

# EISCAT\_3D User Meeting 報告

話題提供者: 小川泰信 (極地研)

- EISCAT\_3D User Meeting
- EISCAT\_3D Science working group活動

(15分間)

## 第3回 EISCAT\_3D ユーザーミーティング

日付: 2011年5月18-20日

場所: スウェーデン・ウプサラ

参加者は約40人(日本からは小川とJohan Keroさん)

(1) EISCAT3D and Atmospheric Science

(2) General EISCAT\_3D Science

(3) Current Status and Future Plans of the Preparatory Phase

の3つのセッションに分けて、講演を行った。

発表資料はEISCAT本部のウェブページに掲載中:

<http://www.eiscat3d.se/content/3rd-eiscat3d-user-meeting-uppsala-18-20-may-2011>

会議のメモについては下記ウェブページ:

<http://polaris.nipr.ac.jp/~eiscat/eiscat3d/introduction.html>

# (1) EISCAT3D and Atmospheric Science

- The EISCAT\_3D Science Case: Atmospheric Section (Ian McCrea)  
EISCAT\_3D Science working group活動報告の中で紹介。
- EISCAT UHF/VHFとMAASYによる複数の送受信周波数を用いたD/E層エコーの研究 (Norbert Engler and Markus Rapp (IAPグループ))
- 各地の流星レーダーの結果も組み合わせた重力波や潮汐波の研究 (Viktoria SofievaやNick Mitchell)
- 高エネルギー粒子の降り込みとD層の化学について (Mark Clilverd (BAS, UK) やJörg Gumbel (ストックホルム大) やEsa Turunen)
- The MU radar head echo observation programme for sporadic and shower meteors: 2009 June to 2010 December, and what to expect from EISCAT\_3D (Johan Kero (NIPR))

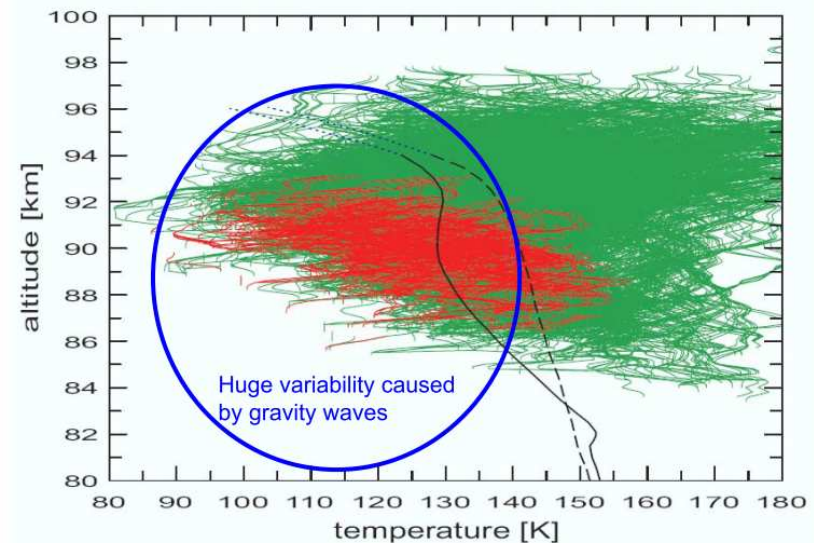
# (1) EISCAT3D and Atmospheric Science

EISCAT UHF/VHFとMAASYによる複数の送受信周波数を用いたD/E層エコーの研究 (Norbert Engler and Markus Rapp (IAPグループ))

- MOST IMPORTANT:
  - The MLT - an atmospheric region driven by small scale dynamics
    - Unprecedented 3D imaging of waves in the MLT
    - Extension of wave and tide studies into the thermosphere
    - Resolving the importance of GW for understanding thermospheric dynamics
- Other issues in the D-region/mesosphere
  - Charged dust and incoherent scatter
  - Polar mesosphere summer/winter echoes
  - D-region plasma instabilities (?)

Norbert Engler博士発表資料より

Is there evidence for these waves?



2001年と2003年のカリウム  
ライダー観測より

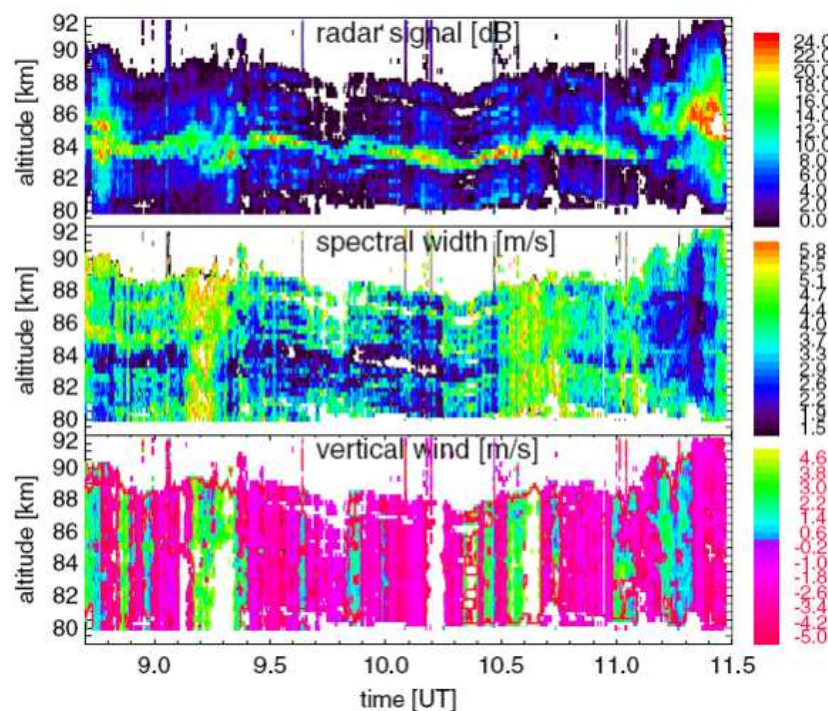
Lübken, Lautenbach, Hoffner, Rapp  
und Zecha, JASTP 2008

# (1) EISCAT3D and Atmospheric Science

EISCAT UHF/VHFとMAASYによる複数の送受信周波数を用いたD/E層エコーの研究 (Norbert Engler and Markus Rapp (IAPグループ))

EISCAT as an ideal tool to study GW and dissipation

*M. Rapp, U.-P. Hoppe / Advances in Space Research 38 (2006) 2408–2412*



Norbert Engler博士発表資料より

## Conclusions

EISCAT\_3D has the potential to make significant contributions to enhance our understanding of dynamics in the MLT and beyond

- Gravity waves (making **short time scales accessible** and resolving **horizontal structures**)
- Tides & Planetary waves
- Most important because of impact on energy and momentum budget and constituent transport!!!

- Furthermore, there are a wealth of open issues in the D-region to be resolved/exploited
  - To be exploited: **Radar measurements of aerosol parameters** (note NLC are discussed as indicators of climate change)
  - Open issues: **Physics of PMWE, D-region plasma instabilities (?), D-region fine structure,...**

## (2) General EISCAT\_3D Science

- EISCAT\_3D Science case (Anita Aikio and Ian McCrea)
- Small scale auroral observations (Betty Lanchester)  
ASKカメラを用いたスモールスケールのオーロラ
- The next orders of magnitude in auroral observation (Björn Gustavsson)  
ロケットとの同時観測に最適なEISCAT\_3Dの設置場所について
- Review of the polar ion upflow (Yasonobu Ogawa)
- Mesoscale ionospheric tomography in Scandinava (TOMOSCAND) and EISCAT\_3D: added value for both projects (Olaf Amm)  
GPS等の電離圏トモグラフィープロジェクト
- Some science questions for EISCAT\_3D (Kjellmar Oksavik)
- Solar wind measurements with EISCAT\_3D (Richard Fallows)
- On designing the EISCAT\_3D system (Markku Lehtinen)
- Dual polarisation lag profile inversion (Juha Vierinen)
- KAIRA – Status, progress and ambitions for a combined EISCAT/LOFAR station in Finland (Derek McKay-Bukowski and Thomas Ulich)
- Radar probing of azimuthal perturbations: experimental demonstration of the spiral (OAM) imaging technique at radio frequencies (Bo Thidé)
- Effects of antenna aperture and radio wave orbital angular momentum on the incoherent scatter spectrum (Thomas Leyser)

## (2) General EISCAT\_3D Science

Mesoscale ionospheric tomography in  
Scandinavia (TomoScand) and EISCAT 3D  
-added value for both projects  
Olaf Amm, et al.

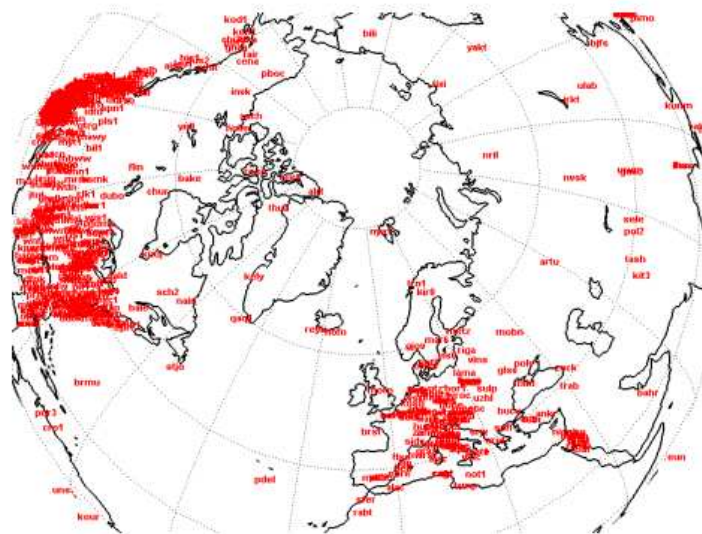
Funded by: Academy of Finland, 2010-2013

- Main components for data analysis:

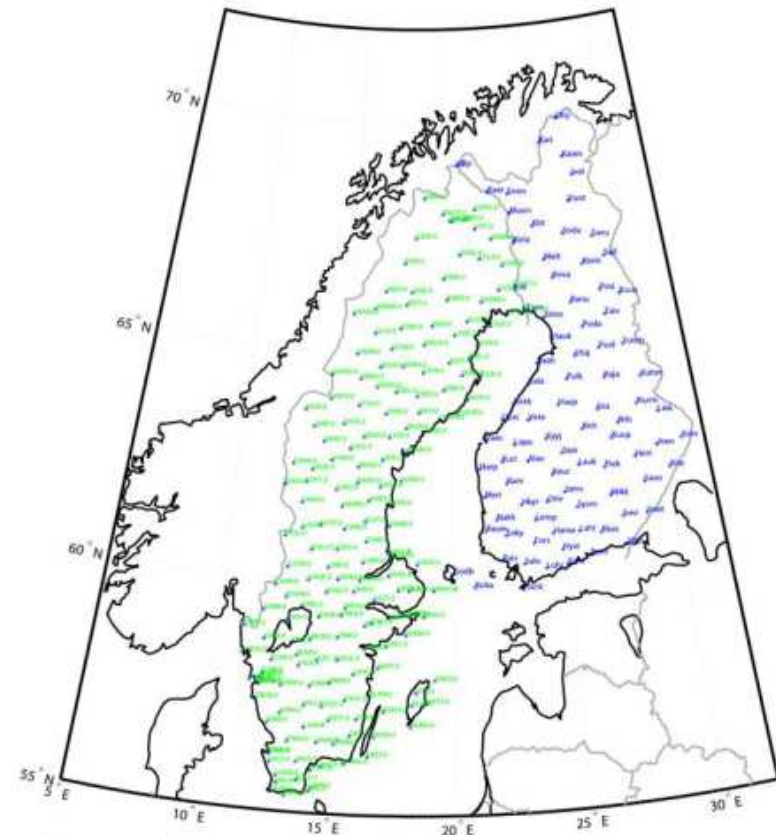
- \* GPS data receiver network
- \* Beacon data receiver network

### Global scale

- IGS network includes over 500 stations around the world.
- Coverage varies greatly with location.



### Ground networks of GPS receivers



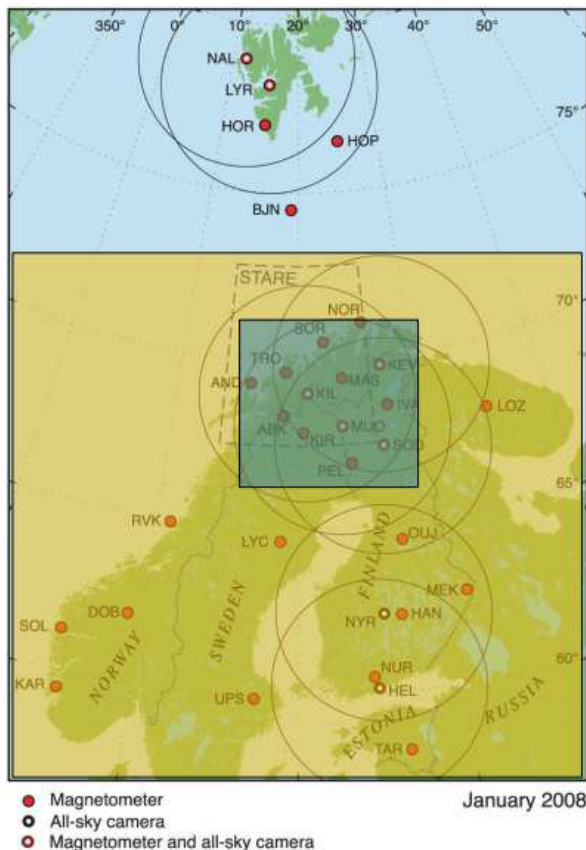
### Mesoscale

Dense networks of GPS receivers in Fennoscandia

- 86 stations in Finland (Geotrim)
- 180 stations in Sweden (SWEPOS)
- more stations in Norway (Statens Kartverk)

## (2) General EISCAT\_3D Science

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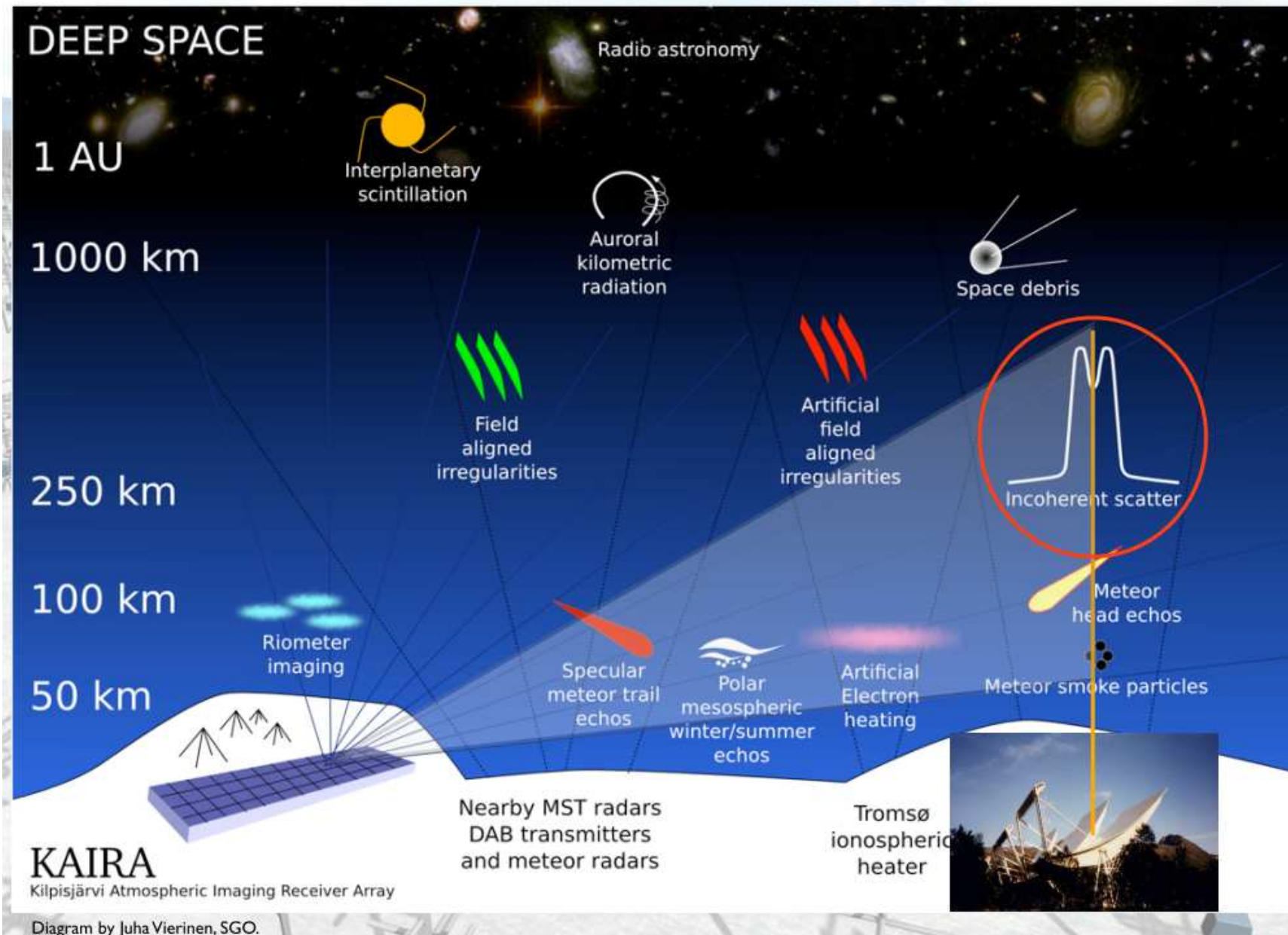


TomoScand analysis  
volume (approximately,  
potential EISCAT 3D  
analysis volume (rough  
sketch))

- TomoScand will reconstruct 3D ionospheric electron density distributions in a  $\sim 1000 * 1000 * 800$  km volume, with  $\sim 50$  km horizontal resolution and  $\sim 10$  sec temporal resolution
- EISCAT 3D can measure electron density and many other parameters, with direct (not integral) measurements; but due to limited amount of energy, either a smaller volume or a lower spatiotemporal resolution is required
- TomoScand can serve as an extension of EISCAT 3D in terms of 3D electron density results, providing a view over the whole Fennoscandian area
- EISCAT 3D can provide a core volume of known 3D electron density results to TomoScand, which will significantly stabilize the inversion and improve the results within the larger TomoScand volume



# KAIRA (Kilpisjärvi Atmospheric Imaging Receiver Array)



# KAIRA (Kilpisjärvi Atmospheric Imaging Receiver Array)

## Schedule for remainder of 2011

- 12<sup>th</sup> May – Final snow clearing, destructive testing
- 16<sup>th</sup> May – Delivery of frames
- 6<sup>th</sup> June – Start of site surveying and preparation
- 18<sup>th</sup> June – Surveying for final HBA layout
- 4<sup>th</sup> July – Start of HBA deployment
- 25<sup>th</sup> July – Cabling commences
- 1<sup>st</sup> August – HBA and electronics ready
- Winter 2011-2012 – Testing with Tromsø VHF
- Summer 2012 – Installation of the LBA

<http://kaira.sgo.fi/>

Derek McKay-Bukowski 博士発表資料より

# スウェーデンの大型予算要求

- ・スウェーデンの研究グループ(IRF、KTH、ストックホルム大学)がスウェーデン政府に10億円程度の予算要求  
(3月末に IRF の A. Wannberg 教授に連絡があり、4月19日締め切り)
- ・発表時のタイトルは「The Esrange 50 MHz HPLA radar, an application to the Swedish Research Council」
- ・キルナのEsrange(ロケット打ち上げサイト)に53.5 MHzの周波数帯のレーダーを設置する計画。
- ・もし採択されれば2012年から施設のインストレーションを開始しなくてはならないため、(230 MHzのEISCAT\_3Dのフルデザインはまだ決まっていないので)やむなく50 MHzの送受信周波数を選択したとのこと。
- ・レーダーはアンドーヤのMAARSYとほぼ同じスペックだが、
  - (1)アンテナ数は510本で開口面積は7400 m<sup>2</sup>( MAARSYは433本& 6300 m<sup>2</sup>)
  - (2)直交八木アンテナを用いて円偏波を観測するように。
  - (3)アンテナ毎の出力を2.5倍(5 kW)になどの違いが挙げられており、現行のトロムソUHFレーダーと同じような非干渉散乱観測を目指しているとのこと。

# FP7 Preparatory Phase

14 work packages:

- WP1: Management and reporting
- WP2: Legal and logistical issues
- WP3: Science planning
- WP4: Outreach activities
- WP5: Consortium building
- WP6: Performance specification
- WP7: Signal processing
- WP8: Antenna, front end and timing
- WP9: Transmitter development
- WP10: Aperture synthesis imaging
- WP11: Software theory & implementation
- WP12: System control
- WP13: Data handling & distribution
- WP14: Mass-production & reliability



## **EISCAT\_3D**

*A European Three-Dimensional Imaging Radar for  
Atmospheric and Geospace Research*

*ESFRI Roadmap Project*

### (3) Current Status and Future Plans of the Preparatory Phase

#### WP1: Management

- EISCAT\_3D\_2 General Assembly : Esa Turunen 所長を含め、計9名
- Technical Advisory Committee (TAC) : Chair は Frank Lind氏 (計5名)
- EISCAT\_3D\_2 Executive Board : Esa Turunen 所長を含め、計5名
- All-Hands Meeting (October)

#### WP2: Legal and logistical issues

Final frequency allocations (Month 6).

– Norway 233 MHz OK

- Finland, ready to protect reception
- Sweden, no authority provided support so far

Site selections (Month 12)

– Design Study Surveys available

- check radio interference

– additional Site Surveys during summer 2011

#### WP5: Consortium Building

- Output after first 6 months
  - first list of potential partner organizations
- Output after first 12 months
  - First update of project costs
  - Initial review of funding possibilities available in various countries

### (3) Current Status and Future Plans of the Preparatory Phase

#### WP6: Performance Specification

- Month 6:
  - Initial version of the Performance Specification Document (D6.1)  
Concept Document, System Design Document, Engineering Specification Document
  - Initial version of Measurement Principles Handbook (D6.2)
- Month 12:
  - Next version of PSD, consistent with Science Case and Measurement Principles Handbook (D6.3)



# Working Package 3: Science Planning and User Engagement

- ・2010年11月にEISCAT\_3D サイエンスワーキンググループ(SWG)の立ち上げ。

初期メンバー(任期は1年)

Dr. Anita Aikio (University of Oulu, Finland, co-convenor)

Dr. Ian McCrea (STFC Rutherford Appleton Lab., UK, co-convenor)

Dr. Yasunobu Ogawa (National Institute of Polar Research, Japan)

Prof. Kjellmar Oksavik (UNIS, Norway)

Prof. Asta Pellinen-Wannberg (IRF Kiruna, Sweden)

Dr. Mark Clilverd (British Antarctic Survey, UK)

Prof. Markus Rapp (IAP Kuhlungsborn, Germany)

- タスク:
- ・2011年1月14日(@FMI)と5月17日(@IRF-U)の2回ミーティング。
  - ・EISCAT\_3Dレーダーに期待するスペックについての表を作成
  - ・新規ユーザーコミュニティの開拓のための、コンタクトリストの作成
  - ・EISCAT\_3D science caseの初版の改訂
  - ・サイエンスキークエスチョンの設定

今後: Workshop of EISCAT\_3D dedicated to the applications and modelling communities

- Workshop will be held on **23 May 2012** in Uppsala in connection with the 4th EISCAT\_3D User Meeting.
- Dates for the 4th EISCAT\_3D User Meeting: **23-25 May, 2012.**
- Science case will be complemented with more detailed plans of **space weather** and **modeling use.**

# EISCAT\_3D SCIENCE CASE



## EISCAT\_3D SCIENCE CASE

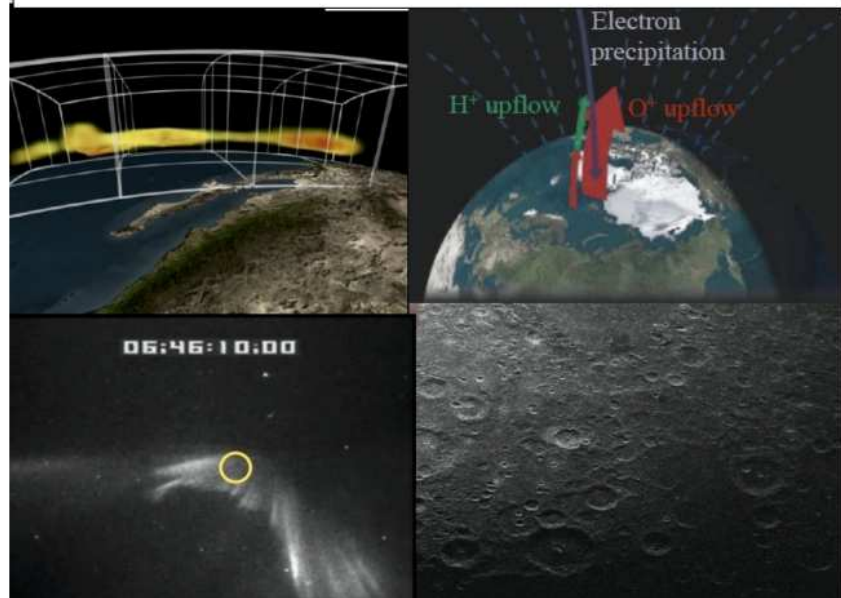
Anita Aikio<sup>1</sup>, Ian McCrea<sup>2</sup>,  
and the EISCAT\_3D Science Working Group

<sup>1</sup>University of Oulu, Finland

<sup>2</sup>STFC Rutherford Appleton Laboratory, United Kingdom

EISCAT\_3D Preparatory Phase Project WP3

Version 1.0, June 2011



2011年6月末にEISCAT\_3D science caseの改訂版(全87ページ)をリリースし、ウェブに公開。

<http://www.eiscat3d.se/content/deliverable-32-initial-revision-eiscat3d-science-case>

EISCAT\_3D SCIENCE CASE の内容:

- A. Atmospheric physics and global change
- B. Space and plasma physics
- C. Solar system science
- D. Space weather and service applications
- E. Radar techniques, coding and analysis

Appendix A: Table of EISCAT\_3D radar performance requirements by science topics