable filters. We describe the current implementation of a VHF software radio radar in Penn State University, as a first step towards developing a new generation of radar systems for meteor and aeronomical science. The software-defined radio for radar systems takes advantage of existing open source radio software created by the GNU Software Radio for AM, FM, and HDTV signal detection [http://www.gnu.org/software/gnuradio/]. The understanding of the properties of the meteor flux is important for several fields of study. Yet, the basic properties of this global meteor flux, such as average mass, velocity, and chemical composition remain poorly understood [Mathews et al., Geophysical Research Letters, 28, 1929, 2001]. We present the general characteristics of continuous and routine measurements of radar meteors using this modern radar system and compare the meteor reflections detected by this instrument meteor events obtained in Puerto Rico and North Carolina with radars of similar sensitivity. We also discuss sampling biases of different meteor observation techniques.