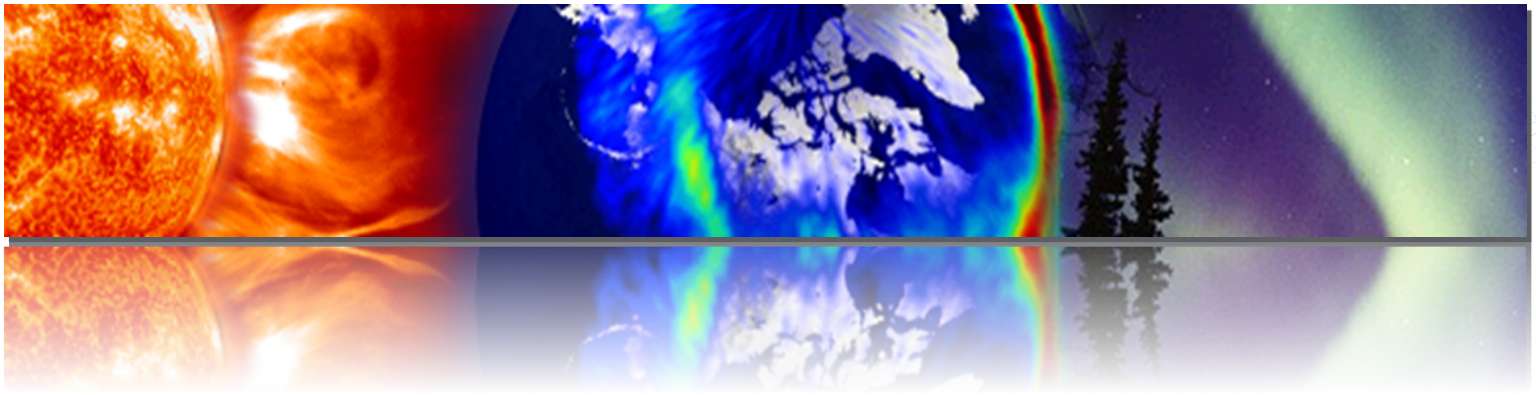


Building a Sustainable Framework for European Space Weather Services within the ESA SSA Programme

A Glover, J Luntama

SSA Programme Office, ESA/ESOC

European Space Agency

PURPOSE OF THE SSA PROGRAMME

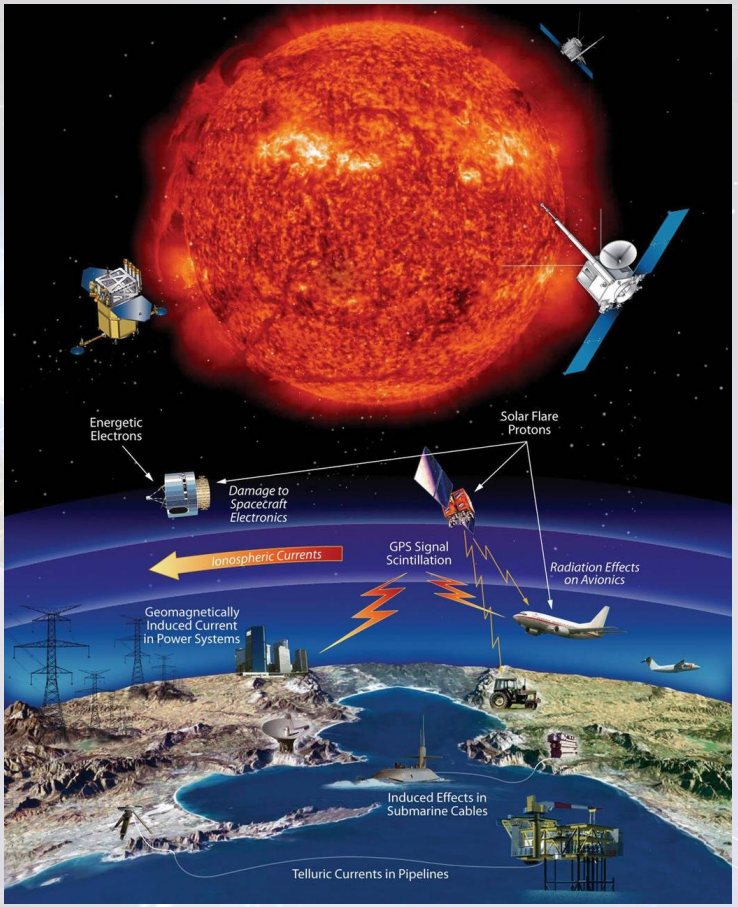
"The objective of the Space Situational Awareness (SSA) programme is to support the European independent utilisation of, and **access to, space** for research or services, through the **provision of timely and quality data**, information, services and knowledge regarding the **space environment**, the **threats** and the sustainable exploitation of the outer space **surrounding our planet Earth."**

- **ESA Ministerial Council November 2008**

ESA SSA SWE Segment Objectives

Detection and forecasting of Space Weather events and their effects on European space assets and ground based infrastructure

- Developments target 8 distinct user domains
- 39 tailored services:
  - Online tools and data repository
  - Alerting
  - Dedicated bulletins for priority users
- End users:
  - Continuous dialogue & consultation
  - Helpdesk feedback
    - Inform & improve requirements baseline

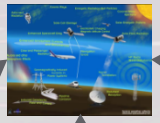


ESA SSA SWE System 2016

SSA and collaborating sensor systems

Federated data archives

SSA-SWE Users



SSA SWE Coordination Centre
Space Pole, Belgium

SWE Data Centre

swe.ssa.esa.int

SWE Expert Service Centres

Solar Weather | Ionospheric Weather | Space Radiation | Geomagnetic Conditions | Heliospheric Weather

European expert groups and centres of excellence

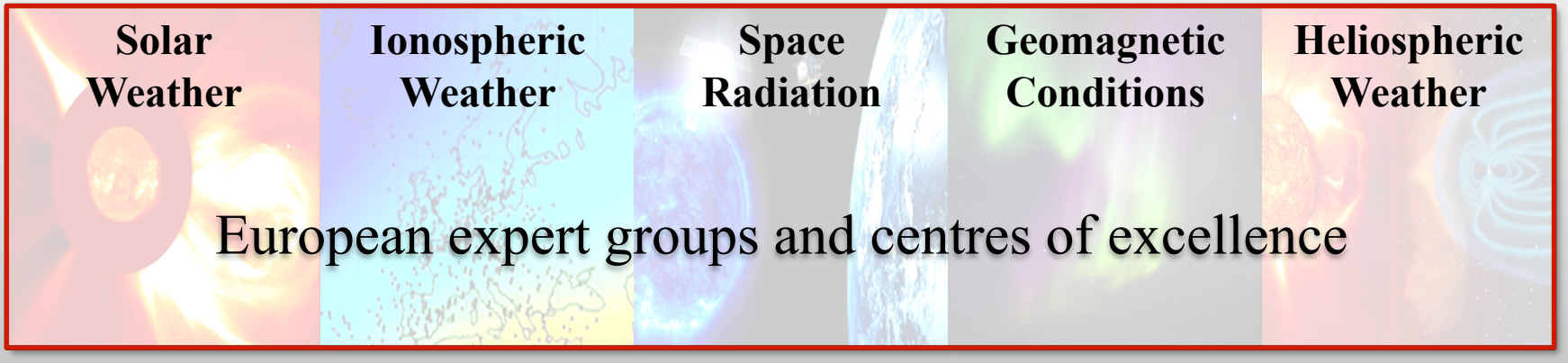
SSA Space Weather Coordination Centre

- User Support
  - Helpdesk (8/5) & guidance
  - Facilitating access to new SWE services
- Service Monitoring
  - Overall SWE network performance
    - SWE Data centre
    - Federated services
- Service Improvement
  - Engaging with user community
  - Translation of user feedback into service improvement recommendations

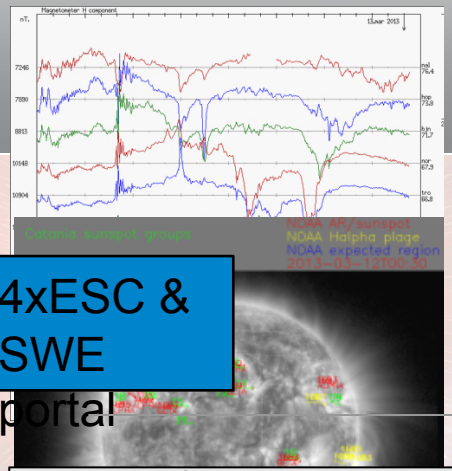
Expert Service Centres

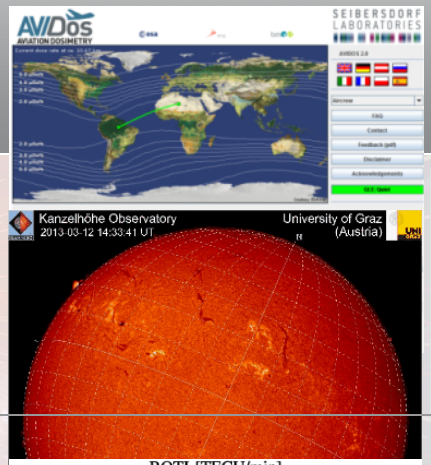
- ESCs are internationally distributed centres of expertise focused on a specific domain.
  - Coordinating Expert Group and participating Expert Groups from multiple SSA participating states
  - broad international collaboration, aiming to foster further development towards advanced space weather products and services
- Primary source for products in all 8 SWE Service Domains

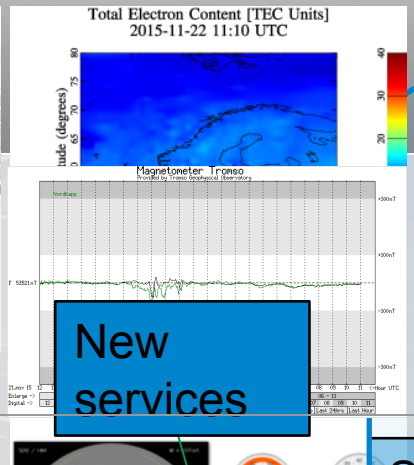
SWE Expert Service Centres

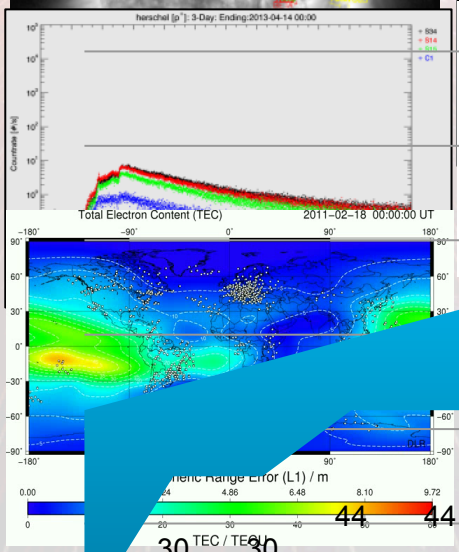


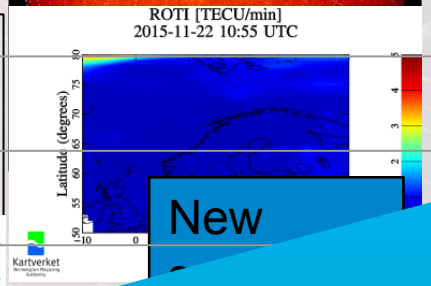
SWE Network Product Growth

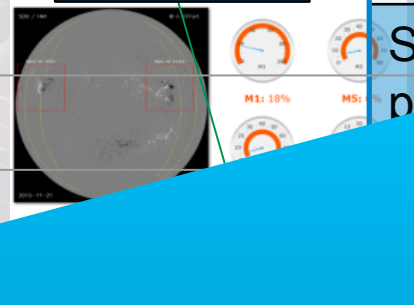












4xESC & SWE portal

New services

SWE-I pt2 + others

SWE-I pt1

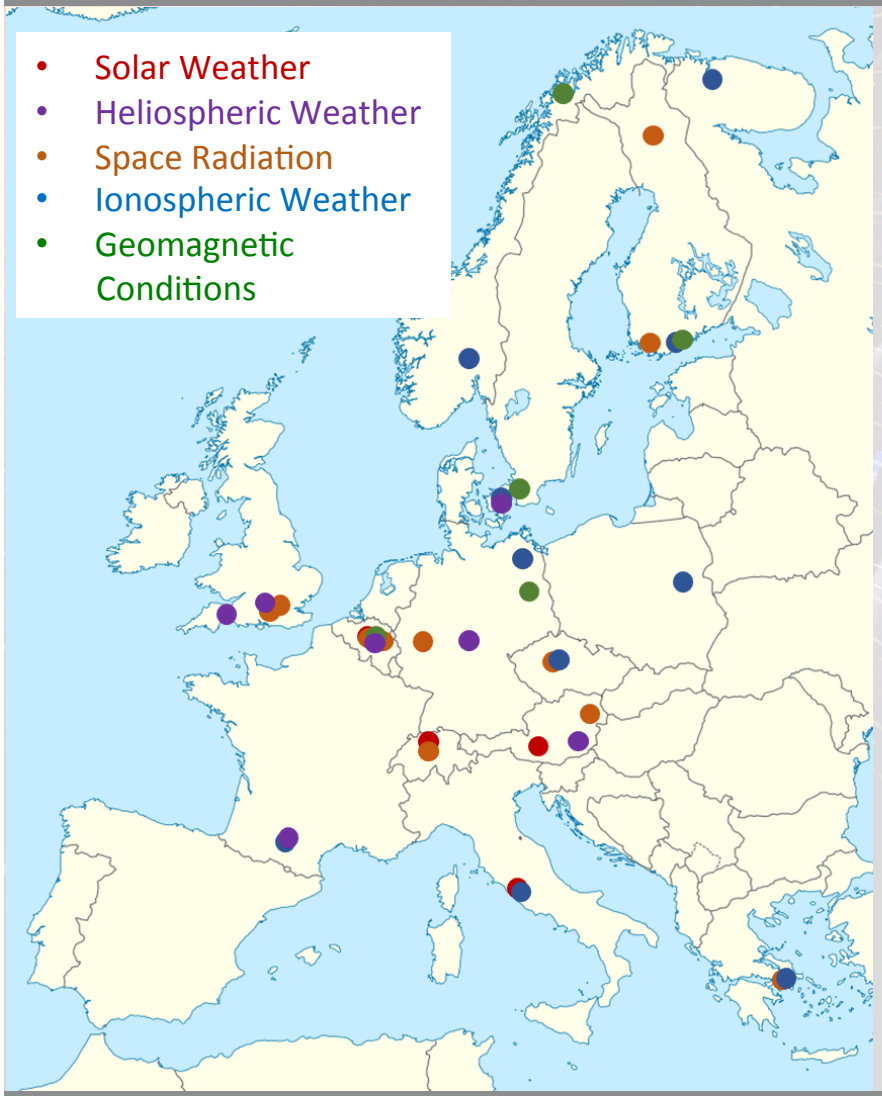
New

0 30 30 44 44 44 44 44 48 48 48 48 48 56 56 56 65 65 130 140

Mar May Jul- Sep Nov Jan- Mar May Jul- Sep Nov Jan- Mar May Jul- Sep Nov Jan- Mar May Jul- Sep Nov Jan- Mar May Jul- Sep Nov

SSCC operations

SSA SWE ESC Network 2016



Belgian Institute for Space Aeronomy
Centre de Données de la Physique des Plasmas
CLS Collecte Localisation Satellites
CSDRadConsultancy Ltd
DH Consultancy
DLR
Finnish Meteorological Institute
Helmholtz-Centre Potsdam – GFZ
Institute of Atmospheric Physics
Instituto Nazionale di Astrofisica
Istituto Nazionale di Geofisica e Vulcanologia
Kanzelhöhe Solar Observatory
MetOffice UK
Mullard Space Science Laboratory
National & Kapodistrian University of Athens
National Observatory of Athens
Norwegian Mapping Authority
Paul Buehler
Polar Geophysical Institute
Research Center for Astronomy and Applied Mathematics
Royal Observatory of Belgium
Seibersdorf Laboratories GmbH
SIDC - Solar Influences Data Center
Space Research Centre of the Polish Academy of Sciences
STFC RAL Space
Swedish Institute for Space Physics
Technical University of Denmark
Tromsø Geophysical Observatory
Université Catholique de Louvain Center for Space Radiations
University College London
University of Applied Sciences North Western Switzerland
University of Göttingen
University of Graz
University of Leuven
University of Oulu Sodankylä Geophysical Observatory
University of Turku

Structuring the Federated Network

User interface & tailoring

SSCC & SWE Portal
http://swe.ssa.esa.int

Roles and responsibilities, >300 customer requirements, >1900 (!) system requirements

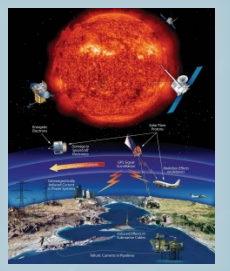
Service Composition

Expert Service Centre 5x Thematic Coordination
& 39 SWE Service Composition

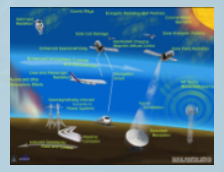
Consistent presentation, validation, user focus, metadata…

Individual Products

SWE Product layer
>30 Expert Groups, >140 products



End Users



ESC Definition & Development in 2016

- **ESC & Service Structuring:**
  - **Blueprint for a sustainable network** of SWE service provision based on distributed network with **strong involvement of scientific community**
    - From products to services (140+ products ➔ 39 services)
    - SLA templates to secure critical data
- **SWE Product Layer:**
  - **Benchmark products**: testing and validation, assessed against user needs → with real users
  - Product development: further work towards targeting **user needs** and delivery requirements

- Review of SWE service roadmaps
  - Reflect progress and identify **key technology developments** for long term improvement of services: Workshop @ ESOC, Darmstadt 10-12th May

SWE Targeted Developments

SN-VI: Services for aviation, resource exploitation & data visualisation toolkit

RHEA

P2-SWE-XIV: Virtual Space Weather Modelling Centre

KU LEUVEN

P2-SWE-II Services for SST domain users

elecnor deimos

Expert Service Centres Definition & Development P2-SWE-I

STFC RAL Space

UNIVERSITY OF TROMSØ

BIRA-IASB

Royal Observatory of Belgium

DLR

AIRBUS DEFENCE & SPACE

P2-SWE-XIII Advanced prototypes: spacecraft operations

P2-SWE-XVI Utilisation of Swarm data for SWE services

GFZ Helmholtz-Zentrum POTSDAM

P2-SWE-XII Tailoring for Arctic Region users

DTU

P2-SWE-XXIV Advanced geomagnetic services

SWE Network looking forward

- Currently developing basis for a sustainable (pre)operational network of entities collaborating to provide high priority SWE services addressing End User needs
- Scope and main focus for next Period (2017-2020) to be decided at ESA Ministerial Council meeting Dec 2016
- Parallel studies (not covered in this presentation) looking at space segment developments during the same period

- SSA applications driven programme targeting services for end users ~~but~~ **AND** foresee good opportunities for targeted space weather R&D
  - Thematic workshops next month @ ESOC ~100 scientists & users discussing priority next step developments

- Network in phase of rapid growth: opportunities for international cooperation, particularly within scientific frameworks, set to expand as network matures

THANK YOU

swe.ssa.esa.int
www.esa.int

European Space Agency