北海道大学低温科学研究所

外部点検評価報告書

2013年3月

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はじめに

低温科学研究所は，1941年（昭和16年）に北海道大学初の附置研究所として設立されました。以来，雪氷学や低温生物学の黎明期を支える研究機関として発展を遂げ，特徴と伝統のある研究所として，学術への貢献を果たしてきました。しかし，歴史を重ねながら常に同じ分野で研究アクティビティを維持していくことは困難であり，本研究所も例外ではありませんでした。多くの附置研究所が改組の嵐に見舞われる中，本研究所も1995年（平成7年）に，寒冷圏の自然現象の基礎と応用の研究を目的とする全国共同利用研究所として，まったく新たな研究所へと生まれ変わりました。研究所の部門構成も，小部門制から大部門制に転換され，教員人事の柔軟性の確保，および物理学や生物学といった従来の学問枠にとらわれない研究者間の交流を活発化させること，などが強く求められることになりました。

この大改組の後も，研究所のさらなる改革を実施するとともに，さまざまな大型研究プロジェクトの実施や国内外の研究機関との連携を積極的に推進してきました。たとえば，2004年（平成16年）にオホーツク海沿岸の紋別市にあった附属流氷研究施設を廃止・転換し，「環オホーツク観測研究センター」を札幌市に設置したのもこのような流れのなかで実行された改革のひとつであり，研究所のアクティビティを高めるための不断の努力がなされてきました。

大改組を経験した本研究所のアクティビティを検証するために，2006年（平成18年）には，本研究所で初めての本格的な自己点検評価がなされました。さらに翌年，この自己点検の結果をもとに，所外の研究者による外部点検評価が実施されました。この外部点検評価では，特に当初の大部門構成による研究活性化が十分に機能していないことが指摘されるなど，新たにいくつかの問題点が提起され，これを受けて2008年（平成20年）には再び改組を行いました。この改組のポイントは，従来は研究領域ごとに分けられていた大部門を研究分野ごとの構成とし，「水・物質循環部門」，「雪氷新領域部門」，および「生物環境部門」の3大部門を新たに設置したことです。さらに，共同利用・共同研究機能を強化するため「共同研究推進部」を設置し，低温科学研究所の看板となりうる分野横断型の研究テーマを遂行するためのプラットフォームとして，「プログラム」研究制度を立ち上げました。これにより，若手研究者を中心とした優れた萌芽研究をプログラムのテーマとして取り上げ，本研究所の自助努力による積極的な支援により研究の推進をはかる体制を整えました。このように，大学附置研究所および全国共同利用研究所として，双方の役割を果たすべく可能な限りの努力を払ってまいりました。

一方，2004年（平成16年）には，大学改革の一環として国立大学が法人化されるとともに，本研究所も北海道大学の中でその存在意義を厳しく問われる立場にさらされることになりました。その結果，2009年（平成21年）度に行われた大学中期計画の第一期における達成度評価では，本研究所は厳しい評価を得ることとなり

ました。このような状況の一方で，2010年（平成22年）からの国立大学法人の第二期中期計画の6年間については，本研究所は「寒冷圏および低温条件下における科学現象の基礎と応用に関する研究」を目的とする共同利用・共同研究拠点としての文部科学大臣認定を得ることが出来，これによって捲土重来を期すこととなりました。従来型の全国共同利用研の役割に加え，拠点としての重要なミッションに位置づけられている，国内外のさまざまな研究コミュニティとの連携が，以前にもまして研究所の重要な責務として科せられることになりました。

以上のように，2006年（平成18年）度の前回の自己点検・外部点検評価から現在までの約6年の間に本研究所で生じた変化は極めて大きなものがあります。まさに，研究所の大変革の6年間であったと言っても過言ではありません。同時に，研究所を取り巻く環境も大きく変化し，研究所の存在意義そのものを問われるなど，6年前とは比較にならないほどその厳しさを増しています。このようなことから，本研究所が社会に開かれた研究所としてその使命を十分に果たしてきたかを振り返り，そして今後ともその使命を継続して果たしてゆくには，その進むべき道を明確に見極めることが重要であると考え，2012年に2度目となる詳細な自己点検評価を実施いたしました。

しかし，このような自己点検評価だけでは，十分な客観性を担保することは不可能です。今回の自己点検評価を通じ，外部の研究者の皆さまによる外部点検評価をお願いすることにいたしました。本報告書は，評価委員の先生方から頂いた貴重なご意見・ご提言を取りまとめたものです。本報告書には，自己点検では気が付かなかった極めて貴重なご意見・ご提言が盛り込まれています。私たち所員は，これを真摯に受け止め，本研究所の将来の改革・発展のために十分に生かしていきたいと考えています。今後の本研究所の発展をご期待頂きたいと思います。

最後に，ご多忙な中，外部点検評価をお願いした先生方には心からのお礼を申し上げます。さらに，本報告書をご覧いただいた皆さまには，忌憚のないご意見やご提言などいただけますようお願いいたします。本研究所がさらに発展を遂げ，社会に貢献していくことをお約束し，所員一同が一丸となってさらに努力を積み重ねてまいります。

2013（平成25）年3月

北海道大学低温科学研究所長　古　川　義　純

Ⅰ．外部点検評価

1．評価委員

1．1　外部点検評価委員

氏　名	所　属	職　名	備　考
大　森　正　之	中央大学理工学部生命科学科	教授	
嶋　津　克　明	北大地球環境科学研究院	研究院長	
田　畑　伸一郎	北大スラブ研究センター	教授	
安　成　哲　三	名古屋大学地球水循環研究センター	特任教授	委員長
山　形　俊　男	海洋研究開発機構アプリケーションラボ	所長	
渡　部　潤　一	国立天文台 天文情報センター	センター長	

（敬称略，五十音順）

1．2　各研究分野の外国人評価委員

氏　名	所　属	職　名	評価対象グループ
Rob Massom	Australian Antarctic Division & Antarctic Climate and Ecosystems Cooperative Research Centre, University of Tasmania, Australia	Senior Research Scientist and Sea Ice Group Leader	海洋・海氷動態
Guy D. Williams	Antarctic Climate and Ecosystems Cooperative Research Centre, University of Tasmania, Australia	Autonomous Underwater Vehicle (AUV)/Sea Ice specialist	大気海洋相互作用
Ronald Stewart	Department of Environment and Geography, University of Manitoba,Canada	Researcher	雲科学
Zhe-Min Tan	Nanjing University President's Office and School of Atmospheric Sciences, China	Vice-President, Professor	雲科学
Kenneth Sassen	Atmospheric Science, University of Alaska Fairbanks, USA	Professor	雲科学
Philip A. Meyers	Earth and Environmental Sciences, University of Michigan, USA	Professor Emeritus	大気環境
Wilfried Brutsaert	School of Civil and Environmental Engineering, Cornell University, USA	Professor	大気陸面相互作用
Atsumu Ohmura	Institute for Atmospheric and Climate Science, Swiss Federal Institute of Technology (E. T. H.), Switzerland	Professor Emeritus	氷河・氷床
Werner F. Kuhs	Department of Crystallography, University of Göttingen, Germany	Professor	相転移ダイナミクス
John S. Wettlaufer	Nordic Institute for Theoretical Physics, Stockholm, Sweden	Professor	相転移ダイナミクス

氏　　名	所　　属	職　名	評価対象グループ
Eric Herbst	Departments of Chemistry and Astronomy, University of Virginia, USA	Professor	宇宙雪氷学, 宇宙物質科学
Alexander V. Krivov	Astrophysical Institute and University Observatory Jena, Germany	Professor	理論惑星
Bo Li	Institute of Biodiversity, Fudan University, China	Director, Professor	寒冷域植物生理生態
Baishnab C. Tripathy	School of Life Science, Jawaharlal Nehru University, Republic of India	Professor	生物適応
Rudolf Amann	Max Planck Institute for Marine Microbiology, Germany	Professor	微生物生態
Bo Qiu	School of Ocean and Earth Science and Technology Department of Oceanography, The University of Hawai'i at M¯anoa, USA	Professor	環オホーツク観測研究センター
Matti Leppäranta	Laboratory of Geophysics, Department of Physics, University of Helsinki, Finland	Professor	環オホーツク観測研究センター

2．評価項目

（1）研究所の理念・学問的意義
（2）研究所の組織体制
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（6）共同利用・共同研究
（7）環オホーツク観測研究センター
（8）教育活動
（9）社会貢献・広報
(10) 技術部
(11) 総括・まとめ

3．国内評価委員による点検評価報告

2012 年 12 月 20 日，低温科学研究所会議室において，外部点検評価委員会が開催された。本研究所からは，古川義純（所長），田中歩（副所長），江淵直人（環オホーツク観測研究センター長），大島慶一郎，三寺史夫，渡部直樹（点検評価委員会委員）及び庶務担当係長が出席した。

会議では，低温科学研究所自己点検評価報告書（概要含む），環オホーツク観測研究センター自己点検評価報告書，年次自己点検評価報告書，過去の外部点検評価報告書等の資料を参考に，所長，副所長，点検評価委員会委員から各自が担当した自己点検評価項目について外部点検評価委員の方々へ説明を行い，その後，諸問題について質疑応答を行った。当日の議論および各評価委員の評価は安成委員長のもとでまとめられ，以下のような報告書として提出された。

3．1　研究所の理念・学問的意義

低温科学研究所は，平成７年（1995 年），「寒冷圏及び低温条件の下における科学現象*に関する学理及びその応用の研究」を設置目的として掲げて国立大学附置全国共同利用研究所として改組された。その後，2007 年 3 月に出された外部点検評価報告書では，この設置目的に沿って，特に「寒冷圏での自然現象の研究を，地球規模の環境変動の解明，予測，保全など人類的課題に対応した総合的・学際的研究として推進する世界レベルの研究拠点の構築をめざす」という理念で進めることを提言している。設置目的そのものは，今もその意義は重要であり，世界でも他に例を見ない「低温科学研究所」のユニークな看板は，今後も大切にすべきである。ただ，地球の「寒冷圏」の研究と，低温条件下における物理・化学・生物過程の研究を，より有機的・統合的に進める努力をすべきであろう。1995 年の改組までは，低温科学研究所における「低温」とは，地球環境下における低温という視点が明瞭であり，2007 年の外部点検評価でも，基本的に「寒冷圏」科学としての「低温科学」の意味を踏襲しているようであるが，現在使われている「低温条件」はややあいまいとなっている。「低温」とは相対的な言葉であり，何に対しての低温か，という視点を再度明確にした上で，「寒冷圏」研究と「低温条件下の自然研究」の連携・統合を再度構築する時期ではないだろうか。

(注) *「科学現象」という言葉はあまり用いられない。「自然現象」に替えるべきではないか。

3．2　研究所の組織体制

2008 年の改組で現在の３大部門制＋共同研究推進部になり，各部門をクロスカットする連携研究の推進のためのプログラム制が立ち上げられた。これは 2007 年の外部点検評価で提言された３つの分野（大気海洋系，雪氷系，生物系）による研究組織による研究推進に

沿った改組であると判断できる。共同研究推進部に属する６つのプログラムにより，Nature などを含む high impact journal の論文がいくつか出され，このプログラム制の成果として高く自己評価しているが，むしろ，連携研究の成果というより，このプログラムに属する若手教員に，研究にかなり専念できる機会を与えたことが大きく寄与しているのではないだろうか。部門・分野間をクロスカットしたプログラムによる成果というのは，今のところ，観測研究センターが中心となった環オホーツク圏以外は，あまりよく見えていない。共同研究推進部の存在は重要であり，現在のかたちを基本的に変更する必要はないが，学外との共同研究に加え，所内での連携・共同研究をまず積極的に進めるプログラム制をより実質化する努力が必要であろう。後述の研究実績では，各部門あるいはその中のいくつかの研究グループで大きな成果を出していることが自己評価結果からも分かるが，その反面，研究所としてのミッション・目標の達成に向けて，どれだけ答えているかについては，更なる努力を期待したい。

1995 年の大改組で，例えば，降雪・積雪にからむ災害研究などは研究所のミッションから外したとのことであるが，寒冷圏・低温科学の基礎とその応用という目標の中で，応用の部分の成果があまり出ていないように見受けられる。寒冷圏を中心とした地球環境問題の解決へ向けた研究の推進は，この研究所のミッションとして重要であることは，2008 年の改組後も変わっていないはずである。そのために，所外の関連組織・機関との連携・共同研究を，更に進めることも重要であろう。また，国立大学法人北海道大学内の附置研究所として，今後，社会に貢献する研究所の役割も更に求められていくはずであり，このような視点で，文理連携も視野に入れた学内外との連携・共同研究の推進を図っていくべきであろう。

３．３　人事

所長選任の副所長を配置し，十分な意思の疎通を図りつつ激増している業務を円滑かつ速やかに遂行する体制を整えている。また，女性教員比率は現在 9%で北大の目標値 20%（2020 年まで）には遠いが，大学の Ｆ３プロジェクトを活用し，女性教員の雇用に努めている。これらの運営および教員配置に関する取り組みは高く評価できる。

前回（2006 年）の外部評価で内部昇任が限られていることが指摘され，「助教または講師の准教授への内部昇任制度」が 2009 年に導入された。外部審査員を加えた厳密かつ多面的な審査を行うことに加えて，制度の評価を行う時期を明記するなど，このような制度を導入する場合に必要なルールを定めて実施されている。これまで 3 名の助教がこの制度を利用して昇任しており，彼等は昇任後も高いアクティビティを保っている。また，制度導入と前後して助教・講師の一人当たりの論文数が約 1.5 倍に増加したことや評価の高い雑誌での論文発表が相次ぐことなど，若手教員のモティベーションが高められたと評価できる効果をも生み出している。したがって，新制度の導入は成功しているように見える。一方で，分野のバランスを考えない方式は組織構想のビジョンと必ずしも常に整合するものではないこと，0.2 ポイントでの昇任は件数が少ない場合はメリットがあるが多くなると全体のポイントを圧迫して他の人事への影響が出ることから本質的に制度としての継続が困難であ

ること，その結果として短期間だけの導入となればこの制度を利用できなかった若手教員に対しては著しい不公平を強いることになることから，制度としてきわめて危うい部分があると指摘せざるを得ない。また，制度導入後の 4 年間のうち，始めの 2 年間だけに実施され最近は実施されていないという事実は，人事の客観性が保たれているか疑問を抱かれる要因となりかねない。本制度を利用した人事 3 件を含み，過去 6 年間に 20 件の人事が行われているが，そのうち結果として内部昇任によるもの（PD や学生を含む）が 17 件を占めている。研究分野が固定したことや研究所教員の業績が上がっていることが要因と推測されるが，内部昇格率は十分に高い。このような状況も踏まえ，さらに労働契約法の改正により「助教の任期に関する規程」の改正が行われる見込みであることから，第二期中期目標期間終了まで待たず，この機会を捉えて制度を広く検証されることを期待する。

3．4　財政

運営費交付金（基盤配分経費）が年々減らされるなかで，外部資金を獲得する努力が真摯になされていることが評価される。とくに，科学研究費補助金の獲得額は 2010 年度から顕著に増加しており，１人当りの獲得額も高いと評価される。2012 年度における４つの基盤研究（S）の採択も特筆に値する。今後は，申請する大型の科学研究費補助金や受託研究のテーマを，研究所のミッションとどのように整合化させていくかが課題になると考えられる。

3．5　研究

まず教員全員の論文の被引用数や h-index の開示など，自己点検評価書は，定量的指標で研究業績の情報を出しており，研究所としての努力に敬意を表したい。公開は全員の了承を得て行われているとのことで，所属教員の高い意識の現れを示すものと判断される。これらの数値と指標をどのように活用されるのかが不明であるが，数字だけがすべてにならないよう総合的見地で運営されることが望まれる。

大型科研費（S）を多く獲得したり，Nature, Nature Geoscience, PNAS などをはじめとする high impact journal にいくつかの論文を出版するなど，個人および研究グループレベルでの研究水準は，全体として非常に高くなっていることは高く評価される。その一面で，これらの研究業績が低温研が掲げる目標（ミッション）と，どの程度整合的なのか，やや首をかしげる側面もある。学部・研究科であれば，個人研究としての実績のみで十分であろうが，低温研の目標に沿った研究の実績を上げる努力もさらに必要であろう。そのためには，所内共同研究の枠組みとしてのプログラムを実質的に強化させることなども重要である。特に大型設備を保有しない本研究所にとっては他の共同利用・共同研究拠点と違って，所内および学内，国内外との実質的な共同研究は決定的な意味を持つ。すでに国内外の多くの大学，研究機関との連携を深め，研究ネットワークを構築して成果を挙げている点は高く評価できるが，所内での連携・共同研究の体制強化も必要であろう。同時に，学内での連携が弱い印象を受けた。人間圏と地球圏の相互作用の解明とそれに基づく持続可能な社会の形成に向けた貢献が重要性を増している昨今，総合大学として北海道大学内で

行われている，関連研究教育活動を本研究所のミッションの下で連携させるようなイニシャチブを期待したい。一例ではあるが，農学や水産学分野などとの連携をより強化する必要があるのではないか。アムール川流域・オホーツク海に関わる研究については，国際的な連携，文理連携，社会貢献など，北海道大学あるいは低温科学研究所でないと主導できない研究であり，これまで以上の努力を期待したい。

所内に関していえば，これも例えば，としての提案であるが，寒冷圏での光ストレスの問題を，生態系グループと光合成の生理グループが組んでやる課題，寒冷な海洋域における深層水形成過程について海洋物理グループと雪氷・陸域グループが組んでやる課題，寒冷圏陸域生態系とエアロゾル過程グループとの連携課題，地球温暖化が寒冷圏に与える影響とその人間圏へのフィードバックなど，低温研でないとリードできないプログラム課題を，所内および学内外との連携で積極的に進めることが必要ではないか。宇宙雪氷学と理論惑星科学のグループの連携なども当然視野に入れているであろうが，出版された論文などを見る限り，明瞭ではない。

３．６　共同利用・共同研究

大学共同利用研究所として，所外，学外の各機関・組織との共同研究と共同利用の推進は不可欠であり，そのために共同研究推進部を設置していることは高く評価したい。所内研究者間の連携のためにプログラムをこの推進部の下に設置しているが，３．２節で述べたように，この面での努力は更に必要であろう。この所内共同研究は，むしろ，所外・学外の研究者を含めて進めるべき課題の設定が重要であろう。学外研究者に少ない研究費を配るよりも，所内研究者がリードできる課題を設定して，学内外の研究者に参加してもらい，文字通りの共同研究を進めるべきではないか。Center of Excellence として研究所や社会に貢献する研究所も，この共同研究推進部の重要な役割と考えるべきであろう。

３．７　環オホーツク観測研究センター

1996 年に低温科学研究所が COE 研究機関に選定されたことを契機にして，寒冷圏環境科学研究を更に推進し，国際研究拠点を目指して，これまでの流氷研究施設を改組し，2004 年に環オホーツク観測研究センターが設立された。専任教員 4 名，兼任教員 5 名の小さな組織にもかかわらず，海氷プロセスを含む環オホーツク域のユニークな海洋循環，物質循環，大気―海洋―陸域相互作用等の研究において，これまで画期的な成果を挙げてきた。特にロシア極東海洋気象学研究所との共同研究により，ロシアの排他的経済水域における観測を実施し，貴重なデータを取得し，解析したことは特筆に値する。更にロシア，中国，モンゴルとアムール・オホーツクコンソーシアムに繋げるなど，多国間国際連携においても活発な活動を行っている。競争的資金の獲得，研究成果の専門誌への発表状況も模範的であり，大学院教育にも熱心である。マスメディアなどを活用したアウトリーチ活動にも極めて積極的で，アムール川起源の溶存鉄の海洋生産への重要性に関する成果は国民に広く知られるに至っている。

地球温暖化にとどまらず，人間圏と地球圏の相互作用が物質循環系に影響を及ぼし，地

球環境の劣化を招いていることから，国際科学会議（ICSU）は人文社会科学分野とも連携して，「Future Earth」計画を推進しようとしている。持続可能な未来の地球には持続可能な海が不可欠である。本センターは世界的にもユニークな海氷プロセスを含む亜寒帯域の縁辺海をフィールドにしており，こうした次期国際計画においてもますますその存在価値が高まることが期待される。周辺諸国との連携が不可欠な環オホーツク域にあって，困難さを乗り超えて構築した理想のパートナーシップをさらに発展させることは，わが国の進むべき道を照らすことにもなろう。

本センターの研究範囲は既に海洋観測にとどまらず，オホーツク海と周辺地域の学際的な研究にまで及んでいること，またシミュレーション研究も活発に行われていることから，センターの名称から観測を外した方がよいように思われる。また今後は水産系の研究者との協働も重要ではないだろうか。

３．８　教育活動

低温科学研究の発展には，有能な若手研究者および学生の確保が重要であることは，言うまでもない。本研究所に在籍する大学院生の漸減傾向は，前回 2007 年の評価以後はほぼ止まっており，本研究所が大学院生の確保のために多くの努力をしたものとして評価できる。今後とも大学院志望学生に対するより積極的な勧誘活動が望まれる。また，講演会の開催，学園祭・オープンキャンパスへの出展，スーパー・サイエンス・ハイスクールへの活動協力など，極域科学のアウトリーチ活動なども教育活動としての意義は高く評価される。しかしながら，学生にとっての低温科学研究所の真の魅力とは，学問としての低温科学の本質的な面白さ，研究の社会的な意義の明確さ，研究職をも含めた就職先の具体的な可能性の大きさなどであろう。本研究所から低温研究の重要性を浮きあがらせる多くの研究が発信され，学会や地方自治体，さらには産業界をも巻き込んで低温科学研究が発展することこそが教育活動にも欠かせぬ基盤であると思われる。

2005 年に開始された国際南極大学への参加と南極学カリキュラムの実施は，地球環境教育でそのユニークさを発揮しており，一層の展開を期待したい。2006 年度から 2012 年度までに総計 37 名の南極学修了証書の授与者が生まれたことは教育上も意義が深い。これからもこのような国際的な連携の上に立った教育活動が強められることを期待する。北海道大学は北極圏大学にも日本の大学で唯一加盟しており（2011 年 6 月に準加盟），国際南極大学と並んで，これを活かした教育活動を主導することを考えてもよいのではないだろうか。

一方，環オホーツク観測研究センターの研究における取組みとその業績には見るべきものがあるが，今後は研究を通じてのロシアを含む関係各国の学生間の交流を活発化させ，南極学カリキュラムと同じような趣旨のカリキュラムを作成することにより，国内外の学生のこの分野への参加を促すとともに教育における国際的な貢献をしてもらいたい。

低温科学研究所はこれまでにも高校生に対する授業の実施などを進めてきており，その努力は高く評価できるが，今後は小中学生をも含めた長期的視野に立った教育の推進を図るなどの努力を，研究との両立の中で進めて欲しい。未来に向けて，教育活動においても，日本のみならず世界における低温科学研究の中核としての役割を果たしてもらいたい。

３．９　社会貢献・広報

社会貢献・広報活動に関しては，様々に努力を重ねつつ，説明責任を果たそうと健闘していることは評価できる。インパクトのある研究成果が出たときにはしっかりとプレスリリースを行っており，ホームページや各種印刷物による情報発信も，この規模の研究所としては健闘している。特に，2011 年から作成・配付をはじめた「研究所で学びたい人のための低温科学研究所ガイド」や，2012 年 2 月のホームページのリニューアルなど，この方面での不断の努力が認められる。

研究所への見学者数も，一般への研究所公開時期を大学祭にあわせた効果によって，増加している。低温科学の面白さを直接伝え，そして研究所の存在意義を理解してもらう機会として，今後も有効に活用されることを望みたい。

低温科学研究所の研究内容は多岐にわたっており，また非常にユニークなものも多い。研究所内あるいは研究者コミュニティにいると，こうした研究がそれほどユニークであると思えなくなってしまうことがあるが，見せ方によっては社会から見ると，あるいは学生から見ると，きわめて魅力的に見えるはずである。こうした視点で研究所内の宝を掘り起こし，今後も無理のない範囲で社会への還元・広報に積極的に取り組むことが望まれる。

３．１０　技術部

技術部は，宇宙から地球海洋気象そしてネットワークに至るまでの広範な研究上のテーマとニーズに対し，これまで蓄積されてきたノウハウを駆使しながら，技術面による支援で低温科学研究所の研究のみならず，関連研究をも支えていることは極めて高く評価できる。個々人の能力も高く，共著論文に名前を連ねるだけでなく自ら論文を執筆したり，学会発表を行ったり，あるいは科学研究費を獲得したりしていることは特筆に値する。これらの活動が低温科学研究所だけでなく，全国的な低温科学の研究を支えていることは明白である。報告会などの様々な機会を生かしながら，自らの技術を磨きつつ，共同利用の研究所として技術部がどうあるべきか，あるいは技術職員がどのような役割と責任を果たすべきかについても検討がなされていることは評価できる。こうした高いレベルの技術部に属する職員に対して，その評価に見合うポストを用意するなどの施策も行われている。今後も職員が高い意識と技術力を発揮できるよう，この種の環境整備を期待したい。

３．１１　総括・まとめ

以上にまとめたように，低温科学研究所の教員による研究活動のレベルは，全体として非常に高いものがある。院生の教育や人材育成の面でも，学内の水準以上のレベルで進められており，国際南極大学の実施など，アウトリーチ的な活動も含め，非常に良くやっていると判断される。今後のひとつの大きな課題は，共同利用・共同研究拠点および，国立大学法人北海道大学の中での「低温科学研究所」のミッションをいかに維持，強化できるかであろう。特に，国立大学法人化以降，学内での関連研究科との「違い」あるいは「研究所としてのメリットと存在意義」をどう強調できるかも，大きく問われている。新しい「環オホーツク研究センター」の役割なども，その文脈の中で位置づけることも問われて

いると考えておくべきであろう。伝統ある「低温科学研究所」という古い革袋に，どのような「新しい酒」を入れるべきか。教員を中心とする構成員で十分に議論を尽くしていただきたい。

４．外国人評価委員による点検評価報告

国外からも１７名の著名な研究者による点検評価を受けた。この評価は共同研究などの実績に基づいて行っているもので，それぞれの研究グループの研究活動について点検評価報告書を提出していただいた。以下，点検評価報告書を掲載する。

氏　　名	所　　属	職　名	評価対象グループ
Rob Massom	Australian Antarctic Division & Antarctic Climate and Ecosystems Cooperative Research Centre, University of Tasmania, Australia	Senior Research Scientist and Sea Ice Group Leader	海洋・海氷動態
Guy D. Williams	Antarctic Climate and Ecosystems Cooperative Research Centre, University of Tasmania, Australia	Autonomous Underwater Vehicle (AUV)/Sea Ice specialist	大気海洋相互作用
Ronald Stewart	Department of Environment and Geography, University of Manitoba,Canada	Researcher	雲科学
Zhe-Min Tan	Nanjing University President's Office and School of Atmospheric Sciences, China	Vice-President, Professor	雲科学
Kenneth Sassen	Atmospheric Science, University of Alaska Fairbanks, USA	Professor	雲科学
Philip A. Meyers	Earth and Environmental Sciences, University of Michigan, USA	Professor Emeritus	大気環境
Wilfried Brutsaert	School of Civil and Environmental Engineering, Cornell University, USA	Professor	大気陸面相互作用
Atsumu Ohmura	Institute for Atmospheric and Climate Science, Swiss Federal Institute of Technology (E. T. H.), Switzerland	Professor Emeritus	氷河・氷床
Werner F. Kuhs	Department of Crystallography, University of Göttingen, Germany	Professor	相転移ダイナミクス
John S. Wettlaufer	Nordic Institute for Theoretical Physics, Stockholm, Sweden	Professor	相転移ダイナミクス
Eric Herbst	Departments of Chemistry and Astronomy, University of Virginia, USA	Professor	宇宙雪氷学，宇宙物質科学
Alexander V. Krivov	Astrophysical Institute and University Observatory Jena, Germany	Professor	理論惑星
Bo Li	Institute of Biodiversity, Fudan University, China	Director, Professor	寒冷域植物生理生態
Baishnab C. Tripathy	School of Life Science, Jawaharlal Nehru University, Republic of India	Professor	生物適応
Rudolf Amann	Max Planck Institute for Marine Microbiology, Germany	Professor	微生物生態
Bo Qiu	School of Ocean and Earth Science and Technology Department of Oceanography, The University of Hawai'i at M¯anoa, USA	Professor	環ｵﾎｰﾂｸ観測研究ｾﾝﾀｰ
Matti Leppäranta	Laboratory of Geophysics, Department of Physics, University of Helsinki, Finland	Professor	環ｵﾎｰﾂｸ観測研究ｾﾝﾀｰ

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January 27, 2013

Evaluation of Ocean and Sea Ice Dynamics Group, ILTS, Hokkaido University

It is an honour to provide an evaluation of the excellent Ocean and Sea Ice Dynamics Group within your wonderful institute, and its work over the past 5-6 years. I have had the great privelege of a close association with this group for a number of years – during which time I have come to recognise its significance not only in and around Japan but also globally. Indeed, Dr Takeshi Tamura spent 2 years with me in Tasmania as a JSPS postdoctoral fellow from 2010-12, after finishing his PhD at ILTS. It was an absolute pleasure to host him, and to further develop close linkage between our two groups. This linkage has included an invitation to join the immensely important Cape Darnley Polynya Project, which Prof Ohshima leads, and participation of groups of Japanese scientists on all recent Australian sea ice cruises to Antarctica. As with the other topics of research carried out by this important group, the Cape Darnley Polynya project is not only highly topical but is also of global significance. This is in fact the hallmark of this group – the ability to focus on key climate-related research questions in a highly logical and systematic fashion, to effectively carry out research under extreme conditions while embracing technological innovation, high-level analytical skills, and subsequent production of important new datasets and publication of results in high-impact scientific journals. Indeed, their publication rate of high-quality papers is nothing short of prolific. Their success and recognition as international leaders in their field also bears testament to the complementary and wide-ranging skills and expertise within the group.

Under the expert guidance of Professor Ohshima, the group has gone from strength to strength. Prof Ohshima is not only an acknowledged leading and highly-respected expert in high-latitude oceanography. He also uniquely has a strong grasp and understanding of complex cross-disciplinary issues and phenomena, and displays considerable leadership skills. The group is closely-knit and highly dedicated. The other 2 faculty members (Associate Prof Fukumachi and Assistant Prof Matsumura) are also world leaders in their field, as are the 2 Emiritus Professors Wakatsuchi and Kawamura. Moreover, they have attracted a succession of high quality and highly-promising postdoctoral research fellows (4 at present) and graduate students (an extraordinary 8 at present). This factor strongly reflects the overall vibrancy of the group, and underlines the key role that it plays in teaching and producing the next generation of world-leading high-latitude researchers.

I became fully aware of the quality of this group and its ability to produce when I recently hosted Dr Tamura as a postdoctoral fellow. With other members of the group, he has been responsible for ground-breaking research into remote sensing of sea ice production rates in both Antarctic and Arctic polynyas. Not only this, but the group have made the resultant datasets

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available to the wider community, which is greatly beneficial to climate research and fills major gaps. We, the wider community, are also extremely grateful to the group for producing yet another highly important new dataset, namely heat/salt flux and sea ice production for the polar oceans. In addition, the group is leading the way towards better understanding of air-sea-ice interactions in the Sea of Okhotsk, and the impact of changing environmental conditions in the region.

In summary, I give my strongest possible recommendation for continued high-level support of the Ocean and Sea Ice Dynamics Group within the framework of your institute (ILTS). The critically important work carried out by this leading-edge group is in fact likely to become even more significant in the light of our urgent need to better understand the processes involved in, and impacts of, changing oceanic and sea ice conditions as a result of climate change. I certainly wish them all the best for the future, and look forward to a long and fruitful association.

Yours sincerely,

Dr Rob Massom

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Assessment Report by Foreign Researcher for Ocean-Atmosphere Research Group, Water and Material Cycles Division, Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan.

To whom it may concern,

My name is Dr Guy Williams and I am an Australian polar research scientist with 15 years experience specialising in ocean/sea ice interactions around Antarctica. My current position is that of Autonomous Underwater Vehicle (AUV)/Sea Ice specialist at the Antarctic Climate & Ecosystems Cooperative Research Centre in Hobart, Australia.

It is my pleasure to provide this assessment report for the Ocean-Atmosphere Group at ILTS (OAG-ILTS). My first contact with group came during the Baseline Research on Oceanography and Krill Experiment (BROKE-West), a 2-month Antarctic research expedition aboard the RSV Aurora Australis in 2006. The team from OAG-ILTS were key participants in the oceanography project examining the large-scale circulation of the Antarctic margin from 30—80 °E. As a direct result of this joint-work, I successfully applied for a JSPS post-doctoral position with OAG-ILTS and worked with Assoc. Prof. Shigeru Aoki from Nov. 2007 to Nov. 2009.

During my time at OAG-ILTS I was very impressed with the outstanding level of research being conducted by its members, from students through to its senior scientists. The OAG-ILTS stands out as a very important group internationally and this is reflected by the participation of its members in key structures such as the International Panel on Climate Change, the International Polar Year and the Scientific Committee on Antarctic Research.

Please feel free to contact me if you need further information.

Yours faithfully,

Guy D. Williams
AUV/Sea Ice Specialist

28th January 2013

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The ACE CRC is a unique collaboration between core partners the Australian Antarctic Division, CSIRO, the University of Tasmania, the Australian Government's Department of Climate Change & Energy Efficiency, the Alfred Wegener Institute for Polar and Marine Research (Germany) and the National Institute of Water and Atmospheric Research Ltd (New Zealand) and a consortium of supporting partners. It is funded by the Australian Government's Cooperative Research Centres Program.

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Institute of Low Temperature Science
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N19W8 Sapporo 060-0819, JAPAN

Dear Prof. Fujiyoshi:

I am writing in support of the Cloud Science Research Group which is comprised of yourself and Assistant Professor Kawashima. I am active researcher in Canada in the field of cloud and precipitation physics and I have been involved in many field studies and I mainly utilize observations within my research. A particular focus is on winter storms and precipitation although I also examine summer phenomena including drought. My interests are applicable to short-term weather prediction up to climate and in particular the water cycle and its tendency to produce extremes.

I have read a number of the articles produced at your Research Group. I am very impressed with the breadth of your studies. They range from the cold season to the Tropics, from the boundary layer to the free atmosphere, from dust devils to rainbands, and from aerosols to snowflakes. And, what a range of observational platforms including aircraft and radar! I am also impressed with the effort that must have been made to acquire the observational data in these studies, let alone the top notch science that you have produced through this information.

The issues you are examining are critical. They range from fundamental processes linked with precipitation initiation all the way to ones which are critical for regional water. It is gratifying to see that your group has made such progress in addressing these and many other issues. Such studies are essential to address many challenges we face as society. In my own smaller manner, I follow your approach as well.

I commend you for carrying out such studies. No university group in Canada comes anywhere near the productivity of yours i this research area. I wish you all the best.

Sincerely,

Ronald Stewart

Ronald Stewart, PhD, FCMOS, FRSC

Nanjing University
President's Office and
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January 25, 2013

Institute of Low Temperature Science
Hokkaido University

To whom it may concern,

I strongly recommend Cloud Science Research Group led by Profs. Yasushi Fujiyoshi and Masayuki Kawashima for continued funding support at institute of Low Temperature Science. This is based on my years of experience in this research area and familiarity with their work. Mesoscale cloud and precipitation systems represent many of the most important, high-impact weather systems, which produce torrential rains, severe winds, hail, lightning, and snow hazards. Because of the overlap of our research scope, I am quite familiar with the work and progress made by Cloud Science Research Group over the last decade. Their work covers the major subjects of the leading edge of this research field, e.g., cloud microphysical model and parameterization, fine-scale structure and dynamics of mesoscale cloud systems, and modulation of mesoscale systems associated with large-scale variability. With novel insight into the physical nature of the research objects and innovative scientific approaches, they've got many original achievements over the last ten years that are published in the authoritative international journals of this field. The work and contribution by Cloud Science Research Group was often mentioned by other lead scientists when we talked about the recent advances in the area.

Cloud Science Research Group is a highly active, effective, and world-class scientific research team. As a peer, I'm strongly impressed by their successes that have been achieved and confident that this team will make more fruitful achievements to improve our understanding of cloud and precipitation science in the future.

Sincerely,

Zhe-Min Tan, Ph.D.
Vice-President of University
Professor of Meteorology

January 24, 2013

Evaluation of the Cloud Science Group, Hokkaido University (Headed by Prof. Yasushi Fujiyoshi)

I am quite familiar with the accomplishments of this group, and without hesitation can say that they are one of the top cloud research centers worldwide. I have visited them twice, including on Sabbatical, and have been very impressed with their remote sensing research facilities, and the solid group of international graduate students they supported. There are only a handful of such comprehensive arrays of Doppler radar and lidar sensors anywhere, and located where they are in northern Japan this is an extremely important facility. (During my earlier polarization lidar studies of the transport of Asian dust clouds to Alaska, for example, their near real-time lidar aerosol data available on the internet were quite useful to me and many others I would guess.) They have also well taken advantage of in situ aircraft research programs in this area.

They have an impressive publication list, and are very visible in international conferences. They specialize in the measurement *and* modeling of cloud microphysics and the mesoscale organization of clouds. Indeed, the term *snow band* is synonymous with the results of their research. Atmospheric waves and instabilities, and even sea ice studies fall under their purview. This combination of cloud microphysical and dynamical research (measurement plus modeling!) is rare and admirable. Again, there are few comparable atmospheric science research groups worldwide.

Kenneth Sassen

Professor of Atmospheric Science,

University of Alaska Fairbanks

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29 January 2013

Professor Yoshinori Furukawa
Director, Institute of Low Temperature Science
Hokkaido University
Sapporo, Japan

Dear Professor Furukawa:

I am honored to have been asked to provide my evaluation of the research activities of the world-famous Atmospheric Chemistry and Organic Geochemistry Group of the Institute of Low Temperature Science. I had the distinct privilege and special opportunity to have spent three wonderful and rewarding months as a visiting scientist with this group in 2008. I first met the leader of this group, Professor Kimitaka Kawamura, during his postdoctoral days at Woods Hole Oceanographic Institution in the early 1980's. We continue to cross paths at research meetings, and I have followed his impressive professional growth and scientific achievements with keen interest and great admiration.

I am not an atmospheric scientist, but I am an organic geochemist who studies climate change and hence can appreciate and understand the research contributions of Professor Kawamura and his group. Aspects of his work actually coincide and complement my interests. In fact, the research that I did during my three months with his group has been documented by the four publications that I wrote principally with him and two of his postdoctoral scholars – Osamu Seki and Shinya Yamamoto. In addition, from time to time he asks me to edit the English and to comment on the science of a manuscript that has been revised and is almost ready to be published by a journal; I do this about once a year. I feel that these various interactions with him qualify me to comment competently on the scholarly and scientific activities of Professor Kawamura.

The research interests of Professor Kawamura and his group focus mainly on the organic geochemistry and atmospheric chemistry of aerosols. The processes involved in this line of inquiry are complicated and include solid-phase, liquid-phase, and gas-phase reactions in response to photochemical and oxidative alterations. Professor Kawamura has built and sustained an impressive group of young and promising scientists who bring energy and innovation to solving the challenging research questions that exist about the origins, fates, and significance of the organic aerosols and are the subjects of their studies. During my relatively short time with his group, I interacted with a number of these young scientists, and I came away impressed by how Professor Kawamura masterfully mentored, encouraged, and guided them in their scientific endeavors. His great success as a scientist, a teacher, and a leader is clearly evident in the remarkable publication record his group has amassed in the last five years – 82 papers published in international peer-reviewed scientific journals!

In summary, I consider the research activities of the Atmospheric Chemistry and Organic Geochemistry Group of the Institute of Low Temperature Science to have been impressive and significant, particularly over the past five years. This group has made important contributions that have improved understanding of how organic aerosols enter the atmosphere, how they are transported, and to what degree they are altered, degraded, and interactive with other atmospheric components. These contributions are globally valuable and appreciated.

Sincerely yours,

Philip A. Meyers
Professor Emeritus

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Professor Yoshinori Furukawa, Director,
Institute of Low Temperature Science
Hokkaido University

January 20, 2012

Dear Professor Furukawa:

It gives me great pleasure to be able to submit this external evaluation report on the activities of the Land-Atmosphere Interaction Group in your Institute. This Group was founded barely some five years ago, and the two leading faculty members have been able to display an intense activity level and developed a number of remarkable initiatives. Looking over the background and the activities of this Group, I am convinced that it will continue to grow and live up to the great tradition of the ILTS. Indeed, I feel that Hokkaido University is fortunate to count Dr. Watanabe and Dr. Shimoyama among its younger faculty members. In what follows, I will try to capture the essence of their background and their contributions, which made me arrive at this conclusion.

My personal acquaintance with Dr. Watanabe goes back to 1994, when he was a Researcher at the Forest Research Institute, and I was a visiting scientist at the University of Tsukuba. But his reputation had already preceded him, because I had learned previously that at Tohoku University he had been one of the top graduate students and collaborators of Prof. Junsei Kondo, the leading researcher in his field in Japan. Since then I have followed Dr. Watanabe's work, and I consider him now one of the most promising scientists in boundary layer turbulence of his generation. His main strengths lie in numerical modeling of turbulent transport phenomena near the Earth's surface.

A fine example of his fundamental approach to these types of problems is his 2009 paper in the *Journal of the Meteorological Society of Japan* (***87***, 39-56); this is an area in which I have some personal experience, and I can vouch for the high quality of his contribution. His 2011 paper in *Ecological Research* (Toda et al., ***26***, 105-121) provides an illustration of his ability to cooperate with many others in the field and shows his leadership potential. As a sign of the quality of his early work and of the respect his colleagues have for him, he was already awarded the 2003 Prize of the Japan Society of Hydrology and Water Resources.

I have not had the privilege of working personally with Dr. Shimoyama. However, I am very familiar with his background. For the sake of full disclosure, the reason is that his doctoral thesis advisor had been a graduate student of one of my own graduate students (and later post-doc) at Cornell, namely Prof. M. Sugita at the University of Tsukuba; Dr. Sugita is a superb and meticulous experimentalist with whom I have worked closely in several large-scale experiments funded by NASA in the United States. The work that Dr. Shimoyama has done in Siberia and the resulting scientific articles show that he is a capable and outstanding experimentalist, who is able to work under the most severe and harsh conditions, and then to publish his results in high level journals.

An outstanding example of the importance of his research is the 2010 paper he co-authored in *Tellus* (Sasakawa et al., ***62***, 403-416) on the measurement of methane in Siberia. My own recent research has dealt with permafrost thawing in Siberia, and one of the important detrimental effects is the subsequent release of methane, a strong greenhouse gas; it

is absolutely essential to monitor methane fluxes in the cold regions of the Earth. Another example, illustrating the importance of his work is his 2009 paper in the *Bulletin of the American Meteorological Society* (Groisman et al., ***90***, 671-676) written with some 28 co-authors of different nationalities (Japanese, US, Russian, Chinese); he is certainly in excellent company: I know several of these authors personally—for example Dennis Lettenmaier and Eric Wood are former presidents of Hydrology of the American Geophysical Union; Pavel Groisman, the senior author, is a leading expert on precipitation in the U.S.. It is a tribute to Dr. Shimoyama as an international scientist, that he was included as a co-author.

Both Dr. Watanabe and Dr. Shimoyama have a good track record of being able to attract funding to support their research activities. I am sure that, as their reputation grows in the field, they will be able to increase their funding even more. They also have been active in graduate education. Although they have been at ILTS only some five years, between the two of them they have already produced nine Master degree graduates, and one doctoral student is in progress.

In summary, while the Land-Atmosphere Interaction Group was started quite recently and is relatively young, it shows great promise for the future. In light of its past performance, I give it my strongest recommendation for continued support within the framework of the ILTS.

Sincerely yours,

W. Brutsaert

Wilfried Brutsaert
W.L. Lewis Professor of Engineering
M. National Academy of Engineering

Evaluation of the "Glacier and Ice Sheet Research Group" at ILTS, Hokkaido University

After the initial several years when the group needed to establish itself, the group for Glacier and Ice sheet Reached succeeded to reach around in 2007 the international level. The performances accomplished during the following several years, can be rated as those by one of the leading research groups of the world. The strength of the group is the combined ability to observe key processes and the modelling of the ice bodies. The combination of these expertise is essential for developing new knowledge and skill in natural science, but very rare to find. Besides the optically visible accomplishments such as in publications and the citation index, this rare combination of experiment and theory should be highly regarded as the source for originality and creativity that will survive also in the future.

The modelling capability of glaciers and ice bodies excels other groups in Europe and North America. The domain of the model-consideration covers a wide spectrum from numerical differential computation to large and regional modelling of the behaviour of an ice flow. The large-scale modelling such as the ice sheets includes outlet glaciers and ice shelves, as well as morphology and ice/water processes at glacier soles. These concrete treatments of smaller scale processes in ice sheets are an essential prerequisite for the future progress in the ice sheet modelling. The observation of the ice sheets and glaciers made original contributions, for example as witnessed in the works on the glacier outbursts in the Gornergletscher. The Gornergletscher is the standard glacier of the outburst research pioneered by late Professor Hand Röthlisberger. The work continued by the members of the Hokkaido University brought the classic work further ahead by relating the outburst to meso-scale glacier-flow, which is useful to predict the moment of the coming outburst.

Strength in glacier and ice sheet-modeling serves as a basis for the ice-core research. The ice core study accomplished by the group is unique in a sense that besides ice chemistry, the group's investigation covered such basic features of the glacier ice, as ice fabrics, micro-particles and hydrates. The group's treatment of sulfate and the salt may provide a strong base for identifying the quantitative history of volcanic sulfate eruption, which is important for interpreting paleo-climate.

The continued progress in the sea ice investigations in the Okhotsk should be highly rated. The sea is close to Japan, and serves as an archive of the sea ice variation in high mid-latitudes oceans. Because the surface is smaller than the Atlantic counterpart, the more detailed studies are possible by a small group. The reported variation in the Okhotsk and its ocean bottom will also stimulate the North Atlantic sea ice studies.

This group is active in the glaciology education by organizing the annual field course in glaciology on the Rhonegletscher. The field course offers invaluable experience for young students and scientists in absorbing skills in the field experiments in a relatively short time. This course should be credited already by educating presently active young scientists in glaciology.

Summing up, the work by the group is an impressive accomplishment, and this reviewer expects that the hard-earned investment in the basic science by this group will show its true value by leading the area of glaciers and sea-ice in the coming decade.

Atsumu Ohmura
Professor emeritus of Institute
for Atmospheric and Climate Science
Swiss Federal Institute of Technology (E.T.H.)

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

Geowissenschaftliches Zentrum

Abt. Kristallographie

Prof. Dr. Werner F. Kuhs

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Göttingen, 14 February 2013

To the director of

Institute of Low Temperature Science
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Evaluation of the work of the Research Group of "Phase Transition dynamics" at ILTS/ Sapporo

It is with pleasure that I follow the request to review the work of the research group on "Phase transition dynamics of ice" (PTD) within the Institute of Low Temperature Science (ILTS) at the Hokkaido University in Sapporo for the years 2006-2012. The group consists of Prof. Yoshinori Furukawa, Prof. Gen Sazaki (since 2008) and Ass.Prof. Ken Nagashima (since 2012).

As the present chairman of the Physics and Chemistry of Ice panel (organizing regular international conferences on this topic) I have insight into a large variety of fields in the context of research on ice and related substances. With this background I may say that the PTD-group has produced scientific output at the highest level and certainly is one of the most visible groups of the ILTS in the internal community of ice researchers.

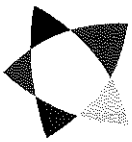
The work of this group comprises fundamental studies of the ice surface with molecular resolution perpendicular to the surface using advanced optical microscopy, studies of the antifreeze properties of proteins as well as experimental studies of ice crystal growth both on bulk material and dendrites. In all these competitive fields the work of the PTD-group is highly renowned and internationally well recognized. This expertise is also highlighted in the invitation to two members of the PTD-group to produce a review article on the "surface of Ice" for the Handbook on Surface and Interface Science.

To further emphasize the importance of laboratory work on ices and snow I may refer to a recent *Comment* in *Nature* (Vol.494, 7 Feb 2013, pp 27-29) which listed "Ten things we need to know about ice and snow": http://www.nature.com/nature/journal/v494/n7435/full/494027a.html?WT.ec_id=NATURE-20130207 . The work actually done in the PTD-group is related to quite a few of these urgent questions and shows how timely and important their laboratory-based research work really is; I name here just a few: "How does ice form?", What is the surface structure of ice?" or "How does ice growth affect impurities?". I fully subscribe to the statement of Thorsten bartels-rausch, the author of this *Comment*, that "Understanding the molecular behaviour of frozen water is essential for predicting the future of our planet". I have little to add to this statement

other than saying that the PTD-group is working exactly along the lines spelled out in this *Comment*.

Thus, I hope very much that the PTD-group can continue their work in the future and, to do so, the ILTS fully supports their activities. I am sure this will produce further crucial insights into the processes in and on ice and snow crystals and add to the reputation of ILTS.

Prof.Dr. Werner F. Kuhs

NORDITA

JOHN S. WETTLAUFER
Tage Erlander Professor
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February 4, 2013

Review: Laboratory for Phase Transition Dynamics of Ice
The Institute of Low Temperature Science
Hokkaido University
N19-W8, Kita-ku
Sapporo 060-0819, JAPAN

Dear Colleagues:

I am pleased to provide a strong letter of evaluation for the *Research Group of Phase Transition Dynamics of Ice* at the Institute of Low Temperature Science, Hokkaido University. It is difficult to emphasize the importance of the confluence of scientific rigor and breadth of impact of their research. Moreover, there are now less than a handful of groups in the world engaged in both the basic physics of ice and the biophysical and geophysical implications. The Hokkaido group is not only the leader of these, but this group has the important place in the pantheon of the field with the present leader, Professor Furukawa, being the progeny of Professor Nakaya.

There are intrinsic–liquid-enhancing–physical mechanisms typically studied in condensed matter and surface physics that, when brought to bear on the study of ice, are seen as propitious for life as well as acting as a test bed for condensed matter physics. These processes can either enhance liquidity, and thus potential habitat, or can be harnessed directly by biota in order to thwart off the icy deleterious effects of low temperatures such as confinement in the ice lattice or excess osmotic pressure. The Hokkaido group has been pioneering in their examination of the principal physical mechanisms that heighten the presence of liquid water or liquid brines at low temperatures and low atmospheric water content. These are the *premelting* of ice; a wide class of phenomenon of which the most common is curvature enhanced melting known as the Gibbs-Thomson effect. Such mechanisms have in common that they are interfacial phenomena with interactions that begin on the sub-nanometer scale and yet have implications up to and beyond planetary scales. The effects, and their theoretical treatment and experimental realizations, have been the centerpiece of this group since most of us in the community can remember. What Professors Furukawa and Sazaki have done in the very recent past and the last several decades combined has been to make deeply

impressive quantitative measurements to test theories and pursue new directions. The group has focused on pioneering optical methodologies for the study of ice surfaces, crystal growth and the interaction of biopolymers with ice surfaces. They have also produced results of high caliber on molecular scale simulations of the same. The major figures in crystal growth generally, and ice crystal growth in particular, are all aware of the impact of this group. Indeed, most of us make it a required sojourn for our students and colleagues to visit the ILTS and learn from this cadre. As far as I am aware, Professor Furukawa is the only scientist to have "flown" an ice crystal in space to examine important issues of buoyancy driven convection in the evolution of dendrites that go far beyond the study of ice.

The *Research Group of Phase Transition Dynamics of Ice* is an innovative, passionate and skilled group of practitioners that has no true competitor in the world. Most of us view their work as something to aspire to. They have published in the world's leading journals and are constantly in demand as speakers at international conferences. Since the time of Nakayam and under the leadership of Furukawa, they have been quietly and brilliantly pursuing a vast landscape of challenging and diverse problems using a spate of fundamental approaches that the subdisciplinary apparatchik could not or did not embrace. They should be supported in their endeavors going forward.

Please contact me should you require refined opinion or clarification.

Yours sincerely,

John S. Wettlaufer

REPORT ON ASTROPHYSICAL CHEMISTRY/ICE AND PLANETARY SCIENCE GROUP

INSTITUTE OF LOW TEMPERATURE SCIENCE, HOKKAIDO UNIVERSITY, SAPPORO

Eric Herbst

Departments of Chemistry and Astronomy, University of Virginia, USA

This report concerns the research of the Astrophysical Chemistry/Ice and Planetary Science Group at the Institute of Low Temperature Science, Hokkaido University, Sapporo. This group is one of the leading groups in the world on the study of low temperature surface and ice reactions related to astrochemistry throughout the universe. Such reactions are particularly important in dense interstellar clouds, which are the birthplaces of stars and planetary systems. These clouds, which often lie at a temperature of 10 K, contain both gas and tiny dust particles. At sufficient gas densities, the dust particles, made of either silicates or amorphous carbon, are covered by mantles of ices. The ices do not in general accrete from the gas directly, but are formed by reactions on the dust particles. These ices can be detected by the absorption of characteristic frequencies of infrared radiation. When portions of an interstellar cloud collapse and heat up, the ice mantles eventually desorb back into the gas, where the molecules are detected by rotational emission spectroscopy from radio and millimeter-wave telescopes on the ground. Eventually the collapse leads to a newly born star surrounded by a protoplanetary disk, which can later condense into planets. The study of what molecules are formed and at what evolutionary stage of star formation they exist is clearly crucial to an understanding of what molecules were present in the initial inventory of newly formed planets, and hence to astrobiology.

Until perhaps a decade ago, astrochemists interested in the chemistry occurring on interstellar dust particles had very little experimental information to aid them. More recently, a number of groups have started to study the chemistry on surfaces/ices at low temperatures that are realistic analogs of interstellar dust. One of the best known of such groups is the Hokkaido institute. This group first came to my attention when they confirmed that methanol (CH_3OH) can be formed on dust particles by hydrogenation of CO ice through a sequence of four reactions, in which HCO, H_2CO, and CH_3O (as well as CH_2OH) are formed before the final production of methanol. The dust formation of methanol is crucial to chemical simulations because there is no gas-phase mechanism to form this species. In cold clouds, some methanol ice can desorb into the gas via non-thermal mechanisms such as photo-desorption, but it is not until the dust particles warm up due to star formation that much methanol goes into the gas. On the ice, methanol is a precursor of more complex organic species once it is photodissociated to form reactive radicals. Methanol in the gas is also a precursor of more complex species. The Hokkaido group followed this path-breaking work on methanol formation with a study of how methanol ice can undergo strong deuterium fractionation, which leads to species such as CH_2DOH,

CHD_2OH, and even CD_3OH. The proposed processes seemed unusual to many astrochemists, but the processes must be included in simulations to reproduce the observed amounts of deuterated species. Deuterium fractionation is an excellent indicator of temperature, and so the work by the Hokkaido group was once again instrumental in aiding the study of interstellar chemistry. The work on methanol formation and deuterium formation was so exciting to me that I invited Prof. Watanabe to present a paper entitled "Formation and Deuterium Fractionation of Organic Molecules on Grain Surfaces" at an international meeting on astrochemistry held at Asilomar, California, USA in 2005.

To get a sense of what the group has been doing in the last two years, we should look at the published papers during this period. In one paper, they reported the discovery of a new mechanism for the formation of water ice at 10 K, via a quantum tunneling surface reaction between OH and H_2. In another paper, they followed the spin temperature of water molecules formed in a number of ways, a topic that is very important in attempts to study the age of cometary ices. Indeed, the group has recently become very interested in the stability of nuclear spin ratios in cold ices. Professor Watanabe has given some excellent and clear talks on spin temperatures of water and hydrogen in ices; it is clear that the Hakkaido group is best in the world in this field of study. Other papers in the last two years concern topics such as the formation of ammonia on cold surfaces, the surface diffusion of H and D atoms on amorphous solid water (ASW), non-thermal desorption back into the gas, formation of the ammonium ion in ice by an acid-base reaction, formation of CO_2 by the reaction between OH radicals and CO, etc. All of these studies are of the utmost importance for chemical simulations of cold and star-forming regions of the interstellar medium, and astrochemists such as myself owe a great debt to Professor Watanabe, Professor Kouchi, and the Astrophysical Chemistry/Ice and Planetary Science Group.

In addition to the papers they publish, the group excels in other ways as well. One example is the workshops that they organize. I have been to two workshops in Sapporo, in 2010 and 2012, and have come away both times with a much better sense of progress in the field of interstellar chemistry, especially that occurring on surfaces/ ices of dust particles.

Professor Watanabe and Professor Kouchi have also publicized the work of the group with a series of international talks on topics such as spin temperatures on ASW, hydrogen diffusion and tunneling reactions on low-temperature surfaces, the role of ice surface chemistry in space, surface reaction of deuterium atoms, fractionation routes, etc.

In summary, Professor Watanabe, Professor Kouchi, and the rest of the group have created a world class institute for the study of low temperature surface and ice processes that is internationally known both for its contributions to basic science and for its contributions that are relevant and useful to astrochemical studies, including the simulation of the growth of complex molecules in the interstellar medium.

Astrophysikalisches Institut und Universitäts-Sternwarte

FRIEDRICH-SCHILLER-UNIVERSITÄT

Prof. Dr. Alexander V. Krivov

Prof. Yoshinori Furukawa, Director
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January 25, 2013

Subject: Group for Theoretical Planetary Science at the ILTS

Dear Professor Furukawa,

I was recently asked by Professor Tetsuo Yamamoto to provide a letter of reference for the Group for Theoretical Planetary Science at the ILTS that he leads on the occasion of the upcoming Institute's evaluation. Since I am well familiar with the group and its activities, and have been collaborating with some of its members for years, it is my great pleasure to meet this request.

The group was established in 2004 and currently includes five scientists. Apart from Professor Yamamoto, these are Dr. Hidekazu Tanaka (Associate Professor), Dr. Koichiro Sugiyama (Assistant Professor), as well as Dr. Kyoko Tanaka and Dr. Takayuki Tanigawa (postdocs). In the past, the group hosted and contributed significantly to the career development of several more researchers who are now well-known in the community and successfully work elsewhere. These include Dr. Hiroshi Kimura (now an Associate Professor at CPS, Kobe), Dr. Koji Wada (now a senior researcher at the Planetary Exploration Research Center, Chiba Institute of Technology), Dr. Hiroshi Kobayashi (now a postdoc at Nagoya University), and Dr. Evgenij Zubko (moved to Tohoku University). I know all of them very well. For instance, Dr. Kimura and I published four papers together and Dr. Kobayashi spent three years as a postdoc in my group in Jena.

The main research field of the group is the theory of formation and evolution of planetary systems, including exoplanets. One distinctive feature of the group's research is that it puts emphasis on the physics of elementary processes involving dust in space. The physics that the group studies includes nucleation and crystal growth, collisional evolution of dust aggregates, and light scattering by small particles. Another important feature is that the group pursues interdisciplinary approach, bringing together dust studies in various fields such as meteoritic science and solid state physics and benefiting from cooperation with scientists working in these areas. The group's research is fully reflected by its strong publication record. Over the last five years, the group members have led or coauthored more than 40 papers in international peer-reviewed journals with high impact factors, such as ApJ, Icarus, GRL, A&A, and JQSRT. Given its moderate size, the productivity of the group is impressive.

The group has become particularly famous for their pioneering theoretical and simulation studies of collisions of dust aggregates, a fundamental process that determines the early phases of planetesimal accretion. This research has evolved from the assessment of the basic physics just a few years ago to an advanced, elaborate level. Using state-of-the-art models, they explore

the conditions for sticking, mass transfer rates, the porosity and strength evolution of aggregates etc. These results are being continuously confronted to those of the direct impact experiments, notably by the group of Prof. Jürgen Blum in Braunschweig. The two methods provide results that have been slowly, but steadily converging to each other. This research contributes decisively to a a better understanding of the crucial first steps in the formation of planetesimals, the building blocks for planets.

The group has also been making valuable contributions to the projects of Japanese planetary exploration programs including the Hayabusa mission, Akatsuki Venus mission, and a future Mars mission. One particular achievement to acknowledge here is a successful analysis of samples retrieved by the Hayabusa mission. The group leader Professor Yamamoto invested considerable time and effort into the organization of teams of the sample analysis in the Hayabusa mission of ISAS/JAXA as a chair of the committee for the sample analysis, and this effort turned out to be fully rewarding.

The group acts as a center of the dust community in astrophysics and planetary science in Japan. A total of 70 scientists from Japan and abroad visited the group in 2012. Discussions with visitors have triggered many collaborative projects and yielded a number of papers. Their coordinating and consolidating activities were supported by two large-scale projects, "Exoplanets" (JSPS) and Global COE Program (MEXT). The latter has also led to establishing the International Center for Planetary Sciences with the headquarters in Kobe.

The group hosts a conference on "Physics of Collisions of Celestial Bodies" with more than 50 participants, which is held every year at ILTS in collaboration with planetary scientists in Japan. The group also takes part in organization of the annual "Grain Formation Workshop". This workshop series began in 1979 and has fostered many dust researchers working actively in astrophysics and planetary science.

At the international level, Prof. Yamamoto's group in Sapporo and my group in Jena organized two dust workshops, one at my University in 2010 and another one in 2012 in Kobe. Organizing and running a dust session in AOGS (Asia-Oceania Geoscience Society) meetings represent another international activity of the group. One more international workshop that the group organized in collaboration with Prof. Wing-Huen Ip of the National Central University (Taipei) was held in 2009.

To summarize, I deem the work of the group led by Prof. Yamamoto very successful by all criteria (own research, promotion of young researchers, services to the Japanese community, international activities) and consider it to be an important part of the astrophysical research landscape in Japan and worldwide.

Sincerely,

Alexander Krivov

cc: Prof. Keiichiro Ohshima

復旦大學
Fudan University
生物多样性科学研究所
Institute of Biodiversity Science

Evaluation of Plant Ecology Group at the Institute of Low Temperature Science, Hokkaido University (led by Prof. Toshihiko Hara)

I am working on plant ecology, which is the area on which Prof. Hara's research is focused. For this reason, I have been quite familiar with Prof. Hara's research area and scientific achievements, and am able to make comments on their work.

Prof. Hara has been using theoretical and experimental approaches to studying various aspects of plant ecology. In my opinion, Prof. Hara has been productive ecologist as he has so far published 106 international journal papers (all peer-reviewed) (I know that he has also published many important papers in Japanese), which has built his international reputation.

Prof. Hara's early work had dealt with plant competition and species coexistence, both of which are core concepts in ecology. In particular, he developed a diffusion model to explain the variation in growth and individual size in the context of competition, which has made unique contributions to understanding the structure and dynamics of plant populations. My personal research interests have also been affected by his influential works. Prof. Hara has also developed a spatial approach to studying species coexistence in forests, which has greatly advanced the understanding of species coexistence.

Later, Prof. Hara diverted his attention to the plant responses to environmental heterogeneities in boreal forest ecosystems. His elegant studies have obtained novel insights into the mechanisms of species coexistence and community structure in such ecosystems.

More recently, Prof. Hara has explored the atmosphere-plant interactions in boreal ecosystems, which are cutting-edge area in modern ecology in the era of global change. His modelling and experimental studies have significantly shed light on the variation of ecosystem processes in these systems that are sensitive to climate change.

In conclusion, Professor Hara is an international leading plant ecologist, and has contributed much to the core areas of plant ecology, which I believe will have long-standing influence on the development of plant ecology, and I expect even greater contributions made by the group he is leading in near future.

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&
Vice-Chancellor, Ravenshaw University,
Cuttack

January 31, 2013

Evaluation of Plant Adaptation Biology Group at the Institute of Low Temperature Science, Hokkaido University

My research area is Photobiology. My scientific interest is shared by Tanaka's group and I and Tanaka's group belong to the same scientific community. I have visited or stayed in many laboratories in many countries including USA, Germany and Japan, and had many chances to understand the trends in our field of research. These are the reasons why I was asked to evaluate the research activity of Tanaka's group.

Research over view

Photosynthesis is one of the most important processes in this planet not only for maintaining the global environment but also for supplying the food for all the living organisms. Chlorophyll harvest light energy and drive electron, and plays essential roles in photosynthesis. Chlorophyll metabolism has long been studied and very recently all the enzymes for chlorophyll synthesis have been identified in higher plant. This research group greatly contributes to this achievement. This group found a new pathway of the interconversion of chlorophyll a and chlorophyll b and the pathway is now called as the Chl Cycle. The members of Tanaka's group succeeded to identify chloropohyllide a oxygenase that eluded the scientific community for several years. They successively identified divinyl chlorophyll a reductase, chlorophyll b reductase, HMChl reductase, pheophorbide a oxygease. These findings are individually important in this field and I am convinced that this group is one of the most important research groups in our field.

This group expanded the study of chlorophyll metabolism to the evolution of photosynthesis and to the agricultural application. In the evolutionary study, this group employs an interesting strategy which mimics the evolutionary process of photosynthesis in vitro. By this approach, this group elucidated the evolutionary process that cannot be unraveled by other method.

Their work of generation of stay green plants will have a profound impact on agricultural research to increase plant productivity. Finally, I must mention that this group also published and interesting paper concerning evergreen plant, where "green leaves" are maintained even under the severe cold conditions inwinter.

Conclusion

In conclusion, Thanaka's group has immensely contributed to photosynthesis and agricultural research in cold temperature and I expect larger contribution by this group in near future.

Baishnab C. Tripathy

MAX-PLANCK-INSTITUT FÜR MARINE MIKROBIOLOGIE

ABTEILUNG MOLEKULARE ÖKOLOGIE

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04.02.13

Evaluation Report

Dear Prof. Dr. Manabu Fukui:

It is my pleasure to accept your invitation to act as an international external evaluator of your group and to provide you with criticism and a constructive opinion from outside so that you can further develop your research. I understand that the Institute of Low Temperature Science (ILTS) in Sapporo is preparing for a Self and External Evaluation Report, which will be submitted to the national advisory board to ask their opinion on your working activity and performances.

During my visit to Sapporo in November 2009 I had the time to visit your laboratories and to talk to your colleagues and students. I was impressed by the nice facilities in your institute, by the high level of activity in your own research group, and the enthusiasm of your students to perform work on an internationally competitive level. I understand that your institute has been selected as a nation-wide joint research center for "Basic and applied studies on scientific phenomena under low temperature environment and cryosphere". Based on our long-term collaboration and my expertise in microbial ecology I believe that I have a detailed knowledge of your work, so that I can provide informed advice.

Let me first and foremost point out that I am very impressed by the high level of internationalization that you have achieved in the past few years. You were personally involved and very effective in achieving important memorandums of understanding with leading German research institutes like the Alfred Wegener Institute of Polar and Marine Research in Bremerhaven, the University of Bremen (recently awarded with the title University of Excellence) and with our Max Planck Institute for Marine Microbiology. In the past three years you have also filled these contacts with life, and it was indeed very productive to host not only you for several visits, but also two of your assistant professors for several months at the MPI Bremen. Our collaborations with Dr. Hisaya Kojima and Dr. Kyoko Kubo have resulted in joint publications that they share with scientists from the Max Planck Institute. Also the recently established collaboration that you have established with the famous protozoologist Professor Thomas Cavalier-Smith has already yielded results published in the journal PLoS ONE and the Journal of Eukaryotic Biology. All of this documents the success of the ILTS internationalization efforts. This needs to be continued and it is of

foremost importance that in particular young faculty such as Drs. Kojima and Kubo will also in the future get a chance to visit and work with international collaboration partners.

The current work of your research group is focusing on the microorganisms in natural environments in the aquatic and terrestrial cryosphere including snow and ice. Your group investigates *Bacteria* such as large filamentous sulfur bacteria, methanotrophic and hydrocarbon-degrading bacteria, but also *Eucarya* like green algae, myxomycetes and ciliates. Recently, you have also started to address *Archaea* involved in anaerobic methane oxidation. This broad scope is indeed necessary to really study the timely research topic of microbial catalysis of element cycling. The multidisciplinary approach (based on field research and laboratory experiments) used by your group in the comprehensive analyses of cryosphere ecosystems has the potential to discover new phenomena such as the new type of snow coloration liked to iron cycling.

I strongly recommend that you continue your integrated approach that combines *in situ* studies on whole microbial communities, with studies on isolated strains and *in silico* work on genomes and metagenomes. The DNA- and RNA-based molecular analyses and the cultivation of ecologically relevant microorganisms complement each other, and the expertise present in your laboratory on these technologies needs to be maintained. I also support your current efforts to integrate proteomics in your method portfolio. I also recommend that you rather go into depth in few relevant habitats than trying to cover too many different areas.

The research in your group has over the past six years resulted in the high number of 37 publications, most of them in peer-reviewed international journals such as Microbial Ecology, Systematic and Applied Microbiology, the International Journal of Systematic and Evolutionary Microbiology, and Aquatic Microbial Ecology. These are among the leading journals in prokaryotic taxonomy and environmental microbiology. Therefore, this is an excellent output.

The performance of Assistant Professor Hisaya Kojima is with 24 publications in the past six years indeed phenomenal, and a promotion should be considered. Assistant Professor Kyoko Kubo has the potential to become a role model for success of women in natural sciences. She has worked for the past 4 years in Germany in my department at the Max Planck Institute in Bremen. It will now be important to provide her with encouragement, strong support and mentoring in her new position. I trust that Associate Professor Yasuhiro Kasahara will further publish successfully in his new research field of soil ciliates with the single cell methods he has now developed.

Considering the rapid methodological developments in environmental microbiology it is of utmost importance that your successful group receives sufficient future support to maintain competitive instrumentation. With cutting-edge technologies applied in detailed polyphasic studies to a few selected habitats it will be possible for your Microbial Ecology group to even further improve its international visibility and national importance as a hub for biological cryosphere research. Finally, I would like to congratulate you, Professor Manabu Fukui, on your excellent leadership and to wish you much success for the future.

Yours sincerely

Rudolf Amann

Professor Dr. Rudolf Amann

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January 17, 2013

Re: Evaluation on Research Activity of Pan-Okhotsk Research Center

I am honered to be asked to evaluate and comment on the Pan-Okhotsk Research Center (PORC) for the past six years.

I would like to start by noting that I visited University of Hokkaido in November, 2009, for an ILTS International Symposium "Frontier of Low Temperature Science". While attending that Symposium, I had the opportunity to visit the PORC office and talked to many faculty members, post-docs, and graduate students involved in PORC. Through the interactions of oral presentations, poster viewings and private conversations, I was very much impressed by the breadth and depth of the very high-quality research the PORC scientists were embarking on. By taking the advantage of being close to the Okhotsk Sea and Russia, the research topics and results by PORC scientists were truly novel, unique, and at the forefront of the Okhotsk Sea research.

To provide the formal comments on PORC, I received the Report of Self Evaluation (PORC, 2012). Going through the report simply re-enforced many of the positive impressions I formed during my 2009 visit. I think the strengths of PORC are in its synergetic approach to the scientific issues relating to the Okhotsk Sea. PORC scientists have done an excellent job in collaborating with international colleages to collecting in-situ data, which might otherwise difficult to obtain. In addition to collecting the new data, the PORC scientists have also conducted impressive analyses of long-term data, putting the new observations into context. At the same time, efforts have also been devoted by the PORC scientists to explore and understand the physical processes of the Okhotsk Sea circulation using various kinds of numerical model experiments. It is this synergetic approach of data collecting, analyses, and numerical modeling that has made PORC a successful and well-respected institution of the past six years.

With the high-latitude ocean becomes increasingly important in the coming decades, there is a clear need to improve and enhance our understanding of the ocean's role in the high-latitude ocean-atmosphere-land coupled system. To fulfill this need requires continued international collaborations and expansion in research efforts. In this regard, I find the restructuring of PORC to cover the 3 new scientific sections very helpful and fore-sighted.

Given its success and achievements of the past six years, I believe PORC is well poised to take the lead in this research direction internationally. I look forward to learning more of PORC's progresses in the coming years.

Bo Qiu, Professor of Oceanography

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

24 February 2013

Institute of Low Temperature Science (ILTS)
Hokkaido University
Sapporo, Hokkaido, Japan

Subject ILTS Pan-Okhotsk Research Center during 2007 – 2012

Re ILTS research evaluation

Dear Sir/Madame,

Pan-Okhotsk Research Center is a part of the Institute of Low Temperature Science with research on cryosphere science and cold ocean oceanography in the Okhotsk Sea region. The center has developed a very high, internationally well-recognized research profile.

Twelve scientists have been working in the center in 2007–2012. The research has had a wide coverage of cold region science: physical and chemical oceanography, sea ice, marine ecology, meteorology, hydrology, soil physics and ecology, snow, and glaciology. Climate change and its consequences and the state of the Okhotsk Sea have been a common motivation in a large part of the investigations. The team has also shown good know knowledge and ability of using remote sensing technology and mathematical modeling tools. There has been a strong contribution in realization of observation programs and data analysis, which has given an excellent and firm basis for the team in their work on environmental questions and climate change. The focus of research being in the Okhotsk Sea region is en excellent strategy and will help Japan to prepare for future environmental and climate changes.

The total number of scientific papers has been about 260, which makes an average 3–5 per year per scientists. A large part of the papers have been published in high-level internationally recognized periodicals, with all the team members having a good contribution. The size of the team is very good to reach its objectives, and being a part of the ILTS its whole research environment is excellent. The publication record also shows that the team has a wide and global international collaboration network.

The research of Pan-Okhotsk Research Center is in the forefront of cold regions research in Earth System Science, knows very well the modern methodology and status of knowledge, and shows excellent promises for the future success.

Yours Sincerely,

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5．所長からのコメント

今回の外部点検評価は，2007年に実施された前回の外部点検評価以来，6年ぶりに実施されたものである。評価委員の皆さまから頂戴した最終報告書は，全体的に本研究所のアクティビティを高く評価頂いた内容であり，この6年間に実施されてきた本研究所の数々の改善策が一定の成果を上げてきたものと，まずは安堵している。外部点検評価委員会の委員長をお務め頂いた安成哲三先生はじめ委員各位のご尽力に心からの感謝を申し上げる。

頂いた報告書ではいくつかの重要な問題点をご指摘いただいている。そのほとんどは大変もっともなことであり，真摯に受け止めなければならない。これらのご指摘の点については，早急に所内で議論を行い，改善策を講じていく覚悟であるが，低温科学研究所長として現時点でのコメントを記しておきたい。

まず，研究所の理念・学問的意義の点では，本研究所が目的として掲げる「寒冷圏及び低温条件の下における科学現象に関する学理およびその応用の研究」のなかで，”寒冷圏”の研究と”低温条件下の自然研究”の連携・統合を再度構築する必要があろうというご指摘を頂いた。これは，本研究所が低温科学研究を推進するユニークな研究所として今後とも生き残っていくために，必要不可欠なことであると強く認識している。2010年の共同研究推進部の設置や大部門の改組は，この点をいかに改善するかを重要な目標として実施されたものである。今回の外部点検評価では，当初の目的を十分には達成できていないという指摘を頂いたことになり，この点は真摯に反省すべきと考えている。改組してから4年半しかたっていないということもあるが，このことは強く念頭において更なる改善を図るべきと考える。

研究所の組織体制では，共同研究推進部の設置とプログラム研究制度については高い評価を頂いた。特にプログラムの中から優れた研究成果が生まれていることも高い評価の要因であった。しかし，一方で所内での連携・共同研究の成果としては，未だ目に見える形では現れていないというご指摘も頂いた。現在のプログラム制度でテーマとして挙げられているものは，すべて制度発足時に選定されたものであり，開始されてから4年が経過している。今回の外部点検評価で頂いた問題点は，我々所員もすでに感じ取っているものであり，すでに1年前からこのプログラム課題の入れ替えの必要性が所内で指摘されてきた。早急な対応がとれるように急ぎ議論を開始したい。

また，本研究所の掲げる目的の中で述べられている”応用“の部分の成果が十分ではないというご指摘も頂いた。特に，寒冷圏を中心とする地球環境問題の解決に向けた研究の推進をはかるために，所外の関連組織・機関との連携・共同研究をさらに推進することが重要であるとの提言を頂いた。本研究所は，現在国内外の研究機関との連携協定の締結など，目に見える形での貢献を目指して努力しているが，今後ともこの方針を堅持していきたい。現在までに，１７件の国際交流協定を締結しているが，地球科学・環境科学を標榜する研究所として，この数は決して多い方ではないと考えている。今後新

たに連携先の増加を目指すとともに，現在の連携先との積極的な研究協力の推進をはかる体制作りについても，今後さらに検討すべきである。

人事に関しては，特に助教の内部昇任制度について，いくつかの問題点の指摘を受けた。この制度は，本研究所の研究分野が極めてユニークであるため人事の流動性の確保が難しいことや，北海道大学の人事管理に導入されているポイント制による残ポイントの活用などを理由に，第２期中期計画中に限定して実施されているものである。しかし，この制度の公平性や継続性などについての問題点が指摘され，この制度の早急な検証を行う必要性が提言された。この指摘を待つまでもなく，本研究所が共同利用・共同研究拠点として外部に開かれた研究所であることを考えると，この制度の実行にはさらに慎重な議論が必要であると思われる。本研究所の人事は，本来すべて一般公募で実施されることが原則であり，本制度による内部昇任は一般公募を行っても勝ち残るだけの成果を上げている人物であることがその適用条件になっている。さらに，実施期限や最大人数なども規定されるなど，安易な内部昇任にはならないよういくつもの縛りが掛けられている。今後，改正労働契約法の施行による助教の任期制の見直しもあり，本制度を含め助教の昇任のあり方については再検証を行う。

研究成果については，おおむね高い評価を頂いたと考えている。自己点検評価では各教員の業績の定量的な指標を示した。すべての教員の客観的なデータを公表したことを評価していただくと同時に数字の独り歩きを危ぶむ指摘を頂いた。もとより，このような指標は業績評価の一断面しか見ていないことは十分に承知しており，これをもって評価のすべてであるとは考えていない。総合的見地での評価を今後とも心がけていきたい。業績評価のあり方は，本研究所に限らずどの研究機関も頭を悩ます普遍的な課題である。本研究所としては，今後ともいかに客観的で公正な評価が可能かを模索していきたい。また，所内の連携・共同研究の体制強化の必要性，さらには学内での研究の連携が弱いとの指摘も頂いた。研究の連携に関するいくつかの貴重な提言も頂いているので，今後この点については強化をはかるための施策を検討したい。

共同利用・共同研究については，本研究所では共同研究推進部を設置するなどの目に見える実施体制を取っていることに高い評価を頂いた。さらに，推進部で行っているプログラム研究課題については，所内研究者がリードできる課題の設定の重要性が指摘された。このプログラムについては所内研究者が中心になるが，拠点として実施している共同研究公募の中にある萌芽研究課題に外部研究者が参加してプログラム研究課題と連携するという体制を取っており，今回頂いた指摘には一応の対策を取っている。しかし，今回改めてこの点を指摘いただいたことは，取り組みの不十分さを示すものであり，改善をはかりたい。この問題は，拠点としての研究所のあり方の根幹にも関連する点であり，今後所内でのさらなる議論が必要であると考えている。

環オホーツク観測研究センターについては，その活動内容について大変高い評価を頂いたことを感謝申し上げる。センターが果たしている役割を鑑みるとセンターの名前から〝観測“の文字を外した方が良いだろうという提案を頂いた。本センターは設置後８

年が経過していることもあり，その組織の変更も含めた改組を検討している所であり，早急に改組を実施する意向である。

教育活動については，特に国際南極大学への参加と南極学カリキュラムの実施に高い評価を頂いた。これは本研究所のみならず北海道大学全体として推進してきたプログラムであるが，研究所としては経費と運営の面で大きな負担となっていることも確かである。特に来年度以降は本プログラムに対する経費の確保が困難になると予想されている。このため，プログラムの見直しを行う必要があるが，本研究所としては独自の努力で何とか経費を確保し，継続の道を探りたいと考えている。

社会貢献・広報については，おおむね高い評価を頂いたと考えている。共同利用・共同研究拠点としての役割と成果を広く社会に広報・還元することは，これまでにも増して重要度が高まっている。頂いた高い評価に甘んずることなく，今後とも努力を重ねていく所存である。

技術部についても大変高い評価を頂いた。技術部の存在は，本研究所の宝とも言えるもので，今後とも教員と一体になって高いパフォーマンスを維持できるよう最大限の支援を行っていきたい。一方で，技術部のあり方については大学全体として統合や組織化などの方向性も示唆されており，現状は決して盤石のものではない。職員の待遇改善の問題も残されており，今後とも改善の努力を継続する必要がある。

最後に，今回の外部点検評価を実施するに当たり，評価委員は国内の各研究分野を代表する研究者の皆さまにお願いした。このため，本研究所の研究分野（教授のいる研究グループ）が国際的にどのような評価を得ているかという視点に欠けている。これを補うため，研究分野ごとに関連の深い外国人研究者からの evaluation letter を頂き，本報告書に収録した。その内容についてはここでは触れないが，これらをご覧いただくことで各分野とも国際的に高い評価を得ていることが明らかになるものと考えている。

今回頂いた外部点検評価の結果は，本研究所の今後の道筋を示すものである。研究所内での真摯な議論を通じて，指摘頂いた改善点を早急にクリアできるよう，本研究所全体で努力を重ねていく決意を表明するとともに，評価委員の皆さまのご尽力に重ねてお礼申し上げる。

以上

2013（平成 25）年 3 月

北海道大学低温科学研究所長　古　川　義　純

Ⅱ．外部点検評価のための資料

外部点検評価資料一覧

1．低温科学研究所　自己点検評価報告書の概要
2．低温科学研究所　自己点検評価報告書（2012 年 11 月）
3．環オホーツク観測研究センター　自己点検評価報告書（2012 年 11 月）
4．低温科学研究所　ダイジェストガイド
5．研究所で学びたい学生のための低温科学研究ガイド[分野別ﾋﾟｯｸｱｯﾌﾟ]
6．低温科学研究所　年次自己点検評価報告書～年報　平成 23 年度版～
7．低温科学研究所　概要（2011～2012）
8．低温科学 2011 vol. 70（2012 年 3 月）
9．研究助成事業　研究成果報告書（2012 年 7 月）
10. 低温研ニュース（2011 年 12 月 No. 32）
11. 低温研ニュース（2012 年 6 月 No. 33）
12. 外部点検評価報告書（2007 年 3 月）

今回の外部点検評価にあたっては，評価委員には上記の資料を配付いたしました。本報告書には紙面の都合上，これらの資料は含まれておりませんが，ご了承ください。

なお，これらの資料はお申し出があれば，可能なかぎりお送りいたしますので，ご覧になりたい方は下記連絡先までご一報くださいますようご案内申しあげます。

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