

UiT

NORGES  
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# NOSWE – Norwegian Centre for Space Weather

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18/11/2019

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UiT – The Arctic University of  
Norway  
Faculty of Natural Sciences and  
Technology

Norwegian Space Agency  
NOSA

Physics etc.

Chemistry etc.

Tromsø  
Geophysical  
Observatory

TGO core  
operations

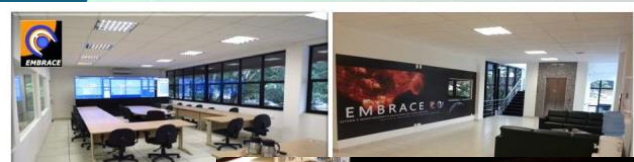
NOSWE

## NOSWE - Background

- Tromsø - strategic position for a space weather centre within Norway and the arctic.
- Norwegian Space Agency (NOSA) and the Faculty at UiT committed to establishing a national and/or regional centre monitoring and studying space weather and providing services for user groups.
- In-house link to EISCAT/EISCAT 3D expertise and background infrastructure support via TGO.
- NOSWE contact point for government bodies, but also for general public.

# National objectives

- Situational awareness and alerts primarily to Norwegian and Arctic users.
- Serving national user needs.
- Transferring science results and data within TGO's scope into operational environment & channelling external expertise from national pool.
- Providing input into a national space weather roadmap (by NOSA) affecting future governmental guidelines and priorities, and advising the government on how to approach space weather preparedness.



Brazil



Canada



Australia



South Africa



UK



**ISES**  
International Space  
Environment Service

**UIT**  
THE ARCTIC  
UNIVERSITY  
OF NORWAY

## Norwegian Centre for Space Weather (NOSWE)

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HOME **NORDIC SITUATION SCREEN** NORTHERN LIGHTS BLOG LINKS CONTACT

### GEOMAGNETIC SUMMARY AND FORECAST

Level	Last 24 h	Last 2-3 h	Last 1h	Now	Next 1h
Auroral zone (Troms)	Green	Green	Green	Green	Green
Sub-Auroral zone (Dombås)	Green	Green	Green	Green	Green

Updated this hour: 18:10:00 UTC 2019

### NORTHERN LIGHTS IN THE NEXT HOUR

**NOSWE**  
event analysis tool

### Solar Wind conditions

$V_s$ : 365.5 km/s  
 $B_z$ : 0.62 nT  
 $X$ -Ray: 7.58e-08 W/m<sup>2</sup>  
(Ref: NOAA Space Weather Prediction Center)  
 -Last Updated: 2019-11-18 10:00 UTC

### About The Norwegian Centre for Space Weather

Mission Partners Organization Operations Norsk

Photo: NPI Galbraith

Space weather is driven by the Sun and refers to the variations of near-Earth space environment that can affect human health, the functioning and reliability of various spaceborne and ground-based technological and, in consequence societal systems.

The Norwegian Centre for Space Weather (NOSWE) was established in collaboration with the

NOSWE is the ISES Regional Warning Centre in Norway

ISES International Space Environment Service

### Recent Posts

Work with Us – OPEN IT POSITION

A telescope comes home

Enjoy some northern light photos taken near Tromsø in 2018 autumn

DOWNTIME ANNOUNCEMENT!

Swarm Utilisation Analysis Meeting at NOSWE/TGO

Follow NOSWE on Twitter

## Nordic Situation Screen

Aurorae & Geomagnetic Field

Ionosphere

Sun & Solar Wind

Event Analysis



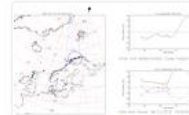
Northern lights



All-sky camera Skibotn



All-sky camera ALOMAR



Auroral EJ tracker



Mag. Equivalent Convection



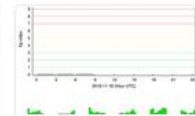
Ground disturbance (deltaH)



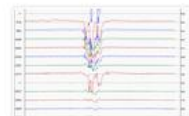
Ground disturbance (dH/dt)



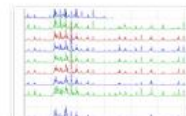
Modelled ground fields



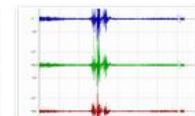
Global activity (Kp)



Geomagnetic time series

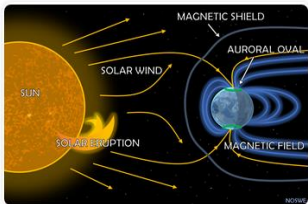


Geomagnetic activity indices



dB/dt time series

# Northern Lights / Aurora Borealis



What are the Northern Lights / Aurora?



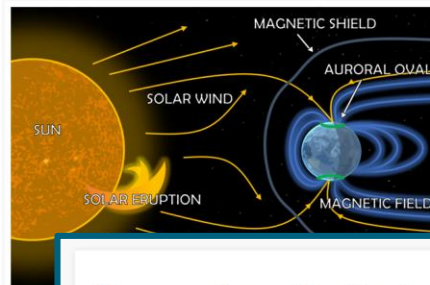
How can I see the Northern Lights?



Northern lights forecast

## What are the Northern Lights / Aurora Borealis?

Northern lights, or Aurora Borealis, is a natural phenomenon caused by high-speed electrically charged particles bombarding Earth's atmosphere. As a result of this bombardment the oxygen and nitrogen atoms in the atmosphere emit light which we then see as the aurora (a similar process happens in neon light tubes).



The bombarding particles actually mainly originate all the way from the Sun. As a result of the Sun's energy production there is a continuous flow of electric particles, or plasma, which we call the solar wind, flowing from the Sun into the interplanetary space and beyond. The solar wind carries, along with its plasma, the magnetic field of the Sun. As the solar wind reaches Earth, it

## How can I see the Northern Lights?

While northern lights are not rare at all, many things must come together in order for us to see them: *You have to be in the right place at the right time.*

### “Where can I see them?”



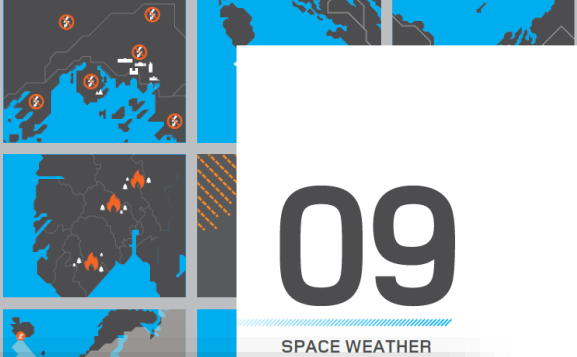
Aurora near Tromsø, Northern Norway

Northern lights can be seen in an area around the north geomagnetic pole called the auroral zone. This zone includes for example the northern parts of Fennoscandia, Iceland, and parts of Greenland and northern Canada. Northern Norway in particular is a popular place to travel to see the aurora since even in the north, the coastal regions have mild winter temperatures. Here, however, the cloud cover can often become an obstacle for seeing the aurora and some people prefer to travel a bit inland to get away from the clouds, even though the colder temperatures require a bit warmer equipment.

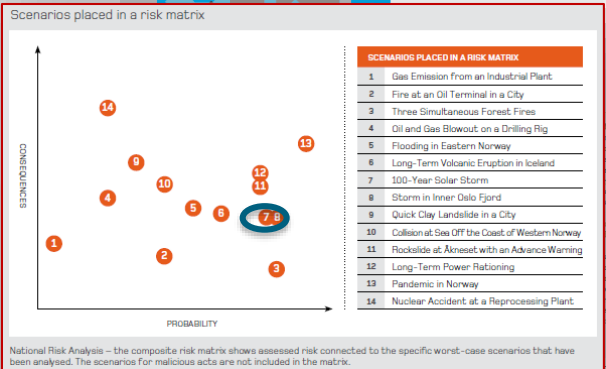
# 2013

NATIONAL RISK ANALYSIS

Space weather is now widely recognized as a risk that must be considered on national/international level, with the largest economic impact due to **geomagnetic activity**.



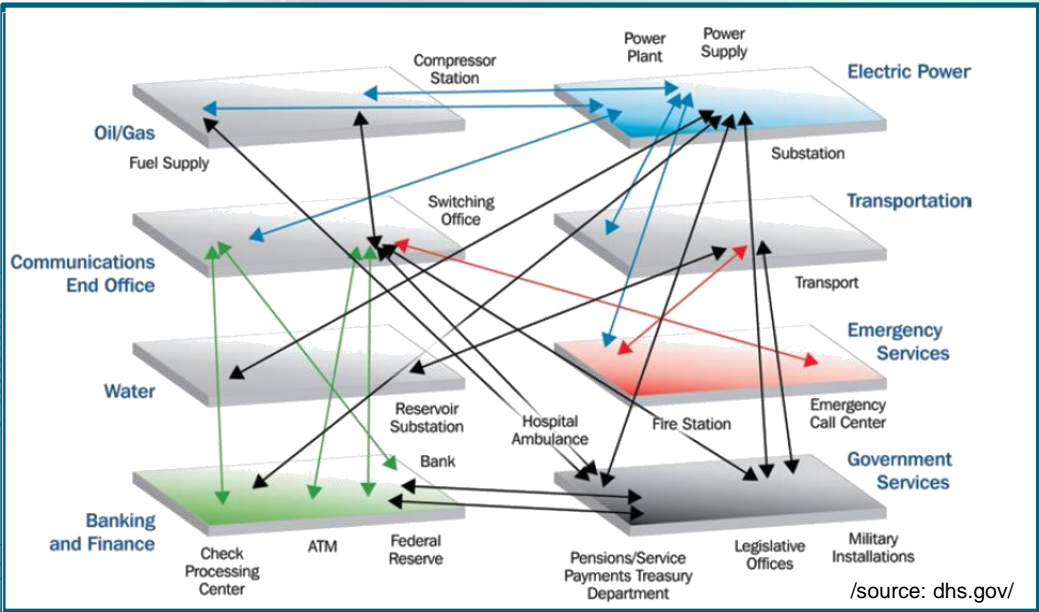
RISK AREA / SPACE WEATHER



National Risk Analysis – the composite risk matrix shows assessed risk connected to the specific worst-case scenarios that have been analysed. The scenarios for malicious acts are not included in the matrix.

Several powerful solar storms over the past decade have caused interference and disruption in the communications and power at irregular intervals. In 2003, there were many violent storms on the sun. In conjunction with the storms, technical problems were reported with satellite telephones from several parts of the world. Problems with radio communications, in particular on transatlantic and polar routes, were reported. Traffic was redirected, and notice was issued concerning radiation risk for aircraft passengers. In the power transformers were also damaged or areas were left in the dark for some hours. The solar storms were estimated as being at the level of a 100-year event.

In Sweden, too, several thousand people were affected as a consequence of this storm.



/source: dhs.gov/

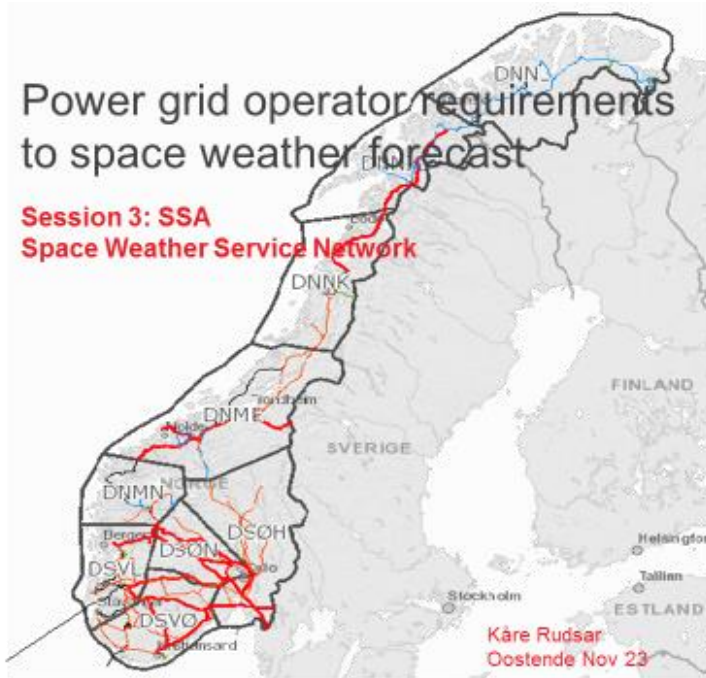
© NARVA (NARVA) working paper 07 August 2010, Norwegian Space Centre (NSC), www.arktis.no (14/12/2010).  
 © National Research Council of the United States of America (2008), Space Data Center - Understanding the Global and Economic Impacts of Space Weather, National Security Council Intelligence Community Assessment (NSA/CSS), National Oceanic and Atmospheric Administration of Commerce, Swedish Civil Contingency Agency (MSB) (2010), Managing Critical Risks in the Transatlantic Domain - The Case of Workshop Summary, February 23-24 February 2010.



# Regional need for a space weather centre

## Power grid operator requirements to space weather forecast

### Session 3: SSA Space Weather Service Network



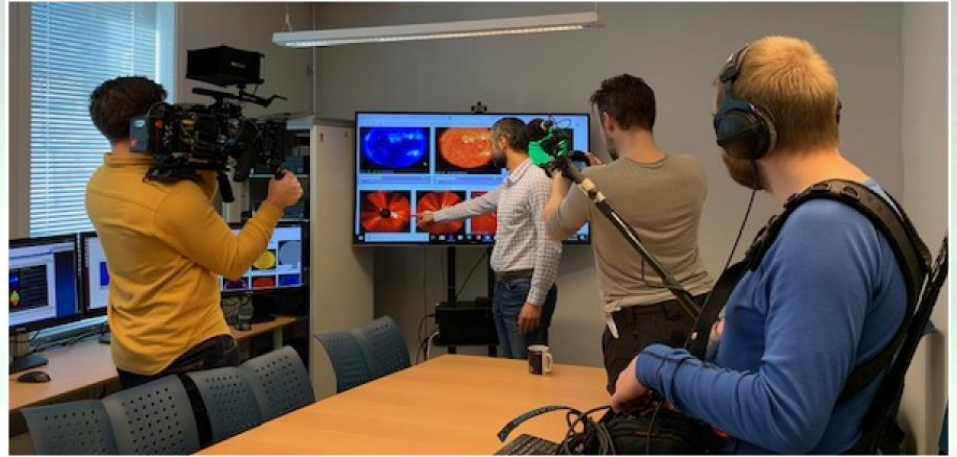
## Introduction

- End-user needs for a space weather service specific to the electricity user domain
- **What we need**
  - 1) A GIC forecast that is extremely precise and highly reliable minimum 4-5 days before the storm hit the earth.
  - 2) An experienced local Norwegian space weather team that our control centres can consult to discuss the implications of the weather forecast on our lines and transformers.

## Warnings and communication 8/5

24/7 capability?

→ Collaboration with  
Norwegian Meteorological  
institute



# Quarterly report on past space weather



## Workshops/education

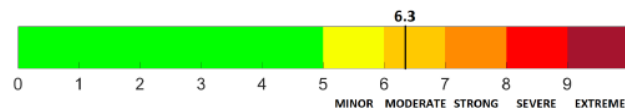


## REPORT ON PAST SPACE WEATHER

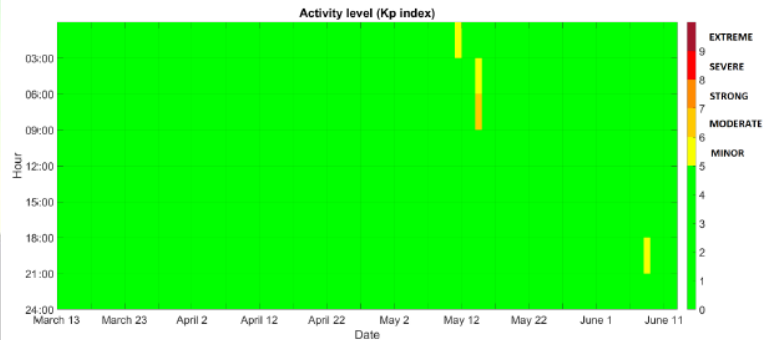
Q2 2019 13.3.2019 - 12.6.2019

### SUMMARY

Highest global activity level during the reporting period:

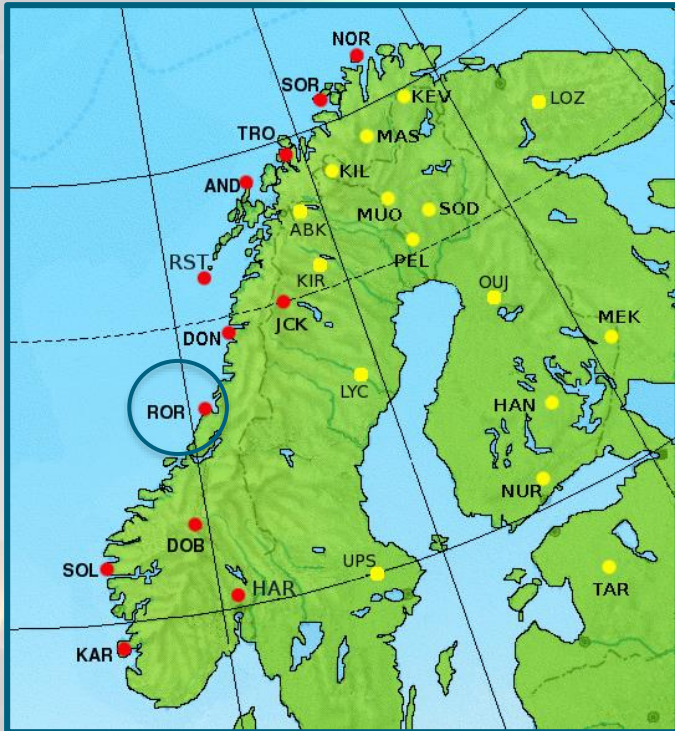


Global activity levels during the whole reporting period:



For more information on the global activity levels and their effects, see Table 2 in the Appendix.

# National space weather metrics



Transformer failures in mid-Norway

Sep 8<sup>th</sup> 2017 - Kp 8.0

Aug 26<sup>th</sup> 2018 - Kp 6.7

Scale	Description	Potential Effects	Physical measure [Kp index]	Average Frequency (1 cycle = 11 years)
G 5	Extreme	<b>Power systems:</b> Widespread voltage control problems and protective system problems can occur; some grid systems may experience complete collapse or blackouts. Transformers may experience damage.	9	4 per cycle (4 days per cycle)
G 4	Severe	<b>Power systems:</b> Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid.	8	100 per cycle (60 days per cycle)
G 3	Strong	<b>Power systems:</b> Voltage corrections may be required, false alarms triggered on	7	200 per cycle (130 days per cycle)

# Thank you!

[www.spaceweather.no](http://www.spaceweather.no)

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