

Technical Development for MST Radar; Pulse Coding, Signal Processing and Spectrum Estimation

Koji Nishimura¹, Taishi Hashimoto², Toru Sato², Kaoru Sato³, Masaki Tsutsumi¹ and Takuji Nakamura¹

¹ *National Institute of Polar Research, Tokyo, Japan*

² *Kyoto University, Kyoto, Japan*

³ *The University of Tokyo, Tokyo, Japan*

We present some optimal signal processing techniques that we have developed for PANSY radar. (1) One of characteristic phenomena in radar observation in Antarctica is strong scattering from the mesosphere called PMSE or PMWE. Whereas the phenomena are themselves observation targets of interest, for observations of the troposphere and stratosphere, range-aliased second or third trip echoes from them interfere. We have developed pulse coding/decoding hardware, and optimized pulse-coding schemes for PANSY. (2) Variety of complementary-coded pulse compression techniques is widely used in MST radar applications. The techniques, however, have some drawback in time resolution when it is compared with single-code pulse compression. We present the optimal signal processing scheme for complementary codes that exhibits the maximal performance in terms of time resolution and code sidelobe. (3) Among many possible techniques of spectrum estimation, the least square fitting method is one that is widely employed in MST radar observation. This method has an obvious underestimate bias in some configurations and, for example, it results in negative estimate of energy dissipation rate. We present the bias-free spectrum estimation technique.

Key words: MST radar, PANSY, pulse compression, range-aliased second trip echo