

Simultaneous observation of Ionospheric Incoherent Scatter and Field Aligned Irregularities using adaptive signal processing techniques by the PANSY radar at Antarctic Syowa Station (39.6°E, 69.0°S)

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The Program of Antarctic Syowa Mesosphere-Stratosphere-Troposphere (MST) / Incoherent Scatter (IS) radar (the PANSY radar) is a large VHF-band atmospheric radar located at Antarctic Syowa Station. Besides the general functionalities of MST radars, the PANSY radar is also capable of observing IS from 100 km to 500 km in altitude to estimate ionospheric plasma parameters. The ionospheric observation was successfully performed in 2015, which was the first in the Antarctic region.

In contrast to existing IS radars using higher frequencies, the ionospheric observation of the PANSY radar suffers contamination from E-region Field Aligned Irregularities (FAIs). Because the perpendicular condition between the line of sight and the geomagnetic field is satisfied around 100 km in altitude using the VHF-band at this latitude, strong coherent echoes from FAIs fall into the same range gates with the F-region peak of IS.

To mitigate the contamination of FAIs in IS observation of the PANSY radar, we have developed a signal processing procedure using adaptive beamforming techniques [1]. The PANSY radar has two peripheral linear antenna arrays, each with twelve three-element antennas for the Directionally Constrained Minimization of Power approach, to separate signals from different directions. Hence, this technique makes it possible not only to measure the background electron densities accurately, but also to observe the structure and motion of FAIs simultaneously.

In this presentation, we briefly overview the signal processing procedure applied to the ionospheric observation of the PANSY radar, and show recent results from simultaneous observations of IS and FAIs, including some radar images of FAIs obtained by adaptive beamforming techniques.

[1] Hashimoto et al., 2018: "First incoherent scatter measurements and adaptive suppression of field-aligned irregularities by the PANSY radar at Syowa Station, Antarctic" , *J. Atmos. Oceanic Technol.*, conditional acceptance.

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