

A large, curved view of the Earth from space, showing the blue oceans and white clouds against the black background of space. The Earth's horizon is visible on the left side.

## SWE SEGMENT OBJECTIVES FOR SSA P3

**JUHA-PEKKA LUNTAMA**  
SPACE WEATHER MANAGER  
SSA PROGRAMME OFFICE

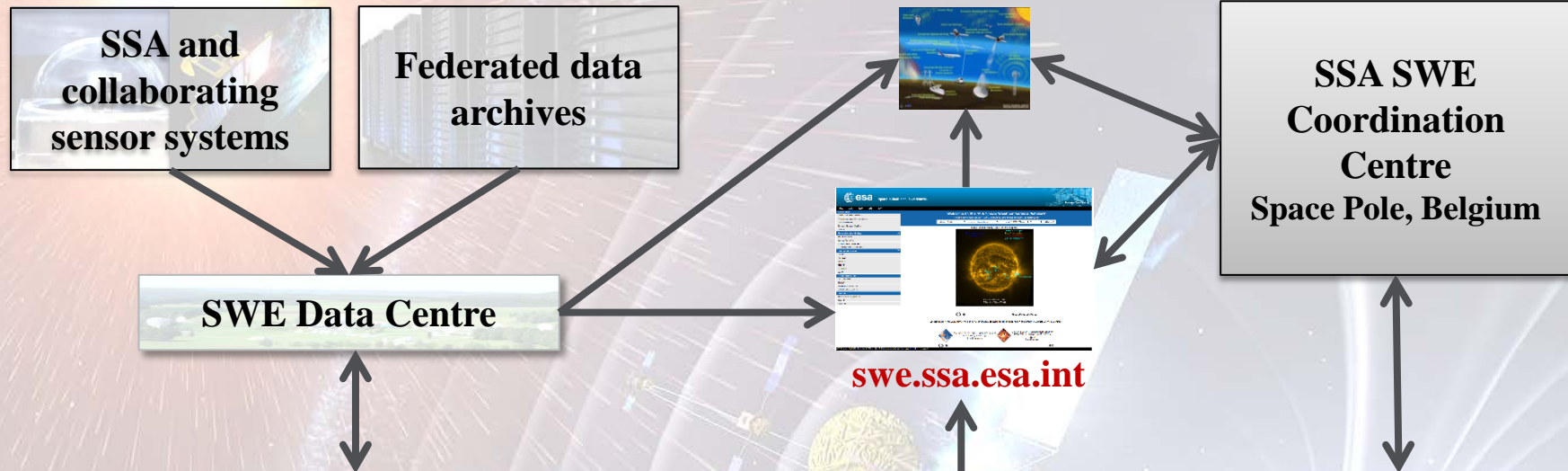
ESA DIRECTORATE FOR HUMAN SPACEFLIGHT AND OPERATIONS

SSA Period 3 Programme Preparation Workshop  
September 28, 2015

- **Objective:**
  - Protection of space and ground assets against adverse effects from space
  - Three main areas or segments:
    - Space Weather (SWE)
    - Near Earth Objects (NEO)
    - Technology R&D for Space Surveillance and Tracking (SST)
  
- **SSA Programme initiated in April 2008**  
(ESA Council, SSA Enabling Resolution)
  
- **SSA Programme executed in Periods**
  - Period 1 decided at MC in November 2008 (Prep. Programme)
  - Period 2 decided at MC12 in November 2012
  - Period 3 to be decided in MC in 2016



## SSA-SWE Users



## SWE Expert Service Centres

 <p><b>Solar Weather</b></p>	 <p><b>Ionospheric Weather</b></p>	 <p><b>Space Radiation</b></p>	 <p><b>Geomagnetic Conditions</b></p>	 <p><b>Heliospheric Weather</b></p>
---	--	---	---	---

European expert groups and centres of excellence

1. SSCC Maintains SWE product catalogue
  - a. 40+ federated product elements
  - b. Complete list ESC services
2. First line user support
  - a. [Helpdesk.swe@ssa.esa.int](mailto:Helpdesk.swe@ssa.esa.int)
  - b. SWE portal user registration
  - c. Ticketing system
3. ESC Interface
  - a. Detailed product specific questions relayed to ESCs
4. Network monitoring procedures
  - a. Daily/weekly/as needed basis
  - b. Monitor service & network performance and usage



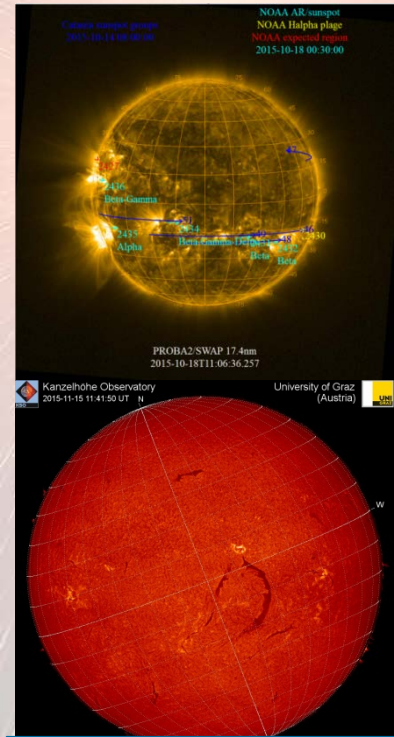
# Expert Service Centres in 2016

1. Solar Weather ESC
  - a. Coordinator ROB
    - KSO Uni Graz, RCAAM, INAF, FHNW
2. Space Radiation ESC
  - a. Coordinator BIRA
    - Seibersdorf, NKU, CSR, DLR, MSSL-UCL, PB, U Turku, IAP, SGO
3. Ionospheric Weather ESC
  - a. Coordinator DLR
    - NMA, NOAA, FMI, INGV, PAS, DTU, IAP, CLS
4. Geomagnetic Conditions ESC
  - a. Coordinator TGO
    - SIDC, DTU, FMI, GFZ, IRF, PGI
5. Heliospheric Weather
  - a. Coordinator STFC RAL Space
    - Met Office, Univ Graz, CDPP, DHC, U Gottingen, KU Leuven, DTU
6. 34 teams & more to come



# SSA SWE Products and Services

swe.ssa.esa.int



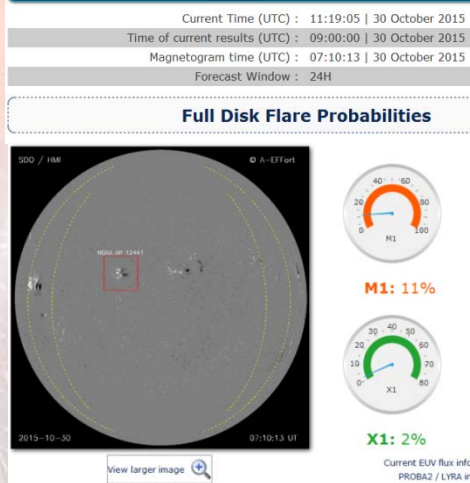
### A-EFFort

Athens Effective Solar Flare Forecasting

Next update in: 00 : 40 : 53

Home About us Product info Feedback form

Current Time (UTC) : 11:19:05 | 30 October 2015  
Time of current results (UTC) : 09:00:00 | 30 October 2015  
Magnetogram time (UTC) : 07:10:13 | 30 October 2015  
Forecast Window : 24H



### Geomagnetic Conditions

Ionospheric Conditions

#### Geomagnetic data from TGO for Geomagnetic Survey

Information about product for geomagnetic surveying

TGO Sites:

- Ny Alesund (NAL)
- Longyearbyen (LYR)
- Hopen (HOP)
- Bjornøya (BJN)
- Nordkapp (NOR)
- Serøya (SOR)
- Tromsø (TRO)
- Andenes (AND)
- Denne (DON)
- Sohnd (SOL)
- Dombås (DOB)
- Karroyv (KAR)

Custom date/time: 01012014 00

Realtime data only: Plot 24 hrs data, Digital - last hour, Digital - last 24 hrs

### GLE Alert System

Real Time GLE ALERT System  
National & Kapodistrian University of Athens / Cosmic Ray Group  
ISNet Company

DATA UPDATED EVERY MINUTE  
Fri, Oct 30, 2015 at 11:27:36 UTC

General Alert Status: QUIET

Alert Level	Count	Total
QUIET	00	34
WARNING	00	
WATCH	01	
QUIET	33	

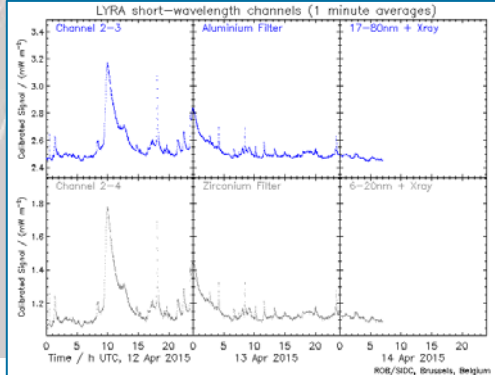
Stations Summary: Total [ 34 ]

Stations in GLE Alert (0)

Last GLE Alert 2014-11-15 04:15:00

Stations in Last GLE Alert AATB IRKS JUNG (3)

Station	Status
AATB	QUIET
IRKS	QUIET
JUNG	QUIET
APT	QUIET
ATHN	QUIET
BIUR	QUIET
CALM	QUIET
FSCN	QUIET
FSMT	WATCH
WATN	WATCH
BMK	QUIET
IRK2	QUIET
IRK1	QUIET
JUN2	QUIET
JUN1	QUIET
KERQ	QUIET
KIEL2	QUIET
LMKS	QUIET
MCMU	QUIET
MCRJ	QUIET
MGDH	QUIET
MJSC	QUIET
MIRY	QUIET
NAIN	QUIET
NEWK	QUIET
INVK	QUIET
OLAU	QUIET
PINK	QUIET
ROME	QUIET
SOPR	QUIET
SOPD	QUIET
TEEA	QUIET
THUL	QUIET
TBYV	QUIET
YKTK	QUIET



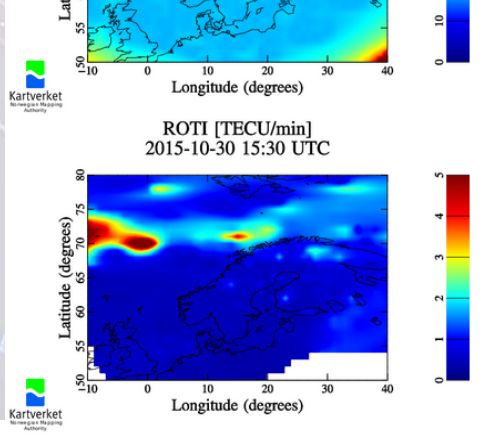
### SPENVIS

The Space Environment Information System

Welcome to ESA's Space Environment Information System, a WWW interface to models of the space environment and its effects, including the cosmic rays, natural radiation belts, solar energetic particles, plasmas, gases, and "microparticles".

System requirements  
SPENVIS requires a browser with JavaScript support (tested with Firefox 2.0.0.6 and MS-IE 7.0). Some outputs require a [VMS/3D0 plug-in](#) (tested with Octagon Player 2.3.0.0).

Current version  
The current version of SPENVIS (4.6.4) was released on June 19, 2011.



### AVIÕES

AVIATION DOSIMETRY

Current dose rate at 10:15:00

SEIBERSDORF LABORATORIES

AVIÕES 2.0

What does 10 µSv mean to me?

3 days of natural background radiation

10 µSv

Flight time (8h 00m)

Calculate



# Entering SSA Period 3

- Federated approach => utilisation of expertise and assets in SSA Member States
- Data processing and service provision through networked ESCs and SSCC  
=> responsibility for services and products
- SLAs with ESCs and key data providers => transition towards operational system
- User requirements for accuracy and timeliness hard to meet, particularly for forecasts  
=> **significant programme of key algorithm development**
- Expansion of existing ESCs through development and R2O activities
- Establishment of new ESCs foreseen

## SWE Expert Service Centres





- First line user support and helpdesk
- Monitoring of SWE system
- Interface with ESCs
- Evolution including new functions:
  - Provision of tailored services
  - Trusted broker for SWE products and services
  - Monitoring according to 3rd party SLAs
  - SWE Data Centre maintenance
  - Monitoring of SWE forecasts
  - Tasking and scheduling of dedicated campaigns
  - Alerts and warnings for severe SWE conditions
- Transition towards operational services with ESC support

**SSA SWE  
Coordination  
Centre  
Space Pole, Belgium**



**Magnetic  
Disturbances**

**Heliospheric  
Weather**

**European expert groups and centres of excellence**

# SSA SWE System evolution: Data Centres

**SSA and collaborating sensor systems**

**Federated data archives**

**SWE Data Centre**

**SWE Expert Service Centres**

**Solar Weather**

**Ionospheric Weather**

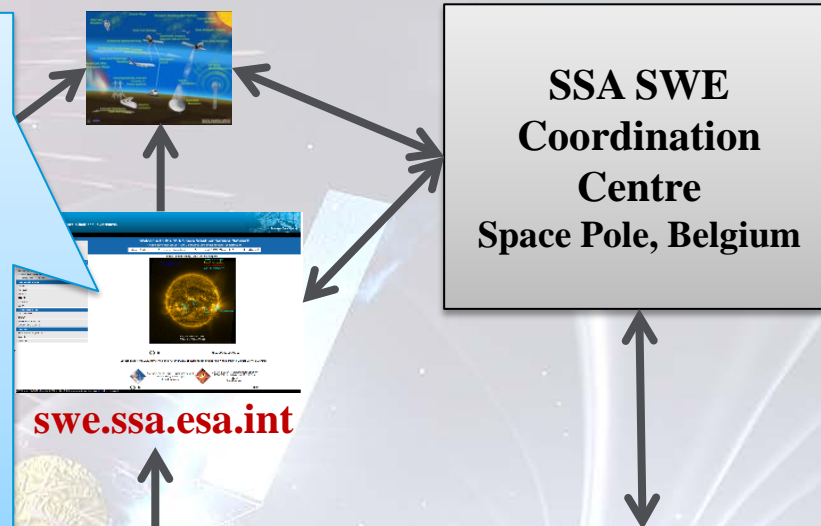
**European expert g**

- Repositories for SWE measurements and products
- Primary data centre in Redu
  - Hosting of SWE tools and applications
  - Hosting of SWE Service Portal
  - Data processing capability
- Coming enhancements in P3:
  - Complementing thematic data centres in Member States
  - Data processing of SSA sensor systems
  - Data import and export for federated applications
  - Enhancements for transition towards operational system

# SSA SWE System evolution: Service Portal

- Coming developments in P3:
  - Enhanced data visualisation and analysis tools
  - Advanced user authorisation
  - Enhanced tailoring and customisation for user preferences
  - Continuous improvement of the user experience

## SSA-SWE Users



**Solar  
Weather**

**Ionospheric  
Weather**

**Space  
Radiation**

**Geomagnetic  
Conditions**

**Heliospheric  
Weather**

European expert groups and centres of excellence

# SSA SWE System evolution: Measurement systems

**SSA and  
collaborating  
sensor systems**

**SWE Data**

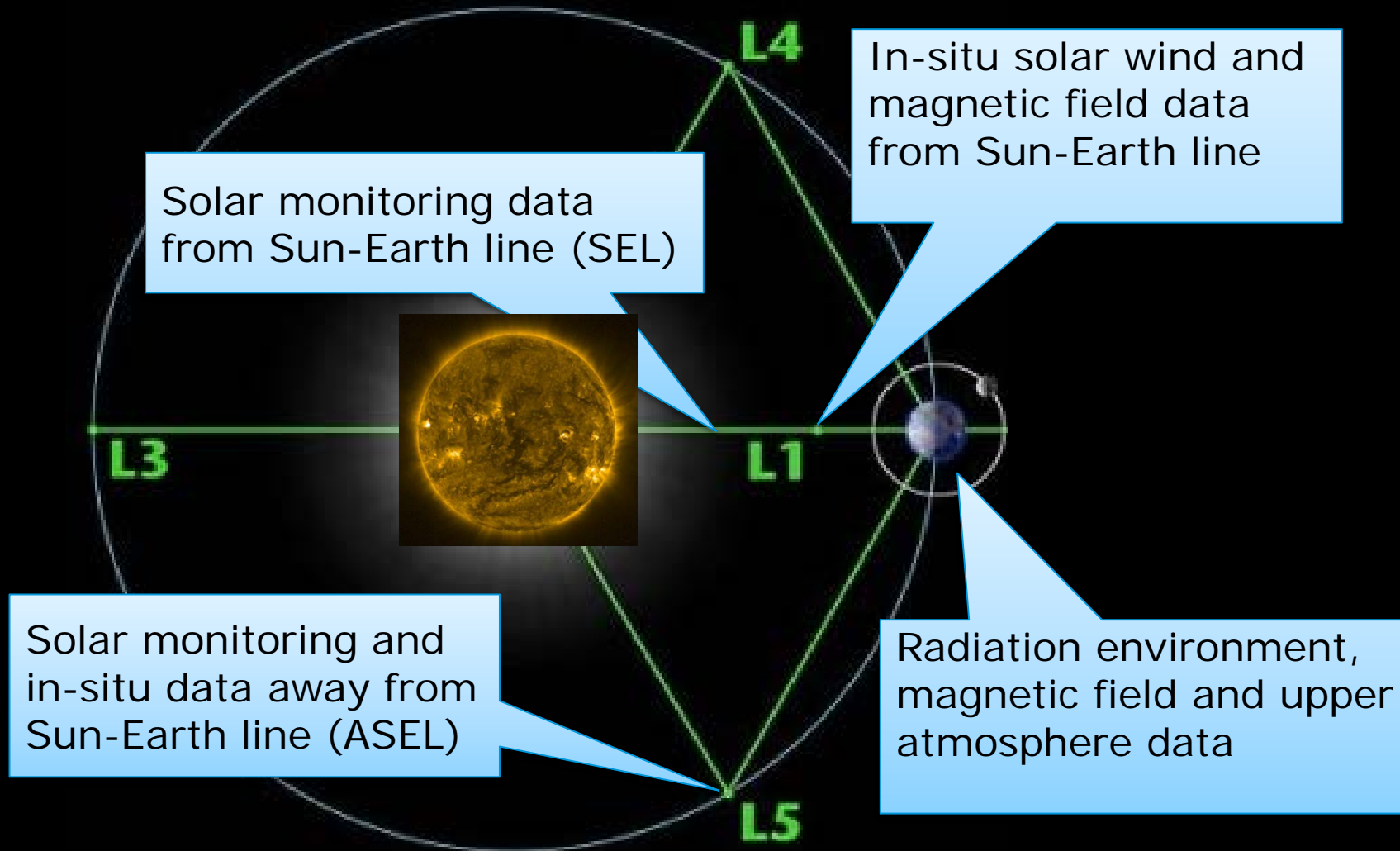
**SWE Expert Serv**

**Solar  
Weather**

- Utilisation of data from existing sources (groundbased and spaceborne) will be continued
- Activities in P3:
  - Enhancement of ground based measurement networks
  - SLAs with data providers
  - Proba-2 mission extension
  - Operation of the first hosted payload missions
    - NGRM
    - SOSMAG
  - Enhancement of the SWE space segment
    - Hosted payload missions
    - First dedicated SWE mission

**European expert groups and centres of excellence**

# SWE SPACE SEGMENT: KEY MEASUREMENTS



# SWE SPACE SEGMENT: P3 PRIORITIES



## Development of ASEL mission (L5):

- Solar corona monitoring
- Heliospheric imaging
- Solar disc magnetic field
- EUV imaging
- In-situ measurements:
  - solar wind
  - magnetic field
  - charged particles
  - hot plasma
- Mission phases in P3
  - A/B1
  - B2
  - Readiness for C/D

## Hosted payload missions:

- In-situ measurements in GEO, MEO, LEO and HEO
- Solar UV, EUV, X-ray flux
- Remote sensing of upper atmosphere

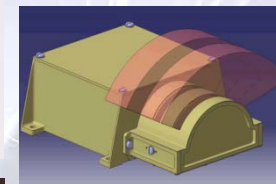
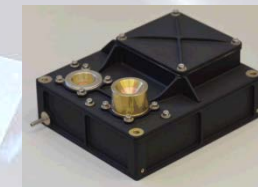
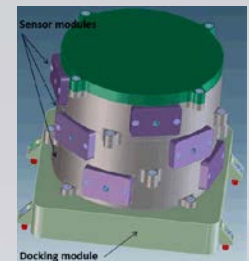
## Utilisation of European missions:

- Galileo, MTG, MOS,...

## Ensured other SEL data availability:

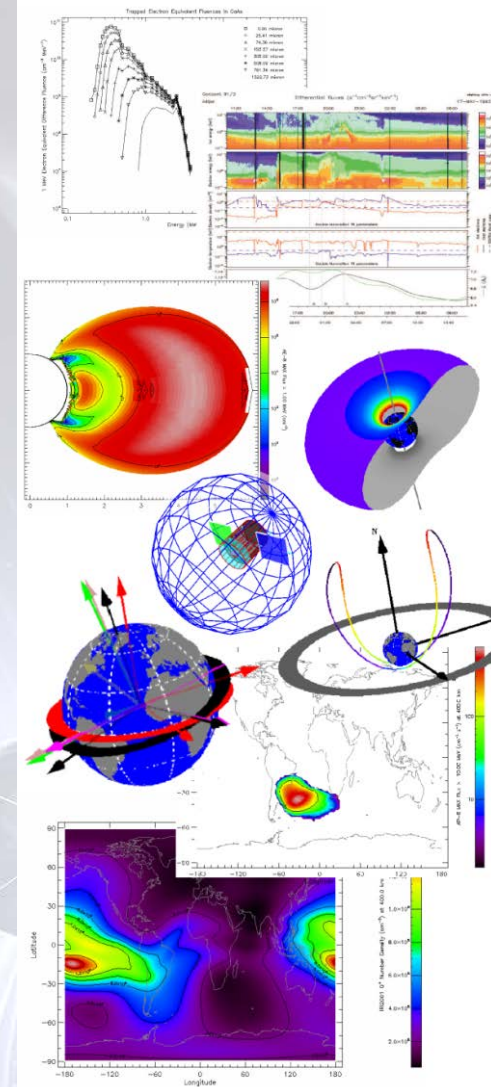
- In-situ L1 + solar imaging
- Potentially through agreements with international partners

- Prototyping new instrument technologies in coordination with ESA TRP, GSP and GSTP
  - Focus on operational instruments for SWE observations
- Flight opportunities for instruments
  - Enhancement of SWE space segment by hosted payloads
  - Raising TRL of the instruments for operational missions
  - Search for regular flight opportunities
- Development of GS technologies for advanced data processing
  - VSWMC
  - end-to-end simulations
  - Tools for space environment and s/c analysis



# Utilisation of scientific advances for SWE forecasting

- Accurate SWE forecasting is a key challenge
    - Required for effective mitigation of SWE hazard
    - Current skill mostly below user thresholds
    - “Understanding space weather to shield society: A global road map for 2015-2025 commissioned by COSPAR and ILWS”
  - SWE Segment activities support scientific research targeting key areas including:
    - Technology for advanced data processing
    - Model validation and inter-comparison
    - SWE data archive & latest data service
  - R2O activities building on ESC experience in P2
- => **utilisation of scientific advances to improve SWE capabilities**







**THANK YOU**

[swe.ssa.esa.int](http://swe.ssa.esa.int)

[www.esa.int](http://www.esa.int)

European Space Agency