Improvement and interpretation of the changes of the Greenland Ice Sheet heights using CRYOSAT2.

Ansøgernavn/Applicantname: Carl Christian Tscherning

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Antal bilag/Number of appendices: 11

Indholdsfortegnelse/Table of content

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Forsknings- og Innovationsstyrelsen
Ministeriet for Videnskab Teknologi og Udvikling

1. Application

Application title:

Improvement and interpretation of the changes of the Greenland Ice Sheet heights using CRYOSAT2.

Application for funding under the following call:

The Danish Council for Independent Research | Natural Sciences

Application for funding under the following:

Instruments
Major research projects

2. Applicant

First and middle names:	Carl Christian
Last name:	Tscherning
Nationality:	Danish
Current position:	Pofessor
Academic title:	Mag.Scient
Has the applicant a Danish civil registration no.?	☐ Yes ☐ No
Civil reg. no.:	210542-0903
Applicant's date of birth (only valid if applicant does not have a Civil reg. No.):	
Alternative ID and type of ID:	
Male/female:	☐ Female ☐ Male

Home Address:

Street:	Number:	Floor:	Suite no:
Solsortvej	95		

Zip code:	Town/city:	Country:
2000	Frederiksberg	Danamrk

Phone number (optional):	E-mail (optional):	Date for change of address if applicable::
004526301468	cct@gfy.ku.dk	

3. Applicants workplace or affiliated institution/company during the project period

Institution/company:	University of Copenhagen
Supplementary name of institution/company – e.g. name of institute/department:	Niels Bohr Institute
CVR (business registration number) of applicant's affiliated institution:	29 97 98 12
Non-Danish Registration Number:	

Address:

Street:	Number:	Floor:	Suite no:
Blegdamsvej	17		

Zip code:	City:	Country:
2100	København Ø.	Danmark

Telephone number:	E-mail:	Web address:
004526301468	cct@gfy.ku.dk	http://www.nbi.ku.dk

5. Additional contact information

Contact type:	
Contact (name of institution/company or name of person):	
Street:	
Number:	
Floor:	
Suite no.:	
Zip code:	
City:	
Country:	

Telephone number:	
E-mail:	
Non-Danish Business Registration Number/Civil reg. no.	

6. Duration

During what period of time would the funding applied for be used?

Start:	End:
01 October 2011	30 September 2014

Duration in months: **36**

Urgent application?	Urgent application - explanatory text:
Yes No	

7. Finances

Amount applied for (DKK):

Amount applied for to cover scientific/academic salaries:	kr 1,107,124
Amount applied for to cover technical/administrative salaries:	kr 822,687
Amount applied for to cover equipment:	kr 50,000
Amount applied for to cover operating expenses:	kr 252,000
Amount applied for excluding overheads/administrative contributions:	kr 2,231,811
Amount applied to cover overheads/administrative contributions:	kr 981,997
Amount applied for:	**kr 3,213,808**

Possible self-financing from the applicant's and other participants' institutions/companies (DKK):	**kr 0**

External financing (co-financing not deriving from applicant's or other participants' institutions/companies) (DKK):	
Danish public-sector sources:	kr 0
Danish private-sector sources:	kr 0
EU:	kr 0
Other foreign sources:	kr 0
Private Danish foundations etc.:	kr 0

Total external funding:	

Total cost of the activity	**kr 3,213,808**

8. Research training

PhD scholarships

Total number of PhD scholarships included in the activity (number of persons):	1
Hereof the number of PhD scholarships this funding application is to cover fully or partly (number of persons):	1
Total number of PhD months in the activity:	36
Hereof number of PhD months this funding application is to cover:	36

Total expenses on PhD scholarships in the activity. The amount must include annual education rates but exclude overheads - in DKK:	kr 1,398,184
Share of this amount to be covered by the funding applied for - in DKK:	kr 1,398,184

Postdoctoral scholarships

Total number of postdoctoral scholarships comprised by the activity (number of persons):	
Hereof number of postdoctoral scholarships this application is to cover fully or partly (number of persons):	
Total number of postdoctoral months comprised by the activity:	
Hereof number of postdoctoral months this funding application is to cover:	
Total expenses on postdoctoral scholarships in the activity. The amount must exclude overheads - in DKK:	kr 0
Share of this amount to be covered by the funding applied for - in DKK:	kr 0

9. Project description

5 scientific keywords to describe the research activity:
Climate change, CryoSat2, Greenland ice cap height, dynamic changes, ice-flow models,

Popular-science description of the activity. Must be completed in Danish and formulated in a language making it comprehensible to lay persons. The description may be used for general publication in connection with the announcement of grants awarded.:

Klimaændringer fører til udtynding i randområder af Grønlands Indlandis. Ved udløbsgletsjerne sker udtyndingen med accelerende hastighed. Det fører til et tilsvarende accelerende massetab fra Indlandsisen. Det betyder at verdenshavene stiger og risiko for oversvømmelser øges. Det unikke i projektet er kombinationen af satellitbaseret altimetri med digitale højdemodeller fra fotogrammetri. Det har været vanskeligt at kortlægge isoverfladen med satellitbaserede data alene, fordi bjerge, gletscherspalter og ujævnheder reflekterer laser- eller radarpulsen fra satelitter. Her vil projektet udnytte nye data fra ESA´s CrySat-2 satellitmission, fordi CrySat-2 tillader måling af højder af randområdernes skrå flader. Med registrering af højdeændringer i overfladen kan massebalancen for Grønlands Indlandsis bestemmes mere nøjagtigt. Dermed vil projektet føre til en bedre forståelse af iskappens stabilitet, og hvordan afsmeltningen langs randområderne påvirker iskappens flydemønster. Kombinationen giver samtidig en unik mulighed for udvikling af nye numeriske modeller der vil kunne udnyttes til skøn for ændringer i massebalancen. Fokus er på randområder og udløbsgletchere, og på isflydemodeller til at undersøge iskappen med henblik på: - at beregne højdeændringer på Indlandsisen - at bestemme tilhørende massetab - at undersøge de dynamiske ændringer af iskappen og dens stabilitet overfor ændringer ved randen - udvikling af nye numeriske modeller til skøn for ændringer af massebalancen

10. Participants

Scientific/academic staff including the applicant:

First name:	Christine
Last name:	Schott Hvidberg
Position:	Ass.Professor
Duration of participation in projects - in months:	36

Place of employment:	Niels Bohr Institute
Will the scientific staff member's salary be covered fully or partly by the grant?	Yes No

Scientific/academic staff including the applicant:

First name:	
Last name:	
Position:	
Duration of participation in projects - in months:	
Place of employment:	
Will the scientific staff member's salary be covered fully or partly by the grant?	Yes No

Technical/administrative staff:

First name:	Martin
Last name:	Veicherts
Position:	Systems programmer
Duration of participation in projects - in months:	14
Place of employment:	Niels Bohr Institute
Will the technical/administrative staff member's salary be covered fully or partly by the grant?	Yes No

Technical/administrative staff:

First name:	
Last name:	
Position:	
Duration of participation in projects - in months:	
Place of employment:	
Will the technical/administrative staff member's salary be covered fully or partly by the grant?	Yes No

Total payroll costs excluding overhead/administrative contributions (all scientific and technical/administrative staff) in DKK:	kr 0

Of which covered by grant in DKK:	kr 0

11. Other applications and grants

Is the application a renewed submission of one or more previously submitted applications – possibly in a revised form?

Yes No

Have you as applicant, within the last three years, been granted funding from The Danish Agency for Science, Technology and Innovation or from other sources for this activity?

Yes No

Year	Amount granted	Granting body
	kr 0	

Add grant ...

Have you as applicant, within the last three years, been granted funding from The Danish Agency for Science, Technology and Innovation or from other sources for other activities?

Yes No

Year	Amount granted	Granting body	Title
	kr 0		

Add grant ...

Have you applied for funding for the activities covered by this application from other sources?

Yes **No**

15. Other information

Any supplementary information:

The CV of a potential PHD-student has been appended in order to show that we have a very qualified possible applicant. However if the project is granted, the PhD-student position will be announced internationally.

16. Appendices

List of appendices		Size	Last modified
1.	fnu2011_project_descr_ver3.pdf	0.3 MB	23/02/2011
2.	cvcctus11-02.pdf	0 MB	24/02/2011
3.	litcct05-10.pdf	0 MB	24/02/2011
4.	CV-short-Christine-Jan2011.pdf	0 MB	24/02/2011
5.	MVeicherts_CV_publ_18_jan_11.pdf	0.1 MB	24/02/2011
6.	JFL_CV_020211.pdf	0.1 MB	24/02/2011
7.	detailed_budget_2011.pdf	0 MB	24/02/2011
8.	budget_confirmation11.pdf	0.1 MB	24/02/2011
9.	DFF-FNU-Oplysning til uddybning af gruppens okonomi-bilag-2_cct.pdf	0.1 MB	24/02/2011
10.	DFF-FNU-Oplysning_til_uddybning_af_gruppens_okonomi-bilag-2_csh.pdf	0.1 MB	24/02/2011
11.	DFF-FNU-Oplysning til uddybning af gruppens okonomi-bilag-2_mv.pdf	0.1 MB	24/02/2011

17. Scientific statistics

Academic disciplines:

Natural science:	100 %
Technical science:	0 %
Health science:	0 %
Agricultural and veterinary sciences:	0 %
Social science:	0 %
Humanities:	0 %
Not distributed:	0 %
Total:	**100 %**

Scientific field in random order:

10510	20709	11000		

Subject/research areas:
The following information in this section is used solely for producing statistical surveys for the research councils and programme commissions administrated under the Danish Agency for Science, Technology and Innovation. The information has no influence on the evaluation of your application.

¢	None of the areas below		
þ	Climate	¢	ICT
¢	Energy	¢	Integration
þ	Environment	¢	Democracy
¢	Biotechnology	¢	Welfare
¢	Food	¢	Gender
¢	Cancer	¢	Globalisation
¢	Nanotechnology	¢	Experience economy

2. fnu2011_project_descr_ver3.pdf

Improvement and interpretation of the changes of the Greenland Ice Sheet elevations using CryoSat-2.

Summary.

Climatic changes cause a thinning in the ice margins of the Greenland Ice Sheet. At the outlet glaciers the thinning accelerates. This result in a corresponding mass loss of the inlandice. Consequently there is a risk of increased sealevel rise leading to an increased risk of floodings.

The unique feature of the project is the combination of satellitebased altimetry with digital height models from photogrammetry. It has been very difficult to map the ice surface from satellite data alone, because mountains, gletchers and roughness of the ground reflected laser- or radarpulses from satelittes. Here the project will utilise new data from ESA´s CrySat-2 mission, because CrySat-2 with two altimeters permit the measurement of the heights of the sloping surfaces of the icemargins. From the registretion of height-changes of the surface we will be able to determine the mass-balance more precisely than before. Therefore the project will lead to a better understanding of the stability of the ice-cap and how a thinning in the margins affects the flow pattern of the ice-cap.
The focus is on the border areas and outlet glachiers and on ice-flow models in order to:
- determine height changes of the ice-cap
- determine the corresponding mass-loss
- investigate the dynamic changes of the ice-cap and its stability
- development of new numerical models for the estimation of mass-balance changes.

Introduction.

The Greenland Ice Sheet is currently responding to climate changes. This is seen in a retreat of the ice along the ice margin and in an acceleration of the surface velocities of the outlet glaciers. It is believed that in the recent years the mass loss from the Greenland Ice Sheet has been accelerating as well.

The overall goals of the project are:

1. To use data from ESA's CryoSat-2 mission in combination with other available datasets to derive volume changes from fast flowing glaciers along the ice margins of the Greenland Ice Sheet.
2. To estimate the corresponding mass changes.
3. To use ice flow models to evaluate the dynamic changes of the ice sheet and its sensitivity to changes at the ice margin.

This project will contribute to estimating the mass balance of the Greenland Ice Sheet and to better understand the dynamic effects of the ice sheet from current mass loss at the margins. This will result in a better understanding of the ice sheet's sensitivity to future climate changes.

Use of CryoSat2 data combined with other (older) data.

The CRYOSAT mission was proposed to the European Space Agency ESA (see http://www.gfy.ku.dk/~cct/CRYOSAT.htm) by a team headed by Professor Duncan Wingham, University College London (UCL), with the applicant as member in 1998. The main purpose of the mission is to map the changing ice surfaces using advanced radar techniques especially designed to enable the measurement of sloping surfaces such as the glaciers.
The proposal was accepted and the satellite was built, but the launch was unsuccessful. Due to the importance of the mission, funds were obtained by ESA to build a copy, CryoSat-2, which was launched on April 8th, 2010, Fig. 1. The data from the satellite has now been calibrated and are ready for scientific use, see European Space Agency (2011).

Figure 1: CRYOSAT-2 seen from the front

During the last decades, several satellites have been used to monitor the surface changes in the Polar Regions. This has been particularly important in the recent years as the polar ice sheets have undergone drastic changes with increased melt rates at the ice margin and disintegrating ice shelves. This contributes to a rise in sea level, see Zwally et al. (2011).
The part of Greenland, which has undergone the largest changes, is the ice margin and marine terminating outlet glaciers, see Pritchard et al. (2009). However, due to rough surface topography along the margins mainly characterized by mountains and crevasses, potential laser or radar pulses from satellite altimeters are deflected when reaching the surface. This complicates measuring exact surface characteristics and clearly demonstrates the need for combining the data available today with those from ESA's CryoSat-2 which uses radar interferometry to determine the surface topography and elevation along the satellite's ground track.

Examples of previous attempts on performing such estimates include the use of either laser or radar altimetry, such as NASA's Ice, Cloud and land Elevation Satellite (ICESat), NASA's Airborne topographic mapper (ATM) and ESA's Envisat, or combinations of altimetry data with photogrammetrically derived Digital Elevation Models (DEM), see Korona et al. (2009). The latter method focuses on combining laser altimetry data with high-resolution stereopairs from SPOT 5 images used to produce DEMs. The vertical error of the laser altimeters is a few cm but due to satellite orbits and limited flight paths the spatial resolution is very low. The opposite is the case for the DEMs, which have a high spatial resolution but errors on the order of tens of m. Combining the datasets thus

enables obtaining high resolution elevation maps, and one of the aims of the project is to make the best possible updated map of the entire ice sheet. However, due to the sparse amount of altimetry data and DEMs as well as surface slopes varying greatly over small distances, the problem still arises of fully taking the surface roughness into account.
One of the main goals with CryoSat is to estimate the surface changes near the ice edge with a high spatial accuracy. This is possible due to the SIRAL instrument (Synthetic Aparture Interferometric Radar Altimeter), Fig. 2, which combines three different modes to measure surface characteristics on relatively flat surfaces, floating ice shelves and in transition zones from ice to land, see Thales Alenia Space (2011).

Figure 2: The SIRAL instrument

There are several interesting ways in which the CRYOSAT data can be analyzed. An example is to constrain the DEMs to CRYOSAT data so high-accuracy, high-resolution surface elevation maps can be produced that correlate with the temporal scale of the DEMs. This can be done in combination with other high accuracy altimetry data sets, and the maps will provide an overview of elevation changes through time.
In this project, we will include DEMs of the basal topography by Greenland's three largest outlet glaciers, Jakobshavn Isbrae, Helheim and Kangerdlugssuaq released by the University of Kansas' Center for Remote Sensing of Ice Sheets (CreSIS), see Center for Remote Sensing of Ice Sheets (2011). Using these DEMs will make it possible to convert the elevation changes into estimates of volume changes and thus provide estimates of the sea level rise with a higher accuracy than what has been possible so far.

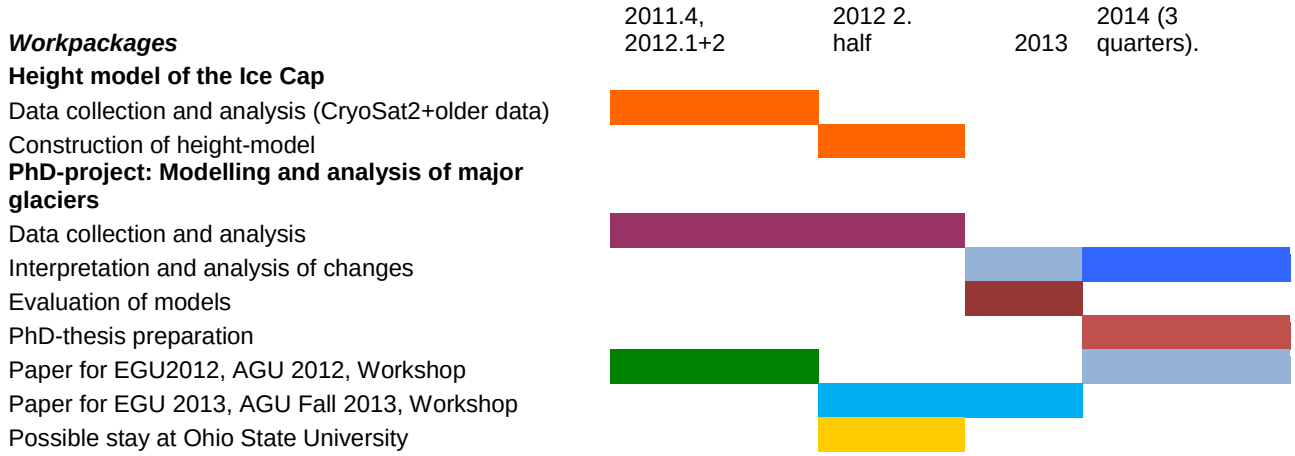
Modelling elevation changes.
The elevation changes will be modeled numerically in order to distinguish between changes due to surface mass balance and ice dynamics (see e.g. Sørensen et al., submitted). We will use the Parallel Ice Sheet Model (PISM) developed by Ed Bueler, University of Alaska Fairbanks (see www.pism-docs.org; Bueler and Brown (2009)), to model large scale flow and high-resolution full-stress models (see Hvidberg et al. (1997a, 1997b), Hvidberg (2003)) to calibrate flow parameters.
One problem here is that the altimetric satellites only determine the height changes. Here, we will take advantage of other projects, which measure the horizontal velocities using GPS or InSAR from satellite, see Joughin et al. (2010). We will combine the datasets with inverse modeling techniques to infer basal properties and constrain ice flow parameters that are difficult to observe directly, such as basal till strength, sliding and ice viscosity, see e.g. Joughin et al. (2009). This will enable us to identify regions with basal melt water that may be more sensitive to changes at the ice margin. Overall, the CryoSat-

2 data can be used to validate, correct and confirm the data and results available so far. Even alone, they provide many great opportunities for important in depth research yielding an overview of climate changes with improved uncertainties that have not yet been attained. It is very important that we take advantage of the CryoSat-2 data having been recently released so we can continually add to the observational record of climate changes occurring in the Arctic.

Project participants:

The project will be lead by Professor Carl Christian Tscherning, who has a long expertise in using altimeter data and in managing large datasets. Associate Professor Christine S. Hvidberg is a pioneer in numerical ice-flow modeling and has used her expertise to interpret altimetry data and other geophysical data both in Greenland and on Mars. Systems programmer Martin Veicherts has worked with satellite data from ESA's GOCE satellite and is an expert in managing large satellite data sets. Stud.scient Joanna F. Levinsen studies the present use of satellite data for glacier monitoring at Ohio State University (OSU). She is scheduled to finish her master thesis in September 2011, and based on her present and previous expertise on working with satellite altimetry she will be very qualified to join the project as a PhD student.

Time Schedule.



National and international collaboration.

The participants work closely with both national and international colleagues. In Denmark, the group cooperates with Professor Dorthe Dahl-Jensen, Center for Ice & Climate, University of Copenhagen (ice flow modeling and interpretation of radar data), Senior Researcher Gudfinna Adalgeirsdottir, Danish Meteorological Institute (ice flow modeling), Senior Researcher René Forsberg, Researcher Louise Sandberg Sørensen and Lars Stenseng all DTU Space (CryoSat-2 data). (The applicant is thesis advisor for the two researchers).

Collaborators abroad are e.g. Associate Professor Ian M. Howat, School of Earth Sciences, Ohio State University (laser altimetry and photogrammetry), Associate Professor Ed Bueler, University of Alaska, Fairbanks (PISM ice flow model), Director Prasad Gogenini, CReSiS, University of Kansas (radar data), SVALI project members – a Nordic Centre of Excellence: Stability and Variation of Land Ice (SVALI) lead by

Professor Jon Ove Hagen, University of Oslo, see (www.ncoe-svali.org). A number of Nordic institutions, including CIC, are participating and the focus is glaciers in the Arctic/ North Atlantic. These are studies on the basis of cryospheric processes observed using remote sensing as well as airborne and in-situ measurements.

References:

Bueler, E.: Brown, J, '*The shallow shelf approximation as a "sliding law" in a thermomechanically coupled ice sheet model*' (2009), Journal of Geophysical Research, 114, F03008, doi:10.1029/2008JF001179.

Center for Remote Sensing of Ice Sheets (2011), '*Data products // Greenland*', https://www.cresis.ku.edu/data/greenland.

Ekholm, S. (1996): '*A full coverage, high resolution, topographic model of Greenland from a variety of digital elevation data'*. Journal of Geophysical Research, 101, pp. 21961 - 21972.

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European Space Agency (2011): 'ESA – *CryoSat: CryoSat ice data now open to all*', http://www.esa.int/SPECIALS/CryoSat/SEM660Y1LJG_0.html

Fishbaugh, K.; Hvidberg, C. S. (2006): '*Martian north polar cap stratigraphy: Implications for accumulation rates and flow*'. Journal of Geophysical Research, 111 (E06012), doi: 10.1029/2005JE002571.

Hvidberg, C. S.; Keller, K; Gundestrup, N. S.; Tscherning, C. C.; Forsberg, R. (1997a), '*Mass balance and surface movement of the Greenland Ice Sheet at Summit, Central Greenland*', Geophysical Research Letters, vol. 24, no. 18, pp. 2307-2310.

Hvidberg, CS; Dahl-Jensen, D; Waddington, ED (1997b), '*Ice flow between the GRIP and GISP2 bore holes in Central Greenland* ', Journal of Geophysical Research - Oceans, no. 102(c12), pp. 26,851-26,860.

Joughin I.; Smith, B.E.; Howat, I. M.; Scambos, T; Moon, T. (2010): '*Greenland flow variability from ice-sheet-wide velocity mapping*', Journal of Glaciology, 56(197), pp. 415 - 430.

Joughin I.; Tulaczyk, S.; Bamber, J. L.; Blankenship, D.; Holt, J. W.; Scambos, T.; Vaughan, D. G. (2009): '*Basal conditions for Pine Island and Thwaites Glaciers, West Antarctica, determined using satellite and airborne data*', Journal of Glaciology, 55(190), pp. 245 - 257.

Korona, J; Berthier, E; Bernard, M; Remy, F; Thouvenot, E (2009): '*SPIRIT. SPOT 5 stereoscopic survey of Polar Ice: Reference Images and Topographies during the fourth International Polar Year (2007 – 2009)'*, ISPRS Journal of Photogrammetry and Remote Sensing (64), pp. 204 – 212.

Pritchard, H. D.; Arthern, R. J.; Vaughan, D. G.; Edwards, L. A. (2009): '*Extensive dynamic thinning on the margins of the Greenland and Antarctic ice sheets*', Nature, vol. 461, no. 15, pp. 971 – 975.

Thales Alenia Space (2011), '*SIRAL 2, a new generation of altimeter'*, http://www.siral-instrument.com/en/siral.php

Zwally, H. J.; Li, J.; Brenner, A. C.; Beckley, M.; Cornejo, H. G.; DiMarzio, J.; Giovinetto, M. B.; Neumann, T.A .; Robbins, J.; Saba, J. L.; Yi, D.; Wang, W. (2011):

‘*Greenland ice sheet mass balance: distribution of increased mass loss with climate warming, 2003 – 2007 versus 1992 - 2002*’, Journal of Glaciology, vol. 57, no. 201.

3. cvcctus11-02.pdf

Curriculum vitae for Carl Christian Tscherning as of Feb. 2011.

Born May 21, 1942. Lieutenant (R), 1991, First Lieutenant (R), 1967, Knight of Dannebrog 1999.

Mag. Scient. in geodesy, may 1970, University of Copenhagen. 1970 - 1988 at the Geodetic Institute of Denmark. Deputy manager computer section 1975-1988. State geodesist and chief of the unit for theory and methodology, july-december 1988. Lecturer (part time) in physical geodesy at the University of Copenhagen since 1977. From December 1. 1988 professor of geodesy here. Director (chairman) of the Department of Geophysics of the University 1989 - 1998. Head "Meteorology, Oceanography, Geodesy" Research Group at the Niels Bohr Institute, 2005-2007, Head "Planetary and Geophysics" Research Group from July 2007 to April 2010.

Have stayed several periods at the Ohio State University (totally 15 months), and at the German Geodetic Research Institute (Munich) 2 months. Visiting senior scientist, U.S.National Geodetic Survey, 3 months in 1981, Visiting Professor Politecnico di Milano, 1 month, 1991.
Invited lecturer to many universities in several different countries. Organized two Danish conferences on space methods in geophysics supported by the Space research Board (Dansk SONG 1978, SANATH 1979) and an international symposium on Management of Geodetic Data, 1981. Convener and Co-convener of several meetings outside Denmark, convener symposium on Advances in Gravity Field Modelling, Vancouver, 1987, co-convener AGU Chapman Conference of Progress in the Determination of the Earth's Gravity Field, FT. Lauderdale, 1988 and co-convener 1. Geoid Commission symposium, Milano, 1990. Member science program committee IUGG General Assembly 1999, 2003 and 2007.

Secretary International Association of Geodesy (IAG) Section III (Gravity Field) 1983-1987. Associate Editor Reviews of Geophysics 1984-87. Editor Bulletin Geodesique 1986-1995 and Manuscripta Geodaetica 1992-1995. Secretary International Geoid Commission, 1987. Member Directing Board International Gravity Bureau 1986-1994. IUGG representative to CODATA, 1987-1995. Secretary General IAG 1995-2007. Honorary Secretary General, 2007. Associate Editor Studia Geodaetica et Geophysica from 2005 to 2009.

Has hold many offices in professional organizations: President of the Geo-Section of the Danish Union of Masters and Ph.D.'s in Science and Humanities (Dansk Magister- forening) 85-87 and president the Science Faculty section 1989-1995. Vice Pres. Danish Geophysical Society 1984-1989 and President 1990 - 1991, secretary 1991. Member faculty council, Science Faculty, University of Copenhagen 1979-1988. Chairman International Committee, Science Faculty, 1992-98, and chairman University international committee 1996-1997. Member of the university Senate (Konsistorium) 1999-2000.
1985 secretary Danish National Committee for the International Union of Geodesy and Geophysics, President 1992-1999. .Member scientific advisory board of the Vening Meinesz Research School of Geodynamics, Universiteit Utrecht from 1998-2000.

More than 250 publications in national and international scientific journals, symposium proceedings and report series. Received Ole Roemer award (Danish), 1971, and W.A.Heiskanen Senior Award (Ohio State University), 1976. Fellow American Geophysical Union, 1991, Foreign Associate Royal Astronomical Society (UK), 1999, IAG Levallois Medal, 2007, EGU Vening Meinesz Medal 2008. Received Niels Bohr Institute teaching Prize for 2006.
Received project support from NATO, EC, Danish Space Board, ESA and was in 1988 appointed principal investigator for an ESA ERS-1 altimetry project and in 1994 CO-PI for the ESA ERS-2 AFRICAR project. Member ESA Fundamental Physics Assessment Group, 1993. ESA STEP Geodesy Working Group, 1994-95. ESA ENVISAT Radar Altimeter Scientific Advisory Group 1995 - 2001, ESA Gravity Mission Science Advisory Group, 1995 -97, ESA Mission Advisory Group for GOCE, 1997- Member GOCE High Level Processing Group from 2004.

Has supervised the thesis of 1 master student and 2 PhD in 2010, see http://www.gfy.ku.dk/~cct/phdandmsc.txt

4. litcct05-10.pdf

Publikationsliste for C.C.Tscherning 2005-2010.

Reviewed publications:

Arabelos, D., R.Forsberg and C.C.Tscherning: On the a-priori estimation of error-covariance functions. A feasibilty study. Geoph. J. Int., idoi:10.1111/j.1365-246X.2007.03460.x. 2007.

Arabelos, D., C.C.Tscherning and M.Veicherts: External calibration of GOCE SGG data with terrestrial gravity data: A simulation study. IAG Proceedings 130, pp. 337-344, Springer Verlag, 2007.

Arabelos, D.N., R.Forsberg and C.C.Tscherning: On the a-priori estimation of collocation error-covariance functions. A feasibility study. Geoph.J.Int., doi: 10.1111/j.1365-246X.2007.03460x, 2007.

Arabelos, D. and C.C.Tscherning: Error-covariances of the estimates of spherical harmonic coefficients computed by LSC, using second-order radial derivative functionals associated with realistic GOCE orbits. J.Geodesy,DOI 10.1007/s00190-008-0250-9, 2008.

Arabelos, D. and C.C.Tscherning: A comparison of recent geopotential models with emphasis on their contribution in refining the gravity and geoid in continental or regional scale. DOI: 10.1007/s00190-10-0397z, J.Geod(2010)84:643-660.

Bouman, J., S.Ripens, T.Gruber, R.Koop, E.Schrama, P.Visser, C.C.Tscherning and M.Veicherts: Pre-processing of gravity gradients at the GOCE High-level processing facility. J.Geodesy, DOI 10.1007/s00190-008-0279-9, 2008.

Knudsen, P., and C.C.Tscherning: Error characteristics of dynamic Topography models derived from altimetry and GOCE gravimetry. IAG Proceedings 130, pp. 3-10, Springer Verlag 2007.

Madsen, K.S., J.L.Hoeyer and C.C.Tscherning: Near-coastal satellite altimetry: Sea surface height variability in the North Sea – Baltic Sea area. GRL, Vol. 34, L14601, doi:10:1029/2007GL029965, 2007.

Migliaccio, F., M. Reguzzoni, F. Sanso and C.C.Tscherning: The Performance of the space-wise approach to GOCE data analysis, when statistical homogenization is applied. Newton's Bulletin, No. 2, Published by BGI and IdGS, 2005.

Nielsen,J., C.C.Tscherning, T.R.N.Jansson, R.Forsberg: Development of a Python interface to the GRAVSOFT gravity field programs. Symposium "Geodesy for Planet Earth", Buenos Aires, Aug. 31-Sept. 4, 2009, IAG Proceedings, pp. 325-330, Springer Verlag 2010.

Sadiq,Muhammad, C.C. Tscherning and Zulfiqar, Ahmad: An estimatetion of the height system bias parameter No using Least Squares Collocation from observed gravity and GPS/leveling data. StudiaGG, Vol. 53, pp. 375-388, 2009.

Sadiq,Muhammad, C.C. Tscherning and Zulfiqar, Ahmad:Regional gravity field model in Pakistan area from the combination of CHAMP, GRACE and ground data using least squares collocation: A case study. J. Advances in Space Research, Vol. 46, Issue 11, pp. 1466-1476, 2010. doi 10.1016/jasr.2010.07.004.

Yuan, Y., C.C.Tscherning, P.Knudsen, G.Xu and J.Ou: The ionospheric eclipse factor method (IEFM) and its application for determining the ionospheric delay using GPS. JoGeodesy, DOI 10.1007/s00190-007-0152.2, Published Vol. 82, no. 1, pp. 1 - 8, 2008.

Non-reviewed publications:

Arabelos, D. and C.C.Tscherning: External calibration of GOCE SGG data with terrestrial gravity data. GO-TN-HPF-GS-0070, GOCE HPF Report, 2005.

Arabelos, D. and C.C.Tscherning: On a strategy for the use of GOCE gradiometer data for the development of a geopotential model by LSC. 3rd Int. GOCE user workshop, ESA-ESRIN, 6-8 2006, ESA-SP-627, pp. 69-75, 2007.

Forsberg, R., H.Skourup, O.B.Andersen, P.Knudsen, S.W.Laxon, A.Ridout, J.Johannesen, F.Sigismund, C.C.Tscherning, D.Arabelos and A. Braun: ARCGICE, Combination of Spaceborne, Airborne and In-Situ Gravity Measurements in Support of Arctic Sea-Ice Mapping. Midterm Report, March, 2006.

Forsberg, R., H.Skourup, O.B.Andersen, P.Knudsen, S.W.Laxon, A.Ridout, J.Johannesen, F.Sigismund, H.Drange, C.C.Tscherning, D.Arabelos, A. Braun and V.Renganathan: Combination of Spaceborne, Airborne and In-Situ Gravity Measurements in Support of Arctic Sea Ice Thickness Mapping. Danish National Space Center, Technical report No. 7, 2007.

Forsberg, R. and C.C.Tscherning: An overview manual for the GRAVSOFT Geodetic Gravity Field Modelling Programs. 2.edition. Contract report for JUPEM, 2008.

Migliaccio, F., M.Reguzzoni, F.Sanso, N.Teselfs, C.C.Tscherning and M. Veicherts: The latest test of the space-wise approach for GOCE data analysis. Proc. 3rd Int. GOCE User Workshop, ESA-ESRIN,6-8 Nov. 2006, ESA SP-627, pp. 241-248, 2007.

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Nielsen, J., T.R.N.Jansson and C.C.Tscherning: Creating a user interface to GRAVSOFT. Report Geodesy Section Dep. of Surveying and Mapping Malaysia, 2008.

Tscherning, C.C.: Orbituary: Torben Krarup. J. Geodesy, Vol. 79, pp. 719-720, 2006.

Tscherning, C.C.: Past officers of the International Association of Geodesy (1991 - 2007). J. Geodesy, Vol. 82, no. 11, pp. 675 - 679, 2008.

Tscherning, C.C.: Report of the IAG Secretary General. J.Geodesy, Vol. 82, no. 11, pp. 713-716, 2008.

Tscherning, C.C.: The use of Least-Squares Collocation for the processing of GOCE data. Paper prepared for Colloquium "Scientific Geodesy" on the occasion of the 75th birthday of Helmut Moritz. Berlin Nov. 14, 2008. Austrian Journal for Surveying and Geoinformation # 1, 2010.

Tscherning, C.C.: The Determination and Use of the Geoid. *Lecture and Seminar Notes.*. Tocho, C. & Guarracino, L. (red.). La Plata : Springer s. 143-172. 30 s. , 2010.

Tscherning, C.C., O.B.Andersen and P.Knudsen: Improvement of gravity prediction from satellite altimetry in coastal areas using data on land. P.Holota (Ed.) "A volume dedicated to Milan Brrursa on the occasion of his 80th birthday", pp. 231-241, Czech National Committee of Geodesy and Geophysics, Prague 2009.

Tscherning, C.C., M.Veicherts and D.Arabelos: Calibration of GOCE gravity gradient data using smooth ground gravity. Proceedings GOCINA workshop, Cahiers du Centre Europeen de Geodynamique et de Seismologie, Vol. 25, pp. 63-67, Luxenbourg, 2006.

Tscherning, C.C. and M.Veicherts: Calibration of GOCE gradiometer data in the MWB using ground data. GO-TN-HPF-GS-0175, 2006.

Tscherning, C.C. and M.Veicherts: Optimization of Gradient prediction. GOCE-TN-HPF-GS-0214, 2007.

5. CV-short-Christine-Jan2011.pdf

Curriculum vitae

Name	**Christine Schøtt Hvidberg**
Born	29 July 1965
Nationality	Danish
Position	Associate Professor (lektor), Niels Bohr Institute, University of Copenhagen
Contact information	Niels Bohr Institute, University of Copenhagen, Juliane Maries Vej 30, DK-2100 Copenhagen, Denmark; Tel: +45 35 32 05 63; Fax: +45 35 36 53 57; e-mail: ch@gfy.ku.dk
Education	*1990*, M.Sc. in Physics (major) and Mathematics (minor), Univ. of Copenhagen; *1993*, Ph.D. in Geophysics, Univ. of Copenhagen. *2003:* Higher education teaching and teaching practice, Univ. of Copenhagen.
Research areas	Ice dynamics and mass balance of the Greenland ice sheet. Developing numerical models of ice sheet flow. Ice core analysis and climate records from ice cores. Ice and climate on Mars. Space observations of ice on Earth and Mars.
Professional experience	*1993-2005*: Research positions at Niels Bohr Institute, University of Copenhagen; *2005-present*: Associate Professor at Niels Bohr Institute, Univ. of Copenhagen; *1990,1992*: Visiting Scientist, Geophysics Program, Univ. of Washington, USA; *2002*: Visiting Scientist at NASA Goddard Space Flight Center, Maryland, USA;
Periods of leave	Maternity leaves four times (*1994, 1997, 2003, 2007*) and part time work *1998-2001*, in total corresponding to 4-5 years of leave.
Research Projects	*1990-present:* Participating Scientist in deep drilling projects at the Greenland Ice Sheet: GRIP, NorthGRIP, and NEEM; *1987-present:* Field experience from the Greenland ice sheet. Surface programs, deep drilling science processing, and logistics. *1993-2001:* Participated in European Ice Sheet Modelling Initiative (EISMINT) *2011-:* Participat in the Nordic Centre of Excellence – Stability and variability of Arctic Land Ice (SVALI).
Space missions	*2002-2006:* Participated in Mars Orbiter Laser Altimeter (MOLA) science team on NASA's Mars Reconnaissance Orbiter; *2006-*: Participating Scientist in the HiRISE team on NASA's Mars Reconnaissance Orbiter. *2009-:* Investigator on ESA's Cryosat2 mission.
Community activites	*1995-96:* Council member, Danish Geophysical Society; *1996-97:* EISMINT Steering Committee member; *2001-2005:* Scientific Editor, Journal of Glaciology; *2002:* Scientific Editor, Annals of Glaciology vol. 37; *2007-2010:* Council member, International Glaciological Society; *2006:* Science Organizing Committee, 4th International Conference on Mars Polar Science and Exploration, Davos, Switzerland. *2009:* Convenor, planetary ice session, IAMAS, Montreal. *2006-:* Organize a Danish network on studies of the Greenland ice sheet. *2011-:* Nordic Centre of Exellence SVALI Graduate School Board member.
Research management	*1990:* PI on a research program "Udvikling af isflydemodeller for store iskapper", a 2.5 year research fellowship from the Danish Research Council. *2002:* PI on "Iskapper og klima på Jorden og Mars", a 3 year research project

	from the Carlsberg Foundation; *2005:* PI on a research program "Ice Sheets on Mars and Earth", a 3-year research project from the Danish Research Council.
Teaching activities And Supervision	*1987-1993*: Teaching Assistant, Institute of Mathematics and Niels Bohr Institute, University of Copenhagen; *1993-present*: Held graduate and undergraduate courses in glaciology, climate modeling, general geophysics and planetary physics at Niels Bohr Institute, University of Copenhagen. *1995-present:* Supervised undergraduate and graduate students in climate, glaciology and planetary science. Chaired Ph.D. evaluation committees. Number of students supervised: B.Sc.: 11, M.Sc.: 6, Ph.D.: 3. *2010-present:* Teaching Committee for Physics, University of Copenhagen, *1996-present:* Ph.D. Committee for Physics, University of Copenhagen; *2001-2004*: Member of a working group on Didactics and Learning in Science, Faculty of Science, University of Copenhagen. *2001:* Co-PI on a project to develop IT teaching material for a graduate course.
Outreach activities	*1988-2006*: organized, fundraised and lectured at "Kopernikursus" (summer school for high school students under Danish Physics Society). *2005:* PI on a 3-year grant from the Danish Research Council to support the Kopernikursus summer school. *1993-:* Each year several outreach activites (public lectures, radio programs, interviews, etc.).
Publications	Peer-reviewed papers: 20, Book chapters: 3, Other scientific articles: 5, Extended abstracts: 17. H-index: 10.

Publications by Christine Schøtt Hvidberg (from 2006).

Peer-reviewed Articles

Fishbaugh, K. and C.S. Hvidberg. 2006. Martian north polar cap stratigraphy: Implications for accumulation rates and flow. Journal of Geophysical Research, 111 (E06012), doi: 10.1029/2005JE002571.

Fishbaugh, K.E., C.S. Hvidberg, S. Byrne, P.S. Russel, K.E. Herkenhoff, M. Winstrup and R. Kirk. 2010. High-resolution stratigraphy of the Martian north polar layered deposits. Geophysical Research Letters, 37, L07201, doi:10.1029/2009GL041642.

Sørensen, L.S. S.B. Simonsen, K. Nielsen, P. Lucas-Picher, G. Spada, G. Adalgeirsdottir, R. Forsberg, and C.S. Hvidberg: Mass balance of the Greenland ice sheet 2003-2008 from ICESat data – the impact of interpolation, sampling and firn density. The Cryosphere. Accepted February 2011.

Book Contributions and other Scientific Articles

Hvidberg, C.S., A. Svensson and S.L. Buchardt. Ice Dynamics of the Greenland Ice Sheet. In "Encyclopedia of Quaternary Science, 2nd Edition" (Ed. Scott Elias). Elsevier, Oxford. Invited contribution. Submitted February 2011.

Fishbaugh, K.E., C.S. Hvidberg, D. Beaty, S. Clifford, D. Fisher, A. Haldemann, J.W. Head, M. Hecht, M. Koutnik, K. Tanaka, and W.J. Ammamm (2008). Introduction to the 4th Mars Polar Science and Exploration Conference special issue: Five top questions in Mars polar science. Icarus, 196, 305-317.

Published Conference Abstracts

Fishbaugh, K. E. and C. S. Hvidberg. 2006. Martian north polar layered deposits: Stratigraphy and relative accumulation rates. LPI Contribution No. 1303, #1647, Lunar and Planetary Science Institute, Houston, Texas.

Hvidberg, C. S. and K. E. Fishbaugh. 2006. Recent flow rates of the Martian north polar layered deposits. LPI Contribution No. 1303, #2053, Lunar and Planetary Science Institute, Houston, Texas.

Hvidberg, C.S., N. B. Karlsson and D. Tyler. 2006. The north polar layered deposits, Mars: Sublimation rates and recent evolution. LPI Contribution No. 1323, #8075, Lunar and Planetary Science Institute, Houston, Texas.

Hvidberg, C. S. 2006. The north polar layered deposits, Mars: Topography, flow and implications for timescales. LPI Contribution No. 1323, #8101, Lunar and Planetary Science Institute, Houston, Texas

Ellehøj, M. D. and C. S. Hvidberg. 2006. Effect of a surface cover of dust on sublimation rates in the north polar layered deposits on Mars. LPI Contribution No. 1323, #8021, Lunar and Planetary Science Institute, Houston, Texas.

Fishbaugh, K. E. and C. S. Hvidberg. 2006. Stratigraphy and accumulation rates of the North Polar Layered Deposits with implications for flow. LPI Contribution No. 1323, #8038, Lunar and Planetary Science Institute, Houston, Texas.

Winstrup, M., C.S. Hvidberg, and D. Dahl-Jensen. 2007. Flow pattern in the North Greenland Ice Stream. Geophysical Research Abstracts, 9, 07538, European Geosciences Union.

A.M. Solgaard, C.S. Hvidberg, H.B. Clausen, and N. Reeh. 2007. An ice flow model of Hans Tausen ice cap, North Greenland. Geophysical Research Abstracts, 9, 07701, European Geosciences Union.

Fishbaugh, K.E., C.S. Hvidberg, S. Byrne, K. Herkenhoff, C. Fortezzo, R. Kirk, M. Winstrup. 2009. The stratigraphic record in the Martian north polar layered deposits as measured by high resolution stereo topography. LPI Contribution No. 1468, #1998, Lunar and Planetary Science Institute, Houston, Texas.

6. MVeicherts_CV_publ_18_jan_11.pdf

Curriculum Vitae

Personal Data

Name: Martin Laimonis Veicherts

Date of birth: 23. april 1966

Employment Record:

University of Copenhagen:

2004 - : Department of Geophysics (Geodesy group)
Programming various satellite (GOCE, CHAMP) data processing SW, - e.g. for energy conservation, orbit examinations, gravity field, gravity gradient filtering and parameter estimation.
Working with GRAVSOFT program suite for geophysical investigations.
Implemented multiprocessing (OpenMP and MPI) Choleski factorisation procedure.
Teaching courses: Geodesy, Satellite geodesy, Intro to Geophysic

L. M. Ericsson:

1999-2003: **Call Centre Design Dept.**
Designed and implemented SMS enabled directory assistance solution for Aircom (main Irish teleoperator).
Designed call handling procedure for Embratel (teleoperator in Brazil).
Test & Support Dept.
Created test plans and performed software test.
Test and installation of telecom sw and hw in more than 15 countries.
Created numerous call centre sw installation and user guides.
Education Dept.
Developed course materials including teaching books in installation, operation and maintenance for two different call centre systems.
Given more than 40 courses in call centre technologies mainly outside Denmark.

Geoteknisk Institut:

1999: Borehole logging in Malmø area.
Full logging suite including gamma ray density, neutron porosity, resistivity, temperature et. al.

1998: Seabed Investigation in Baltic sea, offshore nightshift work.
Included manual work sinking rigs to seabed, managing rigs from control room, description and containment of samples.

GEUS (Danmarks og Grønlands Geologiske Undersøgelser) and DTU:

Martin Veicherts, Asmussens Alle 5, 1808 Frederiksberg. Tel. +45 20231930 Mail: veicherts@google.com

1998: Programming assignments.
Developed programs for correcting erroneous gamma ray logs and calculation of rock core density.

Education:

1998: Master of Science of Engineering. Petroleum Engineering.
Technical University of Denmark.

1995: GIS project mapping volcanic soils, and general soil studies.
Colegio de Postgraduados, Chapingo, Mexico.

Courses:

2009: Multiprocessing with OpenMP and MPI, Technical University of Denmark.
2006: Digital Signal Processing, Technical University of Denmark. Teacher: Jan Larsen.
2006: Satellite Geodesy, University of Copenhagen. Teacher: C. C. Tscherning.
2005: Geoid School, Belgrade, Hungary. Various teachers.
2004: Potential Field Methods, University of Copenhagen. Teacher: Rene Forsberg.
2004: Geodesy, University of Copenhagen. Teacher: C. C. Tscherning.
2004: Object Oriented Programming in Java, Ingeniørhøjskolen.
2003: Programming in Erlang, Ericsson Education Center, Stockholm.
2000: Various Ericsson technical related courses, Ericsson Education Center.
1999: MS NT4 Core Technology and MS TCP/IP, Denmark.

Secondary Employment Record: 1991: Marine Infantry, Bornholm.

Publications:

Bouman, J.,Rispens, S.,Gruber, T.,Koop R. Schrama, E. Visser, P.,Tscherning, C., Veicherts, M. Pre-processing of gravity gradients at the GOCE HPF.
Journal of Geodesy, 2008.

Arabelos, D., C.C.Tscherning and M.Veicherts: External calibration of GOCE SGG data with terrestrial gravity data: A simulation study.
IAG Proceedings 130, pp. 337-344, Springer Verlag, 2007.

Migliaccio, F., M.Refuzzoni, F.Sanso, N.Tselfes, C.C.Tscherning and M. Veicherts: The latest test of the space-wise approach for GOCE data analysis. Proc. 3rd Int. GOCE User Workshop, ESA-ESRIN,6-8 Nov. 2006, ESA SP-627, pp. 241-248, 2007.

Tscherning, C.C., M.Veicherts and D.Arabelos: Calibration of GOCE gravity gradient data using smooth ground gravity. Proceedings GOCINA workshop, Cahiers du Centre Europeen de Geodynamique et de Seismologie, Vol. 25, pp. 63-67, Luxembourg, 2006.

Tscherning, C.C. and Veicherts, M.: Calibration of GOCE gradiometer data in the MWB using ground data. GO-TN-HPF-GS-0175, 2006.

Martin Veicherts, Asmussens Alle 5, 1808 Frederiksberg. Tel. +45 20231930 Mail: veicherts@google.com

7. JFL_CV_020211.pdf

Curriculum Vitae

For:
Joanna Fredenslund Levinsen
Moentmestervej 38, 1. th
2400 Copenhagen NV
Denmark

Email: Joanna@nbi.ku.dk
Telephone: +45 2636 8690

Date and place of birth: May 10th 1986, Denmark

Education

Stud.MSc (Stud.Cand.Scient) in Geophysics, August 2009 – present
Expected end date: September 2011
Niels Bohr Institute, University of Copenhagen
Thesis work is taking place at the School of Earth Sciences, Ohio State University, USA from September 2010 – September 2011

- Current grade average (ECTS-weighted): 10.8/12
- Master's thesis: "*Developing a Method for Mapping High-Resolution Surface Elevation Changes of Outlet Glaciers Using Combined Laser Altimeter and Digital Elevation Model Data*"

BSc in Geophysics, August 2006 – June 2009
Niels Bohr Institute, University of Copenhagen

- Grade average (ECTS-weighted): 7.6/12
- Bachelor's project: *"Elevation changes and corrections near the Kangerdlugssuaq Glacier from ICESat, 2003 – 2008"*

Basic Studies in Natural Sciences, August 2005 – June 2006
University of Roskilde

- Grade average (ECTS-weighted): 11/12
- Project, second semester: *"Crustal motions measured with GPS"*

Research Experience

- Theory development and implementation
- Scientific program development in Fortran and Matlab

Teaching Experience

- Spring semester 2009: Teaching Assistant in the bachelor's course *"Geodesy and Geostatistics"* at the Niels Bohr Institute, University of Copenhagen.
- Copenhagen, 2006, 2007: Giving lectures and exercises as part of the *"Danish Science Festival"*. Topic of lectures + exercises: GPS and its applications in geophysics with respect to measuring surface- and elevations changes of the Greenland Ice Sheet.
- Roskilde, 2005: Giving lectures and making exercises as part of the *"Festival of Research"*. Topic of lectures: Same as above.

Exercises: Hands-on experience with the use of GPS. This is achieved through a treasure hunt, where specific points have to be found.

Other Work

Research project, February 2010 – June 2010
Niels Borh Institute, University of Copenhagen

- Measurements of elevation changes of the Greenland Ice Sheet using satellite data from the European Space Agency's satellite ENVISAT. Data are to be compared to results from bachelor's project.

Student assistant, August 2009 - present
Department of Geodesy, DTU Space, DTU

- Extracting GPS data from original data files from sites in Denmark using Fortran. Data are then prepared for use in the programme cats_MLE, which uses Maximum Likelihood Estimation to fit a multi-parameter model to a time series.

Student assistant, August 2007 – January 2009
Department of Geodesy, DTU Space, DTU

- Processing GPS data from the outlet glacier Helheim in Southeast Greenland. This gives elevation changes and measurements of isostatic uplift of the crust due to the melting ice. Period of observations: 2006 – 2007.
- Processing GPS data from the glacier Jakobshavn Isbrae in Westgreenland. The vertical coordinates were considered thus providing measurements of isostatic uplift of the crust. Period of observations: 2008.

Conferences and workshops

- December 13th - 18th 2010: *"American Geophysical Union"*, San Francisco, USA.

Participated with poster on thesis topic: "*High-Resolution Maps of Outlet Glacier Surface Elevation Change from Combined Laser Altimeter and Digital Elevation Data*"

- June 28th – July 2nd, 2010: *"ESA Living Planet Symposium"*, Bergen, Norway

Participated with poster on research project about analysis of ENVISAT: "*Elevation Changes and Corrections in the Area of the Kangerdlugssuaq Glacier in the Period 2003 - 2008*"

- March 25th and 26th, 2010: *"Paleoclimatology, oceanography and glaciology in the Helheim Glacier region"*, Geological Museum, Copenhagen
- March 16th - 20th 2009: *"Heating, Ventilation and Air Conditioning"*, Sisimiut, Greenland. Participated in order to contribute with geophysicist's point of view regarding the subject of the conference.

Language skills

- Danish: Excellent (native speaker)
- English: Fluent (eight years of classes, travelling and year long stay at Ohio State University, USA)
- French: Good (five years of classes, travelling)
- Greek: Basic

8. detailed_budget_2011.pdf

Detailed sub-budget applicant

Name of the institution at which the applicant has his/her principal place of employment during the project period: Niels Bohr Institute, KU.

(i.e. the institution administrating a possible grant)

The automatically added-up fields in this file are solely a service to you as an applicant. It is your responsibility to ensure that the fields contain the correct figures and that they are correctly added up.

Mo = months

RED FIGURES ARE COMPLETED AUTOMATICALLY BASED ON DATA IN THE YELLOW FIELDS FOR THE INDIVIDUAL YEARS

	Total						2010						2011					
	Applied for from the Council		co-financing		funding from other sources*		Applied for from the Council		co-financing		funding from other sources*		Applied for from the Council		co-financing		funding from other sources*	
	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK
Total scientific/academic salaries	0,0	0	0,0	0	0,0	0												
PhD		1.285.000											12,0	385.000				
Total technical administrative salaries	12,0	634.000	0,0	0	0,0	0												
Total operating expenses incl. equipment		0		0		0												
Uddannelsestilskud		240.000												80.000				
COMPUTER		80.000												80.000				
Travel		91.500												17.500				
Visiting scientist (Arabelos)		68.000												34.000				
Stay POLIMI		35.000												35.000				
Sub-total		2.433.500		0		0		0		0		0		0		0		0
Overhead/adm. expenses		1.070.740		0		0												
Total	12,0	3.504.240	0,0	0	0,0	0		0		0		0		0		0		0

	2012						2013					
	Applied for from the Council		co-financing		funding from other sources*		Applied for from the Council		co-financing		funding from other sources*	
	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK
Total scientific/academic salaries												
PhD	12,0	430.000					12,0	470.000				
Total technical administrative salaries							12,0	634.000				
Total operating expenses incl. equipment												
Uddannelsestilskud		80.000						80.000				
COMPUTER												
Travel		39.000						35.000				
Visiting scientist (Arabelos)		34.000										
Stay POLIMI												
Sub-total		0		0		0		634.000		0		0
Overhead/adm. expenses												
Total		0		0		0		634.000		0		0

* Funding from other sources that the applicant's and the other participants' institutions/companies

NOTE: The detailed budget must be accompanied by specific reasons stating why the individual budget items are necessary, cf. Chapter 5.5 of the call for proposals. Reasons may be stated in the rows below. including, e.g., what the operating expenses comprise.

XX

XX

XX

XX

	2014						2015					
	Applied for from the Council		co-financing		funding from other sources*		Applied for from the Council		co-financing		funding from other sources*	
	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK	Mo.	DKK
		0		0		0		0		0		0
		0		0		0		0		0		0

Date and signature of applicant:
Only required for proposals to FTP and FNU

1 March 2.010

Stamp and signature of the applicant's principal place of employment during the project period:
Only required for proposals to FTP and FNU

9. budget_confirmation11.pdf

NIELS BOHR INSTITUTET
KØBENHAVNS UNIVERSITET

Det Frie Forskningsråd
Forsknings- og Innovationsstyrelsen
Bredgade 40
1260 København K

22. FEBRUAR 2011

Vedr. Christian Tschernings ansøgning:" Improvement and interpretation of the changes of the Greenland Ice Sheet elevations using CryoSat-2"

Niels Bohr Institutet støtter varmt Christian Tschernings ansøgning om støtte til ovennævnte projekt og bekræfter, at instituttet med glæde stiller de nødvendige faciliteter til rådighed for projektet.

Med venlig hilsen

John Renner Hansen
Institutleder

INSTITUTLEDELSEN

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REF: JRH/MMM
Sag: 031
Bedes oplyst ved henv.

Budget Confirmation

Danish Agency for Science
Technology and Innovation
Ministry of Science
Technology and Innovation

The present template for the confirmation of the budget must be used in all applications to the five research councils in the Danish Council for Independent Research. The template must be printed, filled in, signed and stamped and subsequently attached to the application in PDF format as an appendix. See chapters 4 and 5.5 in the call for proposals.

The applicant hereby confirms with his/her signature that all information given in the application is correct and that the total amount applied for from the research council (including overhead/administration expenses) is as follows:

3342486

Amount applied for in DKK including overhead/administration expenses.

The amount stated must be identical with the amount stated in the template "DFF – Total Detailed Budget", as follows: amount shown in cell D47 in the template spreadsheet "Detailed Sub-budget Applicant " for applications with no other participating institution/companies, or the amount shown in cell D72 in the template spreadsheet "Total Detailed Budget" for applications with other participating institutions/companies.

Signature of applicant

The institution or company defraying and recording the expenses for the applicant during the project period confirms with its signature and stamp that the budget is approved and that the project can be carried out at the institution.

Professor John Renner Hansen
Institutleder
Niels Bohr Institutet, Københavns Universitet
Blegdamsvej 17, 2100 København Ø
Tel: +45 3532 5292 - Fax: +45 3532 5217
Email: head@nbi.dk - www.nbi.ku.dk

Signature and stamp of institution/company

The requirement of stamp and signature from the institution/company does not apply to applications that are not to be administered by a Danish institution.

The Danish Council for Independent Research

Ver. 10 Dec 2010

Danish Agency for Science Technology and Innovation

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10. DFF-FNU-Oplysning til uddybning af gruppens okonomi-bilag-2_cct.pdf

Skema til uddybning af ansøger eller ansøgergruppens økonomi

bilag til ansøgninger om Forskningsprojekter og Store Forskningsprojekter 2010

Det Frie Forskningsråd | Natur og Univers

Hovedansøger og de medansøgere, der forventes at få en andel af det ansøgte beløb, skal hver udfylde ét skema. Postdoc'ere og ph.d. studerende, som skal aflønnes af det ansøgte beløb, skal ikke udfylde et skema. I det nedenstående skema skal kun opgøres den andel, der søges fra rådet.

Deltagers navn: Carl Christian Tscherning

Projekttitel:

Improvement and interpretation of the changes of the Greenland Ice Sheet heights using CRYOSAT2.

	VIP-løn[1]	Apparatur	Drift[2]
Deltagers forventede andel af det ansøgte budget	1925671 (+ overhead)	50000	171000
Deltagers forventede tidsforbrug (mandemåneder/år)	6 (til udgang 2012), herefter 9 til projekt slut.		

Ansøger/medansøgers deltagelse i andre projekter (både råds- og ikke råds-finansierede) i perioden, der søges støtte til ved FNU

Projekttitel	Navn på hovedansøger	Bevilget af	Projektperiode	Ansøgers tidsforbrug i mandemåneder/år	Totalt bevilget beløb	Ansøgers andel af VIP-lønmidler[3]	Ansøgers andel af apparatur-midler	Ansøgers andel af drifts-midler

[1] Deltagers forventede andel af de totalt ansøgte lønmidler til evt. egen løn og løn til ph.d.-studerende og post docs som vedkommende skal lede
[2] Deltagers forventede andel af de ansøgte driftsmidler (herunder også rejser, studentermedhjælp, konsulentydelser o.lign.).
[3] Deltagers forventede andel af de totalt ansøgte lønmidler til evt. egen løn og løn til ph.d.-studerende og post docs som vedkommende skal lede

11. DFF-FNU-Oplysning_til_uddybning_af_gruppens_okonomi-bilag-2_csh.pdf

Skema til uddybning af ansøger eller ansøgergruppens økonomi

bilag til ansøgninger om Forskningsprojekter og Store Forskningsprojekter 2010

Det Frie Forskningsråd | Natur og Univers

Hovedansøger og de medansøgere, der forventes at få en andel af det ansøgte beløb, skal hver udfylde ét skema. Postdoc'ere og ph.d. studerende, som skal aflønnes af det ansøgte beløb, skal ikke udfylde et skema. I det nedenstående skema skal kun opgøres den andel, der søges fra rådet.

Deltagers navn: Christine S. Hvidberg

Projekttitel:

Improvement and interpretation of the changes of the Greenland Ice Sheet heights using CRYOSAT2.

	VIP-løn[1]	Apparatur	Drift[2]
Deltagers forventede andel af det ansøgte budget	0	0	48000
Deltagers forventede tidsforbrug (mandemåneder/år)	2 til slut 2010, derefter 4 til projekt slut.		

Ansøger/medansøgers deltagelse i andre projekter (både råds- og ikke råds-finansierede) i perioden, der søges støtte til ved FNU

Projekttitel	Navn på hovedansøger	Bevilget af	Projektperiode	Ansøgers tidsforbrug i mandemåneder/år	Totalt bevilget beløb	Ansøgers andel af VIP-lønmidler[3]	Ansøgers andel af apparatur-midler	Ansøgers andel af drifts-midler

[1] Deltagers forventede andel af de totalt ansøgte lønmidler til evt. egen løn og løn til ph.d.-studerende og post docs som vedkommende skal lede
[2] Deltagers forventede andel af de ansøgte driftsmidler (herunder også rejser, studentermedhjælp, konsulentydelser o.lign.).
[3] Deltagers forventede andel af de totalt ansøgte lønmidler til evt. egen løn og løn til ph.d.-studerende og post docs som vedkommende skal lede

12. DFF-FNU-Oplysning til uddybning af gruppens okonomi-bilag-2_mv.pdf

Skema til uddybning af ansøger eller ansøgergruppens økonomi

bilag til ansøgninger om Forskningsprojekter og Store Forskningsprojekter 2010

Det Frie Forskningsråd | Natur og Univers

Hovedansøger og de medansøgere, der forventes at få en andel af det ansøgte beløb, skal hver udfylde ét skema. Postdoc'ere og ph.d. studerende, som skal aflønnes af det ansøgte beløb, skal ikke udfylde et skema. I det nedenstående skema skal kun opgøres den andel, der søges fra rådet.

Deltagers navn: Martin Veicherts

Projekttitel:

Improvement and interpretation of the changes of the Greenland Ice Sheet heights using CRYOSAT2.

	VIP-løn[1]	Apparatur	Drift[2]
Deltagers forventede andel af det ansøgte budget			21000
Deltagers forventede tidsforbrug (mandemåneder/år)	I 2011 12, i 2013 11.		

Ansøger/medansøgers deltagelse i andre projekter (både råds- og ikke råds-finansierede) i perioden, der søges støtte til ved FNU

Projekttitel	Navn på hovedansøger	Bevilget af	Projektperiode	Ansøgers tidsforbrug i mandemåneder/år	Totalt bevilget beløb	Ansøgers andel af VIP-lønmidler[3]	Ansøgers andel af apparatur-midler	Ansøgers andel af drifts-midler

[1] Deltagers forventede andel af de totalt ansøgte lønmidler til evt. egen løn og løn til ph.d.-studerende og post docs som vedkommende skal lede
[2] Deltagers forventede andel af de ansøgte driftsmidler (herunder også rejser, studentermedhjælp, konsulentydelser o.lign.).
[3] Deltagers forventede andel af de totalt ansøgte lønmidler til evt. egen løn og løn til ph.d.-studerende og post docs som vedkommende skal lede