SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

Participants: 104 online + x on site…

Agenda

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

Minutes:

- **Short SWWT intro** (S. Poedts): see slides
- **Planning for Chair election** (Stefaan/Alexi): Call for expressions of interest for chair of the SWWT
- **Space Safety Program update** (Jussi/Alexi): Jussi first gave a short overview of the ESA Space Weather Activities in the Space Safety Programme (see slides).

  Then Alexi gave an update of the ESA Space Weather Service Network, including the new SWESNET activity that just started (see slides).

- **ESA technology programmes** (Piers): Piers went over the different technology programmes and Technology R&D for Space Weather and gave a brief update (see slides).

- **TWG reports** (TWG leaders): short reports of three TWG leaders (see slides)

- **WMO plans in space weather** (Ken Holmlund): see the slides of Ken.

- **Short report on UK national severe space weather preparedness strategy** (Mike Hapgood). Mike did not present slides but rather encouraged people to go a look at the slides that Mark Prowse presented this morning in his talk on the UK strategy. He orally highlighted some points that may be of particular interest to SWWT attendees, e.g. the high-level structure of the strategy and what that implies for future work, especially in regards of international collaboration.

- E**SF/European Space Science Committee** (Mauro Messerotti). Mauro gave a short overview of the activities of the European Space Sciences Committee, Europe‘s Advisor on Space Science and Policy since 1974. See slides.

- **Quo Vadis election results** (Sophie Chabanski). Sophie gave some background on the Quo Vadis initiative and revealed the results of the vote on the name of the newly formed community: E-SWAN (European Space Weather and space climate Association). See slides.

- **Next meeting announcement** (Mateja Dumbović). Mateja presented the ESWW2022 which will be organized in Zagreb (see slides).

SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

SWWT intro

- The SWWT is a **forum** open to European experts in a variety of both scientific and applied fields relating to space weather.
- The SWWT plays an **important role in advising ESA in space weather strategy** and acts as a forum for discussion amongst the European space weather community.
- The SWWT is responsible for **promoting coordinated European space weather activities at both national and industry levels**.

SWWT intro

- The SWWT seeks to identify and discuss **potential collaborations and/or synergies** with other structures or organisations such as the EC H2020 & COST programmes and others.
- SWWT membership is **open** to representatives of any European university, institute, company, or international organisation currently undertaking space weather related activities or affected by space weather.

Topical Working Groups

- Several **Topical Working Groups** (TWGs) maintain regular contact via email. TWGs are responsible for *initiating projects, discussing new advances and/or progress in existing research and service development*. The current list of TWGs is as follows:
  - Drivers of Space Weather Subgroup: Solar Storms (Solar Flares, CMEs, SEP events), spokepersons: N. Vilmer (Paris Observatory) and O. Malandraki (NOA)
  - **Ground Effects** (GIC, prospecting, tourism), spokesperson: Ari Viljanen (FMI)
  - Atmospheric Effects (incl. drag), spokesperson: S. Bruinsma (CNES)
  - Ionospheric Effects, spokesperson: M. Angling (University of Birmingham and QinetiQ)
  - **Spacecraft, Launcher and Aircraft Environments**, spokesperson: S. McKenna-Lawlor (STIL), co-spokespersons F. di Marco (VEGA) and G. Reitz (DLR)
  - **Education, Outreach and Emerging Markets**, spokesperson: P. Vanlommel (ROB), co-spokesperson G. Cessateur (BIRA-IASB)
  - Space Weather Forecast, spokesperson: L. Trichtchenko (NRCan), co-spokesperson S. Bloomfield (Trinity College Dublin)

SWWT short history

- SWWT was set up to coincide with the start of ESA's two parallel space weather studies (RAL and Alcatel-Space) in 1999 and originally consisted of approximately 30 SWWT members coming from a variety of backgrounds and ESA member states.
- In 2003 the SWWT became open to the wider European space weather community during the Space Weather Application Pilot Project. During this phase, the SWWT assisted ESA in evaluating the lessons learned from the operation of the pilot project and how these changes could be implemented within a strategy for any future space weather programme.
- With SWWT membership steadily growing it was decided in 2006 to create the SWWT Steering Board (third phase of the SWWT).

SWWT short history

- On Jan 1st 2009 the SWWT entered its fourth phase with the formal launch of the ESA Space Situational Awareness Preparatory Programme (SSA-PP).
- Today the SWWT has grown into a community of more than 200 members covering a wide range of disciplines and nationalities.

SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

Space Weather Working Team Evolution

- Alexi Glover(ESA), Stefaan Poedts (KULeuven)

- SWWT Plenary Meeting
- ESWW17, Glasgow, UK

SWWT Objectives

- Advise ESA on strategies and objectives in space weather
    - Service priorities & community feedback
    - Provide a means for community input to/feedback on the process
  - Representation on Lagrange Mission Advisory Group (MAG)
  - Lessons learned from precursor activities
  - Inputs on future strategy

- Facilitate information exchange

- European SWE Roadmap and other initiatives

- Actions supporting the wider space weather community

Evolution and New Chair Election

- Current structure under review in light of evolution both in ESA S2P and within wider space weather domain
- ToR update
- ***Volunteers for new chair needed!***
- Mandate: 2 years +1

- Draft Schedule for chair election:
- *19/11/21 Expressions of interest -> email to Stefaan Poedts and Alexi Glover: short statement of motivation (1 paragraph)*
- *26/11/21 list of candidates and motivation statements sent to SWWT mailing list for online vote*
- *10/12/2021 voting closes*
- *17/12/2021 new SWWT chair announcement*

SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

ESA Space Weather Activities in the Space Safety Programme

Juha-Pekka Luntama

17th European Space Weather Week

25-29.10.2021

S2P SPACE WEATHER SYSTEM OBJECTIVES

Space Weather Service Network

Early warnings with actionable information

Space weather monitoring system

Ground & space

S2P Developments

Tailored space weather services

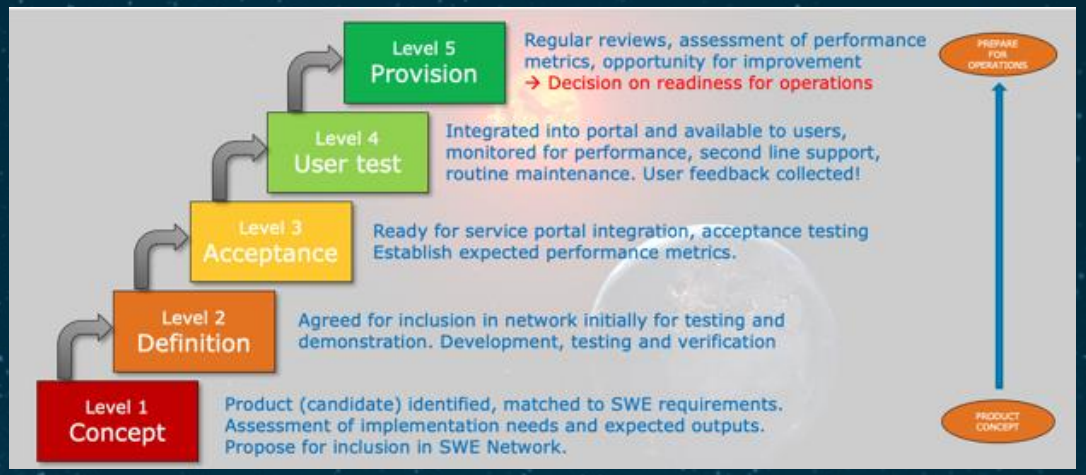
Space Weather protection for Europe

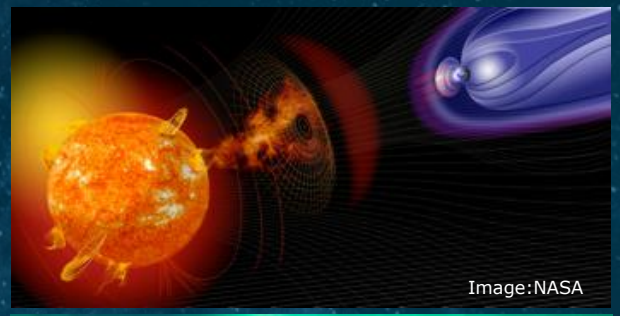
Resilient society

- User engagement
- Impact studies
- CBAs
- Focussed tools and apps
- Awareness

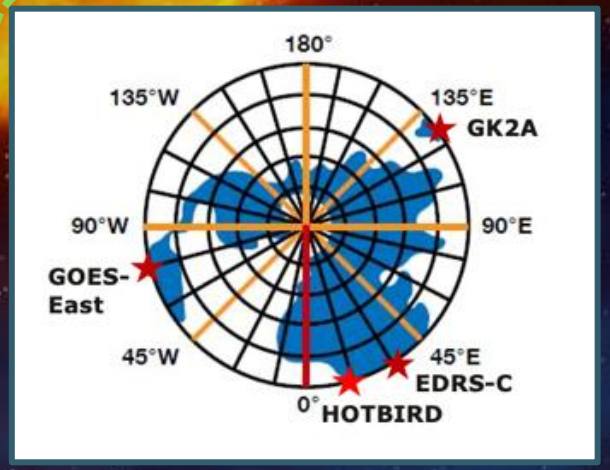
SPACE WEATHER CAPABILITY ENHANCEMENT

- World class R2O – O2R environment
  - Testing, validating, maturing European prototypes
  - Utilisation of existing and new measurement data
  - Readiness for transition to operational framework
- Enhancement of SWE service concept
  - User driven capability developments
  - Added-value elements: use cases, event reports, user training, service tailoring
  - Networkwide alerting approach
- End-to-end space weather modelling
  - Utilising results of developments in progress: VSWMC, SPENVIS-NG, …
- Coordination of ESA and EU funded activities





HOSTED PAYLOAD ACHIEVEMENTS



SOSMAG

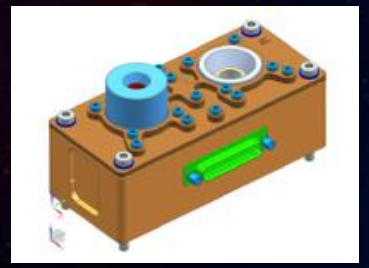
GK2A 2018

ICARE-NG

HOTBIRD™ F1 2022 + ERSA on Lunar Gateway 2023/2024

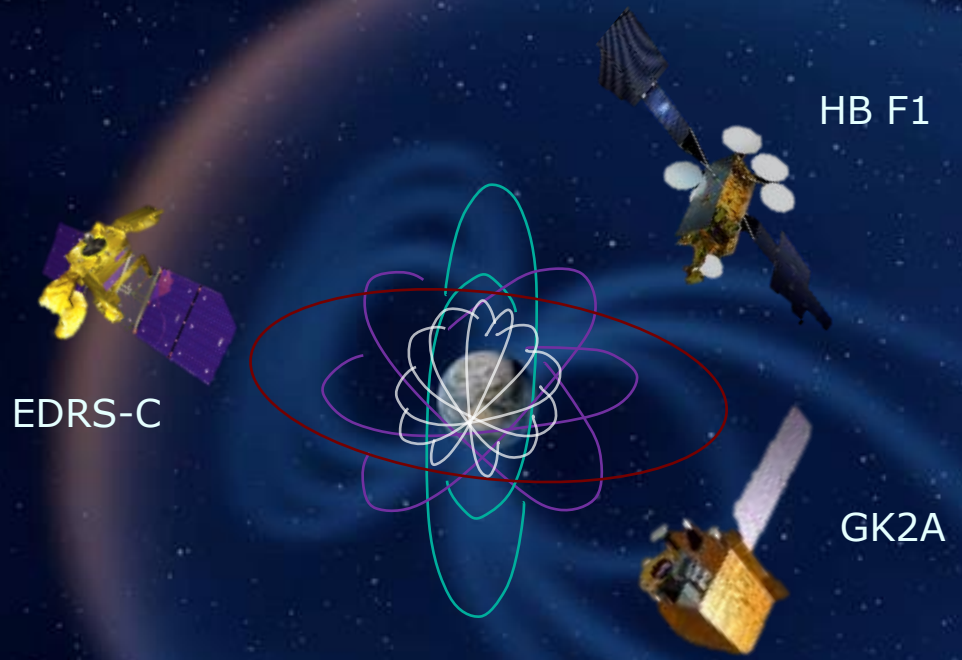
NGRM

EDRS-C 2019 (as RMU on MTG, Metop-SG, Sentinel-6,…)



MiniRMU

Lunar Pathfinder 2023/2024



D3S HOSTED PAYLOADS – NEXT STEPS

S2P P1

- Hosted payload radiation monitor in LEO
- Development of miniaturised radiation/magnetic field instrument package
  - ➢ Base on RadCube IOD launched in August 2021

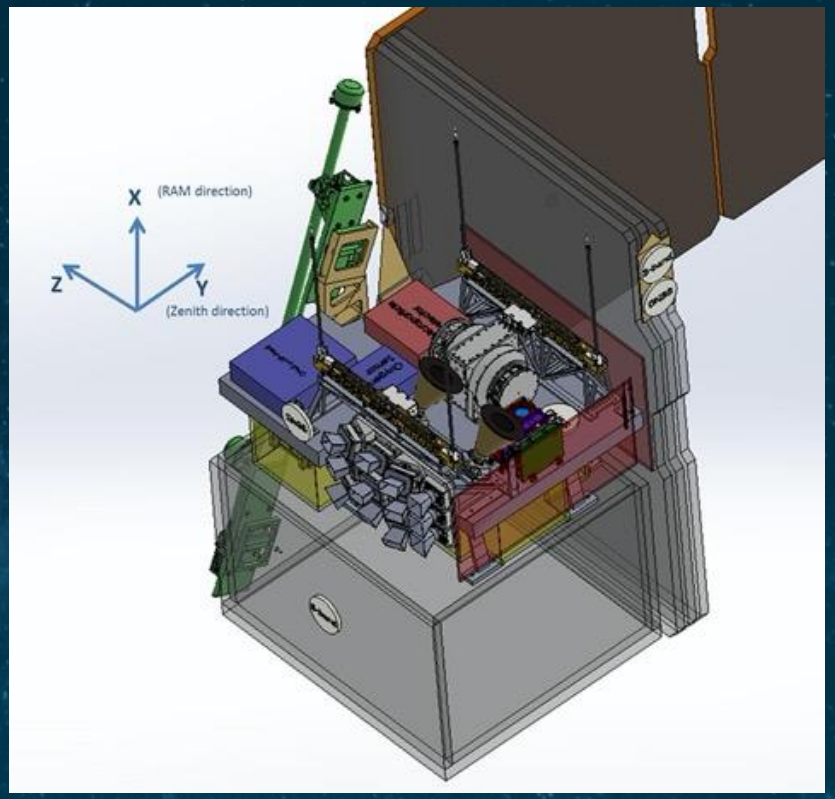
S2P P2

- Magnetometer in GEO at European Longitudes
- In-situ package for MEO s/c
- Radiation monitors on s/c in undersampled regions
- Environment monitoring package in large constellations
- Continuous radiation monitoring in Lunar orbit
- …

D3S SMALLSAT MISSION STUDY

SWE SmallSat Phase A/B:

- Continuous auroral oval monitoring and multi-point in-situ measurements of Earth's magnetosphere, ionosphere and thermosphere
- Payload candidates:
  - **WFAI (optical & FUV)**
  - Magnetometer
  - Radiation Monitor
  - Multi-Needle Langmuir Probe
  - Plasma Analyser
  - Oxygen Sensor
  - GNSS receiver
  - Microparticle Detector



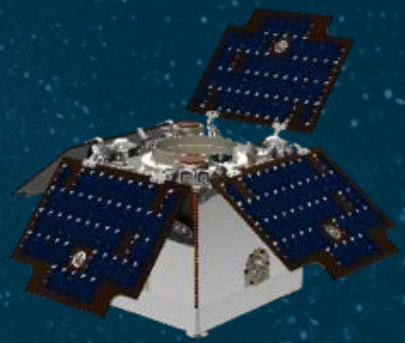
- **Two new mission concept studies to be initiated in Q4 2021**

D3S NANOSATELLITE MISSIONS

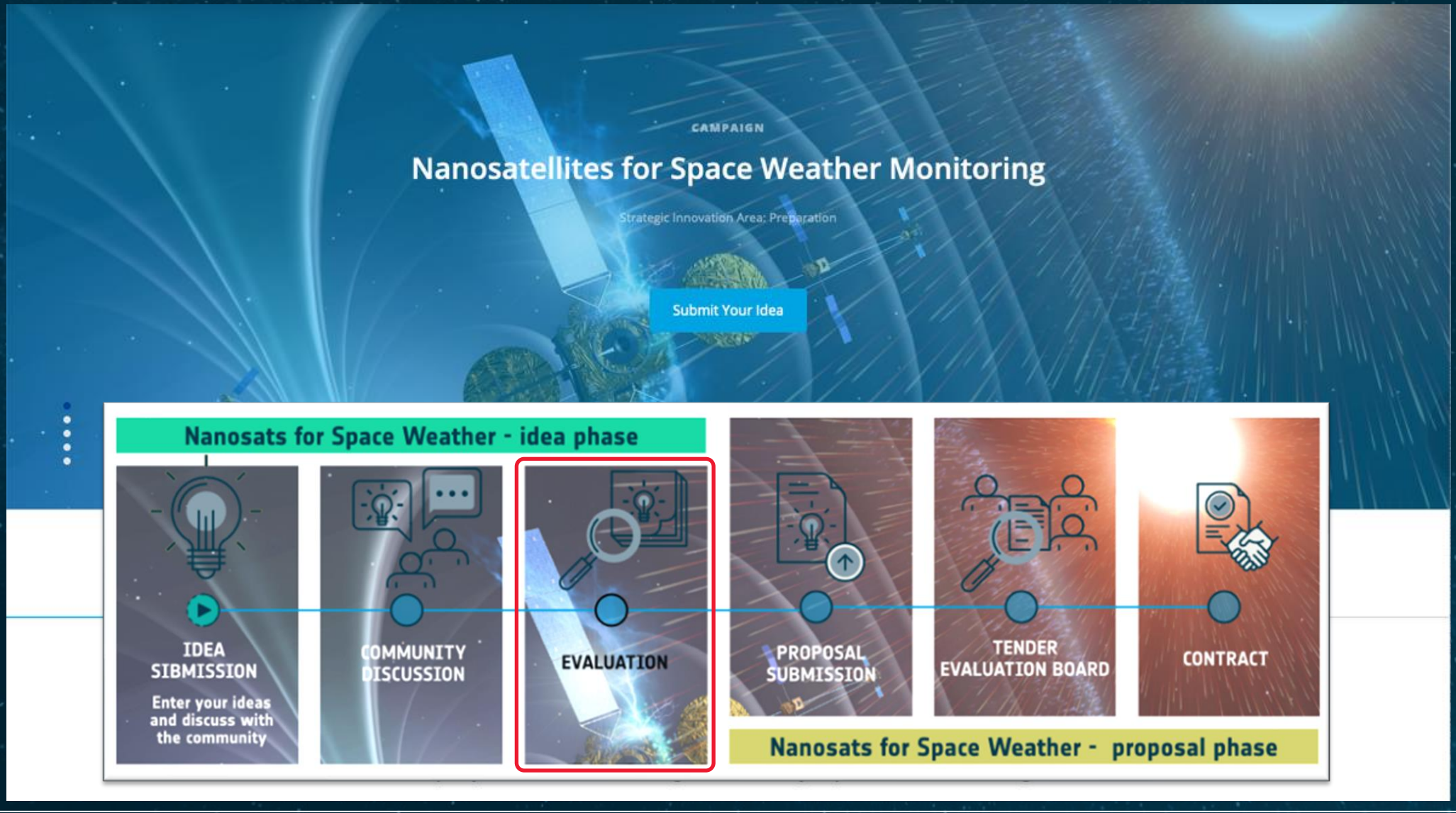
- Phase 0/A study in progress by SSTL
- Scope:
  - Mission concept study to assess feasability (latency, lifetime, reliability) to use nanosatellites for operational space weather monitoring in near-Earth space
- Mission baseline overview:
  - Orbit: 500-600 km SSO, LTAN 10:30, 3-5 years lifetime
  - Platforms: 12 U / 16 U / Microsat – all with fully redundant avionics
  - # S/C: 2 – 20, with or w/o ISL
  - Successful MAR in July

    => two mission baselines selected for next study phase

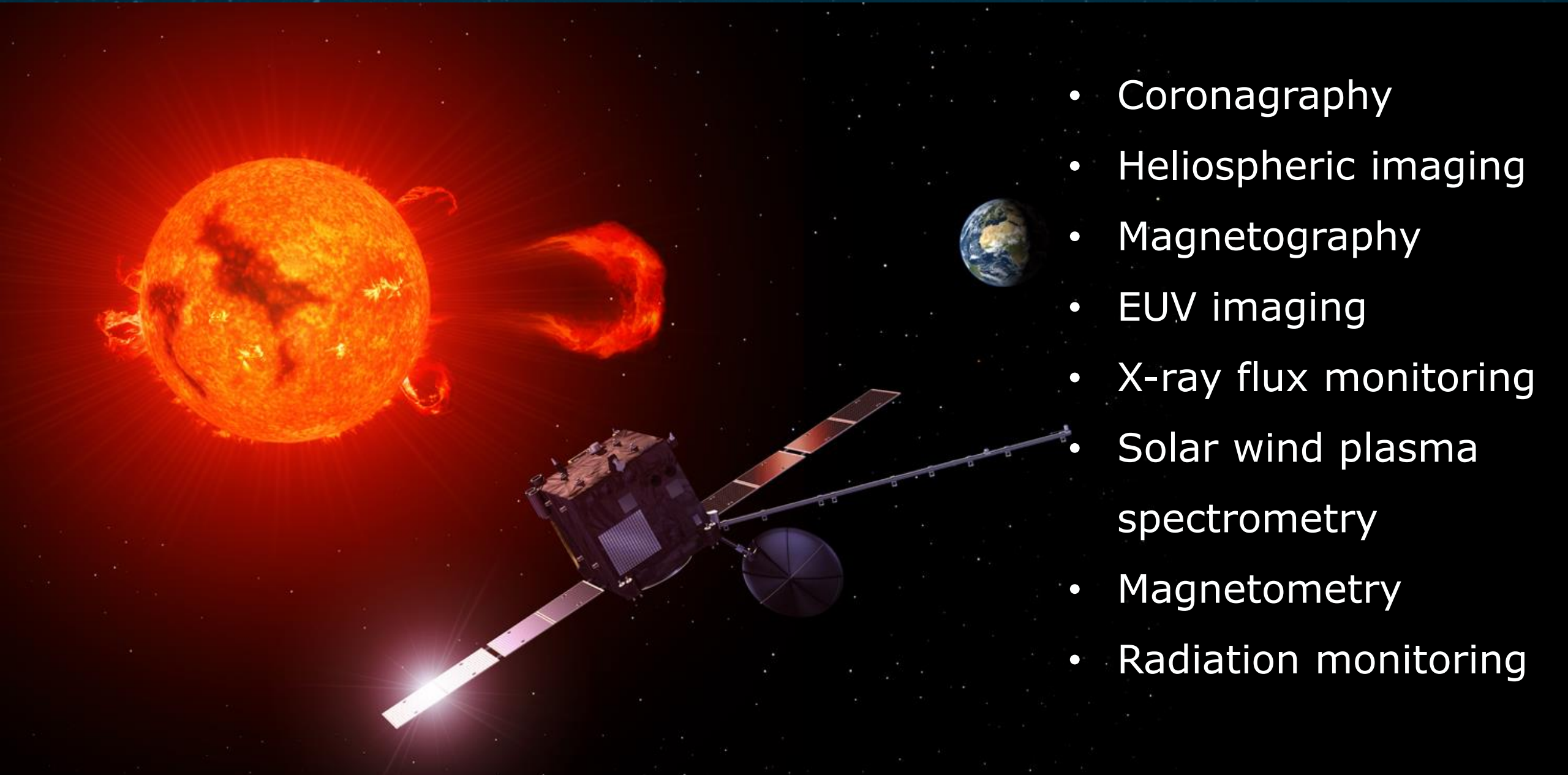
    => observations: radiation, magnetic field, upper atmosphere, plasma



Nanosatellite Community Challenge



LAGRANGE MISSION TO L5



- Coronagraphy
- Heliospheric imaging
- Magnetography
- EUV imaging
- X-ray flux monitoring
- Solar wind plasma spectrometry
- Magnetometry
- Radiation monitoring

THANK YOU

swe.ssa.esa.int

www.esa.int

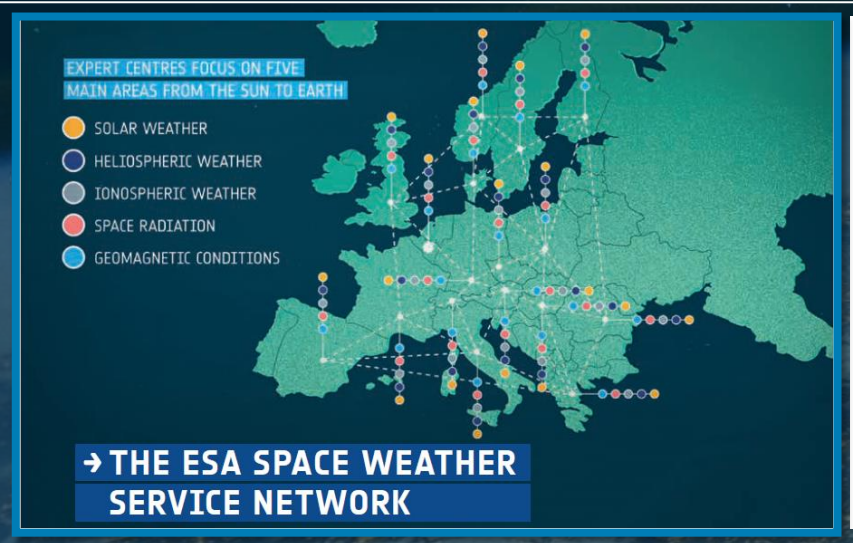
@esaspaceweather

ESA Space Weather Service Network Update

Alexi Glover & OPS-SW Team
Space Weather Office, Space Safety Programme Office, ESA/ESOC, Darmstadt, Germany

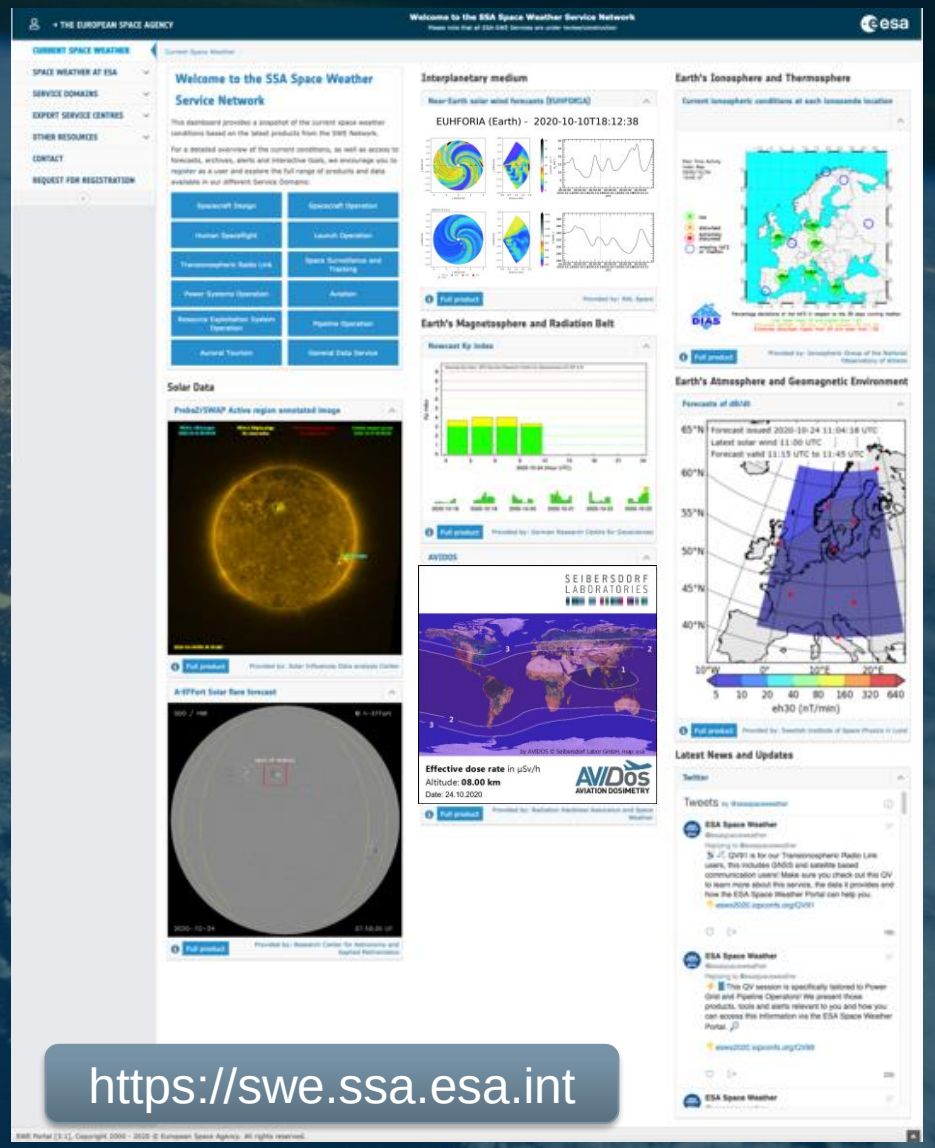
27/10/2021

ESA SPACE WEATHER SERVICE NETWORK TODAY



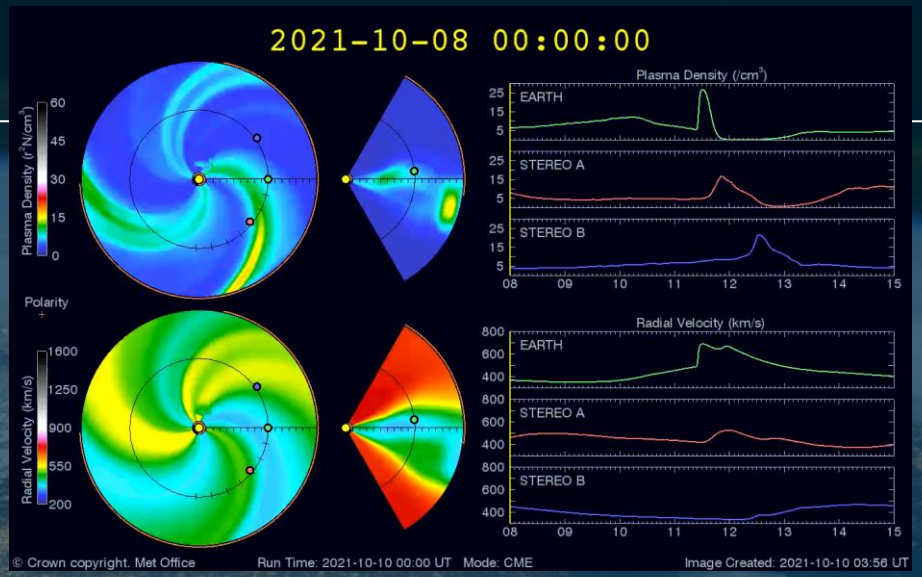
Spacecraft Design	Spacecraft Operation
Human Spaceflight	Launch Operation
Transionospheric Radio Link	Space Surveillance and Tracking
Power Systems Operation	Aviation
Resource Exploitation System Operation	Pipeline Operation
Auroral Tourism	General Data Service

- 29 pre-operational services based on >200 products
- Service user support and staffed helpdesk
- European Service Network of >50 participating entities
- > 1800 registered users
- > 1.5M hits on service portal monthly
- Coordinated Communication Protocol

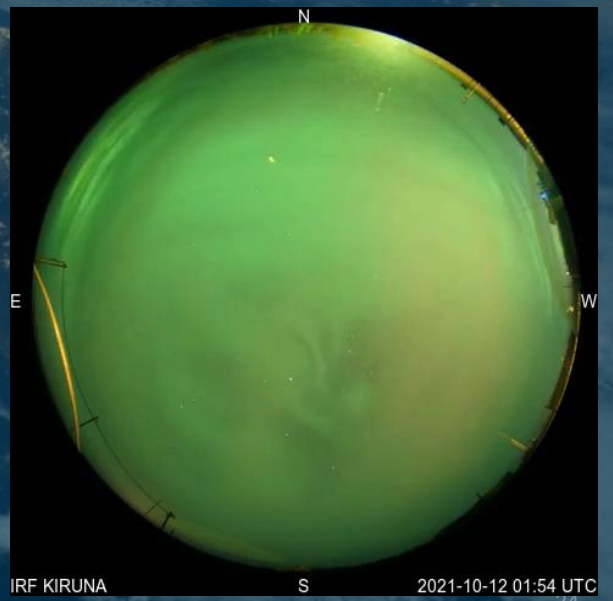


SWE Portal Deployment 3.3

- >50 new and updated products
- New and updated tiles
  - Including SOSMAG
- New aurora dashboard
- https://swe.ssa.esa.int/nso_tou_dashboard



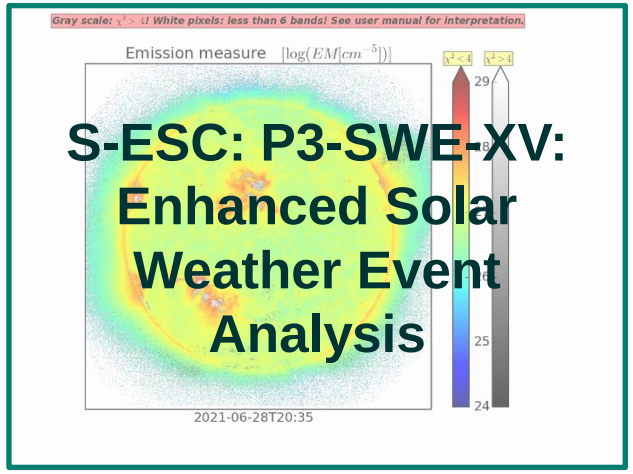
- Release date 7th October
- CME on 9th October led to geomagnetic activity overnight on 11th October



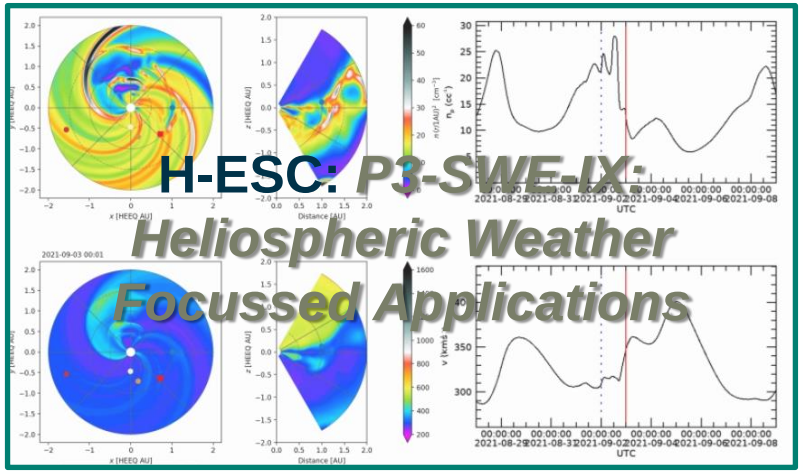
SWESNET Activity KO

- New development phase for the SWE Service Network
  - 2-yr activity KO September 2021
  - Lead BIRA/BUSOC, 50+ teams participating
- Brings together ESC and SSCC activities
  - Pre-operational service provision
  - Product and service development
- Consolidation phase
  - Review of tools, templates and means of operation
- End user engagement
  - End user events and training during ESWW
  - End-user targeted webinar 19th Oct, follow-up with user workshop in November

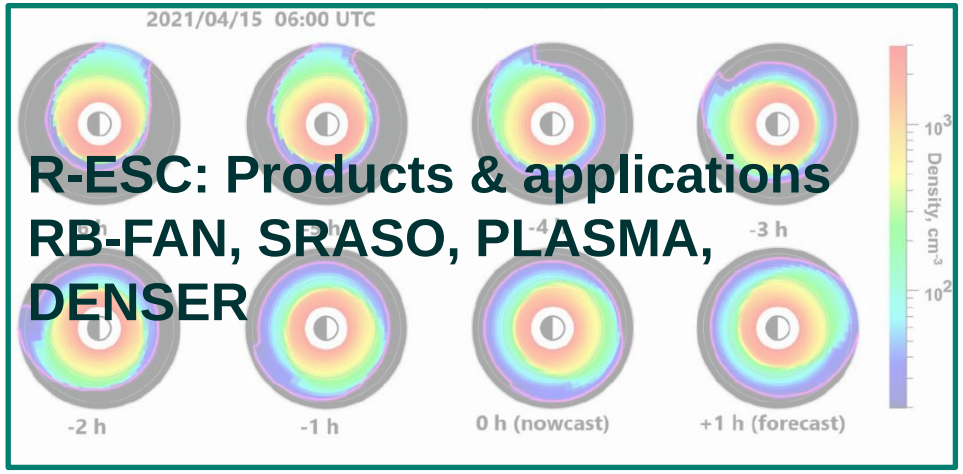
SWE Service Ecosystem



S-ESC: P3-SWE-XV: Enhanced Solar Weather Event Analysis



H-ESC: *P3-SWE-IX: Heliospheric Weather Focussed Applications*



R-ESC: Products & applications RB-FAN, SRASO, PLASMA, DENSER

I-ESC: SWIGPAD: GNSS performance, *P3-SWE-XXXVII: SWE for Southern Europe, P3-SWE-XL: Scintillation Products for Arctic*

G-ESC: MAG-SWE-DAN, DENSER, *P3-SWE-XXXVII: SWE for Southern Europe, P3-SWE-XLV: 3D MHD Modelling of Earth's Magnetosphere*

- **Planning: P3-SWE-VIII: SWE Service System Design, User Requirements for Med. Region, Use of L5 data in CME propagation, LOFAR demonstration**
- **Technology/tools *P3-SWE-XLIV: Online validation platform*, VSWMC pt 3, 3D Ionospheric Modelling**

- SWESNET developments feed into parallel developments
- Results of parallel activities integrated into network following successful validation, testing & acceptance

System Design Study: P3-SWE-VIII

- Current system considered to be pre-operational
  - Mature service provision with monitoring, support available during normal working hours
- Improved networking and interfacing between components
  - API
  - Standard data and metadata model
  - Support for alerting, role of GEN services
  - System wide monitoring and control
- Parallel system design activity P3-SWE-VIII [Lead: Rhea UK]
  - Recommendation and roadmap for system upgrade/enhancement towards a hybrid approach to service provision including both operational and pre-operational elements
  - Includes core enabling software such as service portal, interfacing and monitoring components
  - Phase 2 about to start, full design expected next spring
  - Workshop proposal with SSCC & ESC participation in November


THANK YOU
www.esa.int
swe.ssa.esa.int
@esaspaceweather
esa
→ THE EUROPEAN SPACE AGENCY

SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

ESA's Technology Programmes

- Wide range of technology programmes in ESA funding developments:
- **Technology Development Element (TDE)** for Advancing novel technologies
- Work plan was determined in 2020 for 2021 & 2022 - Many new activities
- Primarily open competition with participation from any ESA member state.

- **General support Technology Programme (GSTP)** compendium update expected in 2022
- Activities must be supported by delegation before ITT issue.
- Should be mature hardware/software concepts

- All ITTs can be found on ESA-Star:

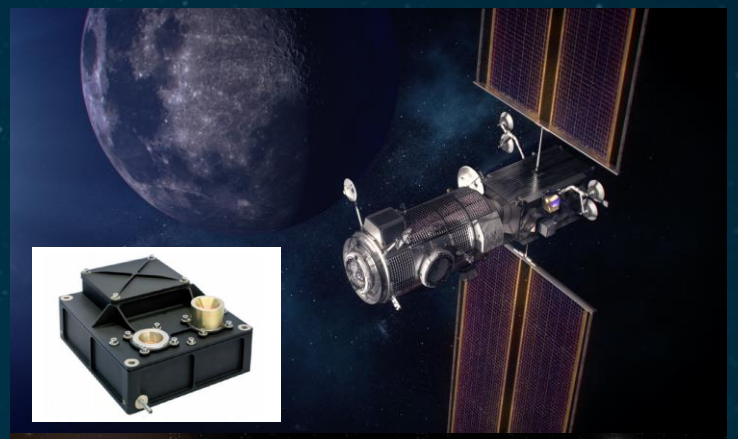
https://esastar-publication-ext.sso.esa.int/

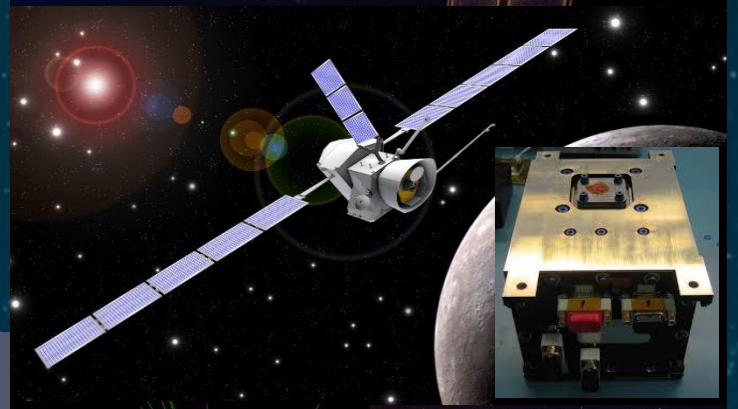
Open Space Innovation Platform (OSIP)

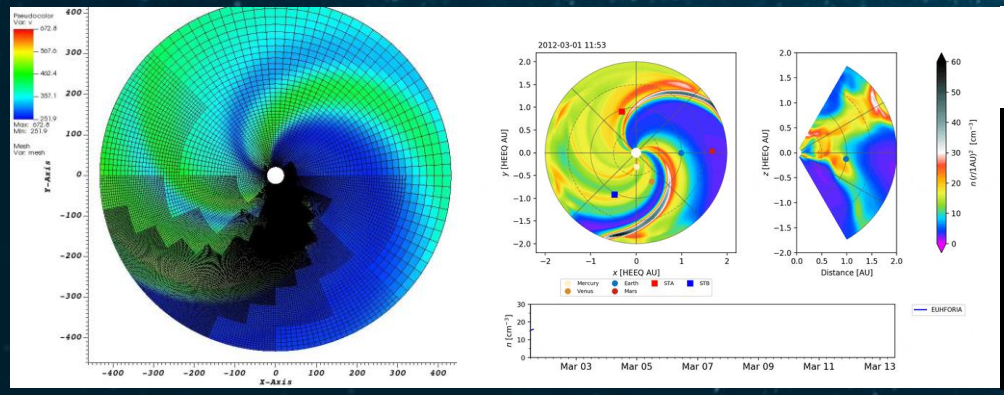
- Consists of dedicated campaigns presently including:
- Nanosats for SWE Monitoring
- Announcement of Opportunity for ERSA & IDA at Gateway
- Open channels including **Discovery element** and Co-funded research

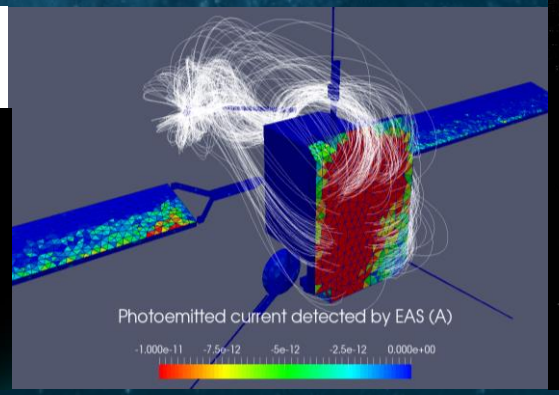
Technology R&D for Space Weather

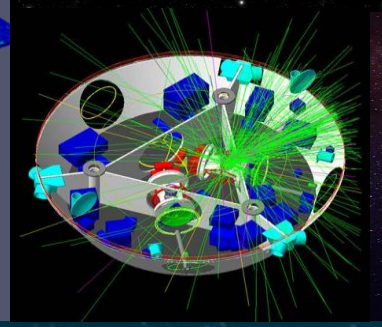
- ESA's Space Environment and Effects Section (ESTEC, NL)
- Environment definitions, Effects calculations, Project (mission) support (environment specification, impacts assessment, etc.)
- Part of Directorate of Technology and Quality Management (TEC)
- Oversees a wide range of software and hardware R&D in various programmes
- Supports Space Safety Programme (S2P) through delivery of lower-TRL R&D
- Also responsible for Space Weather Euro News (SWEN) – every ~6 weeks
- Special mention for SUNSTORM and RubeCube cubesat launches in August 2021 on Vega flight – a great way for successful IoD

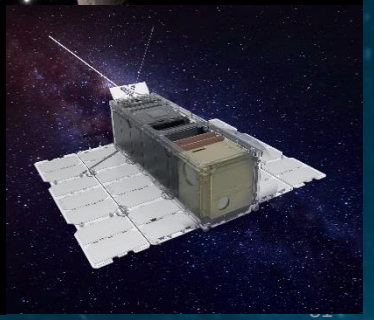












SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

Topical Working Group reportss

- Drivers of Space Weather Subgroup: Solar Storms (Solar Flares, CMEs, SEP events
- **Ground Effects** (GIC, prospecting, tourism), spokesperson: Ari Viljanen (FMI)
- Atmospheric Effects (incl. drag), spokesperson: S. Bruinsma (CNES)
- Ionospheric Effects, spokesperson: M. Angling (University of Birmingham and QinetiQ)
- **Spacecraft, Launcher and Aircraft Environments**, spokesperson: S. McKenna-Lawlor (STIL), co-spokespersons P. Jiggens (ESA) and G. Reitz (DLR)
- **Education, Outreach and Emerging Markets**, spokesperson: P. Vanlommel (ROB), co-spokesperson G. Cessateur (BIRA-IASB)
- Space Weather Forecast, spokesperson: L. Trichtchenko (NRCan), co-spokesperson S. Bloomfield (Trinity College Dublin)

Ground Effects

Examples of (European) GIC efforts within the latest years

Rapidly increasing research activity in subauroral and mid-latitude regions: Austria, Czech, Germany, Greece, Ireland, Italy, Poland, Portugal, Spain, UK, ...
(not to forget a few high-latitude countries)

Transition from simple 1D ground conductivity models to realistic 3D descriptions.

Data-based extreme event estimations.

National risk assessments including space weather and GIC.

Ground Effects

Elsewhere (US):

Geoelectric hazard maps for the continental United States.

Near real-time geoelectric field (NOAA/SWPC, USGS, NRCAN, NASA/CCMC).

Realistic-looking MHD simulations of Carrington-scale storms.

Spacecraft, Launcher and Aircraft Environments

In 2019 Piers and Guenther conducted the WG meeting:

Matthias Meier presented a talk about" First Steps Toward the Verification of Models for the Assessment of the Radiation Exposure at Aviation Altitudes during quiet Space Weather Conditions with co-authors Kyle Copeland, Daniel Matthiä, Christopher J. Mertens, and Kai Schennetten .

Discussion points were: *Further need of instruments, data, models and strategies to forecast doses due to solar particle events in airflight altitudes? Prewarning issues?*

Spacecraft, Launcher and Aircraft Environments

Bernie Jackson talked about space activities “Suggestions to optimize the observation of Space Weather impacts on the Environments of Venus and Mercury during the BepiColombo Mission”.

Discussions points were: *Needs and requirements for infrastructure to allow human presence in space, which includes the assessment of different shielding geometries and its influence on the biological effects occurring in humans. Forecasting services relevant for human explorative missions to the Moon and Mars and in aircraft operations .*

no WG meeting was planned for 2020 & 2021

Education, Outreach and Emerging Markets

For **the space weather community**: researchers, companies, businesses, users, …

Education, Outreach and Emerging Markets

- **Tailored courses and trainings**
- **Lectures**
- **Promotion** of educational activities organised by partners.
- **Academic collaboration**

Education, Outreach and Emerging Markets

Visit the STCE virtual fair stand

SWEC

Space Weather Education Center

SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

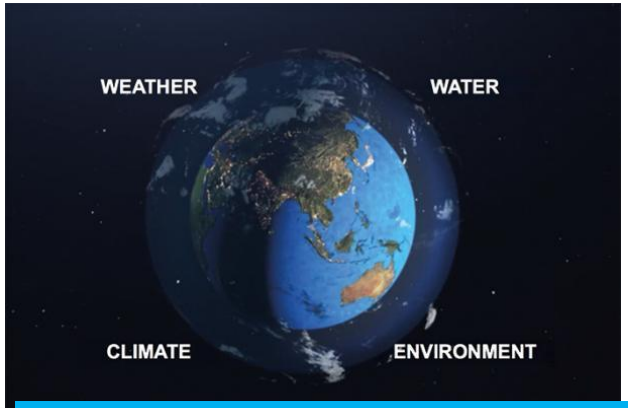
WMO & Space Weather
SWWT-41 Plenary

Kenneth Holmlund
WMO Space Programme

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

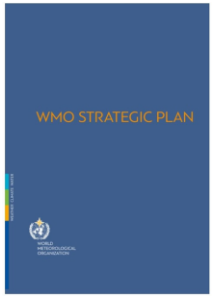
WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

World Meteorological Organization



- Founded as International Meteorological Organization (IMO) in 1873
- Established in 1950 as World Meteorological Organization (WMO)
- UN specialized agency and UN authoritative voice for weather, climate, water and environmental services, since 1951
- 193 Member States
- Represented by Directors of National Meteorological and Hydrological Services (NMHSs)

See https://public.wmo.int/en/about-us/who-we-are



WMO Strategic Plan 2020-2023

VISION 2030

A world where **all nations**, especially the **most vulnerable**, are **more resilient** to the **socioeconomic impact** of **extreme weather, climate, water** and other **environmental events**, and **empowered** to boost their **sustainable development** through the **best possible weather, climate and water services**

OVERARCHING PRIORITIES

Preparedness for, and reducing losses from hydrometeorological extremes	Climate-smart decision-making to build resilience and adaptation to climate risk	Socioeconomic value of weather, climate, hydrological and related environmental services

CORE VALUES

Accountability for Results and **Transparency**	**Collaboration** and **Partnership**	**Inclusiveness** and **Diversity**

LONG-TERM GOALS

1 Services	2 Infrastructures	3 Science & Innovations	4 Member Services	5 Smart Organization
Better serve societal needs	**Enhance Earth system observations and predictions**	**Advance targeted research**	**Close the capacity gap**	**Strategic realignment of structure and programmes**

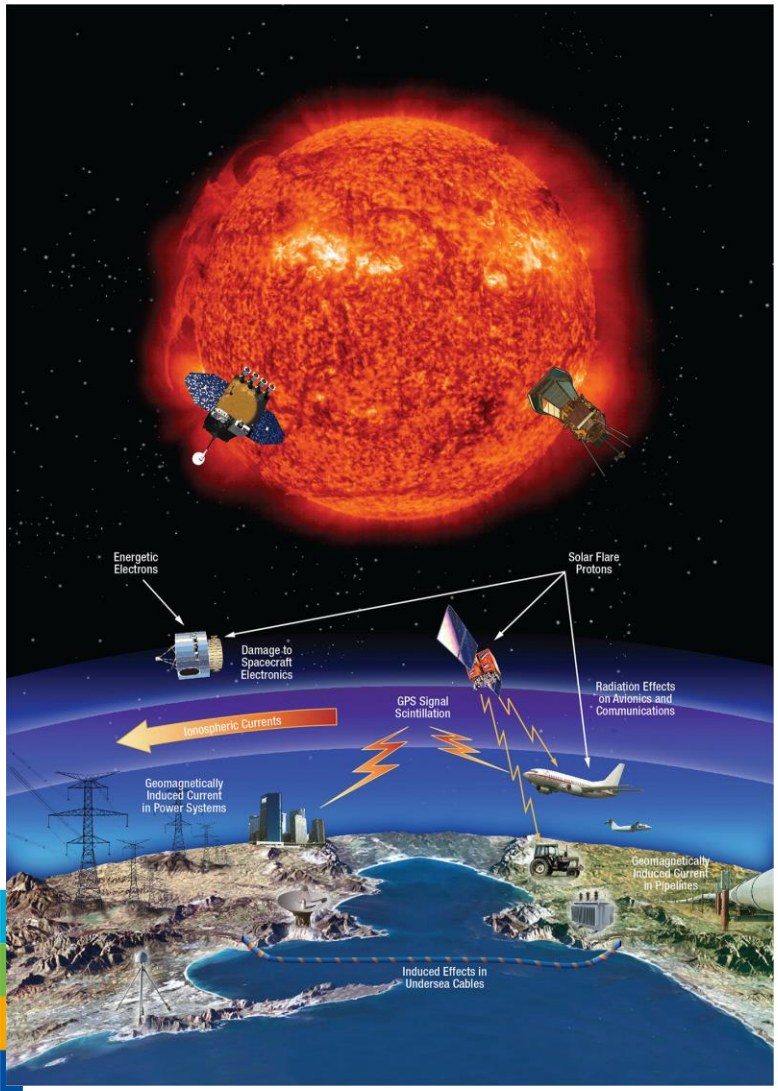
STRATEGIC OBJECTIVES

FOCUSED ON 2020-23

• Strengthen **national multi-hazard early warning/alert systems** • Broaden provision of **policy- and decision-supporting climate, water** and **weather services**	• Optimize **observation data acquisition** • Improve access to, exchange and management of **Earth system observation data and products** • Enable access and use of **numerical analysis and prediction products**	• Advance **scientific knowledge of the Earth system** • Enhance **science-for-service value chain** to improve predictive capabilities • Advance **policy-relevant science**	• Enable developing countries to **provide** and **utilize essential weather, climate, hydrological** and related **environmental services** • Develop and sustain **core competencies** and **expertise** • Scale up **partnerships**	• Optimize WMO **constituent body structure** • Streamline WMO **programmes** • Advance **equal, effective** and **inclusive participation**

WMO OMM

WMO and Space Weather

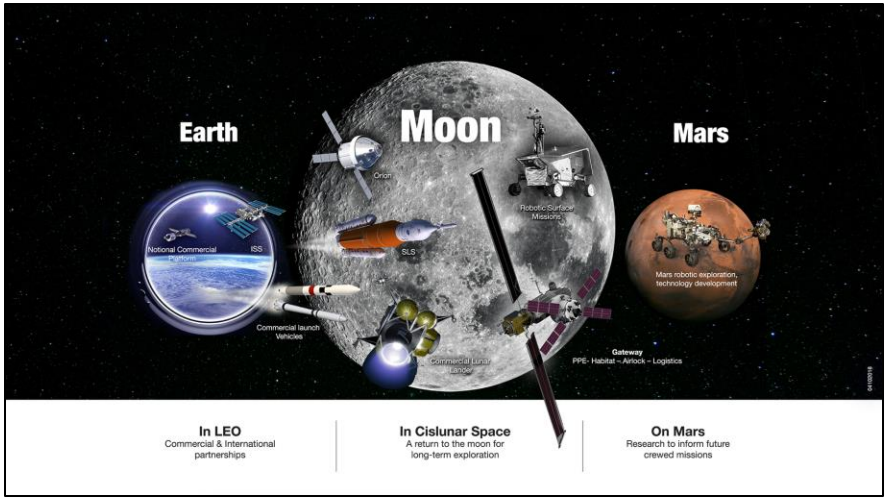


ICAO UNITING AVIATION

Establishment of Space Weather Information Service
For International Air Navigation

Raul Romero
Technical Officer MET
ICAO Headquarters, Montreal

CGMS Space Weather Coordination Group
(CGMS SWx CG)



WMO OMM

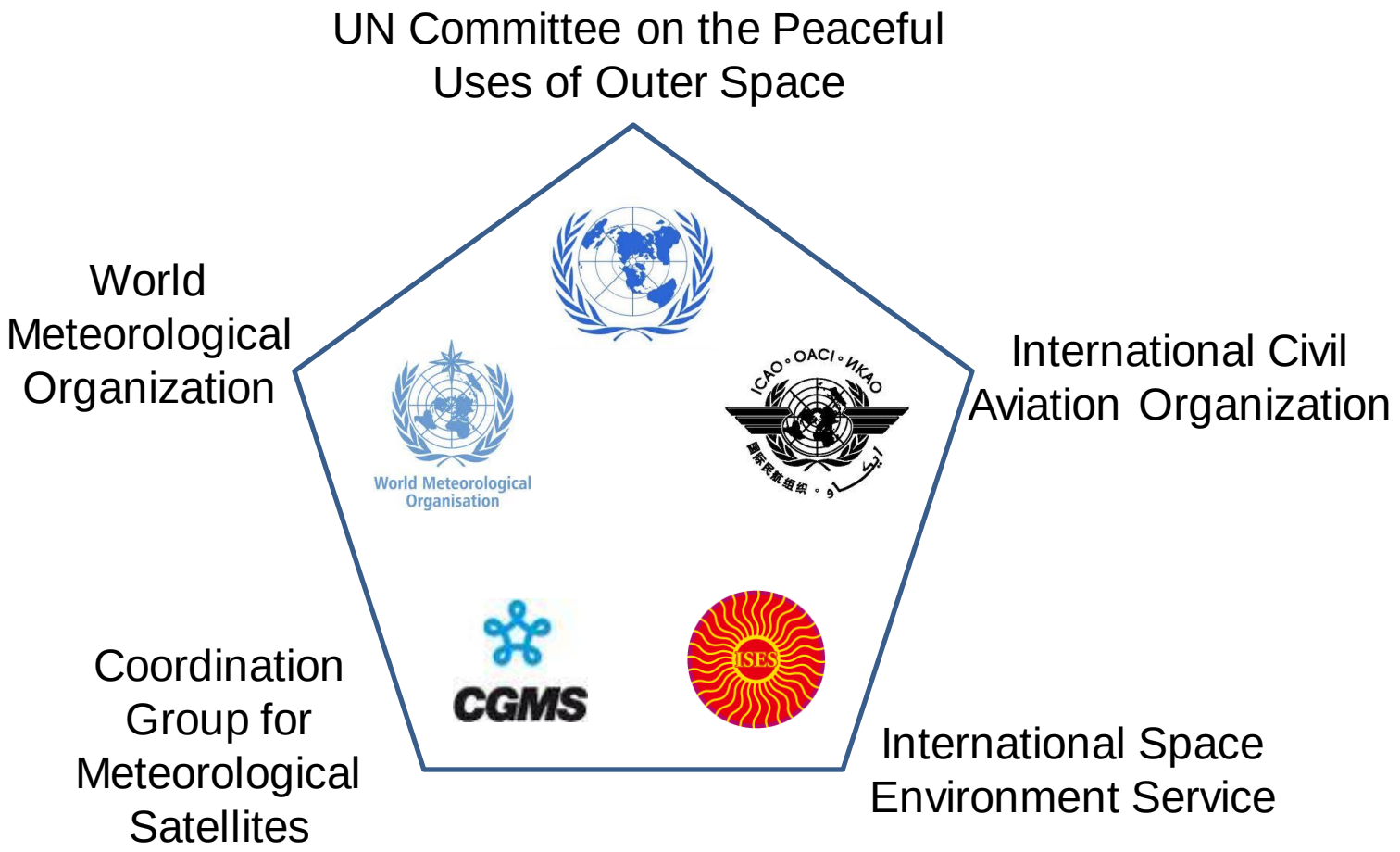
See https://community.wmo.int/activity-areas/wmo-space-programme-wsp/space-weather-introduction

Background

WMO Congress (Cg-17) in 2015:

- Noted that the expression “space weather” was understood as the “physical and phenomenological state of the natural space environment, including the sun, the solar wind, the magnetosphere, the ionosphere and the thermosphere, and its interaction with the Earth”
- reognized the increasing societal demand for space weather services
- the primary importance for WMO are the requirements for space weather information emerging from international air navigation
- agreed that WMO should undertake international coordination of operational space weather monitoring and forecasting

International Organizations Engaged in Space Weather Activities



Numerous other groups are active in space weather research (COSPAR, ISWI, ILWS, IAU, URSI, SCOSTEP, etc.)

WMO OMM

Cg-17 deliberations

Cg-17 agreed that WMO should

- coordinate international operational Space Weather monitoring and forecasting in order to better support the protection of life, property and critical infrastructures as well as impacted economic activities.
- facilitate international commitments and enable the establishment of operational space weather services, in particular in the context of support to the International Civil Aviation Organization (ICAO).

Cg-17 requested

- space weather observation requirements to be developed within the WMO Rolling Review of Requirements (RRR);
- space weather observations be integrated into the WMO Integrated Global Observing System (WIGOS);
- integrative approach for data sharing and management within the WMO Information system (WIS);
- data processing within the Global Data Processing and Forecasting System (GDPFS);

Cg-17 supported integration of

- space weather services within WMO Services Delivery and Disaster Risk Reduction activities.

Cg-19 deliberations

Reaffirmed the WMO commitment to the support of space weather activities

Adopted the Four-year Plan for WMO Coordination of Space Weather Activities 2020-2023

Requests the Secretary-General:

(1) To take appropriate action to facilitate the activities identified in the FYP2020-23 in partnership with relevant organizations such as the International Space Environment Service, as well as national and international agencies;

(2) To submit to the Nineteenth World Meteorological Congress a report on the results achieved and a proposal for future activities in this domain.

WMO UNIFIED POLICY FOR THE INTERNATIONAL EXCHANGE OF EARTH SYSTEM DATA

International data exchange is a major purpose of WMO, WMO Convention, Art. 2b

- The WMO Data Policy has been a key element in ensuring free and open data exchange observations for weather, climate and hydrology
- New challenges and opportunities have driven the need for a new data policy
- The WMO Ext Cg-21 approved a new WMO Unified Data Policy (Res. 1) replacing the old Res 40, 25 and 60
- Single, overarching data policy resolution;
- Modernized language and context;
  - Emphasis on earth system monitoring and prediction;
  - A unified concept
    - New elements with respect to Res. 40, 25 and 60:
      - (weather, hydrology, climate)
    - Built-in cycle for reviewing and updating as requirements change;
    - Call for subsequent implementation activities (regulatory material, capacity development);
    - Request for systems and procedures to review of compliance.

Key changes from Resolution 40

Resolution 40 (1995)

1. Covers weather data only;
2. Two main categories of data:
   - *Essential* (*shall* be exchanged);
   - *Additional* (*should* be exchanged);
3. Specific "*essential*" datasets listed directly in Annex I to the resolution (with some reference also to RBSN);
4. "*Free and unrestricted*" exchange (term not defined in the Resolution);
5. Covers exchange of data between NMHSs

Draft recommendation 3.1(4)/1

1. Covers all WMO Earth system data: weather, climate, hydrology, ...
2. Two main categories of data:
   - *Core* (*shall* be exchanged);
   - *Recommended;* (*should* be exchanged);
3. Specifics on *core* and *recommended* data referred to Technical Regulations, primarily Manuals on WIGOS, GDPFS;
4. "*Free and unrestricted*" exchange (term defined directly in the Resolution, literal interpretation);
5. Addressed to Members, but covers exchange of data between all partners, inclucing private sector, academia, etc.

Key changes from Resolution 40

Resolution 40 (1995)

1. Covers weather data only;
2. Two main categories of data:
- *Essential* (*shall* be exchanged);
- *Additional* (*should* be exchanged);
3. Specific "*essential*" datasets listed directly in Annex I to the resolution (with some reference also to RBSN);
4. "*Free and unrestricted*" exchange (term not defined in the Resolution);
5. Covers exchange of data between NMHSs

Draft recommendation 3.1(4)/1

1. Covers all WMO Earth system data: weather, climate, hydrology, ...
2. Two main categories of data:
- *Core* (*shall* be exchanged);
- *Recommended:* (*should* be exchanged);
3. Specifics on *core* and *recommended* data referred to Technical Regulations, primarily Manuals on WIGOS, GDPFS;
4. "*Free and unrestricted*" exchange (term defined directly in the Resolution, literal interpretation);
5. Addressed to Members, but covers exchange of data between all partners, inclucing private sector, academia, etc.

WMO OMM

Annex I of the Unified data Policy describes the core and recommended data required for seven application areas, including space weather

7. Space weather

This section references space weather data necessary (core) for provision of the essential operational space weather services. It should be noted that space weather is currently going through the process of being fully integrated into WMO Integrated Global Observing System (WIGOS) and being specified in the related WMO documents in more detail. Currently global and regional space weather services, requiring near-real-time exchange of space weather surface-based and space-based observations, are operated on bilateral and multilateral data exchange agreements between centres. However, as the operational space weather services promptly evolve and are further established, the need for globally coordinated exchange of space weather data will increase significantly in the years to come.

Annex I of the Unified data Policy describes the core and recommended data required for seven application areas, including space weather

7. Space weather - continued

Three broad categories of data that need to be considered for such exchange are:

7.1 Surface-based:

All observations required by operational Space Weather Centres providing essential operational services, e.g. International Space Environment Service (ISES) Regional Warning Centres, as detailed in the GBON, which will be further specified in the *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160), as well as data presented in the *WMO Statement of Guidance for Space Weather;*

7.2 Space-based:

All satellite data required for the performance and quality of essential operational space weather services as agreed with Members operating satellites or relevant satellite operators and reflected in the Coordination Group for Meteorological Satellites (CGMS) Baseline, subsequently adopted into the *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160), as well as data presented in the *WMO Statement of Guidance for Space Weather*.

7.3 Other data:

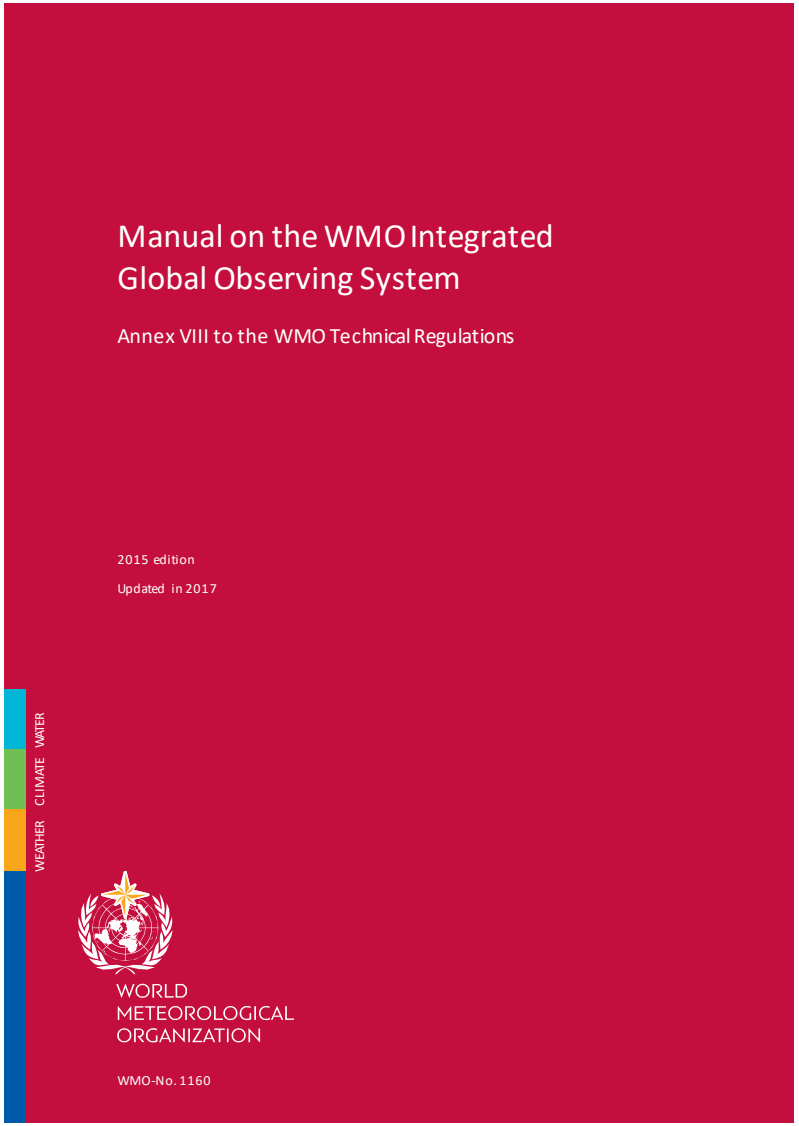
(a) Analysis and prediction fields provided by national operational space weather services;

Suggested Activities for 2020-2023

WMO OMM

1. WMO Technical & Regulatory Framework

- As requested by CG-17, space weather needs to be included in the WMO technical and regulatory framework
  - WIGOS Manual & Guidelines
  - WIS Manual & Guidelines
  - GDPFS Manual & Guidelines

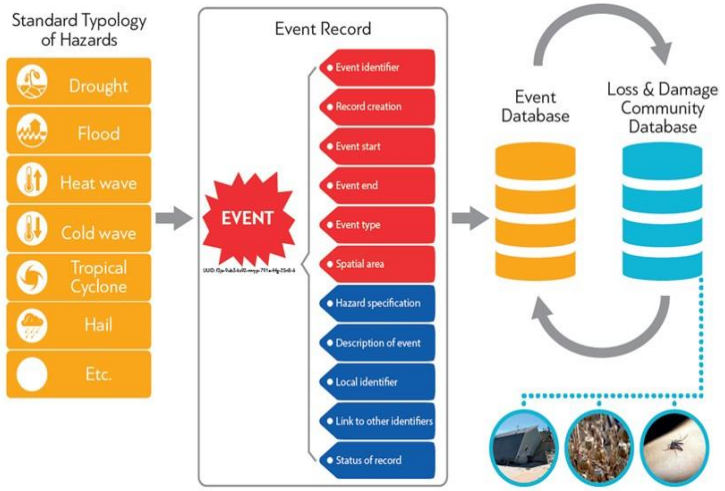


WMO OMM

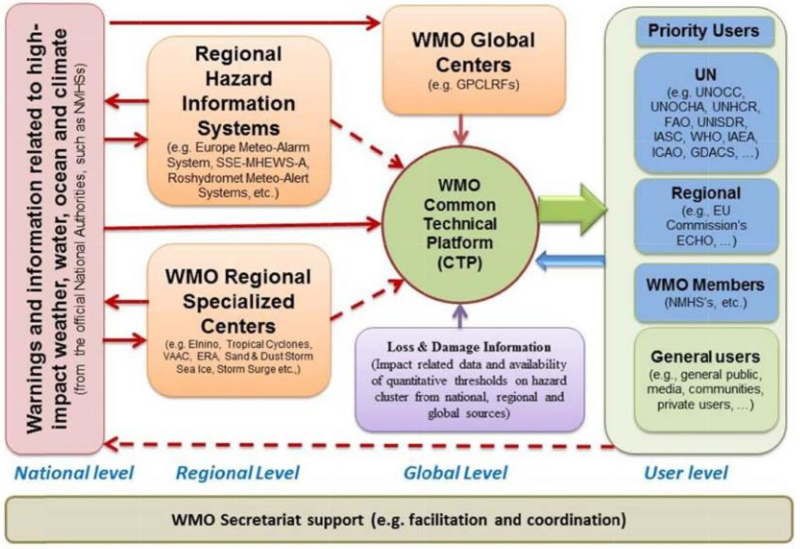
2. Space Weather and DRR

- Integrating space weather into
  - WMO Cataloging Initiative
  - Global Multi-Hazard Alert System (GMAS)

The WMO Cataloging Initiative



WMO Global Multi-Hazard Alert System (GMAS) Framework



WMO OMM

3. Coordination Among SW Entities

- How can we structure our activities so that they efficiently complement each other?

Entity	Focus
CGMS SWCG	space-based observing system, OSCAR/Space
COSPAR	Science, capacity building
ICAO	Operational centres for aeronautics community
IPT-SWeISS	Technical, regulatory frameworks, WIGOS, WIS
IROWG SW Subgroup	Radio occultation observation
ISES	Operational data providers
ISWI Network	Science, surface-based observing systems
UN COPUOS Expert Group	Policy/law framework, space situational awareness

4. Space Weather and OSCAR/Space

Handling of Space weather data in OSCAR/Space

10 November 2019

1. Introduction

The Observing Systems Capability Analysis and Review Tool (OSCAR) draws its origin from a CEOS initiative carried out in 1996-1997 for a "*Database on User requirements and Space capabilities*". The implementation was taken over by the WMO Space Programme Office. The collected information started to be issued in electronic form as a *Dossier on the Space-based Global Observing System*, published from 2004 to 2012, updated initially yearly, thereafter quarterly. Since Autumn 2012 the Dossier was replaced by the version-1 of an on-line database (OSCAR). In the Database, the information on Programmes, Satellites and Instruments is also utilised to provide an evaluation of the retrievable geophysical variables. In the current version-2, active since Autumn 2016, the evaluation is performed by means of an *expert system* that process the main instrument characteristics ("Properties") on the basis of the main features of the retrieval algorithm ("Rules").

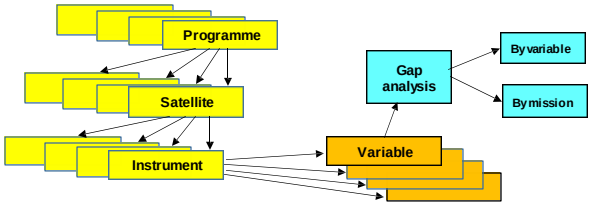
The Database includes the data from all meteorological satellites and probably all EO satellites at large since TIROS-I (1st April 1960), current and planned till about 2040. Space weather satellites have been entered later, starting from 2013, and the current list includes most satellites since 1990 and some earlier, current and planned till about 2030. The total number of described instruments is over 900 (>600 for EO, >300 for Space Weather).

It is acknowledged that, because of the late addition of the Space weather subject, the EO and SW sections do not have the same level of maturity. The architecture has been developed for EO data handling, and it is not optimal for SW data handling. In fact:

- for EO, the basic observation is essentially only one: e.m. radiation emitted or reflected by the target; the required measurement consists of several geophysical variables indirectly derived by means of retrieval models, that may be rather complex;
- for SW, the required measurement directly consists of the observed quantity: several types of energetic particles, of e.m. atomic or nuclear radiations, of fields. The *expert system* currently running in OSCAR, when applied to SW measurement, is too simplistic, in so far there is no algorithm linking the required geophysical variable to the basic observation.

It is possible to define a number of SW geophysical variables as a more complex quantity, for instance involving information complementary to the basic observed quantity (e.g., directional information, temporal structure, …). This could be included in the *expert system* if the User community provides the definition and a description of an appropriate retrieval algorithm.

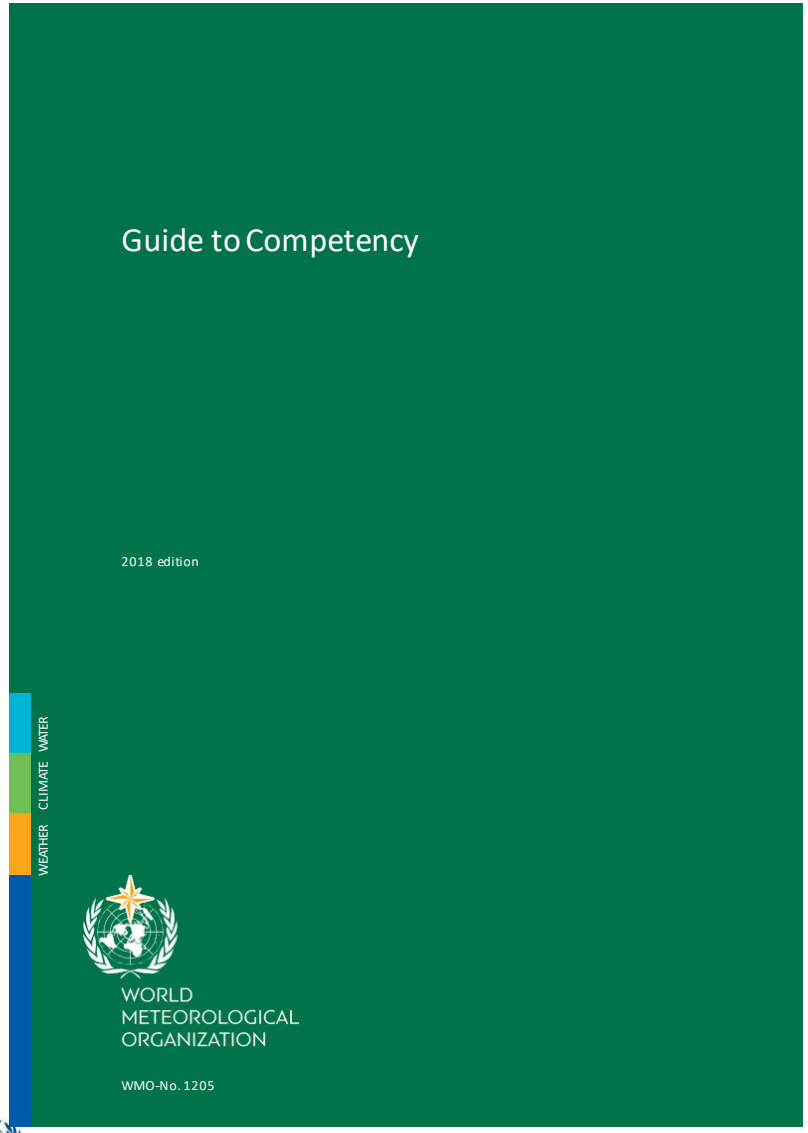
The following figure shows the OSCAR architecture and the information hierarchy.



- Updates on space-based SW observing systems requested via Space Agency focal points
- In addition, CGMS SWCG requested to provide updatdes
- Data latency information will be implemented to support OSCAR Gap Analysis

WMO OMM

6. Development of SW Competencies

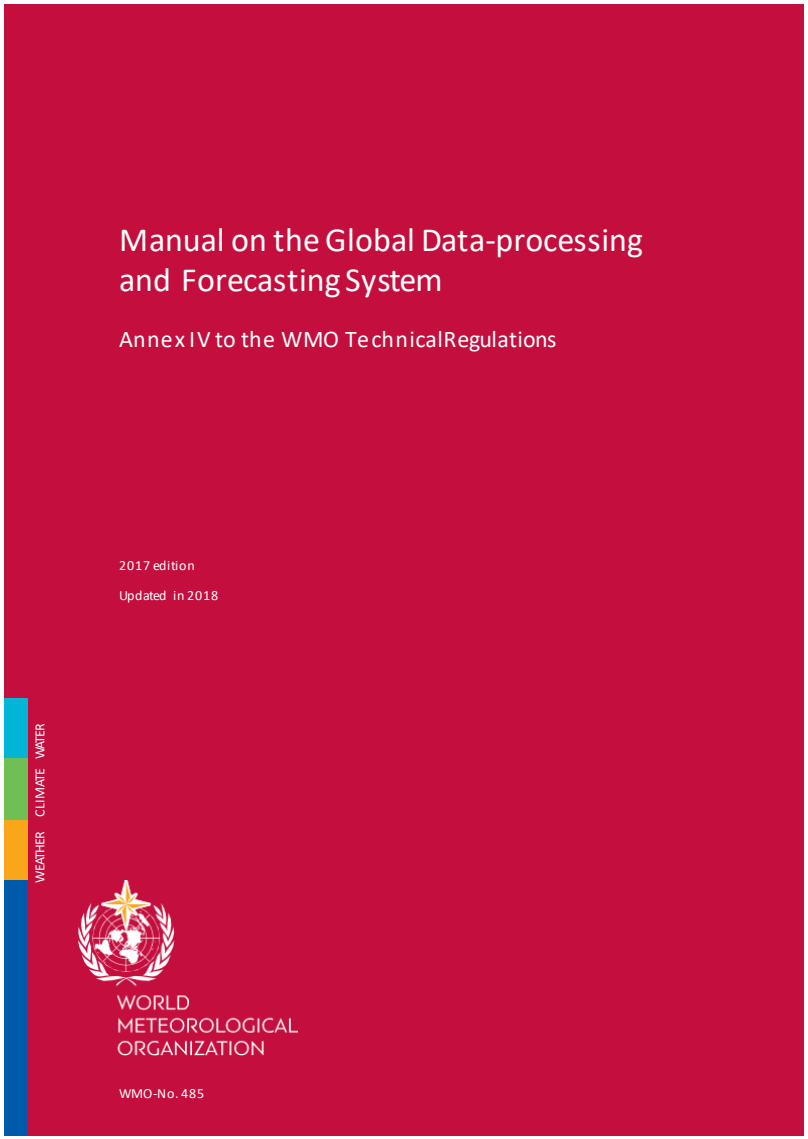


- Space Weather forecaster competencies
- Guidance
  - WMO-No.1205 – Guide to Competency, PART II. DEVELOPING A COMPETENCY FRAMEWORK
  - WMO-No.1209 - Compendium of WMO Competency Frameworks
- Aeronautical Forecaster competencies are a good model to follow.
- Support from WMO-CGMS VLab community

WMO OMM

8. Space Weather and GDPFS

- Service provision arrangements for Space Weather will be described in the GDPFS Manual and related WMO Technical Regulations and will be submitted to the 19th World Meteorological Congress (Cg-19) in 2023 for approval.



WMO OMM

9. Space Weather Data Exchange

- Data exchange, management and processing
- Establishment of Core and Recommended data including
  - Latency requirements
  - Formats
  - Delivery mechanism
- WIS Catalogue
- WIS Data Collection and Production Centre (DCPC)

WMO OMM

Expert Team on Space Weather

- WMO has Expert Teams supporting its various activities
- WMO is establishing an Expert team to Support the Space Weather Activities
- Membership is open to WMO Members
- Members need to nominate

Draft Terms of Reference of ET-SWx

1) Coordinate with relevant WMO bodies, the development of WMO Technical Regulations and guidance and other relevant documents on all aspects related to space weather. The following is the list of immediate steps:

   a) Develop a new GDPFS activity regarding the Space Weather Forecasting under the guidance from SC-ESMP by
      i) Development of the concept of Regional Specialized Meteorological Centers for Space Weather including specified global and/or regional activities and list of mandatory products to be included in the Manual on GDPFS (WMO-No.485)
      ii) Demonstration of the new GDPFS activity for Space Weather Forecasting with the candidate Centers
      iii) Drafting the proposal to establish the new GDPFS activity for Space Weather Forecasting and designation of the new RSMC for Space Weather Forecasting.

   b) Support the access to operational space weather data with the Standing Committee on Earth Observing Systems and Monitoring Networks (SC-ON) by participation in
      i) Integration of ground and space-based Space Weather instrumentation and observational capabilities into OSCAR and other WIGOS Tools;
      ii) Identification of core and recommended Space Weather data as per the new WMO Unified Policy on the International Exchange of Earth System Data;
      iii) Standardization and enhancement of Space Weather data exchange and delivery through the WMO Information System (WIS);
      iv) Execution of the Rolling Review Requirements for Space Weather data (observations and forecasts) and services

   c) In close cooperation with the Expert Team on Radio Frequency Coordination, support the work regarding the Space Weather recognition and protection in the international radio regulation at ITU-R level by:
      i) Providing detailed frequency bands used : in operational space weather applications, in process of transition from research to operational use and in research systems currently not used operationally
      ii) Providing priority and level of protection criteria for the corresponding Space Weather systems

Draft Terms of Reference of ET-SWx

2. Work closely with the Services Commission (SERCOM) Standing Committee on Services for Aviation (SC-AVI) to support the International Civil Aviation Organization (ICAO) in the operation and further enhancement of the space weather information service for international air navigation, including the development or refinement of space weather-related operational procedures and best practices amongst the ICAO-designated global and regional space weather providers

3. Liaise with relevant WMO Programmes, technical commissions and their subsidiary bodies as well as other international bodies as required to
   a) Develop guidelines for the provision of sustained Space-Weather data and operational services
   b) Provide guidance to WMO Members and partner organizations for their development of specification and emergency response activities for severe and high impact space weather events
   c) Provide guidance to Members on the establishment of operational space weather service delivery as relevant to ET-SWx, including development of best practices and operational procedures for Space Weather end-products and services following WMO Manuals, Guides and Guidelines
   d) Coordinate capacity-building, training and outreach activities towards WMO Members and their service providers together with partner organizations

Draft Terms of Reference of ET-SWx

4. Regularly review new developments and advances in Space Weather event monitoring and prediction, particularly with regard to severe and high impact Space Weather events

    a) In collaboration with other international organizations and space weather initiatives identify a way forward to collect and make available information on severe and high impact Space Weather events

5. In collaboration with other relevant WMO Standing Committees and with the assistance of the WMO Space Systems and Utilization Division prepare a new four-year plan for WMO activities related to Space Weather for 2023 – 2027

6. Ensure coordination of the work of ET-SWx, with the support of the Coordinator on Satellite Matters (C-SAT), with other Standing Committees, Expert Teams and Study Groups of the Technical Commissions and with the Research Board

7. Coordinate WMO Space Weather related activities with other relevant organizations as required.

WEATHER CLIMATE WATER

Thank you

WMO Space Programme Webpage

WMO Space Programme (WSP) | World Meteorological Organization

WORLD METEOROLOGICAL ORGANIZATION

SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

The European Space Sciences Committee

Europe‘s Advisor on Space Science and Policy since 1974

Presentation given by Mauro Messerotti on behalf of ESSC and SSEP
for the ESA Space Weather Working Team (SWWT)
on 27 October 2021 at the European Space Weather Week 2021

ESSC Mission

The European Space Sciences Committee provides impartial scientific advice to the European Space Agency, the European Commission, EU national space agencies, and other decision-makers in the space domain. **We strive to be the reference body in Europe for independent expertise on matters of space science, acting as a representative voice of the European space science community and promoting international cooperation in the field**

ESSC Vision

To become established as the authentic and trusted voice of the European Space Science Community, recognized for our expertise in the field of space science, promoting fundamental, use-inspired, and applied space research, seeking to ensure maximum scientific benefits of Europe's investments in the space domain (including the commercial sector), and increasing interest in and support for space science in the general public, the private sector, and the media

SCIENCE CONNECT
YOUR PARTNER IN SCIENCE
European Science Foundation

Secretariat support

European Union

DG-DEFIS, EUSPA

HE stakeholder consultation

Direct interactions with programme executives

Advice and policy foresight on S&T

ESSC

47 years old
28 members
4 panels

Advice and policy foresight on S&T

esa

DG, EOP, HRE, SCI

Direct interactions with programme executives

SSAC, HESAC, ACEO ex-officio representation

ESA Council at Ministerial level

International and National Representation

- COSPAR Science Advisory Committee (ex-Officio)
- Observer status to UN COPUOS
- Copernicus Academy member

- Annual meeting with ESSC Funding Organisations
- Representation in national space agencies or advisory committees

- USA NAS Space Studies Board
- China CAS/NSSC & CAST
- Japan JAXA
- Russia RAS-IKI

History

The European Space Sciences Committee (ESSC) was established in 1974, as a mean to give European space scientists an independent voice in the space sciences arena.

ESSC Chairs, 47 years of history

EUROPEAN SPACE SCIENCES COMMITTEE

ESSC

ESSC

ESSC

Our Members

The ESSC is constituted of leading European researchers working in four panels to reflect the variety of space-related disciplines

Astronomy & Fundamental Physics

Nabila Aghanim
AFP Panel Chair
Université Paris Sud, FR

Earth Sciences

Maarten Krol
ES Panel Chair
Wageningen University, NL

Life & Physical Sciences in Space

Dominique Langevin
LPS Panel Chair
Université de Paris-Sud , FR

Solar System Exploration

Mahesh Anand
SSE Panel Chair
The Open University, UK

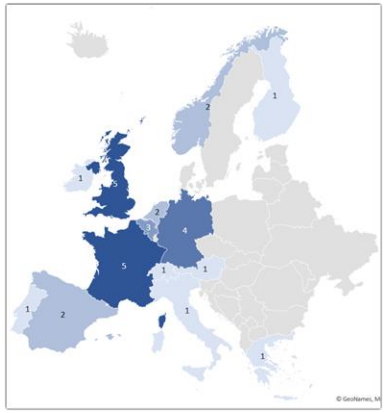
ESSC Panels & Expertise

Astronomy & Fundamental Physics

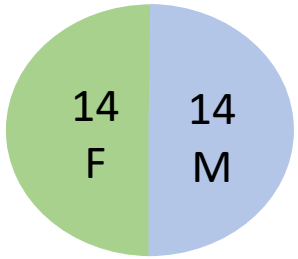
Nabila	Aghanim	Cosmology, Panel Chair	FR
Manolis	Plionis	cosmology	GR
Juri	Poutanen	astrophysics	FI
Michael	Perryman	astrophysics	IR
Saskia	Hekker	stellar physics	DE
Floris	van der Tak	infrared & instrumentation	NL
Ravit	Helled	exoplanets	CH

Solar System Exploration

Mahesh	Anand	Planetology, Panel Chair	UK
Vinciane	Debaille	solar system composition	BE
Sonia	Fornasier	Small solar system bodies	FR
Mauro	Messerotti	Space physics	IT
François	Raulin	planetology	FR
Nicole	Schmitz	Robotics, small bodies	DE
Robert	Wimmer-Schweingruber	heliophysics	DE



The ESSC 61st plenary finds the committee with 28 members from 12 countries



Life & Physical Sciences in Space

Dominique	Langevin	fluid physics and foams, Chair	FR
Alexander	Choukèr	integrated physiology, Chair Elect	DE
Sarah	Baatout	biology	BE
Kai	Bongs	quantum physics	UK
Marc	Heppener	human spaceflight & exploration	NL
Ann-Iren	Kittang Jost	biology & material science	NO
Zita	Martins	Astrobiology, Cosmochemistry	PT

Earth Sciences

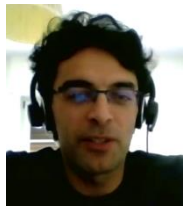
Maarten	Krol	atmospheric sciences	NL
Camilla	Brekke	marine and sea ice obs.	NO
Anny	Cazenave	geodesy, satellite altimetry	FR
Michaela	Hegglin	Earth observations	UK
Yann	Kerr	SMOS, land hydrology, land surfaces	FR
Sindy	Sterckx	optical instrumentation and cal/val	BE

New Panel Chair

Joined in May 2021

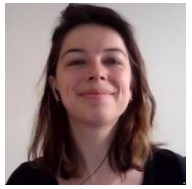
ESSC

Secretariat



Dr Emmanuel Detsis

- ESSC Scientific Executive Secretary (ExBo+)
- Astrophysics and Project Management



Ms Mariette Vandermersch

- ESSC administrator and LPSP/AFPP secretary
- Logistics and Operations Management

Dr Jonas L'Haridon

- Junior Science Officer , SSEP secretary
- Mars Geology and Planetary Science

Ms Shorouk Elkobros

- Junior Science Officer Communication, ESP secretary
- Climate System Sciences/ Science Communication

Dr Mari Kolehmainen

- Junior Science Officer, LPSP studies
- X-Ray Astrophysics

The ESSC Secretariat is located in the European Science Foundation, in Strasbourg, France

Re ons

J. Space Weather Space Clim., 9, A37
© H.J. Opgenoorth et al., Published by EDP Sciences 2019
https://doi.org/10.1051/swsc/2019033

JSWS

Available onli
www.swsc-jour

Agora – Strategic or programmatic article OPEN ACC

Assessment and recommendations for a consolidated European approach to space weather – as part of a global space weather ef

Hermann J. Opgenoorth[1,8,*], Robert F. Wimmer-Schweingruber[2], Anna Belehaki[4], David Berghman
Mike Hapgood[5], Michael Hesse[6], Kirsti Kauristie[7], Mark Lester[8], Jean Lilensten[9], Mauro Messerott
and Manuela Temmer[12]

[1] Department of Physics, Umeå University, 901 87 Umeå, Sweden
[2] Institute of Experimental and Applied Physics, Kiel University, 24118 Kiel, Germany
[3] Royal Observatory of Belgium Brussels, 1180 Uccle, Belgium
[4] National Observatory of Athens, 118 51 Athens, Greece
[5] Rutherford Appleton Laboratory, OX11 0DE Didcot, UK
[6] Department of Physics and Technology, University of Bergen, 5007 Bergen, Norway
[7] Finnish Meteorological Institute, 00101 Helsinki, Finland
[8] Department of Physics and Astronomy, University of Leicester, LE1 7RH Leicester, UK
[9] University Grenoble Alpes, CNRS, IPAG, 38000 Grenoble, France
[10] INAF Astronomical Observatory of Trieste, 34131 Trieste, Italy
[11] Department of Physics, University of Trieste, 34127 Trieste, Italy
[12] Institute of Physics, University of Graz, 8010 Graz, Austria

Received 25 July 2019 / Accepted 30 August 2019

Abstract – Over the last 10–20 years there has been an ever-increasing international awareness of risks to modern society from adverse and potentially harmful – and in extreme cases even disastrous – space weather events. Many individual countries and even international organisations like the United Nations (UN) have begun to increase their activities in preparing for and mitigating effects of adverse space weather. As in the rest of the world there is also in Europe an urgent need for coordination of Space Weather efforts in individual countries as well as in and among European organisations such as the European Space Agency (ESA) and the European Union (EU). This coordination should not only improve our ability to meet space weather risks, but also enable Europe to contribute to on-going global space weather efforts. While space weather is a global threat, which needs a global response, it also requires tailored regional and trans-regional responses that require coordination at all levels. Commissioned by the European Space Science Committee (ESSC) of the European Science Foundation, the authors – together with ex-officio advice from ESA and the EU – have over two years assessed European activities in the realm of space weather and formulated a set of recommendations to ESA, the EU and their respective member states, about how to prepare Europe for the increasing impact of adverse space weather effects on man-made infrastructure and our society as a whole. We have also analysed parallel international activities worldwide, and we give advice how Europe could incorporate its future activities into a global scheme.

Keywords: space weather / hazards / societal effects / public Issues / strategy

Assessment and Recommendations on European Approach to Spac Weather

SSEP study

J. Space Weather Space Clim., 9, A37
© H.J. Opgenoorth et al., Published by EDP Sciences 2019
https://doi.org/10.1051/swsc/2019033

JSWSC

Available online at:
www.swsc-journal.org

Agora – Strategic or programmatic article OPEN ACCESS

Assessment and recommendations for a consolidated European approach to space weather – as part of a global space weather effort

Hermann J. Opgenoorth[1,8,*], Robert F. Wimmer-Schweingruber[2], Anna Belehaki[4], David Berghmans[3], Mike Hapgood[5], Michael Hesse[6], Kirsti Kauristie[7], Mark Lester[8], Jean Lilensten[9], Mauro Messerotti[10,11], and Manuela Temmer[12]

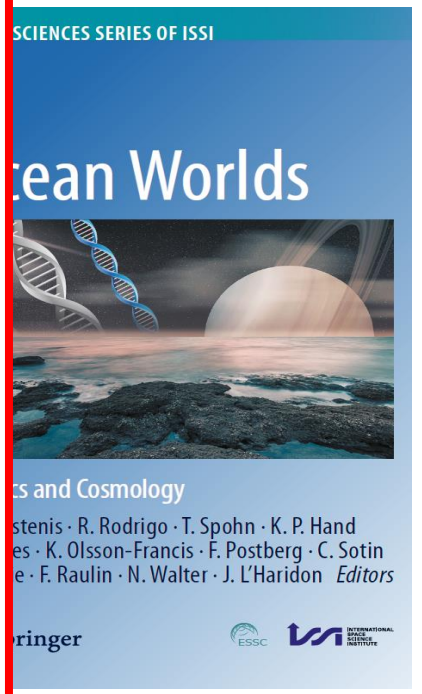
[1] Department of Physics, Umeå University, 901 87 Umeå, Sweden
[2] Institute of Experimental and Applied Physics, Kiel University, 24118 Kiel, Germany
[3] Royal Observatory of Belgium Brussels, 1180 Uccle, Belgium
[4] National Observatory of Athens, 118 51 Athens, Greece
[5] Rutherford Appleton Laboratory, OX11 0DE Didcot, UK
[6] Department of Physics and Technology, University of Bergen, 5007 Bergen, Norway
[7] Finnish Meteorological Institute, 00101 Helsinki, Finland
[8] Department of Physics and Astronomy, University of Leicester, LE1 7RH Leicester, UK
[9] University Grenoble Alpes, CNRS, IPAG, 38000 Grenoble, France
[10] INAF Astronomical Observatory of Trieste, 34131 Trieste, Italy
[11] Department of Physics, University of Trieste, 34127 Trieste, Italy
[12] Institute of Physics, University of Graz, 8010 Graz, Austria

Recommendations
a. Advance Science
b. Improve Sensors
c. Guarantee Fundings

Received 25 July 2019 / Accepted 30 August 2019

Abstract – Over the last 10–20 years there has been an ever-increasing international awareness of risks to modern society from adverse and potentially harmful – and in extreme cases even disastrous – space weather events. Many individual countries and even international organisations like the United Nations (UN) have begun to increase their activities in preparing for and mitigating effects of adverse space weather. As in the rest of the world there is also in Europe an urgent need for coordination of Space Weather efforts in individual countries as well as in and among European organisations such as the European Space Agency (ESA) and the European Union (EU). This coordination should not only improve our ability to meet space weather risks, but also enable Europe to contribute to on-going global space weather efforts. While space weather is a global threat, which needs a global response, it also requires tailored regional and trans-regional responses that require coordination at all levels. Commissioned by the European Space Science Committee (ESSC) of the European Science Foundation, the authors – together with ex-officio advice from ESA and the EU – have over two years assessed European activities in the realm of space weather and formulated a set of recommendations to ESA, the EU and their respective member states, about how to prepare Europe for the increasing impact of adverse space weather effects on man-made infrastructure and our society as a whole. We have also analysed parallel international activities worldwide, and we give advice how Europe could incorporate its future activities into a global scheme.

Keywords: space weather / hazards / societal effects / public Issues / strategy



Ocean Worlds

SEP study with
everal EU and
national partners

ESA Council at Ministerial Level: 26-28 November 2019, Seville, Spain

ESSC

EUROPEAN SCIENCE FOUNDATION

ESSC-ESF POSITION ON THE SPACE 19+ PROGRAMMES OF ESA

CONTACT

European Space Sciences Committee Secretariat

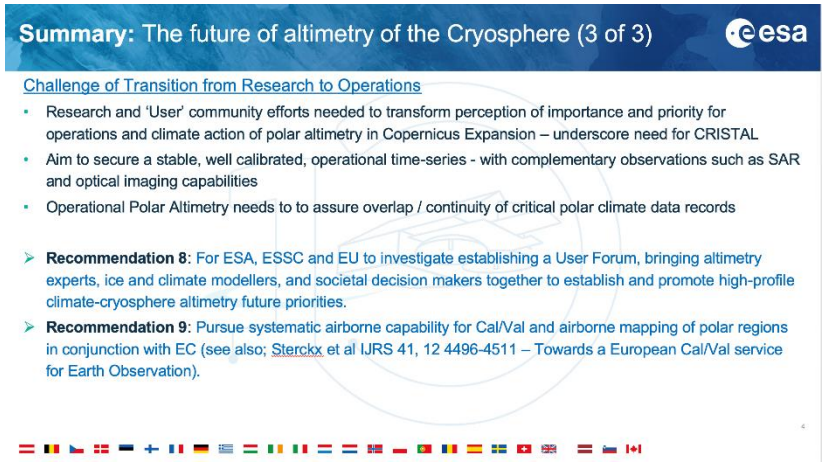
European Science Foundation

1 quai Lezay-Marnésia, BP 90015
67080 Strasbourg cedex, France
essc@esf.org
+33 (0)388 767 100

12 November 2019

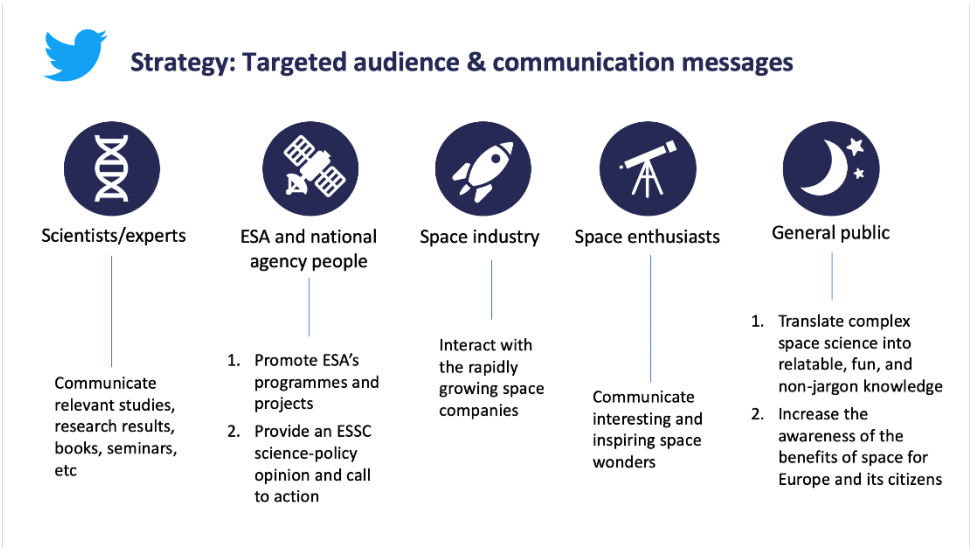
Issue

- **Insufficient visibility to the wider (European) scientific community, and to public and private sector**
- **Actions in 2021 to address above**:
  - Use Conferences / Workshops to raise profile and connect with community



Issue

- **Insufficient visibility to the wider (European) scientific community, and to public and private sector**
- **Actions in 2021 to address above**:
  - Use Conferences / Workshops to raise profile and connect with community
  - New Communications / Social Media strategy



Space Weather Tweet Campaign

The European Space Sciences Committee
@ESSC_media

How's the weather .. in #space?

Today we will be tweeting about #SpaceWeather and its impact on #Earth🌍and future space #missions🚀.

Stay tuned and follow us for more tweets!💫

The European Space Sciences Committee
@ESSC_media

Replying to @ESSC_media

Weather happens in space too, so what is space weather?

Although the #sun is 150 million kilometers from Earth, yet, space weather can affect Earth and the rest of the solar system.☀️🌌

A thread ⬇️

The European Space Sciences Committee
@ESSC_media

Replying to @ESSC_media

Eruptions of plasma and magnetic field structures from the sun's atmosphere called coronal mass ejections (CMEs), and sudden bursts of #radiation☢️, called solar flares☀️, can cause #SpaceWeather effects at or near Earth🌍.

Published Blogs

Published the **first two blogs** on the website and cross-posted on social media

The European Space Sciences Committee @ESSC_media · Apr 22

In a thought-provoking interview, Hermann Opgenoorth, #SpacePhysics Prof @UmeaUniversity & ESSC SSE Panel Chair, discusses #SpaceWeather impacts on #Earth, #SpaceExploration risks, and the need for consolidated efforts.

Now on our #blog bit.ly/3dHQzCC #EarthDay2021

Hermann Opgenoorth

6 10

The European Space Sciences Committee @ESSC_media · Apr 20

"28 editions since the annual exercise began, the message is the same, yet incrementally worse."

@ucl #ClimateScience prof and ESSC chair, Chris Rapley, comments on the @WMO's State of Global Climate 2020 report.

Now on our #blog: A Climate of Folly bit.ly/3n21KZL

New Brochure

Current studies and projects

- Community Consultation - Research in microgravity perspectives, publication expected beginning of 2022
- “20 Years of Science Results from the ISS” Book in 3 volumes, publication expected in 2022:
  - Life sciences
  - Physical Sciences
  - Social Sciences
- Inter-Cal/Val of ‘Grand Heliospheric Orchestra’ and implications for mission extensions and selection
- Diversity and Inclusion?


The European Space Scienc...
74 Tweets
Tweets
Tweets & replies
Media
Likes
428
5,112
43.8K
The European Space... · 03/03/2021
Hi Twitterverse! Follow us for more #ESSC news & stories! #ThisIsESSC🚀
Follow us
@ESSC_media
@ESSC_media
221 views
2
1
5
The European Space... · 03/03/2021
@esa @FWF_at @FWOVlaanderen @frsFNRS @SuomenAkatemia @CNES @helmholtz_de @ASI_spazio @FnrLux @SRON_Space @spacegovuk @forskningsradet @Romsenteret @CSIC @RymdstyrelsenSE @snsf_ch
1

SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

Quo Vadis European Space Weather Community?

Election Results

QuoVadis European Space Weather and Space Climate

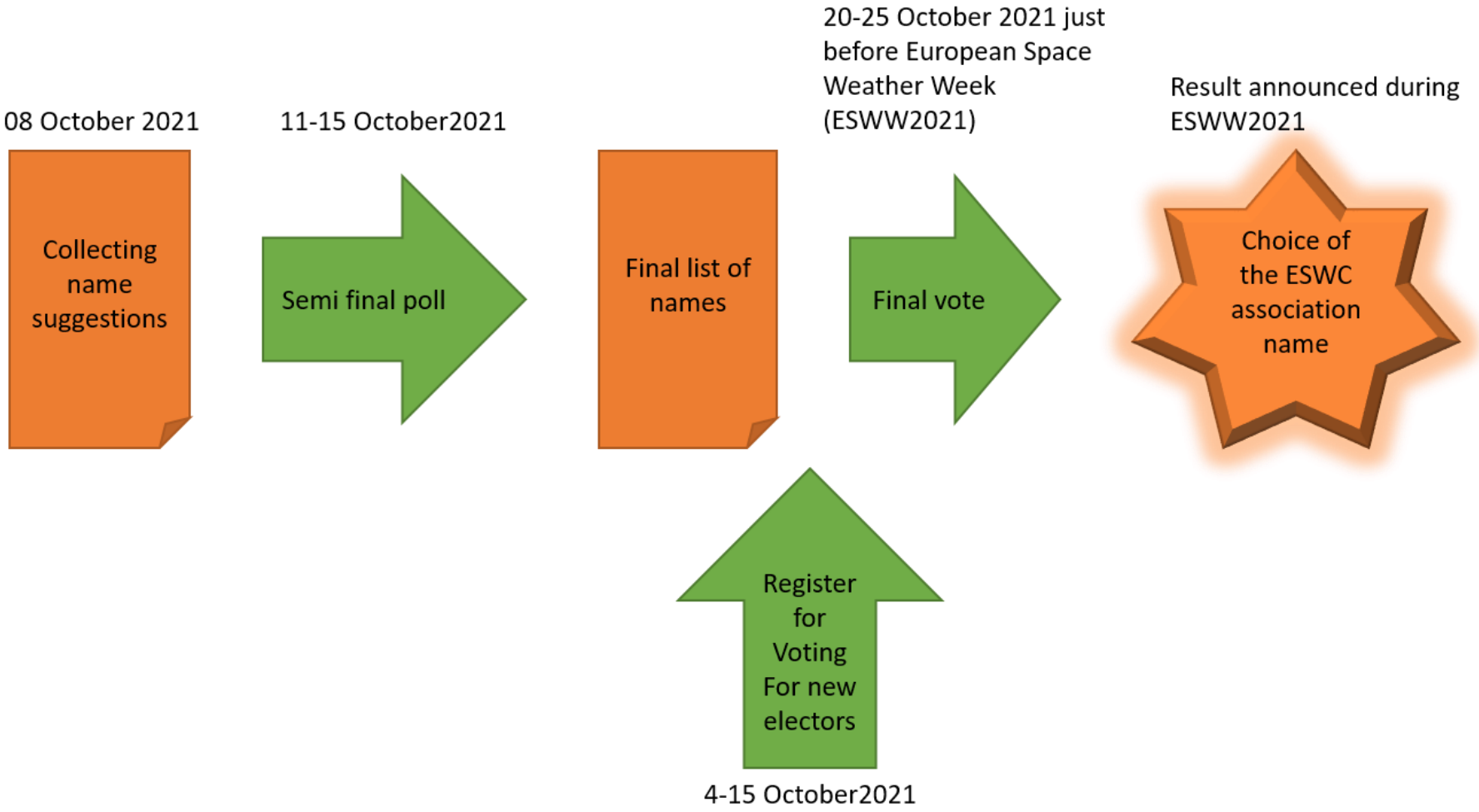
Sophie Chabanski, Anna Morozova, Antonio Guerrero, Marianna Korsos, Ellen Clarke, Jean Lilensten , Mateja Dumbovic, Luca Spogli, Anna Belehaki, Mario Bisi, Claudia Borries, Denis Bousquet, Gaël Cessateur, Ioannis Daglis, Robertus Erdelyi, Ingemar Häggström , Giovanni Lapenta, Anwesha Maharana, Sophie Murray, Dalia Obrazova(Buresova), Hermann Opgenoorth, Paolo Pagano , Laurianne alin, Nuno Peixinho, Rui Pinto, Dave Pitchford, Stefaan Poedts, Paolo Romano, Marina Skender, Ioanna Tsagouri, Jaroslav Urbar, Ronald Van der Linden

Quo Vadis European Space Weather Community?

- The QuoVadis initiative seeks to unite, sustain and develop Space Weather and Space Climate activities in Europe
- In June 2021 the community voted to create an International Non-Profit Association (INPA)
- To create the association we need Statutes and a name.
- Since June 2021, the interim board and the community are preparing the statutes
- We present here the steps undertaken to select the name

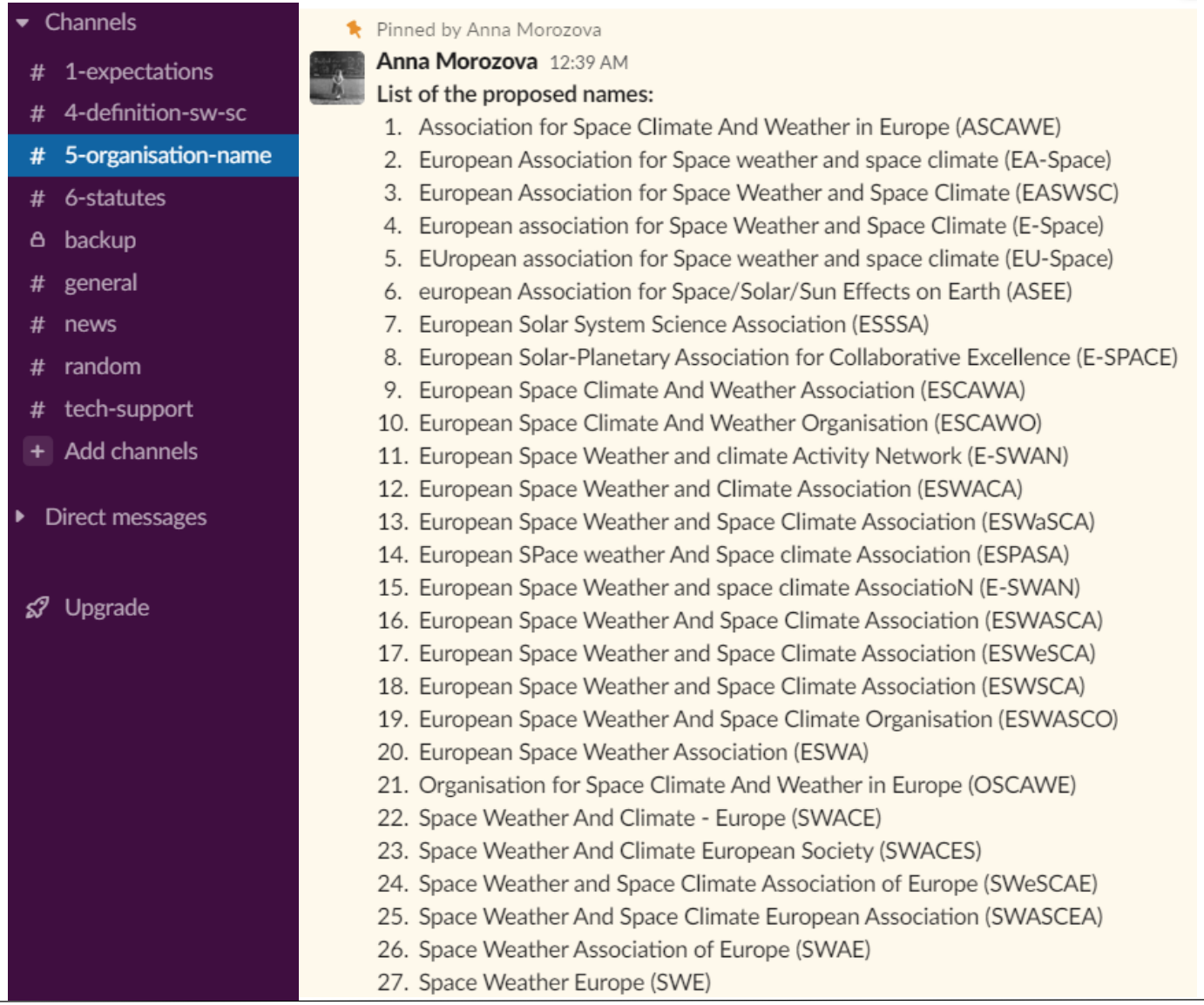
Quo Vadis European Space Weather Community?

Steps to Establish the name:



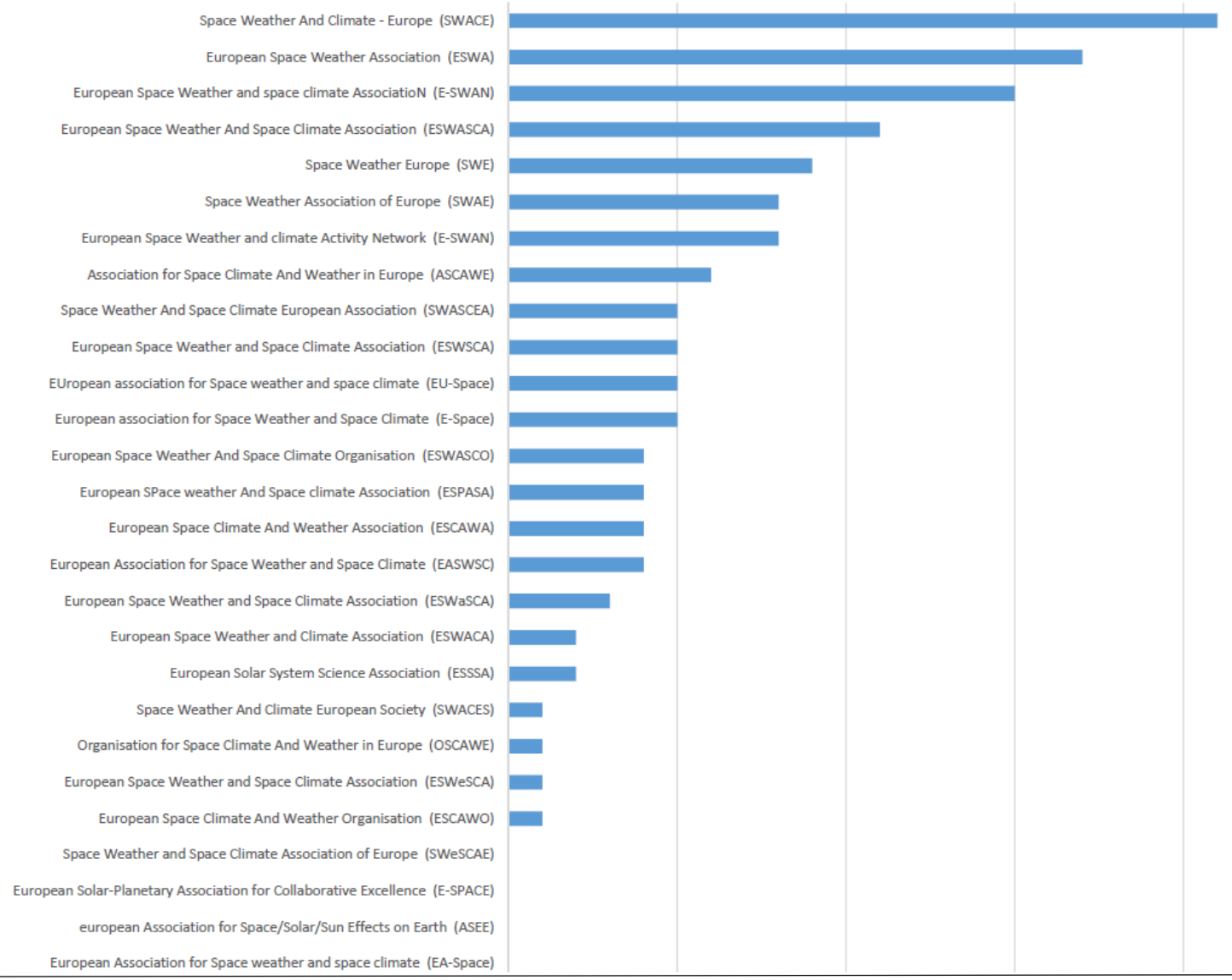
Quo Vadis European Space Weather Community?

July-October 2021
Collected name suggestions:



Quo Vadis European Space Weather Community?

11-15 October 2021
Poll results:



Quo Vadis European Space Weather Community?

20-25 October 2021
Vote among 5 Finalists

This is a vote to select the name for the future association for the European Space Weather and Space Climate Community.

The options are (in alphabetical order):

- Option 1: Association for Space Climate And Weather in Europe (ASCAWE)
- Option 2: European Space Weather and space climate AssociatioN (E-SWAN)
- Option 3: European Space Weather And Space Climate Association (ESWASCA)
- Option 4: Space Weather And Climate - Europe (SWACE)
- Option 5: Space Weather Association of Europe (SWAE)

The results of the vote will be announced during SWWT session of ESWW17 on October 27th 2021 at 13:30-15:00 BST.

Instructions: Click to select or unselect a choice. You may select up to 1 choice.

Your ballot:

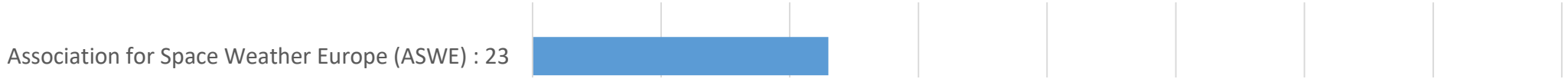
- ☐ Option 1: (ASCAWE)
- ☐ Option 2: (E-SWAN)
- ☐ Option 3: (ESWASCA)
- ☐ Option 4: (SWACE)
- ☐ Option 5: (SWAE)

Instructions: Double check your ballot. Then click the "Vote!" button to cast your vote.

✔ Vote!

Quo Vadis European Space Weather Community?

Results of the vote for the name of the new organisation:

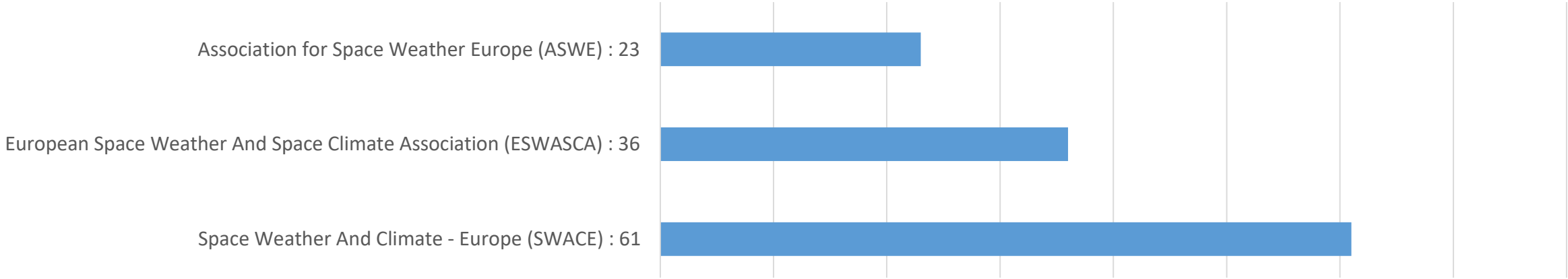


Quo Vadis European Space Weather Community?

Results of the vote for the name of the new organisation:

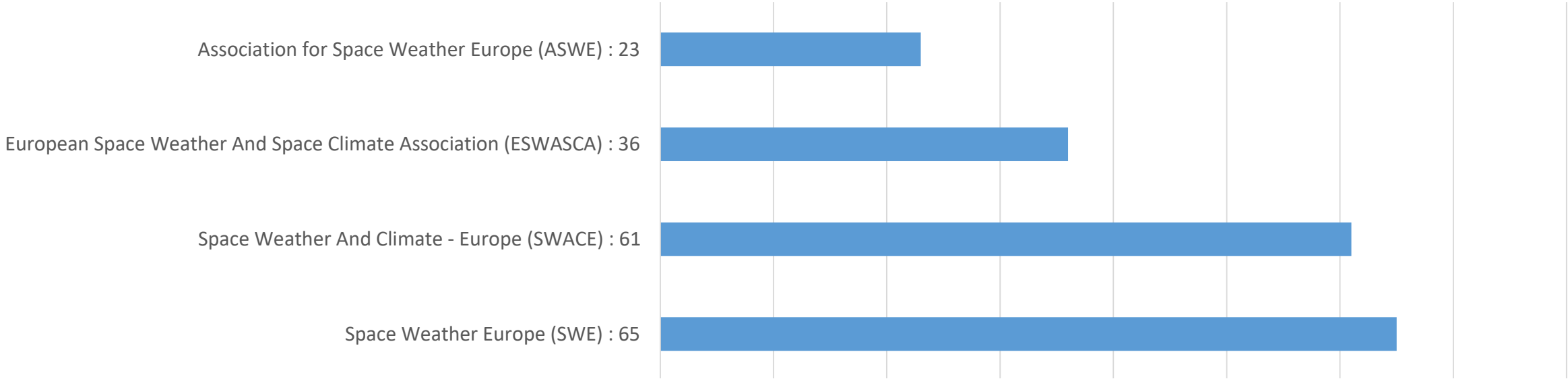
Quo Vadis European Space Weather Community?

Results of the vote for the name of the new organisation:



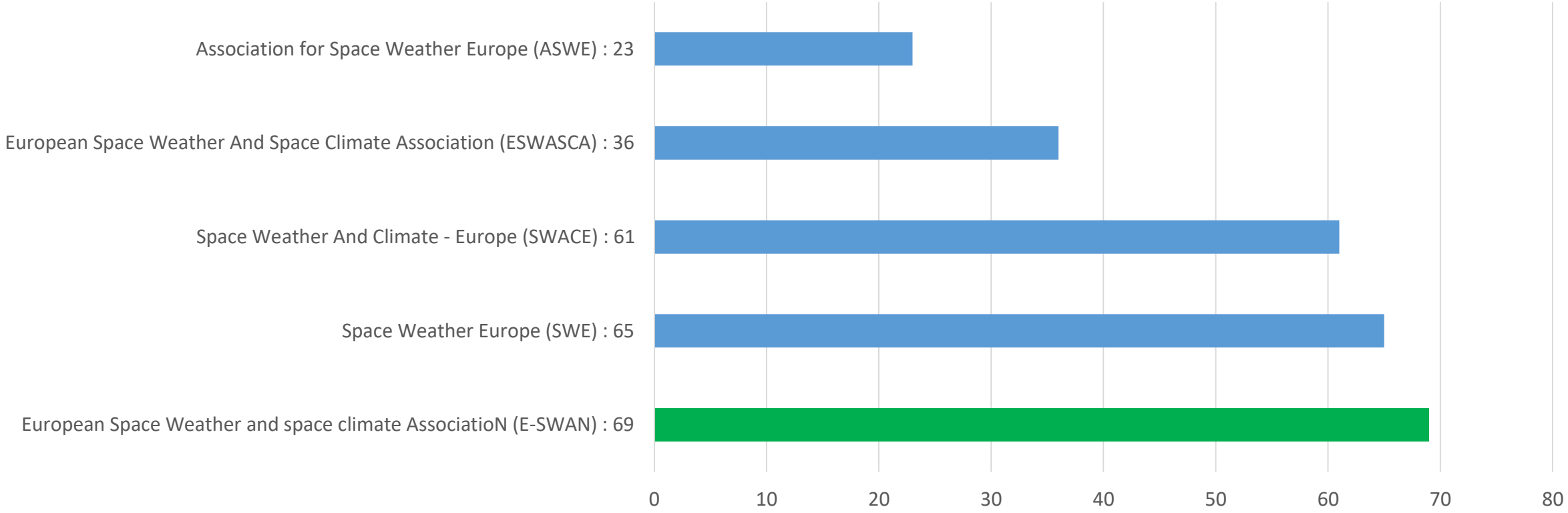
Quo Vadis European Space Weather Community?

Results of the vote for the name of the new organisation:



Quo Vadis European Space Weather Community?

Results of the vote for the name of the new organisation:



Quo Vadis European Space Weather Community?

You are invited to join us on Friday 29 Oct 11:25-12:30
in the main auditorium for our Topical Discussion Meeting

t07 - Quo Vadis European Space Weather and Space Climate Community?

Location: Main Auditorium

Mateja Dumbovic (Hvar Observatory, Faculty of Geodesy, University of Zagreb), **Luca Spogli** (Istituto Nazionale di Geofisica e Vulcanologia), **Sophie Chabanski** (Royal Belgian Institute for Space Aeronomy)

TDM type: 4. Other

For the past year there has been an initiative to consolidate European space weather and climate community and to sustain and develop the successful efforts made thus far.This initiative culminated in the community vote which decided that an International Non-Profit Association (INPA) should be formed. Since then, a group of volunteers (the Interim board) has worked to prepare all legal and administrative aspects needed to establish the INPA, which will be formally registered and led by a group of people elected by the community at the Space Weather Working Team meeting at European Space Weather Week 2021. This topical discussion meeting (TOM) is devoted to discuss how this new structure will be organized, what are the rights, privileges and obligations of its members, what is its future and how to get involved. The TOM is open to everyone who is interested in the future of the European Space Weather and Space Climate community (users, scientists, stakeholders, European, non European...).

SWWT Plenary Meeting 41

27 /10/2021, 14:30 to 16:00 (CET), Glasgow, UK

- 14h30-14h35: Short SWWT intro (S. Poedts, 5 min)
- 14h35-14h45: Planning for Chair election (Stefaan/Alexi)
- 14h45-15h00: Space Safety Program update (Jussi/Alexi)
- 15h00-15h15: ESA technology programmes (Piers)
- 15h15-15h30: TWG reports (TWG leaders)
- 15h30-15h45: Ken Holmlund: WMO plans in space weather
- 15h45-16h00: Short report on UK national severe space weather preparedness strategy (Mike Hapgood)
- 16h00-16h15: ESF/European Space Science Committee (Mauro Messerotti)
- 16h15-16h25: Quo Vadis election results
- 16h25-16h30 Next meeting announcement (Hvar & STCE, Croatia)

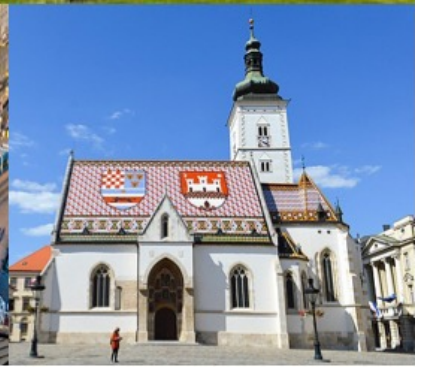
18th European Space Weather Week

2022, Zagreb, Croatia

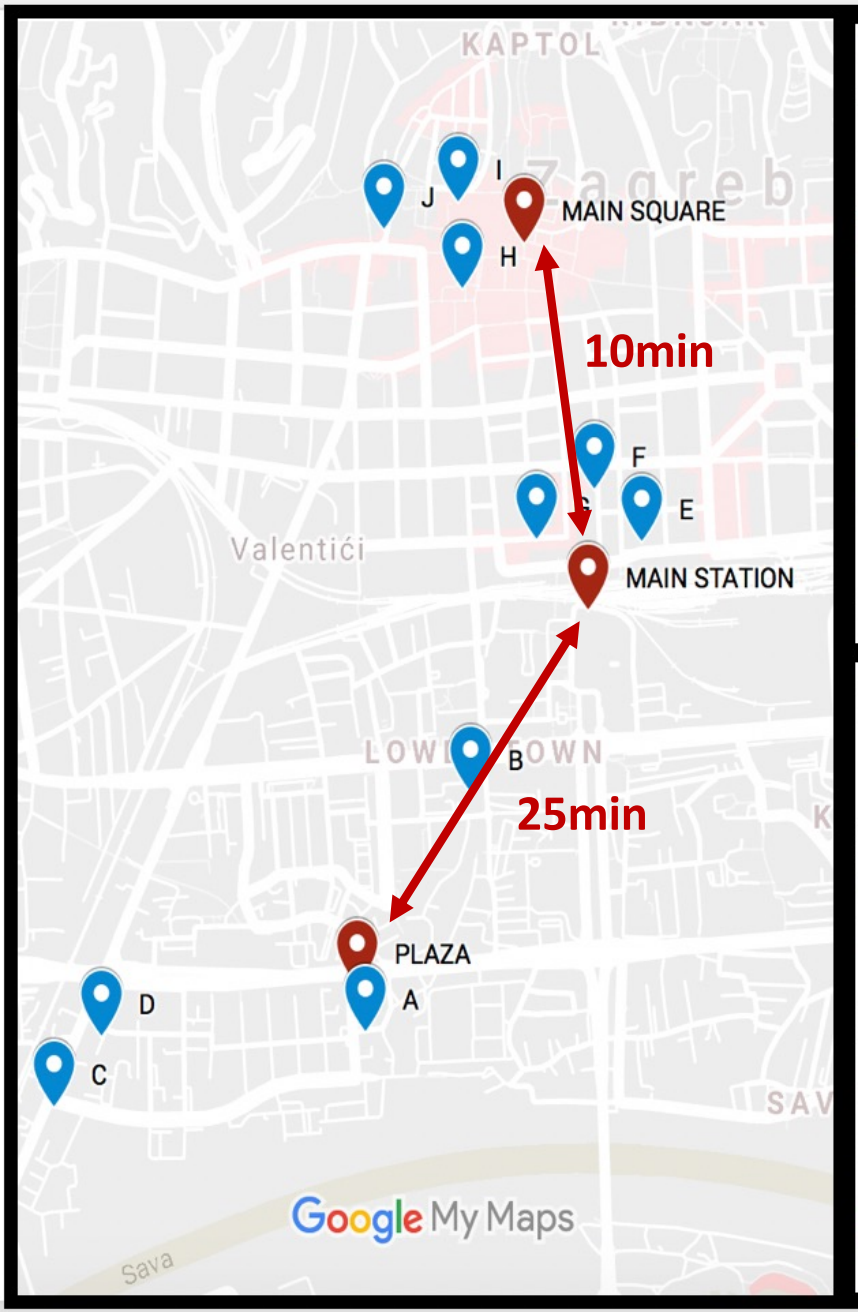
24-28.10.2022.

ESWW

Zagreb, Croatia



Venue: City Plaza



Local organizing team

Hvar Observatory
Zagreb, Croatia

LOC Co-chair: Mateja Dumbovic
+
Jasa Calogovic
Bojan Vrsnak
Davor Sudar
Domagoj Ruzdjak
Ivica Skokic
+
Students..

STCE
Brussels, Belgium

LOC Co-chair: Petra Vanlommel
+
Elke D'Huys
Olivier Lemaitre
Ronald Van der Linden
Sarah Willems

TAKE AWAY MESSAGES about ESWW2022:

WHERE: Zagreb, Croatia

WHEN: 24-28.10.2022.

HOW: hybrid (in person+online)

WEBSITE: https://www.stce.be/esww2022/

See you in Zagreb next ESWW!