南極大型大気レーダーにおける電離圏観測のためのサブアレイを用いたアダプティブクラッター抑圧

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Basic study of adaptive clutter rejection technique with small sub array for Ionospheric observation of the PANSY radar

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The PANSY (Program of Antarctic Syowa) MST/IS radar has a VHF active phased array with 1045 crossed Yagi antennas at Syowa Station, Antarctica. Receiver outputs of every 19 antennas are synthesized in-phase, constituting 55-channel adaptive array. The PANSY radar also has another antenna array (FAI array, in later) for the observation of the Field Aligned Irregularities (FAIs,) which consists of 24 Yagi antennas directed to where the line of sight crosses perpendicularly with the geomagnetic field line of the earth. The FAI array has 8 channels, with each 3 antenna output combined in-phase.

In ionosphere observations, the main and FAI arrays are designed to work simultaneously for observing the incoherent scatterings and FAIs, respectively.

While FAIs are of great interest for the PANSY radar, they are also assumed to be clutters for the observations of ionospheric incoherent scatterings and cause errors in estimating plasma parameters around 230 km, because they are very strong coherent radio sources at the same range.

In this presentation, the result of basic study for suppressing FAI clutters in the ionosphere observations of the PANSY radar is shown. The methodology is based on the norm- and directionally constrained minimization of power (NC-DCMP) algorithm, and modified to be used with nonuniform-gain array. The receiver outputs of the main array are all synthesized nonadaptively and the FAI array is used as the sidelobe cancellers in this method. The simulational result shows that the proposed method enjoys smaller SNR loss and much less computational cost than the ordinary uniform-gain NC-DCMP method. Also the proposed method is tested on an actual observation of the atmosphere and coherent clutter sources (the ground and a helicopter) by the PANSY radar with FAI array.