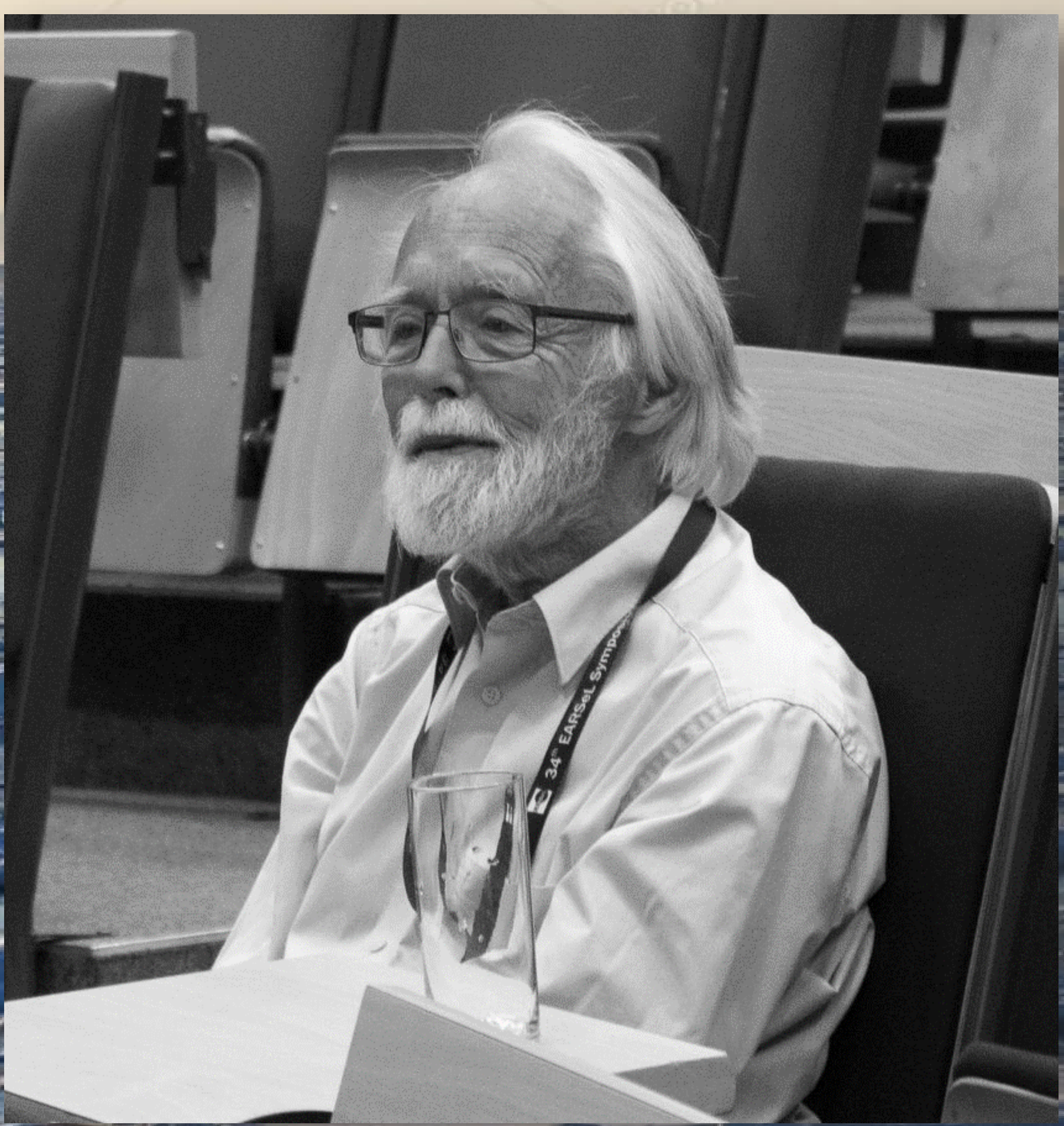
Commemoration for Prof. Dr. Preben Emanuel Gudmandsen

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)

Results from a Three-Hop Tropospheric Scatter Link in Norway with Parallel Operations on 900 mc and 2200 mc*

N. H. KNUDTZON† AND P. E. GUDMANDSEN†

IRE TRANSACTIONS ON COMMUNICYTION SYSTEMS 1959

Summary—A three-hop troposcatter system in Norway with simultaneous operation at 900 mc and 2200 mc is described briefly. From measurements on a 360-km hop in the period October 1957 to June 1958, it is concluded that 1) the monthly amplitude distributions are approximately Gaussian, and the 1-minute amplitude distributions are approximately of the Rayleigh type, 2) the signals are generally considerably stronger (differences up to the order of 10 db) in summer than in winter, 3) the monthly median strength of the 900-mc signals is generally 0–2 db stronger than that of the 2200-mc signals, 4) the foreground conditions may be critical, 5) the 1-minute fade duration distributions are approximately log-normal, 6) there are indications that the normalized 1-minute fade duration distributions are about equal for 900 mc and 2200 mc, 7) considerable reductions in telegraph error rate are effected by increasing orders of diversity reception, 8) the telegraph error rates are equal for 900-mc and 2200-mc signals of equal median strengths, 9) frequency-modulated telegraph multiplex equipment is slightly superior to two-tone telegraph multiplex equipment, when adjusted to equal loadings, 10) antenna radiation diagrams depend critically on local surroundings, such as woods.

I. Introduction

A COMMUNICATION system employing so-called "troposcatter" propagation beyond-the-horizon has been built in Norway for SHAPE (Supreme Headquarters Allied Powers Europe) as an operational system for telephone and telegraph traffic. It is the first part of a large communication network which is bei[...] planned to extend from northern Norway to east[...] Turkey. The system in Norway was built to gai[...] perience in Europe as soon as possible, both on ele[...] and constructional techniques as well as on pr[...] and operation, which could serve as a basis for [...] of the extensive network. Consequently, th[...]d system has several unique features, and it [...]ject of a rather comprehensive test program.

This paper will first describe the syste[...]nd will then discuss several of the results ob[...] 360-km hop of the system during the last y[...]

II. System Des[...]

The system consists of thr[...]tween Oslo (A), Trondheim (B), Mosjøen (C)[...] (D). The distances and horizon angles are give[...]ap in Fig. 1. In this figure it has also been in[...]t, while the hop A–B

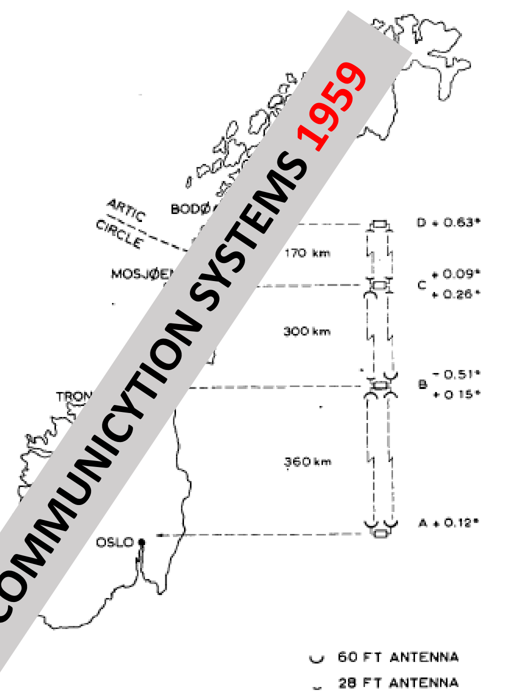


Fig. 1—Communication system in Norway. The figures give pat[...] distances, horizon angles and antenna configuration.

has 60-foot antenna reflectors and the hop C–D has 28-foo[...] reflectors, the hop B–C has a combination of 60 and 28 foot reflectors.

The two intermediate stations are back-to-back re[...]peaters. The block diagram for one terminal station i[...] shown in Fig. 2. The system uses frequency modulatio[...] with frequency division multiplex. It will be seen that th[...] equipments have been arranged according to the operat[...]ing spare principle. There are two parallel transmittin[...] branches operating simultaneously, one low-band (LB[...] and one high-band (HB), each consisting of modulator exciter, 10-kw power amplifier, diplexer, and antenna Each of the horizontally spaced antennas also receive[...] both the low-band and the high-band signals, thus pro[...]viding for quadruple diversity reception. For variou[...]

* Manuscript received b[...]CS, July 2, 1959. This paper was presented at the National [...]posium on extended Range and Space Communications, (co-spon[...]ored by the PGCS, the PGAP, and George Washington University) Washington, D. C.; October 6–7, 1958.

† SHAPE, Air Defense Tech. Cen., The Hague, Netherlands.

The Geographical Journal, Vol. 135, No. 4, 1969, pp. 548-551

II. AIRBORNE RADIO ECHO SOUNDING OF THE GREENLAND ICE SHEET

P. GUDMANDSEN

(Technical University of Denmark, Laboratory of Elect … agnetic Theory, Lyngby, Denmark)

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

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

Radar system.—The tests were carried … 35 MHz with a radar system which is composed of four main parts: transm … eceiver, aerials and recording system. The transmitter was a pulsed power c … r coupled directly to the aerial cable with a peak power of 500W, a pulse du … of 0·25 μsec and a repetition frequency of 16 kHz (Evans and Smith, 1969) … eceiver had a 3 dB band width of 14 MHz and was designed to have a logar … response with a dynamic range of 70 dB. The receiver had two video output … vith the full dynamic range and another with an amplitude limited signal. T … em comprised two aerials, one for transmitting and one for receiving. The … erials were folded dipoles about 4 m long, installed 1 m below the wings of t … oplane, one at each wing. The received signals were displayed on two cathod … scilloscopes. One was the so-called A-scope which was connected to the recei … put with the full dynamic range. This display was photographed every 15 se … The other display was the so-called Z-scope connected to the other receiver … resulting in an intensity modulated presentation of pulses with an amplitu … e a certain level. This display was photographed on a continuously movi … m film. Correspondence between the two films was ensured by means of a ti … k system.

Measurem … d results.—The measurements in May 1968 were carried out by means of a … aeroplane based at Søndre Strømfjord. Seven flights were performed with a to … ng time of 18·5 hours. The navigation was based on the normal flight instru … nd observations from the co-pilot seat. In few cases a radar fix was obtai … uring 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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Journal of Glaciology, Vol. 15, No. 73, 1975

LAYER ECHOES IN POLAR ICE SHEETS

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

Résumé. *Niveau d'échos dans les calottes glaciaires polaires.* Une multitude de larges niveaux de réflexion ont été observés lors de sondages par radio-écho au Groenland. Par comparaison avec le profil des isotopes stables provenant de Camp Century on trouve que la formation de niveaux dan … le haut de la calotte date de la période écoulée depuis la dernière glaciation. Les niveaux d'échos radio … rvés à de plus grandes profondeurs dans le Groenland central peuvent s'être créés dans les périodes i … s et plus bas encore ils peuvent dater de la période précédant la dernière glaciation. Il faudra … lles recherches pour apporter des preuves.

Zusammenfassung. *Schichtechos in polaren Eisdecken.* Eine Vielzahl a … Schichten wurde durch Radar-Echolotung in Grönland beobachtet. Aus dem Vergleich mit de … -Profil von Camp Century ergibt sich, dass die Schichtung im Scheitelbereich des Eises in der … letzten Eiszeit ausgebildet wurde. Schichten, die mit Radar-Lotung in grösseren Tiefen … nlands beobachtet wurden, können in der Zeit der Interstadiale und noch tiefer unten möglich … der letzten Eiszeit entstanden sein. Ein Beweis hierfür erfordert weitere Untersuchungen.

1. Introduction

Radio-echo soundings have revealed stratificat … olar ice sheets. Thus Robin and others (1969) describe from soundings in 1964 i … t echoes apparently returned from a single layer on a track south of Camp Centu … n-west Greenland. Other soundings carried out by the Danmarks Tekniske Høj … 969 showed a multitude of extensive layers in central Greenland briefly reported … andsen (1970). Harrison (1973) shows the geographical distribution of layer echo … ned by the Scott Polar Research Institute in Antarctica between 1969 and 1971.

The one thing which may be said … tainty about the origin of the layer echoes is that they are caused by changes of th … ivity of the ice, but what the mechanism is that caused these changes is still an ope … n. Robin and others (1969) showed that a small change in ice density in an isola … layer relative to its surroundings gives a reflection coefficient of sufficient magnitu … plain the observed echo. Harrison (1973) finds that variations of ice crystal orien … st explain the changes in permittivity at large depths while density variations an … melt associated with ash layers may account for permittivity changes in the … red metres. G. de Q. Robin (private communication in 1973) suggests that chan … impurity level of the ice may cause changes in the permittivity (changes of the lo … t).

The other thing … ay be stated about the layer echoes is that they extend almost continuously over … s of kilometres and thus seem to establish time horizons of a mechanism as yet un … n which occurred when the layer in question was at the surface.

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 cores 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 of the order of five metres (pulse width of 60 ns) 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

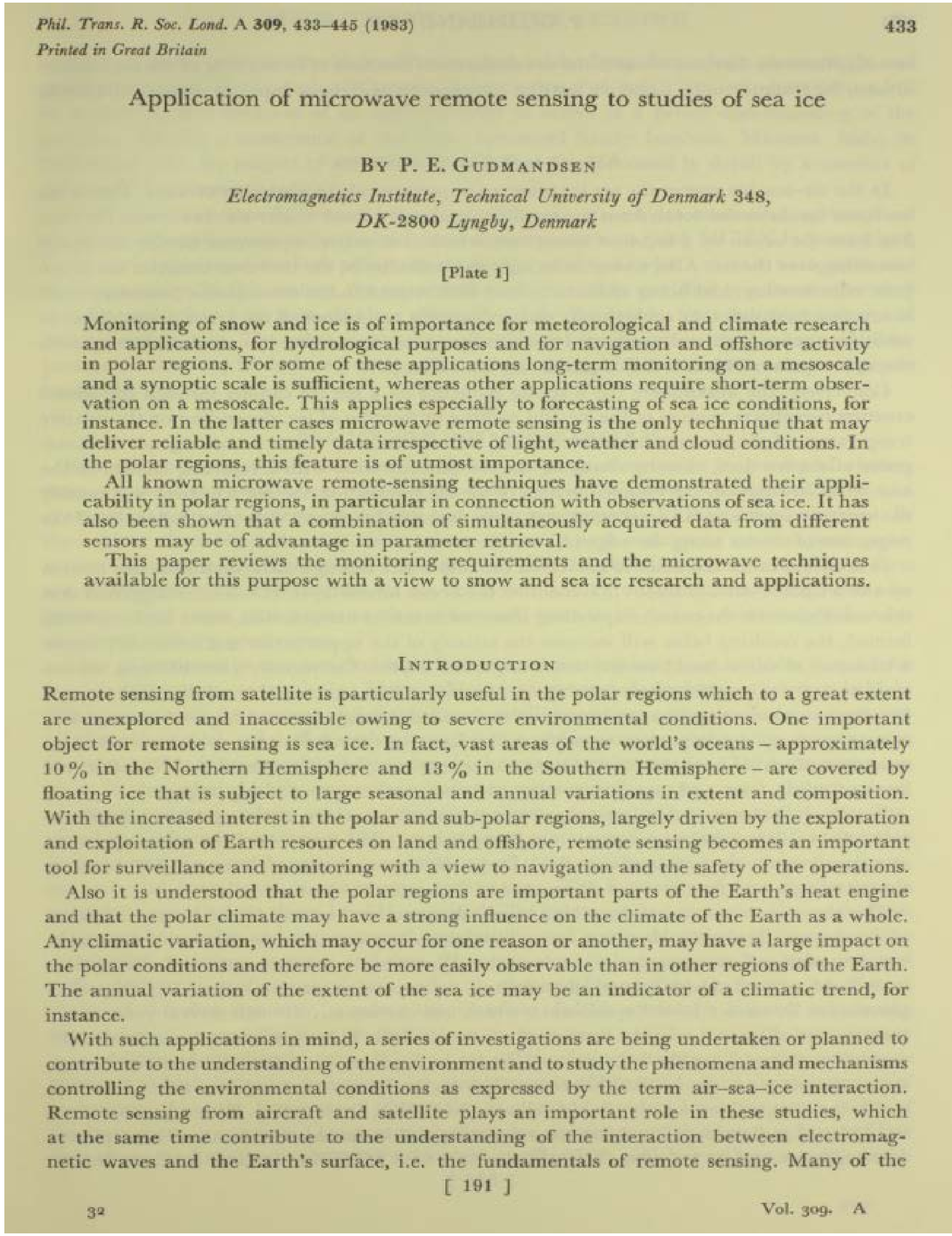
1976 Together with other colleagues he founded EARSeL

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.

1972 – 1994 Danish delegate to ESA in various boards and working groups, including the ESA Council from 1987 – 1994

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.



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Application of microwave remote sensing to studies of sea ice

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[Plate 1]

Monitoring of snow and ice is of importance for meteorological and climate research and applications, for hydrological purposes and for navigation and offshore activity in polar regions. For some of these applications long-term monitoring on a mesoscale and a synoptic scale is sufficient, whereas other applications require short-term observation on a mesoscale. This applies especially to forecasting of sea ice conditions, for instance. In the latter cases microwave remote sensing is the only technique that may deliver reliable and timely data irrespective of light, weather and cloud conditions. In the polar regions, this feature is of utmost importance.

All known microwave remote-sensing techniques have demonstrated their applicability in polar regions, in particular in connection with observations of sea ice. It has also been shown that a combination of simultaneously acquired data from different sensors may be of advantage in parameter retrieval.

This paper reviews the monitoring requirements and the microwave techniques available for this purpose with a view to snow and sea ice research and applications.

Introduction

Remote sensing from satellite is particularly useful in the polar regions which to a great extent are unexplored and inaccessible owing to severe environmental conditions. One important object for remote sensing is sea ice. In fact, vast areas of the world's oceans – approximately 10 % in the Northern Hemisphere and 13 % in the Southern Hemisphere – are covered by floating ice that is subject to large seasonal and annual variations in extent and composition. With the increased interest in the polar and sub-polar regions, largely driven by the exploration and exploitation of Earth resources on land and offshore, remote sensing becomes an important tool for surveillance and monitoring with a view to navigation and the safety of the operations.

Also it is understood that the polar regions are important parts of the Earth's heat engine and that the polar climate may have a strong influence on the climate of the Earth as a whole. Any climatic variation, which may occur for one reason or another, may have a large impact on the polar conditions and therefore be more easily observable than in other regions of the Earth. The annual variation of the extent of the sea ice may be an indicator of a climatic trend, for instance.

With such applications in mind, a series of investigations are being undertaken or planned to contribute to the understanding of the environment and to study the phenomena and mechanisms controlling the environmental conditions as expressed by the term air–sea–ice interaction. Remote sensing from aircraft and satellite plays an important role in these studies, which at the same time contribute to the understanding of the interaction between electromagnetic waves and the Earth's surface, i.e. the fundamentals of remote sensing. Many of the

Ice Dynamics in Lincoln Sea and Nares Strait

P. Gudmandsen [a], S. Hanson [b], J. Wilkinson [c], L. Toudal Pedersen [b]

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[b] Danish Meteorological Institute, Copenhagen, Denmark – sha@dmi.dk - ltp@dmi.dk
[c] Scottish Association for Marine Science, Oban, Scotland, UK – jpw28@sams.ac.uk

Abstract – Freshwater variability, i.e. low-salinity water and sea ice, is the subject of current studies of indications of Arctic climate change. The region of the Lincoln Sea and the Nares Strait is an important contributor to the outflow of ice from the Arctic Ocean and therefore is subject to monitoring of sea ice flux. This paper presents examples of high-resolution ice dynamics in the region using data from satellite radar data and drifting buoys. Such complementary large-scale/small scale studies are necessary because the region is subject to large tidal forcing and strong wind events.

Keywords: sea ice, tides, Lincoln Sea, Nares Strait.

1. INTRODUCTI...

Since Kozo (1991) fir... feature of open... Lincol... been based active ... and Rad... sea ice in Gudmands... fluxes from shelf is pres... observations annual variati... with the last fo... might reflect la... (Kwok et al., 201...

Studies of the sma... been carried out by ... the Lincoln Sea and ... and 2008 complemen... with remote sensing ... ...ellites at irregular intervals and v... ...me. This paper presents examples obtai... ...m the campaign in 2008 when eight buoys were deployed in the Lincoln Sea and the Nares Strait.

Greenland side, controlling the wind that essentially has two major components oriented along the Strait forcing the ice drift (Samelson et al. 2006).

3. METHODS

The eight buoys deployed in the region were developed by the Scottish Association for Marine Science (SAMS), in Oban, Scotland. They cons... ...tially of three parts: a GPS receiver, a co... ...t and a control unit encased in a ... ...Communications is establ... ...communications ... 20 minutes to ...state of the host ...he mechanical floe or when

...a from the ...) on the ...m Wide ...tion of ... of ice ...active ... two

... is ... ...and ...cal model

...OBSERVATIONS

...relude

The Lincoln Sea - Nares Strait is a coupled system of ocean current and ice flux controlled by wind but also by ice barriers that form at the entrance to Nares Strait and/or at places in the Strait. These barriers may last for weeks or months causing a complete stop of the ice transport through the Strait (Kwok et al, 2010). Thus, an ice barrier was present in central, western Kane Basin

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Proceedings

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Extended Abstracts of the Contributions presented at the "Oceans form Space" Symposium
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V. Barale, J.F.R. Gower, L. Alberotanza, ed.s

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EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

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Context for the Recent Massive Petermann Glacier Calving Event

PAGES 117–118

On 4 August 2010, about one fifth of the floating ice tongue of Petermann Glacier (also known as "Petermann Gletscher") in northwestern Greenland calved (Figure 1). The resulting "ice island" had an area approximately 4 times that of Manhattan Island (about 253±17 square kilometers). The ice island garnered much attention from the media, politicians, and the public, who raised concerns about downstream implications for shipping, offshore oil and gas operations, and possible connections to Arctic and global warming.

Does this event signal a change in the glacier's dynamics? Or can it be characterized as part of the glacier's natural variability? Understanding the known historical context of this event allows scientists and the public to judge its significance.

An Overview of Petermann Glacier

Petermann Glacier is a major outlet that drains about 6% of the Greenland Ice Sheet area. It is one of four such major outlet glaciers surrounding Greenland that are grounded substantially (500 meters) below sea level and one of two that retain significant floating ice tongues. The Petermann ice tongue feeds into a high-walled fjord, 15–20 kilometers wide and about 80 kilometers in length. The main flow of ice that crosses the grounding line is augmented by smaller inflow glaciers descending along the sides of the fjord (Figure 1; see also Figure S1 in the online supplement to this *Eos* issue (http://www.agu.org/eos_elec/)). The ice tongue thins substantially from about 600 meters at the grounding line to 200 meters approximately 20 kilometers downstream of the line. It thins more gradually thereafter to 45–70 meters at the seaward edge, corresponding to a height above sea level of only 4–7 meters [*Rignot and Steffen*, 2008].

Petermann's ice tongue is supplied by flow from the Greenland Ice Sheet and a small amount of local precipitation. It loses ice via sublimation, runoff or evaporation after surface melting, calving, and melting from contact with seawater. Members of the British Arctic Expedition first mapped the tongue's ice front in 1876. It had a similar position in 1922 and was within 6 kilometers of this position in 1962, leading to speculation that the Petermann ice front was relatively stable despite regional warming during 1920–1950. Indeed, until the recent calving event, it had been presumed that the Petermann ice tongue was approximately in steady state even allowing for sporadic calving that occurs on a decadal time scale.

Rignot and Steffen [2008] have recently considered the Petermann ice tongue in mass balance terms. Combining measured

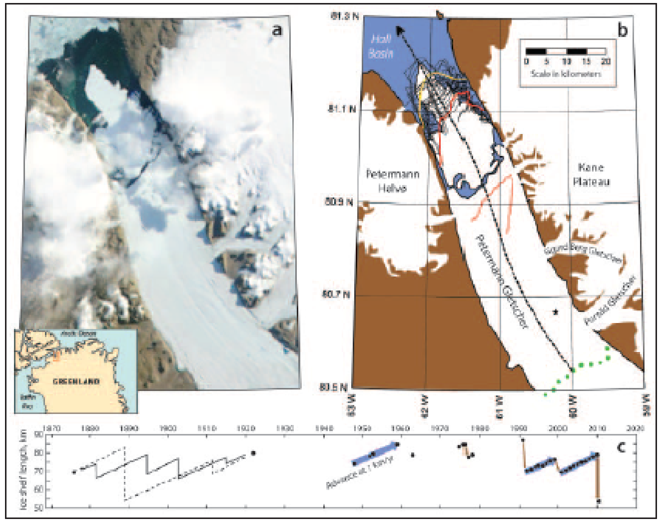

Fig. 1. (a) NASA Aqua satellite Moderate Resolution Imaging Spectroradiometer true-color image, taken 0840 UTC on 5 August 2010, showing calving of Petermann Glacier, northwestern Greenland. There was no sign of a break on 3 August (based on Envisat's advanced synthetic aperture radar data from its wide-swath mode, observed at 1530 UTC), but Envisat imagery revealed the break on 4 August 2010. (b) A map of 31 known frontal positions of the ice tongue (sources are in Table S1). The seaward red curve is the ice front in 1876; behind it in red are the locations of large "fissures" also observed at that time. The yellow curve shows the frontal position in 1922; black curves represent frontal positions in 1948, 1952, 1953, 1959, 1963, 1975–1978, 1991–1999, 1999–2010, and July 2010. Green dots represent the grounding line, and the black star is the location of an automatic weather station [Rignot and Steffen, 2008]. The black arrow traces the total movement of the glacier from 1922 to 2010. White is glacial ice. (c) Times series of ice shelf length as measured along the central axis from the grounding line. Lines connecting 1876 and 1922 are hypothetical trajectories. Blue arrows indicate steady ice advance velocities between calving episodes (brown arrows).

By K. K. Falkner, H. Melling, A. M. Münchow, J. E. Box, T. Wohlleben, H. L. Johnson, P. Gudmandsen, R. Samelson, L. Copland, K. Steffen, E. Rignot, and A. K. Higgins


RADIOGLACIOLOGY
V.V. BOGORODSKY C.R. BENTLEY P.E. GUDMANDSEN
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Taylor & Francis Online
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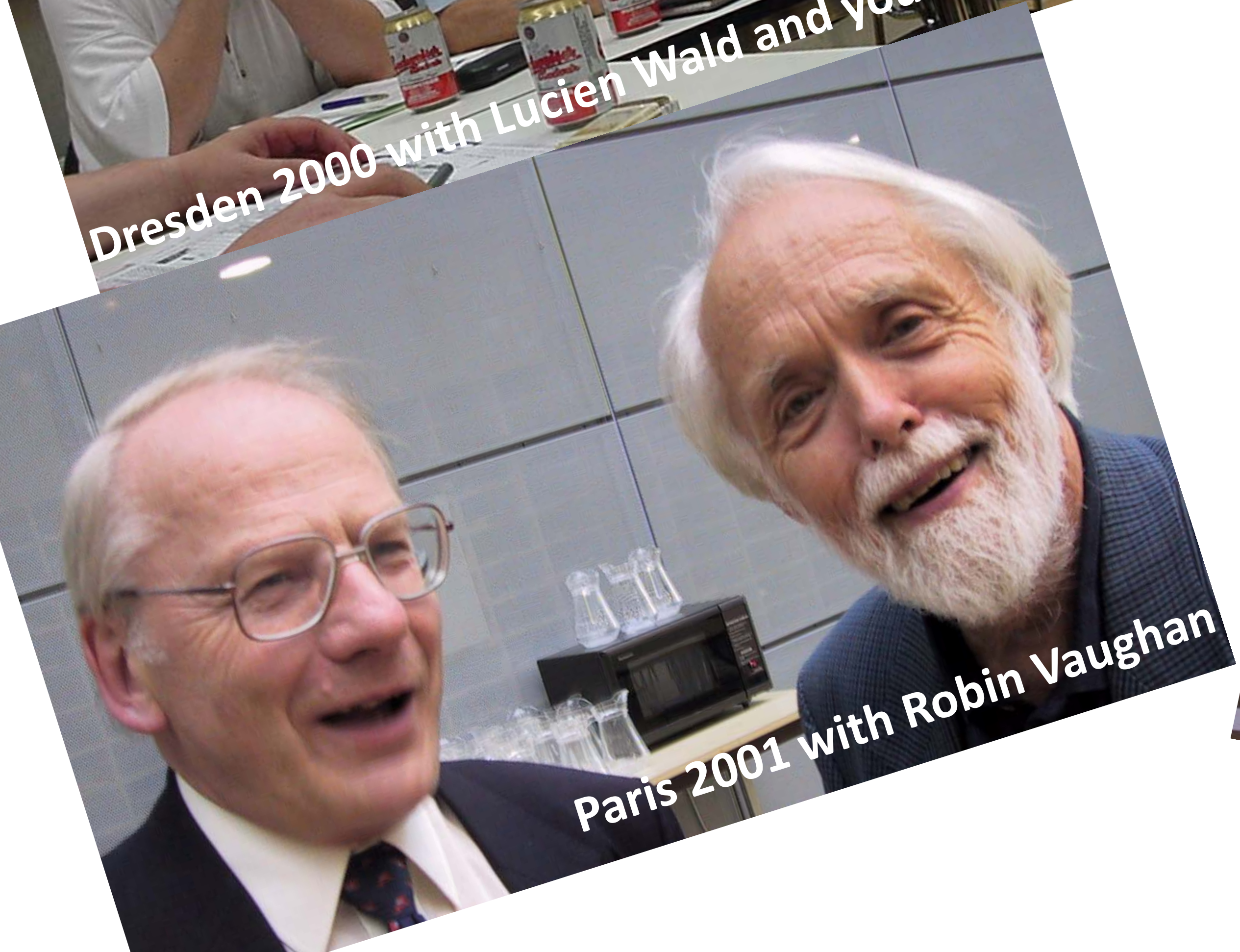
North-East Water polynya: satellite observations summer 1992 and 1993
P. GUDMANDSEN, B. B. THOMSEN, L. T. PEDERSEN, H. SKRIVER & P. J. MINNETT
https://doi.org/10.1080/01431169508954632
Abstract
Polynyas in the Arctic have recently attracted much attention

Dresden 2000 with Lucien Wald and young Rudi

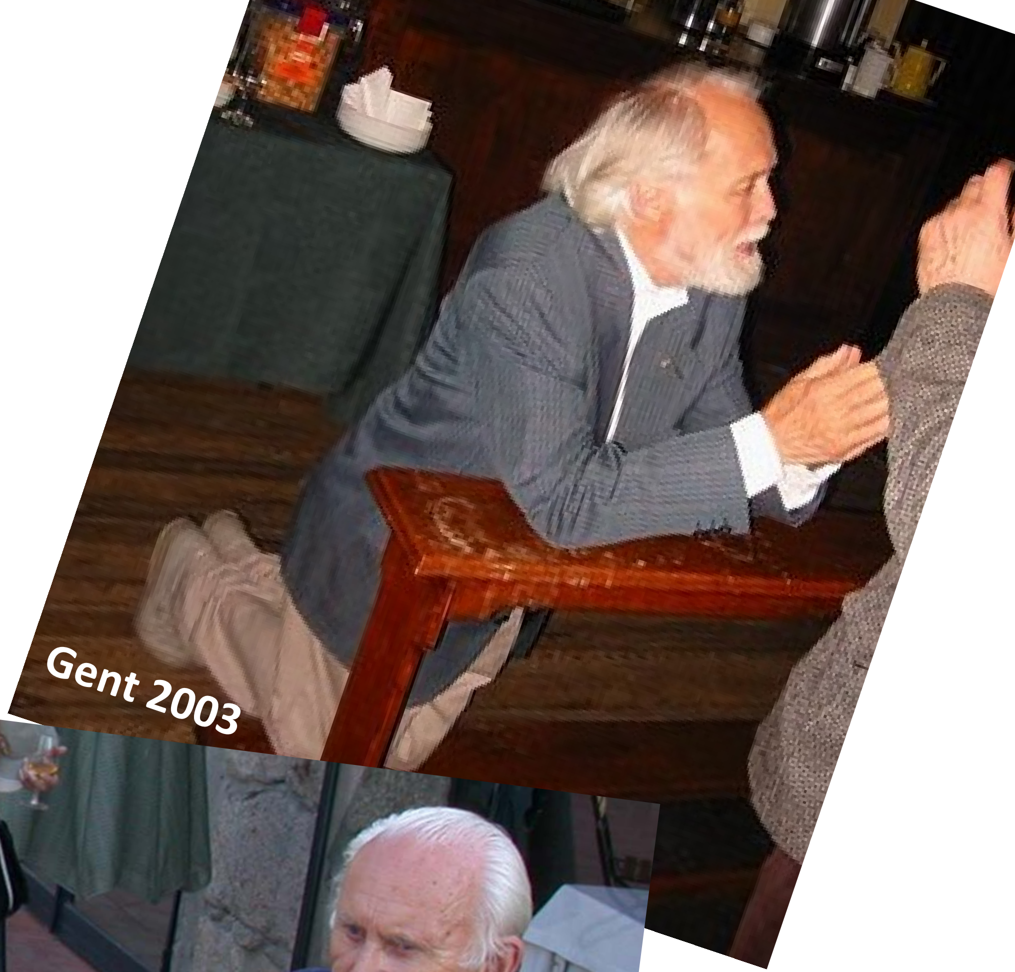
Paris 2001

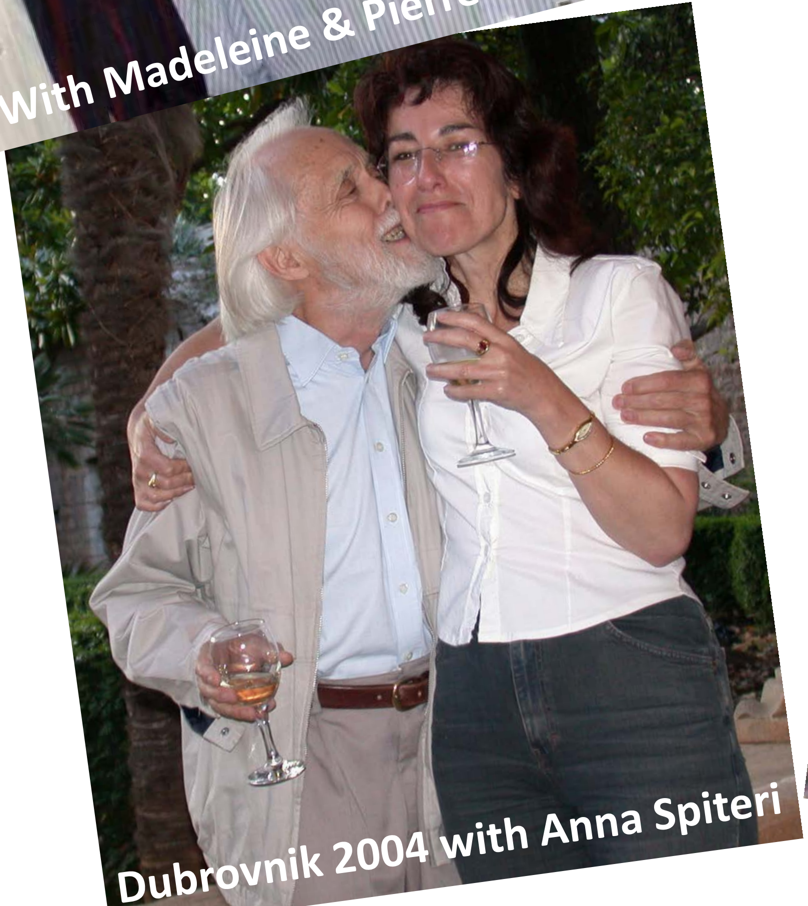


Paris 2001 with Robin Vaughan

With John Trinder (former ISPRS President) and Gottfried Konecny at Liechtenstein Palace Prague 2002


With Madeleine & Pierre Godefroy /Gent 2003


Gent 2003


Dubrovnik 2004 with Anna Spiteri


With Gunnar Østrem & Robin Vaughan /Porto 2004

Symposium 2008 Istanbul


Stockholm 2014: giving a speech at Stockholm Stadshuset where the NobelPrize Laureats are honored


Chania 2009 : Preben came with a stick
…… and finally danced Sirtaki

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

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.