Commemoration for Prof. Dr. Preben Emanuel Gudmandsen

5. October 1924 – 2. May 2019

Founder, President and Honorary President of EARSeL

Salzburg, July 2019
1950 Preben graduated as M.Sc. in Electrical Engineering from Danmarks Tekniske Højskole with a thesis on waveguide structures.

1950 – 1957 he worked as a research engineer at the Microwave Laboratories of the Academy of Technical Sciences, Denmark.

1957 – 1960 he was a research scientist and later head of section at Shape Air Defence Technical Centre in The Hague in the Netherlands.

1960 – 1961 he was employed as a development engineer at Titan A/S, Copenhagen.

1961 – 1964 Postdoc and assistant at DTU

1967 Preben was one of the first who initiated remote sensing activities from aircrafts and satellites at DTU

1994 – 1972 Associate Professor at DTU

1972 – 1994 Full Professor for Microwave Techniques (retirement)
II. AIRBORNE RADIO ECHO SOUNDING OF THE GREENLAND ICE SHEET

P. GUDMANNSEN

(Technical University of Denmark, Laboratory of Electromagnetic Theory, Lyngby, Denmark)

Introduction.—This paper gives a short account of the investigation being carried out at the Laboratory of Electromagnetic Theory concerning the techniques for radar sounding of thick ice. The work is being carried out with a view to future large scale investigations and mapping of the Greenland ice sheet. Therefore, emphasis has been placed on testing the techniques of airborne sounding rather than collecting glaciological data.

The first field tests were carried out in May 1967 as part of the international glaciological expedition to Greenland (EGIC).

Radar system.—The tests were carried out at 35 MHz with a radar system which is composed of four main parts: transmitter, receiver, aerials and recording system. The transmitter was a pulsed power supply coupled directly to the aerial cable with a peak power of 500 W, a pulse duration of 0.5 μsec and a repetition frequency of 16 kHz (Evans and Smith, 1969). The receiver had a 3.5 dB band width of 14 MHz and was designed to have a logarithmic response with a dynamic range of 70 dB. The receiver had two video outputs, one with the full dynamic range and another with an amplitude limited signal. The system comprised two aerials, one for transmitting and one for receiving. The aerials were folded dipoles about 4 m long, installed 1 m below the wings of the aeroplane, one at each wing. The received signals were displayed on two cathode ray oscilloscopes. One was the so-called A-scope which was connected to the receiver output with the full dynamic range. This display was photographed every 15 seconds. The other display was the so-called Z-scope connected to the other receiver output, resulting in an intensity modulated presentation of pulses with an amplitude above a certain level. This display was photographed on a continuously moving film. Correspondence between the two films was ensured by means of a time circuit system.

Measurements and results.—The measurements in May 1968 were carried out by means of an aeroplane based at Sondre Stromfjord. Seven flights were performed with a total flying time of 18 hours. The navigation was based on the normal flight instructions and observations from the co-pilot seat. In few cases a radar fix was obtained during the measurements it proved difficult to detect an echo from the bedrock after a number of equipment modifications, echoes were finally recorded when the aeroplane was flying low over the surface of the ice. Fig. 1 shows the flight routes for two flights. The thick lines in Fig. 1 indicate flight routes where almost continuous bedrock echoes were recorded. The letters A and B refer to the recording examples included in this paper.

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LAYER ECHOES IN POLAR ICE SHEETS

By Preben Gudmansen

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Abstract. Of extensive layers have been observed by radio-echo sounding in Greenland. By comparison with the stable isotope profile from Camp Century it is found that layering in the top of the ice must have formed the period since the last glaciation. Radar-echo layers observed at greater depths in central Greenland may have been created in the period of the interstadials and for latter down possibly in the period prior to the last glaciation. Further investigations are needed to prove this.

Résumé. De nombreuses couches de résonance ont été observées lors de sondages par radar-écho au Groenland. Par comparaison avec le profil de l'isotope stable provenant de Camp Century on trouve que la formation de couches de résonance dans la partie supérieure de la calotte glaciaire date de la dernière glaciation. Les couches d'échos radar ont été produites à des époques de lhistoire préglaciaire. Les couches d'échos radar observées à des profondeurs plus grandes dans le travers central du Groenland peuvent être créées dans les périodes interstadiales et ultérieures. Les couches d'échos radar ont été observées au cours d'expéditions de l'EGIC.


1. Introduction

Radio-echo sounding have revealed stratification in polar ice sheets. Thus Robin and others (1969) describe from soundings in 1964 it is a single layer echo apparently returned from a single layer on a test track south of Camp Century in Greenland. Other soundings carried out by the Danmarks Tekniske Højskole in 1969 showed a multitude of extensive layers in central Greenland briefly reported by Gudmansen (1970). Harrison (1973) shows the geographical distribution of layer echo in Antarctica between 1959 and 1971. The one thing which may be said with certainty about the origin of the layer echoes is that they are caused by changes of the dielectricity of the ice, but what the mechanism is that caused these changes is still an open question. Robin and others (1969) showed that a small change in ice density in an isolated layer relative to its surroundings gives a reflection coefficient of sufficient size to be observed. Harrisons (1973) findings indicate that variations of ice crystal orientation may explain the changes in permittivity at large depths while density variations are thought to melt associated with ash layers may account for permittivity changes in the upper 500 metres. G. de Q. Robin (private communication in 1975) suggests that changes in impurity level of the ice may cause changes in permittivity (changes of the ionic level).

The other things which may be stated about the layer echoes is that they extend almost continuously over tens of kilometres and thus seem to establish time horizon of a mechanism as yet unknown which occurred when the layer in question was last active.

This paper gives a short account of some observations related to layer echoes recorded during Danmarks Tekniske Højskole Greenland soundings in 1969, 1971, 1972, and 1974.

2. Layer Echoes and Drill-Hole Core Data

Correlation between radio-echo soundings and physical data for the ice as obtained from corers recovered from drillings may be difficult to establish for a number of reasons.

One reason is the difference in resolution in the two cases. The finest resolution of a sounder today is the order of five metres (pulse width of 60 μm) whereas the core data have a
1972 He started together with NASA GSFC the application of satellite data from ESMR (Electrically Scanning Microwave Radiometer) for mapping of sea ice in the waters around Greenland. It flew on Nimbus 5, launched in 12/1972. This instrument could detect the thermal microwave (1.55 cm) emission from an area on the ground or the surface of the ocean about 30 by 30 kilometers in size.

1975 Pioneering development of a passive microwave sounder for measuring through the Greenland ice sheet down to bedrock.

1976 Together with other colleagues he founded EARSeL.

1994 – 2019 as very active emeritus he conducting research at DTU for many years, for instance studied the sea ice situation in Nares Strait using Sentinel-1 satellite data.


1970s-80s His pioneering contributions to the development of microwave systems was very helpful for the ERS-1 radar satellite launched in 1991.

4. May 2008 he establish an AWS on Hans Island (80°49'35"N, 66°27'35"W), a small island of about 1.3 square kilometers and 168 meters height just between Greenland (DK/Greenland) and Ellesmere Island (CA), claimed by both countries.
Ice Dynamics in Lincoln Sea and Nares Strait

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Context for the Recent Massive Petermann Glacier Calving Event

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On 4 August 2009, about one fifth of the floating ice tongue of Petermann Glacier (also known as the Peterman Glacier) in northwestern Greenland calved (Figure 1). The resulting iceberg had an area approximately 4 times that of Manhattan Island (about 2570 square kilometers). The ice tongue is a large body of glacier ice, which from media, politicians, and the public, who may construe it as a significant event, is of interest to scientists and the public to judge its significance.

Petermann Glacier is a major outlet

In that during about 1% of the Greenland

ice sheet area. It is one of four such

major outlet glaciers surrounding Greenland that are of significant floating ice tongues. The Petermann ice tongue feeds into a high-walled fjord, 50-200 meters wide and about 80 kilometers in length. The

main flow is thinned significantly by

the lowering of the ice tongue, and

icebergs descending along the sides of

the fjord (Figure 1; see also Figure 10 in the online supplement to this Eco issue: http://www.icecap.a.dk). This ice tongue thins substantially from about 600 meters at the grounding line to 200 meters, approximately 20 kilometers downstream of the main tongue. Its mass gradually decreases to

about 40-50 meters at the seaward
dge.


1. INTRODUCTION

Since Kozlo (1991) noted the feature of Petermann

ice tongue, it has been

an

active

system of sea ice

and

the study of

ice bergs that form at the entrance to Nares Strait

and

at

places in the Straits. These barriers may last for

weeks or months causing a complete stop of the ice

transport through the Strait (Knudsen et al. 2010). Thus, an

ice barrier was present in central.

Ocean Dynamics

Proceedings

“Oceans From Space” Venice 2010

Stockholm 2014: giving a speech at Stockholm Stadshuset where the Nobel Prize Laureates are honored.

Symposium 2008 Istanbul

Chania 2009: Preben came with a stick...... and finally danced Sirtaki
Prof. em. Preben E. Gudmandsen passed away on May 2, 2019 after a fulfilled private and above all very successful scientific life. We all lost a highly esteemed university professor, enthusiastic scientist, the EARSeL Founder and Honorary President and a great friend.

Preben, tak for alt, din hjælp, din støtte og venskap! Har det godt!