Ice sounding with radar is a well-established technique for the retrieval of ice depth, and provides information on ice structures and layering. Airborne radar ice sounders suffer from off-nadir surface clutter that masks the signal from bedrock and ice layers with unwanted but simultaneously received surface reflections. This is of importance for future satellite ice-sounding missions, as the spaceborne geometry leads to strong surface clutter even for deep subsurface returns. This paper presents analysis and comparison of different clutter-suppression techniques applied to data acquired with the European Space Agency's P-band POLarimetric Airborne Radar Ice Sounder (POLARIS). The 4 m long antenna of POLARIS enables simultaneous reception of up to four across-track channels. It was operated in 2011 over Antarctica at a high flight altitude of 3200 m. Different coherent weighting techniques of the receive channels were used to suppress the surface 'clutter'. However, with a channel spacing of 1.4 times the wavelength, the grating lobe imposes a limitation to the off-nadir angular range in which clutter can be effectively attenuated. Results of ice sounding over Jutulstraumen glacier are described, where we demonstrate a clutter suppression of up to 10 dB.