Cancellation of Multiple-Trip (Range-Aliasing) Echoes for MST Radar

Koji NISHIMURA[(1)], Masaki TSUTSUMI[(1)], Taishi HASHIMOTO[(2)], Kaoru SATO[(3)] and Toru SATO[(2)]

(1) National Institute of Polar Research, Tachikawa-shi, Tokyo 190-8518, Japan

(2) Dept. of Communications and Computer Engineering, Kyoto University, Kyoto 606-8501, Japan

(3) Dept. of Earth and Planetary Science, The University of Tokyo, Tokyo 113-0033, Japan

In the Antarctic region, where we operate PANSY MST/IS radar (69S, 39E), as well as the Arctic region, there exist strong radio scatter phenomena in the mesosphere known as polar mesosphere summer echo (PMSE) and polar mesosphere winter echo (PMWE). These strong echoes returning from high altitude about from 60 to 90 km contaminate the echoes of interest from the troposphere and stratosphere when the T (=inter pulse period, IPP) is set to $cT/2<60$ km. While obviously one solution for this problem is to use a larger T, however, this is not always optimal, considering system limitations in range resolution, code complexity, and duty ratio. Another possible solution is to employ elaborate coded-transmission schemes, which is properly designed in order to cancel multiple-trip echoes. To cancel second-trip echoes, as a simple example, we transmit coded waveforms in the order so that the sum of cross-correlations of adjacent codes becomes 0. A more general explanation will also be given in the presentation. We developed a transmission and reception system that put it in operation in September 2015. In this paper, we present a brief introduction of the technique and some results obtained by the PANSY radar.