Geophysical Research Abstracts
Vol. 16, EGU2014-5376-1, 2014
EGU General Assembly 2014

Experimental Determination of Electromagnetic Propagation and Scattering Properties of Ice-Sheets at P-Band

Chung-Chi Lin (1), Björn Rommen (1), Christopher Buck (1), Tania Casal (1), Jørgen Dall (2), Anders Kusk (2), Ulrik Nielsen (2), Hugh Corr (3), Arnaud Ginestet (4), Guillaume Decerprit (4), Nick Walker (5), and Steen S. Kristensen (2)

(1) ESA-ESTEC, Earth Observation Projects, Noordwijk, Netherlands (chung-chi.lin@esa.int), (2) Technical University of Denmark, National Space Institute, Kgs. Lyngby, Denmark (jd@space.dtu.dk), (3) British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, UK (hfjc@bas.ac.uk), (4) Noveltis, 153 rue du Lac, 31670 Labège, France (arnaud.ginestet@noveltis.fr), (5) eOsphere Ltd, 3 Great Farm Offices, West Woodhay, Newbury, RG20 0BP, UK (nick.walker@eOsphere.co.uk)

The electromagnetic (EM) propagation and scattering properties of the ice and its inclusions strongly affect radar reception signals in radio echo sounding of ice-sheets. In particular, those properties are very strongly dependent on the sensing frequency, with penetration depth rapidly decreasing with increasing frequency. Furthermore, the surface scattering signals, which mask the radar echoes from the depth, increases monotonically with frequency. In spite of those drawbacks, the recent interests in the use of P-band (435 MHz), as compared to the more established sensing frequencies at 60 and 150 MHz, are driven mainly by two reasons: (1) the use of a shorter wavelength improves the spatial selectivity of the sensor as a reasonably sized antenna system could generate narrow beams; (2) P-band is the lowest frequency band allocated for active sensing from space, potentially adequate for satellite-based sounding of ice-sheets. New datasets acquired by P-band radar sounders are becoming available, e.g. from the systems built by University of Kansas and ESA's POLARIS instrument built by Technical University of Denmark, thus opening a possibility to quantitatively compare the merits and drawback of ice sounding at P-band.

This paper will report the result of the analysis carried out on the POLARIS data which were acquired over East Antarctica in Feb. 2011 in the frame of the Danish IceGrav 2011 campaign. More specifically, ice sounding measurements were performed over the areas of Dronning/Queen Maud Land and its coastal ice-shelves (e.g. Princess Astrid Coast and Fimbul ice-shelf), and Adelaide Island. Different ice types and regimes have been covered in order to build up a comprehensive catalogue of the ice electromagnetic properties. In addition to the POLARIS data, some in-situ data on the surface roughness, ice core data from EPICA and ice-shelf basal roughness data from an upward looking sonar experiment (Autosub Under Ice programme, 2005) have been gathered. Other important information for retrieving the wave attenuation and basal scattering, derived mainly from model-based estimations, are respectively the three-dimensional ice temperature field and the basal slipperiness, the latter being closely related to the basal roughness and conditions. Those additional data are used mainly to resolve the ambiguity between the basal scattering coefficient and path attenuation, as the sounder data only deliver combined value of those parameters. The main macroscopic parameters of interest are the ice attenuation, surface and basal scattering coefficient, the magnitude of the internal radar reflection horizons and incoherent volume scattering. Parameter extractions were carried out for each type and regime of ice as identified above. The result of parameter retrievals will be presented and comparisons with available models in the literature will be made.