SWWT Plenary Meeting 39

Wednesday, 7 November 2018, 15:15 to 17:15

Leuven, Belgium, MTC 00.10

Present: 161 participants(!)

Agenda

1. Welcome and Introduction (Stefaan Poedts, 2 min)
2. The SSA Programme and SWE Segment status: Period 3 (Jussi, 20 min))
3. SSA SWE service network overview and development within Period 3 (Alexi, 15 min)
4. Upcoming H2020 Space call – 2019 with the focus on the Space weather topic (Andrej Rožkov, European Commission Research Executive Agency, 10 min)
5. ESA Space Environment related R&D activities within the ESA technology programmes (Piers Jiggens, 10 min)
6. Four-year Plan for WMO Activities related to Space Weather 2020-2023 (Toshiyuki Kurino, 5 min)
7. UN SWx activities and COSPAR SWx activities (Hermann Opgenoorth, 10 min))
8. Reports on national activities and perspectives (all members, 10 min)
    a. Italian Space Agency and National Institute of Astrophysics projects (Mauro Mezzerotti)
    b. OFRAME (Nicole Vilmer)
9. Hosting arrangements for ESWW 16 (2019) and 17 (2020) (Alexi Glover (10min)
10. Action Item Review (S. Poedts, 2 min)
11. Any other business

Minutes

Welcome and Introduction (Stefaan Poedts)

SP welcomes the participants and presents the agenda of the meeting which is adopted without any changes.

The SSA Programme and SWE Segment status: Period 3 (Juha-Pekka Luntama)

Jussi starts by mentioning that he will also talk about SSA beyond Period 3. He first lists the objectives of the SSA program, viz. to support mitigation of the adverse impacts of space weather, to establish European capability for operational modelling and forecasting of space weather events and impacts, and to ensure continued availability of data for objectives 1 and 2. Then he briefly discussed the current SSA SWE network and the SSA space weather system today (see slides in Annex 1). There are currently 25 pre-operational services based on > 150 products, >850 registered users and > 400 000 hits on the service portal monthly. Moreover, there are two hosted payload mission waiting for launch and the Lagrange L5 mission is in Phase A/B1.

Then Jussi moved to the enhanced space weather monitoring system, i.e. the future. He first showed an artist impression of what might be seen by an L5 mission, incl. the solar disk magnetic field, EUV imaging, Solar X-ray flux, etc. There are two parallel system studies (led by Airbus and OHB, resp.) and a very strong (leading) UK contribution. The decision about Phase C/D funding in the ministerial Council Meeting 2019. The launch is foreseen in 2025 (so not at the end of 2023 as mentioned before). There are also dedicated SmallSat missions foreseen (Phase 0 study was completed in November 2017) and more proposals for Phase A/B studies are welcomed.

SSA will be replaced by Space Safety: protection of our planet, humanity, and assets in space and on the Earth from dangers originating in space . There is a 'Debris and Cleanspace' component and a Planetary Defense component. Prospects for Space Safety Space Weather Activities include maturing the SWE network, coordinated V&V, coordinated communication enhancement, R2O/O2R, etc.

See the slides in Annex 1.

SSA SWE service network overview and development within Period 3 (Alexi)

Alexi started with an overview of the current SWE network, a unique SWE service system, led by the 5 expert service centres (ESCs) and spread over whole Europe. The SWE services business logic starts bottom up from individual products (SWE product layer), going through a coordination layer (by the ESCs) and ending on the top with the user interface and tailoring

(SSCC & SWE portal). The network operation in order to provide SWE services has been successfully demonstrated and the SSCC gained 4 years of experience in the meantime.

Review and update recommendations made to SWE Service Roadmaps. Next the SWE system will be reinforced and matured, the dependence on non-European systems will be reduced and the transition towards operations will start. Alexi then showed a few examples. The SSCC evolution in 2018 includes a joint helpdesk (BIRA/ROB team + AIRA) providing additional redundancy in operations & extra coverage during e.g. bank holidays; and prototype "user customizable dashboard" pending deployment of a new customizable portal interface, as well as training courses. The SWE coordination and SWE product layers of the service will be improved (see 'slide 29' of the annex). Operations procedures enable a consistent network-wide response. The SSCC already has well establish procedures and the ESCs set up well established procedures with coordinators. The first version of the ESC procedures is being developed and in review. A relational database to store common information will be developed. Key Performance Indicators (KPIs) are important to evaluate the success of the SSA SWE Network. The SWE service currently contains 25 preliminary online services and 177 products. Next steps include the implementation of network-wide procedures in time for Network Review (Jan 2019) and a major update to SWE portal interface and SSO upgrade Q2 2018. The P3-SWE-VIII SWE system design is in preparation and will include enabling data system developments. As of January 2019 the following deployments are expected: P2-SWE-XIII (Satellite risk indices based on radiation belt modelling), P2-SWE-XIV (Virtual Space Weather Modelling Centre Pt 3), as well as products under development within the ESC frameworks.

See the slides in Annex 2.

Upcoming H2020 Space call – 2019 with the focus on the Space weather topic (Andrej Rožkov, European Commission Research Executive Agency)

Andrej advertised the recently (Oct 16th) opened Space 2019 call and provided a short overview of the call and the work programme, incl. a space weather segment. Projects should be complementary to existing infrastructure, incl. new models and new forecasting techniques. There are no limits on countries, everybody can participate. Inclusion of SMEs is encouraged. The closing date is 12 March 2019 and the indicative budget amounts to 9 million EUR.

See the slides in Annex 3.

ESA Space Environment related R&D activities within the ESA technology programmes (Piers Jiggens)

First, Piers gave a quick overview of the Space environment and effects section (TEC-EPS) and of Technology Readiness Levels (TRLs) going from 1 to 9. TEC-EPS operates between TRL1 and TRL5. ESA has a wide range of Technology Programmes, incl. TDE, GSTP, and SSA. Then Piers

showed an overview of the TDE/TRP ongoing activities, incl. Solar Energetic Particle Radiation Advanced Warning System (SAWS-ASPECS), GEO telecoms radiation tools efficiency improvement with methods and geometry exchanges for industrial tools, AlphaSatTDP-8 MFS Particle Spectrometer Data Analysis, Radiation environment at extremely low altitude and latitude, and improvement of energetic solar heavy ion environment models (ESHIEM).

The GSTP programme includes more instrument oriented activities. Upcoming and planned activities include the VSWMC-Part III, Heliospheric modeling techniques, Spenvis-NG,… Interested people are urged to contact their GSTP delegates.

See the slides in Annex 4.

Four-year Plan for WMO Activities related to Space Weather 2020-2023 (Toshiyuki Kurino)

See the slides of Toshiyuki-San in Annex 5, which are quite informative and complete.

UN SWx activities and COSPAR SWx activities (Hermann Opgenoorth)

Hermann clarifies that he will rather talk on the European Space Sciences Committee (ESSC) which is organized in 4 panels and has interactions on very high level with the EU, National Space Agencies and ESA. It provides strategic advice and prepares detailed recommendations for a consolidated and strategic European approach to SWx activities.

See the very detailed slides in Annex 6.

Reports on national activities and perspectives (all members)

Italian Space Agency and National Institute of Astrophysics projects (Mauro Messerotti)

See slides in Annex 7.

OFRAME (Nicole Vilmer)

French organization for applied space weather = OFRAME (in French).
See slides in Annex 8.

Hosting arrangements for ESWW 16 (2019) and 17 (2020) (Alexi Glover)

Petra Vanlommel announced that ESWW16 (in 2019) will be 'in the neighborhood of Brussels'.

Alexi announced that 6 expression of interest have been received to organize ESWW17 in 2020. The Program Committee will now ask for a more detailed offer and select a candidate on the basis of these more detailed bids.

Action Item Review (Stefaan Poedts)

There are no Action Items from recent previous Plenary SWWT meetings. However, there are still 2 open actions form PM 33 and the question is what to do with these as they are already more than 5 years "on-going":

AI M33/1	Draw up a list of national contact points within civil contingency agencies.	**ON-GOING**
AI M33/2	Draft white paper, describing the potential impact of Space Weather on civil infrastructure.	**ON-GOING**

AI M33/1 is actually taken up by SSA now, hence the action is closed.

AI M33/2 is still very useful.

Any other business

SWWT Forecasting Forum: new challenges (Larissa Trichtchenko)

See slides in Annex 9.

The meeting closed at 5:15PM

SWWT PM-39 20181107-minutes

Annex 1

Space Situational Awareness

ESA Space Situational Awareness Programme (SSA) is an initiative aiming to provide European autonomy in civil systems and services needed to protect satellites and the Earth

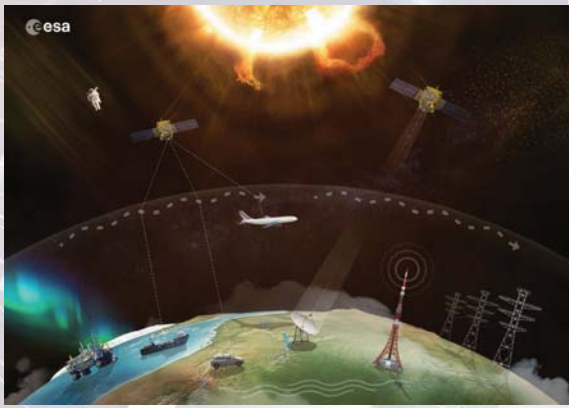
ESA SSA Space Weather Activities and Prospects

Juha-Pekka Luntama
Alexi Glover
Stefan Kraft

Space Weather Office
ESA Space Safety Programme Office

SSA Space Weather – Objectives

1. Support mitigation of the adverse impacts of space weather
2. Establish European capability for operational modelling and forecasting of space weather events and impacts
3. Ensure continued availability of data for objectives 1 and 2



SSA SWE Network 2018

http://swe.ssa.esa.int

Data archives
- SSA SWE Data Centre (Redu)
- Federated data repositories

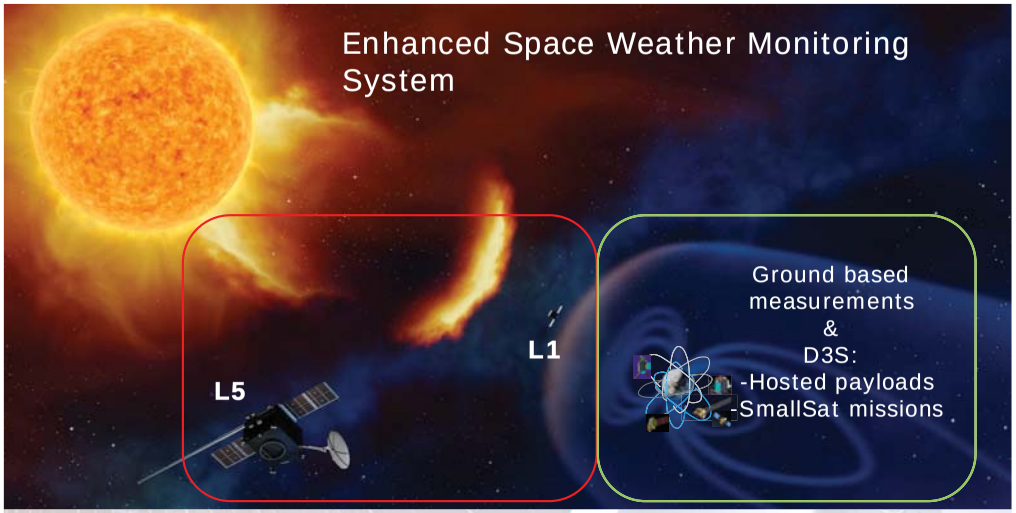
SSA SWE Coordination Centre
- User Helpdesk
- Space Pole, Belgium

SWE Expert Service Centres (ESCs)

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

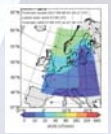
European expert groups and centres of excellence

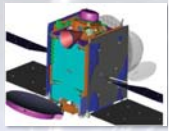
Sensor systems

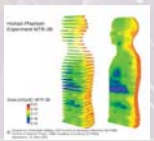


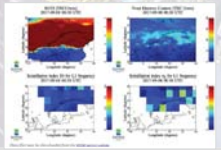
SSA Space Weather System Today

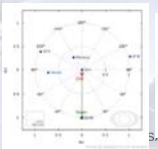
- 25 pre-operational services based on >150 products
- European Service Network of >40 Expert Groups
- > 850 registered users (October 2018)
- > 400 000 hits on service portal monthly
- Two hosted payload missions waiting for launch
- Lagrange L5 mission in Phase A/B1
- Coordinated Communication Protocol for Europe









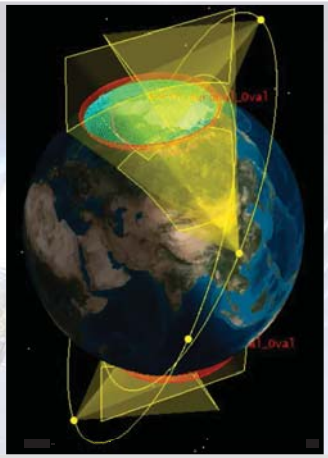


Lagrange Mission Status

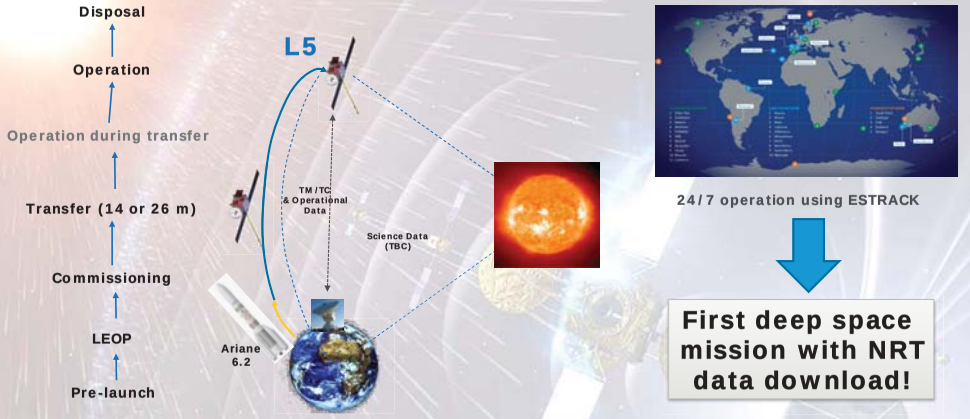
- Phase A/B1 in progress
  - 2 parallel system studies: AIRBUS, OHB
  - Remote sensing instrument study: RAL Space
  - In-situ instrument study: UNIVERSITY COLLEGE LONDON, DEPARTMENT OF SPACE & CLIMATE PHYSICS, MULLARD SPACE SCIENCE LABORATORY
- Two first reviews completed: PCR & PRR
- Decision about Phase C/D funding in CM19
- Launch foreseen in 2025

Dedicated SmallSat Missions

- Phase 0 study completed in November 2017
- A possible concept for SmallSat constellation
  - Auroral monitoring main objective
  - Number of other measurements
    - Low and medium energy particles
    - Plasma environment
    - Local magnetic field
    - Ionospheric electron density
    - Thermospheric neutral density
    - Microparticles
- Phase A/B study ITT open
- ITT for instrument package to be released shortly



Lagrange Mission architecture



Space Situational Awareness

Protection of our planet, humanity and assets in space and on Earth from dangers originating in Space

Provide European autonomy in civil systems and services needed to protect satellites and the Earth

Space Weather

able to protect critical space and ground infrastructure

Planetary Defence

early warnings for asteroids > 40 m ~3 wks in advance; deflect asteroids <1 km, known > 2 yrs in advance part of a global international effort

Debris and Cleanspace

– a vibrant space traffic – monitored and safe with autonomous systems free from causing damage and EoL measures

Vision

…by 2030 Europe…

SSA and Space Safety Industry Day

28 November 2018 at ESA's European Space Operations Centre, Darmstadt, Germany

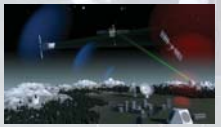
Registeration by 9 November:

Send your name, title and company name by email to:

Nicole Michailidis via SSA.Events@esa.int

or call: +49 6151 904365.



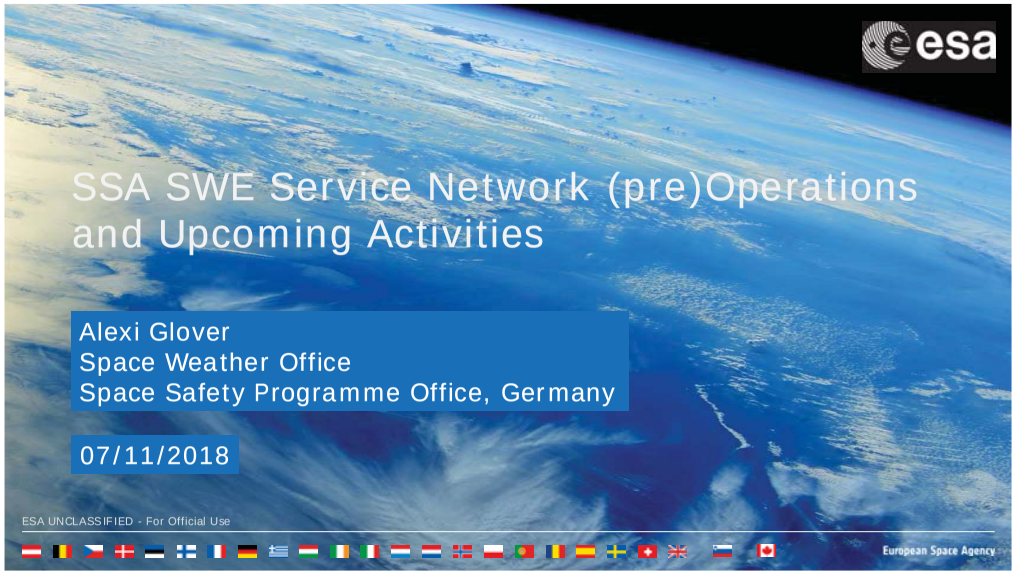



Prospects for Space Safety Space Weather Activities

- Maturing of SWE Network
- Coordinated V&V
- Coordinated communication enhancement
- R2O/O2R
- Enhancement and development of products and services
- Enhancement of data system including APIs
- European SWE measurement system

=> Transition towards operations starting 2020

SSA Virtual Research Environment Survey



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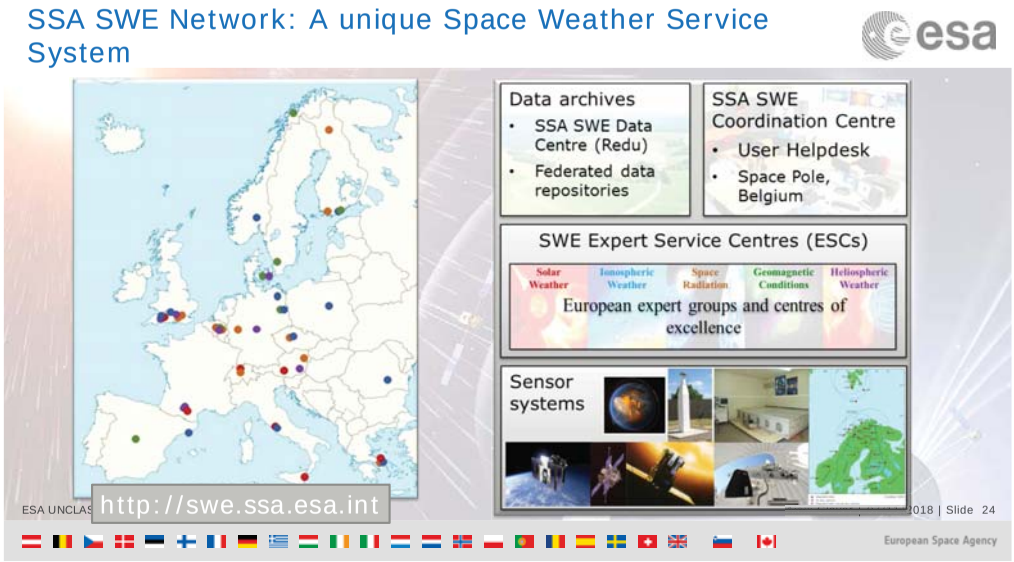
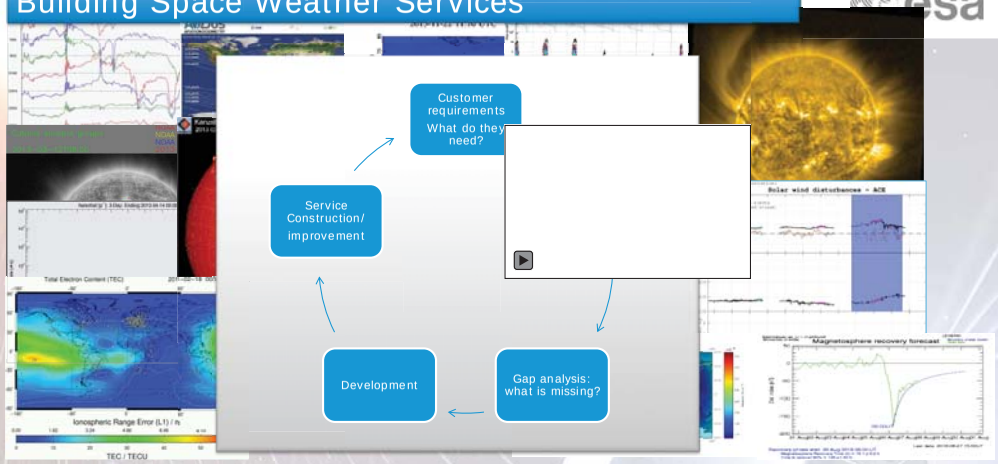
Annex 2



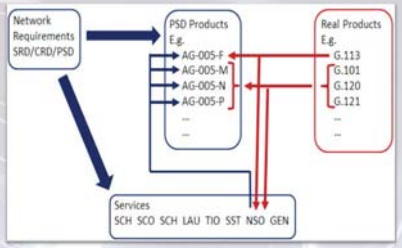
SWE Services Business Logic

Building Space Weather Services



SWE Network Status P2 & P3 Strategy

- Successfully demonstrated network operation in order to provide SWE services
- ESC establishment & development
- Deployment of 21 preliminary SWE Services
- Product content grew to ~140
- SSCC gained 4 years experience
- Review and update recommendations made to SWE Service Roadmaps



Reinforce & mature the SWE System

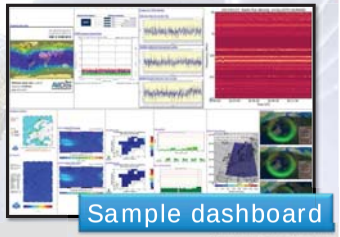
Reduce dependence on non-European systems

Begin transition towards operations

SSCC Evolution in 2018

- Joint helpdesk: BIRA/ROB team and AIRA
  - Additional redundancy in operations & extra coverage during e.g. bank holidays.
- Prototype “user customisable dashboards” pending deployment of new customisable portal interface
- Bespoke training courses
  - General use and tailored to individual client
  - Trial approach at ESA (Mars Missions), ESWW, BIRA

SSCC room @SpacePole



Sample dashboard

Structured Service Improvement

- SWE Coordination layer
  - Mature & consistent **network-wide processes**, interaction between network entities
  - **Coordinated V&V** feeding into maturity levels
  - Continue SWE **Coordinated Communication** exercises
- SWE Product layer
  - Extension & improvement to **address service gaps: targeted developments**
  - Regular product **availability & timeliness monitoring**
  - Work towards **API**s enabling ease of utilisation within Network

Reinforce & mature the SWE System

Begin transition towards operations

Key Performance Indicators

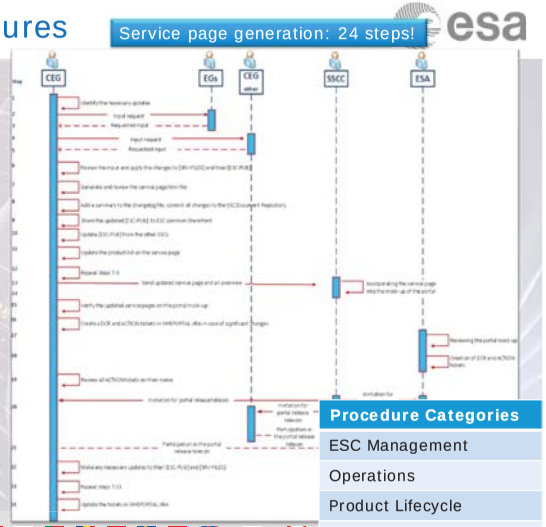
Used to evaluate the success of the SSA SWE Network. Quantitative indicators to verify whether the objectives of the SSA SWE Network have been achieved.

Objective #	Description
1	*The SSA SWE Network shall reach End Users*
2	*The SSA SWE Network shall be able to demonstrate user engagement*
3	*The SSA SWE Network shall be able to demonstrate user satisfaction*
4	*The SSA SWE Network shall demonstrate increasing service maturity*
5	*The SSA SWE Network shall demonstrate a high level of Service Quality*

Measurable Goal (examples)
Increasing Service usage
Increasing # of users regularly accessing the SWE Portal
Second line support engagement
Time to ticket resolution & follow up
Engagement activities
Move towards Provision of complete services
Increasing reliability (availability)
Product accuracy
Accurate description of model and parameters used

Operations plans and procedures

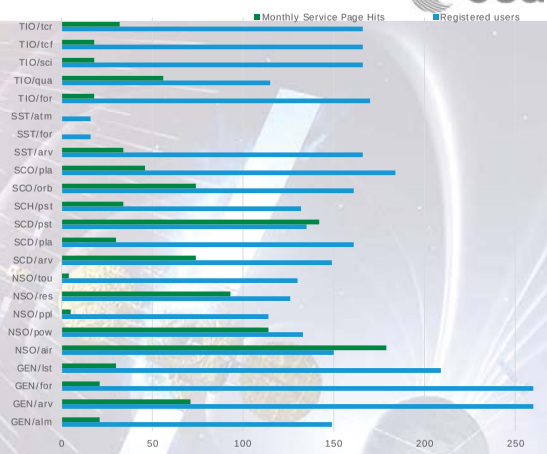
- Enables a consistent network-wide response
- SSCC already well establish procedures
- ESCs well established procedures with coordinators
  - Documenting the procedures and workflows
  - interaction with EGs
  - interaction with SSCC
- First version of ESC procedures being developed and in review.
- Development of relational database to store common information



Procedure Categories
ESC Management
Operations
Product Lifecycle
Service Lifecycle

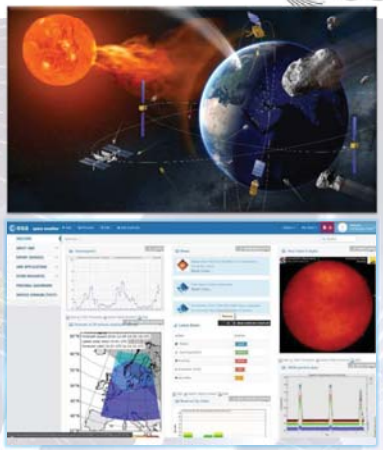
SWE Service Status

- 25 preliminary services online
  - >875 users
  - ~500,000 hits/month
- 177 products
- Service page hits show NSO/pow, SCD/pst and NSO/air as most frequently visited
- >590 twitter followers



Next Steps

- Implementation of network-wide procedures in time for Network Review, Jan 2019
- Major update to SWE portal interface and SSO upgrade Q2 2018
- P3-SWE-VIII SWE system design in preparation
  - Will include enabling data system developments



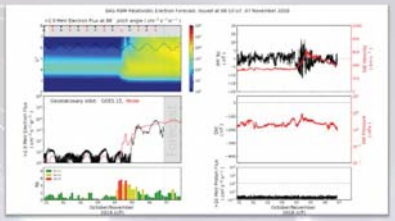
Upcoming Activities

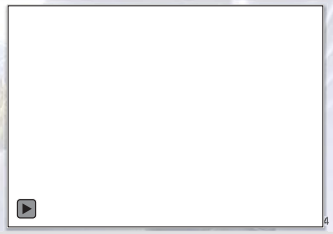
- Activities planned in all five ESC domains plus overall system development, feasibility studies and requirements activities
- Some product development and feasibility study examples:
  - P3-SWE-126 Use of L5 data in CME propagation models (450 k€)
  - P3-SWE-124 Utilisation of EISCAT-3D in SSA SWE services (200 k€)
  - P3-SWE-XV: Enhanced Solar Weather Analysis (250 k€)
  - P3-SWE-XVIII Space Environment Nowcast & Forecast (800 k€)
  - P3-SWE-XXXI: Space Radiation Applications for Spacecraft Operators (400 k€)
- For full list and more detail **SSA and Space Safety Industry Day 28th November**

Upcoming Deployment: Examples

Expected in January 2019:

- P2-SWE-XIII: Satellite risk indices based on radiation belt modelling
- P2-SWE-XIV: Virtual Space Weather Modelling Centre Pt 2
- Products under development within ESC frameworks





THANK YOU

swe.ssa.esa.int
www.esa.int
@esaspaceweather

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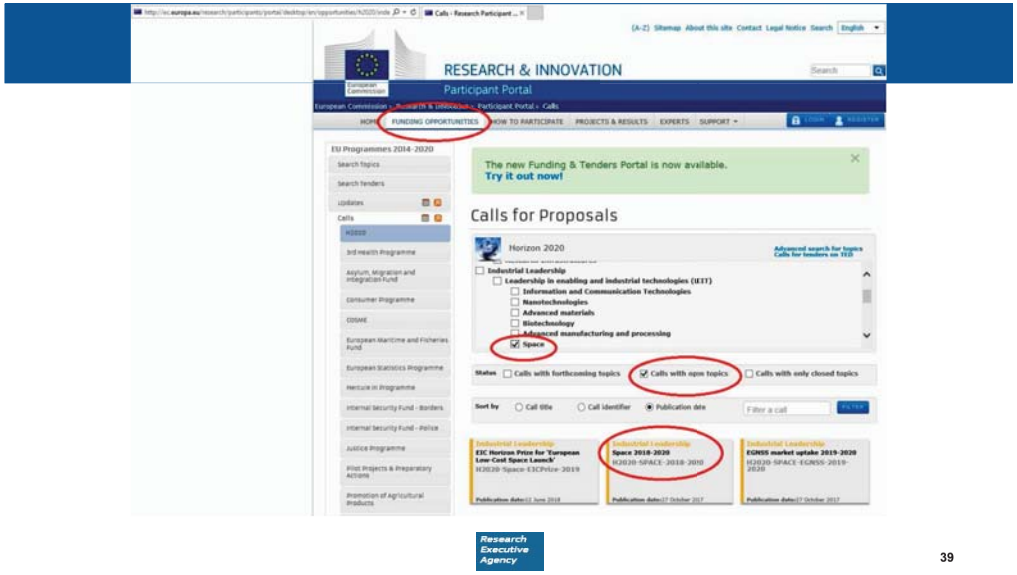
Annex 3



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EN

Horizon 2020

Work Programme 2018-2020

5.iii. Leadership in Enabling and Industrial Technologies - Space

IMPORTANT NOTICE ON THIS WORK PROGRAMME

This Work Programme covers 2018, 2019 and 2020. The parts of the Work Programme that relate to 2019 (topics, dates, budget) have, with this revised version, been updated. The changes relating to this revised part are explained on the Participant Portal. The parts that relate to 2020 are provided at this stage on an indicative basis. Such Work Programme parts will be decided during 2019.

(European Commission Decision C(2018)4708 of 24 July 2018)

European Commission

40

SU-SPACE-22-SEC-2019: Space Weather

Scope

- Proposals shall address the development of modelling capabilities and/or the delivery of prototype services able to interpret a broad range of observations of the Sun's corona and magnetic field, of the Sun-Earth interplanetary space and of the Earth magnetosphere/ionosphere coupling relying on existing observation capacities.
- The goal is to pave the way for forecasting horizons for space weather events in the order of tens of hours or days and to identify potential indicators (or proxies) of extreme events potentially through the joint analysis of interdisciplinary data.

SU-SPACE-22-SEC-2019: Space Weather

Scope

- Proposals shall address application domains which may include space as well as terrestrial infrastructure.
- Proposals shall include architectural concepts of possible European space weather services in relation to the application domains addressed and they shall demonstrate complementarity to and, if relevant, utilize precursor Space Weather services already available through the Space Situational Awareness programme of ESA and take into account the global space weather service developments by the World Meteorological Organisation (WMO).

SU-SPACE-22-SEC-2019: Space Weather

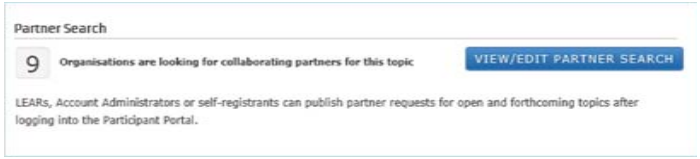
Impact

- Improved scientific understanding of the origin and evolution of space weather phenomena;
- New models and forecasting techniques capable of extending the time horizon of a future space weather forecasting capability to several days;
- Inventory of potential early indicators of extreme space weather events.

SU-SPACE-22-SEC-2019: Space Weather

This action is also open to cooperation with international partners with relevant expertise.

Participation of industry, in particular SMEs, is encouraged, as well as the involvement of post-graduate scientists, engineers and researchers, for example through professional work experience or through fellowships/scholarships as applicable.



SU-SPACE-22-SEC-2019: Space Weather

Indicative

Call opening: 16 October 2018

Call closing: 12 March 2019

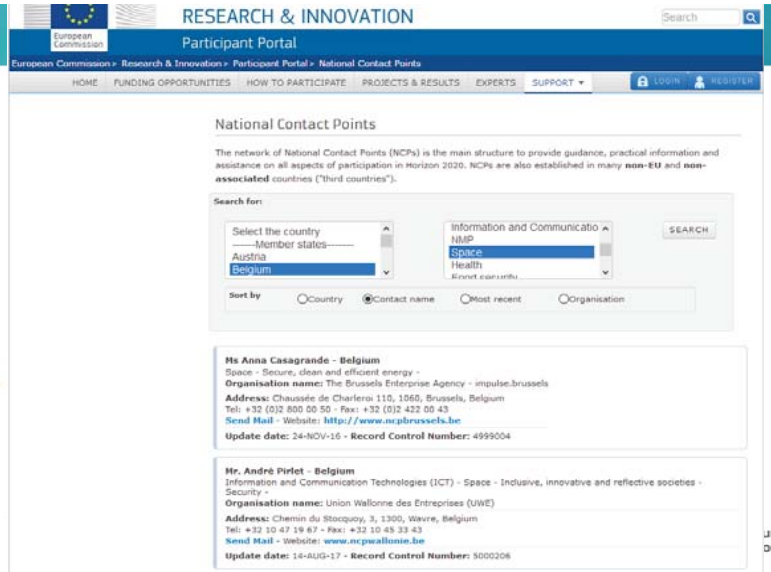
~~A guidance document will be published (available when the call will be open).~~

You may ask Your National Contact Points for the slides presented during the last NCP Info day, which took place on 3 October 2018.

SU-SPACE-22-SEC-2019: Space Weather

Indicative budget 9 million EUR.

The Commission considers that proposals requesting a contribution from the EU of between EUR 2 and 3 million would allow this specific challenge to be addressed appropriately.



SWWT PM-39 20181107-minutes

Annex 4

Space Environment and Effects Section (TEC-EPS)

ESA's Space Environment and Effects Section based at ESTEC in Noordwijk, The Netherlands is responsible for:

- Environment definitions (e.g. radiation, plasma, micro-particles, planetary atmospheres)
- Effects calculation (e.g. radiation dose, single event effects, charging, ESD, particle impacts)
- Project (mission) support (environment specification, impacts assessment, etc.)

The Research and Development (R&D) can be sub-divided into the main research area's of the Space Environment and Effects (TEC-EPS) section:

- Radiation environment and Instrumentation
- Space debris environment
- Plasma environment
- Atmosphere and planetary environments
- Atomic oxygen environment
- Space Weather Technology Development

Technology Readiness Levels (TRLs)

TRL 1	Basic principles observed and possible capability recognised		
TRL 2	Technology concept and possible useful application identified	**H / W**	**S / W**
TRL 3	Active R&D, proof-of-concept by analysis and experimentation		
TRL 4	Technology implemented in breadboard and detailed characterisation performed including testing of critical elements	BB	Alpha
TRL 5	Validation in relevant environment integrated with realistic supporting elements for end-to-end testing	EM	Beta
TRL 6	Representative model/prototype demo. in relevant environment	EQM	Public
TRL 7	System prototype demonstration in a space environment (Opt.)	PFM	
TRL 8	Actual system "flight qualified" through test and demonstration	FM	Final
TRL 9	Actual system "flight proven" through successful mission ops		

Increasing Maturity of Technology

See: ESA TRL Handbook (Sept. 2008)

ESA Technology Programmes

There are a wide range of technology programmes in ESA funding developments spanning the different TRL levels including:

Technology directorate (TEC)

GSP - General Studies Programme

TDE – Technology Development Element (formerly TRP:Technology Research Programme)

GSTP – General Support Technology Programme [Develop – Make – Fly (small missions)]

Other directorates

Science (SCI): CTP – Core Technology Programme

Telecommunications (TIA): ARTES - Advanced Research in Telecommunications Systems

Human spaceflight and Robotic Exploration (HRE): E3P – Exploration Envelope Programme

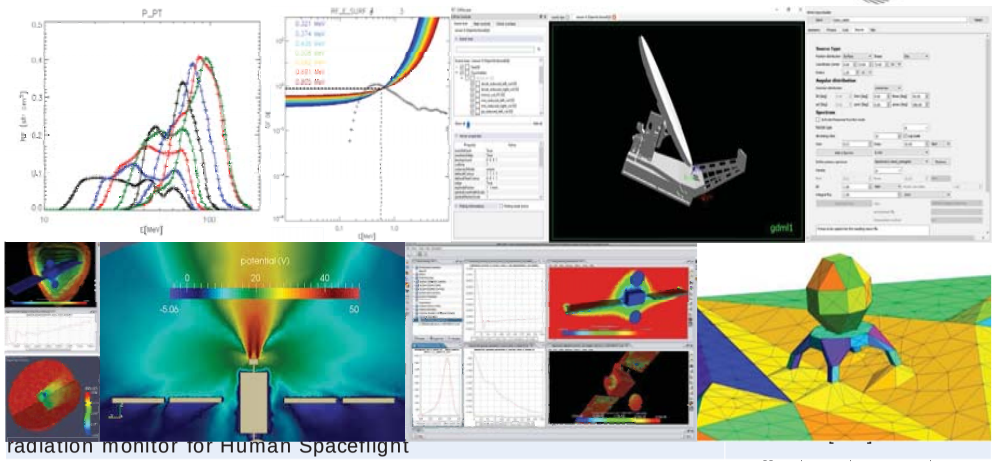
ExPeRT – Exploration Preparation , Research and Technology

Space Transportation (STS): FLPP - Future Launchers Preparatory Programme

Earth Observation (EOP): EOEP - Earth Observation Envelope Programme

Navigation (NAV): EGEP - European GNSS Evolution Programme

TDE/TRP ongoing Activities (1)



radiation monitor for Human Spaceflight

ESA Technology Programmes and SSA

Technology Development Element (TDE - formerly TRP)

- Nominal TRL: 1-3
- Mandatory programme, budget from mandatory contribution of all member states
- EMITS – **http://emits.sso.esa.int**

General Support Technology Programme (GSTP)

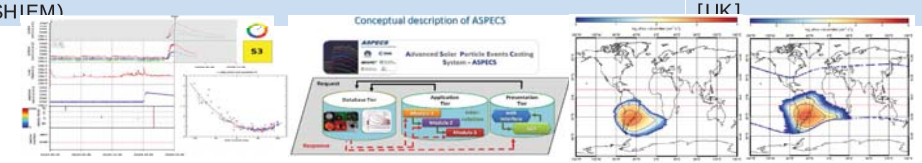
- Nominal TRL: 3-6
- Optional Programme, funding requested per activity
- Check EMITS, **GSTP-6 compendium of potential activities**

Space Situational Awareness (SSA) – Space Safety

- Nominal TRL: 5-9
- Optional Programme, funding confirmed by the Member States separately for each period (presently in Period 3)
- EMITS - ITTs targeted to industry in participating Member States

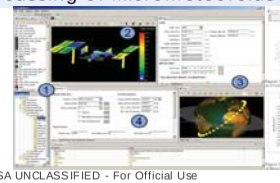
TDE/TRP ongoing Activities (2)

Activity	Prime Contractor
Solar Energetic Particle Radiation Advanced Warning System (SAWS-ASPECS)	NOA-IAASARS [GR]
GEO telecoms radiation tools efficiency improvement with methods and geometry exchanges for industrial tools	TRAD [FR]
AlphaSat TDP-8 MFS Particle Spectrometer Data Analysis	EFACEC [PT]
Radiation environment at extremely low altitude and latitude	RadMod Research [UK]
Improvement of energetic solar heavy ion environment models (ESHIEM)	Kallisto Consultancy [UK]

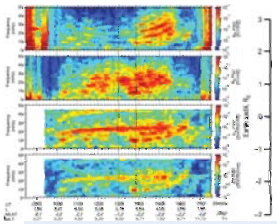
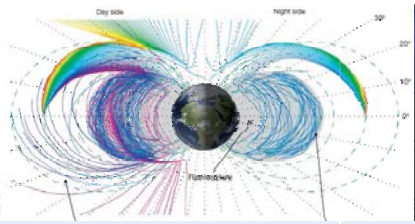
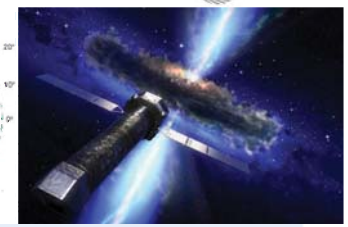
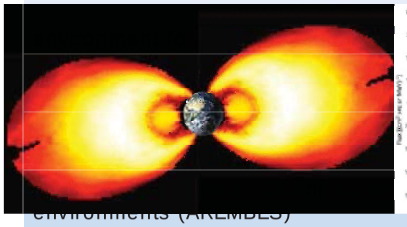
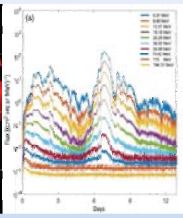
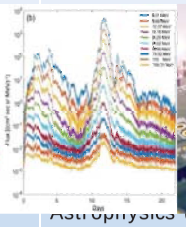


TDE/TRP ongoing Activities (3)

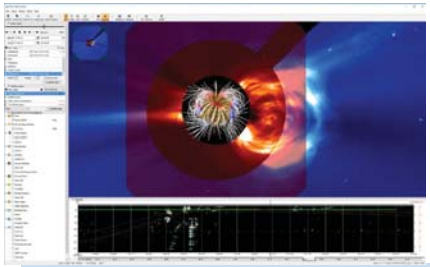
Activity	Prime Contractor
Radiation Belt Model Development and Validation (VALIRENE)	DH Consultancy [Be]
Innovative materials for passive radiation shielding for Human spaceflight (ROSSINI-3)	TAS-I [IT]
Multi-scale high accuracy engineering tools for single event effects analysis in modern technologies	TRAD [FR]
Tissue-equivalent crew dosimeter based on novel 3D Si processing	SINTEF [NO]
Enhanced interplanetary meteoroid population model	Univ. Stuttgart [DE]
Focussing of Micrometeoroids in X-ray optics	Univ. Stuttgart [DE]



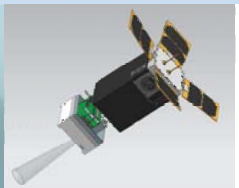

GSP, CTP, ARTES and other ongoing Activities

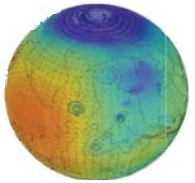








GSTP ongoing Activities





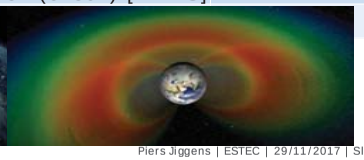




Upcoming and Planned Activities

Activity	Status
Virtual space Weather Modelling Centre – Part III (€800k) [GSTP]	Mostly supported
Heliospheric Modelling Techniques (€1M) [GSTP]	Partly supported
SPENVIS-NG Interfaces, Tools and Models (€300k) [GSTP]	Supported
Plasma environment modelling in Earth's magnetosphere (€250k) [TDE] (tbc)	ITT in 2019
European Contribution to International Rad. Env. Near-Earth (ecIRENE) [CTP]	RFQ soon (DN)
Radiation Hazards and Scenarios System for Human Spaceflight (€300k) [TDE]	ITT closing soon
Electric Orbit Raising Rad. Env. and Solar Array Degradation (€750k) [ARTES]	ITT in Q1 2019
Mini-Io	





GSTP Compendium Items

Code	Title	Budget (k€)
GT17-072EP	Low resource spacecraft plasma monitor prototype	500
GT17-073EP	Radiation energy effects on electronic components with very high energy heavy ion and electron beams	500
GT17-074EP	Radiation monitor data analysis for radiation belt modelling	700
GT17-075EP	Microparticle model validation based on in-flight data	400
GT17-077EP	Large mom[illegible]ng impact	500
GT18-002EP	Solar	600
GT18-003EP	Radiation Monitor System in a Package	600
GT18-008EP	Space Weather Instruments for SmallSat and Hosted Payloads Missions	1800
GT18-010EP	Global Magnetospheric Modelling to Drive Geomagnetic Services	600
GT18-011L	Data Analytics for Early Warning of Space Weather Events	300

Contact us and contact your GSTP Delegate

SWWT PM-39 20181107-minutes

Annex 5

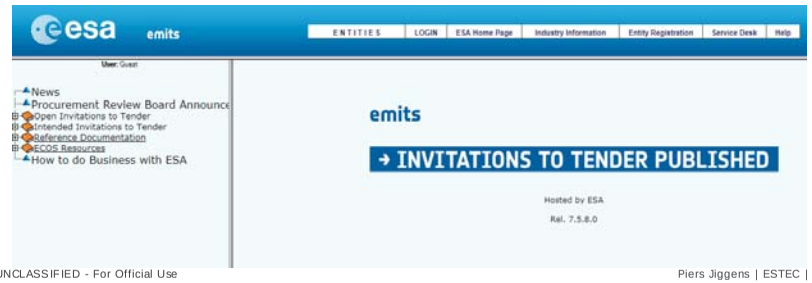
EMITS (Electronic Mail Invitation to Tender System)

For information on upcoming and open ITTs (Invitations To Tender) go to EMITS:

http://emits.sso.esa.int/

Any questions you can contact me and if I don't know I'll find someone who does:

Piers.jiggens@esa.int



Background (1/3)

- WMO the 68th session of the executive Council (EC-68) in 2016 approved the Four-year Plan for WMO Activities related to Space Weather 2016-2019 (FYP2016-19).
- The FYP2016-19 aimed at the integration of WMO activities related to space weather into existing WMO Programmes, including the integration of space weather observations into the WMO Integrated Global Observing System.
- FYP2016-19 is available from the following link;

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwiBmP_Xh8LeAhVCM-wKHbvbBO0QFjAAegQIAxAC&url=http%3A%2F%2Fwww.wmo.int%2Fpages%2Fprog%2Fsat%2Fdocuments%2FSAT-GEN_Space-weather-Four-Year-Plan-2016-2019-en.pdf&usg=AOvVaw1IVA3rm10hZtK5ha4zoQL7

Background (2/3)

- EC-68 requested the Commission for Aeronautical Meteorology (CAeM) and the Commission for Basic Systems (CBS) to establish an Inter-Programme Team on Space Weather Information Systems and Services (IPT-SWeISS)
- IPT-SWeISS has pursued the work of the Inter-Programme Coordination Team on Space Weather (ICTSW) initiated its activities in 2010, to take appropriate action to support the activities identified in the FYP2016-19 in partnership with relevant organizations such as the International Space Environment Service (ISES), as well as national and international agencies.

Background (3/3)

- EC-68 requested to submit to the 18th World Meteorological Congress (Cg-18) a report on the results achieved and proposal for future activities in this domain, which include;
  1) establish actions for the next four-year period and update the working structure for WMO activities regarding space weather
  2) foster multi-disciplinary collaboration, noting the diversity of organizational schemes of space weather activities which in many countries are conducted outside the NMHSs, and
  3) leverage national, regional or global initiatives and programmes, avoiding duplication but promoting instead complementary action through partnerships with internationally recognized UN or non-UN entities active in this area.

IPT-SWeISS Membership and Working Structure

WMO Members Argentina, Australia, Belgium, Brazil, Canada, China, Finland, France, Germany, Ind… Korea, Mex… Zealand, Pa… South Africa **UN, Intergo… and Interna… Communiti…** ICAO, ITU, CGMS (SWxCG), ESA, IROWG (SWxSG), ISES	IPT-SWeISS members reviewed FYP2016-19, and broke down into action items. Those action items were assigned to the task teams in IPT-SWeISS: …tems, including …niques and …exchange, …y; …cluding issues …tion and …te, and …ions; …tions, including requirements evaluation, the delivery of services, capacity building and user interaction; **Ad-hoc TT-AVI**: Space Weather Information Service for Aviation

The 2nd IPT-SWeISS meeting in May 2018 decided to organize the ad-hoc TT-FYP for drafting FYP2020-23

23 WMO Member Countries, 2 UN specialized agency, 3 Intergovernmental Organizations, and 1 International Research Community (updated: 12 July, 2018)

Chapters in FYP2020-23

1. **Introduction to the Four-year Plan 2020-2023**
   - 1.1. Purpose of This Document
   - 1.2. WMO Coordination of Space Weather Activities
   - **1.3. High-level Goals**
   - 1.5. Results Achieved
   - 1.6. Proposal for Future Activities

2. **Results Achieved in 2016-2019**
   - 2.1. Implementation of Space Weather Basic System in WMO framework
   - 2.2. Promoting Space Weather Science in WMO framework
   - 2.3. Development of Space Weather Applications in WMO Framework
   - 2.4. Collaboration with ICAO for Space Weather Information Service for Aviation
   - 2.5. Collaboration with ITU on Radio Frequency Coordination for Space Weather Observation

High-level Goals for the Four-Year Plan for WMO Activities related to Space Weather 2016-2019

- Promote the sustained availability, quality, and interoperability of the observations that are essential to support space weather warning and other services, while optimizing the overall cost of the observing system;
- Improve the collection, exchange and delivery of space weather data and information through open sharing … WMO Information …
- Ensure … operational service … advances from …
- Suppo… …ng and addres… …onses are required … …eronautical Meteorology Program… …blic Weather Service (PWS) programme;
- Foster the production … …end products and services by WMO Members, building on ISES centres and other exa… …cognized services, in developing best practices, to improve the accuracy, reliability, interoperabili… …erall cost-efficiency of the provision of services;
- ***Improve the emergency warning procedures and global preparedness to space weather hazards in accordance with the WMO Strategy on Disaster Risk Reduction***;
- Promote synergy between the space weather and the meteorological/climate communities and activities, and advance the understanding of space weather impacts on weather and climate processes;
- Support training and capacity-building, based on science and operational experience, to develop skills in the generation and interpretation of space weather products and services in order to allow WMO Members to utilize existing information in a meaningful way, build their own service capabilities, and facilitate user uptake of new products and services.

Improve the emergency warning procedures and global preparedness to Space Weather Hazards in accordance with the WMO Strategy on Disaster Risk Reduction

3. Proposal for Future Activities
   - 3.1. Implementation of Space Weather Basic System in WMO framework
   - 3.2. Promoting Space Weather Science in WMO framework
   - 3.3. Development of Space Weather Applications in WMO Framework

4. Collaboration with UN and Intergovernmental Organizations for Promoting Space Weather in WMO Framework
   - 4.1. Collaboration with ICAO for Promoting Global Space Weather Information Framework for Aviation Users
   - 4.2. Collaboration with ISES to Establish Global Framework for Space Weather Monitoring and Forecasting in Operation
   - 4.3. Collaboration with COSPAR and CGMS-VLab to Enhance Training and Capacity Building for Space Weather
   - 4.4. Collaboration with ITU on Radio Frequency Coordination for Space Weather Observation

WMO's Initiative for Promoting Space Weather will be realized in collaboration with

- Service providers (**ISES**)
- Space-based observations providers (e.g., **CGMS, ESA**)
- Scientific organizations (e.g., **COSPAR**)
- UN and Intergovernmental organizations (e.g., **ICAO, ITU**)
  - **ICAO**: operational, global space weather information service for aviation
  - **ITU**: Radio Frequency Coordination
- Overall UN space policy framework (**UN COPUOS**)

Schedule

- The first draft will be available by the end of November for the review by IPT-SWeISS members with inviting comments from Space Weather communities
- The second draft will be reviewed by WMO CAeM and CBS for reflecting comments from WMO Members.
- The final draft FYP2020-23 will be submitted to 18th Session of WMO Congress (Cg-18) in June 2019 for approval.

SWWT PM-39 20181107-minutes

Annex 6

The European Space Sciences Committee

Hermann Opgenoorth for the ESSC

Challenges for the European Research Area

ESSC MISSION STATEMENT

" The mission of the ESSC is to provide an independent European voice on European space research and policy.

It is the ESF's expert body on space research "

ESSC POSITION

International Environment

European Union

- H2020 Space Advisory Group (individuals)
- Horizon 2020 stakeholder consultations
- Direct interactions with programme representatives

National Space Agencies

- Annual meeting with ESSC FO
- CNES CERES
- Direct Ad-Hoc contacts

ESA

- Council at Ministerial level
- High-level Science Policy Advisory Committee (ex-Officio)
- Scientific advisory committees at programme level (ex-Officio)
- Meetings with ESA DG and programme executives,

  e.g. D-SCI, D-EOP, D-HME, ESA-SWE

- COSPAR Science Advisory Committee (ex-Officio)
- Observer status to UN COPUOS (via ESF)
- Overlapping membership COSPAR and UN

- **US National Academies Space Studies Board**
- CAS/NSSC
- JAXA
- IKI

ESSC MEMBERSHIP

ESSC Chair: Athena Coustenis, Paris Observatory and CNRS, France

Life and Physical Sciences in Space ***Panel Chair:*** **Dominique Langevin**, Université de Paris-Sud, France • Sarah Baatout, Belgian Nuclear Research Centre (SCK-CEN), Belgium • Alexander Chouker, Hospital of the Ludwig-Maximilian University, Germany • Berndt Feuerbacher, DLR, Germany • Helen Fraser, The Open University, United Kingdom • Marc Heppener, France • Anne Pavy Le Traon, University Hospital of Toulouse, France • Roberto Piazza, Milano Politecnico, Italy • Peter Preu, DLR, Germany • Hubertus Thomas, DLR, Germany	**Solar System Exploration** ***Panel Chair:*** **Hermann Opgenoorth**, Swedish Institute of Space Physics, Sweden • Mahesh Anand, The Open University, United Kingdom • Ester Antonucci, Torino Observatory of Astronomy, Italy • Luisa M. Lara, Instituto de Astrofisica de Andalucia -CSIC, Spain • Gerhard Paar, Joanneum Research, Austria • Petra Rettberg, DLR, Germany • Robert Wimmer-Schweingruber, University of Kiel, Germany
Earth Sciences ***Panel Chair:*** **Ian Brown**, Stockholm University, Sweden • Andreas Kääb, University of Oslo, Norway • Maarten Krol, University of Wageningen, Netherlands • Rosemary Morrow, LEGOS, France • Sindy Sterckx, VITO, Belgium • Pepijn Veefkind, Royal Netherlands Meteorological Institute, Netherlands	**Astronomy and Fundamental Physics** ***Panel Chair :*** **Stéphane Udry**, Université de Genève, Switzerland • Conny Aerts, Katholieke Universiteit Leuven, Belgium • Nabila Aghanim, IAS-CNRS, France • Michael Perryman, North University College, Ireland • Manolis Plionis, National Observatory of Athens, Greece • Alexander Tielens, Leiden Observatory, NL

The ESF CEO is ex-officio member of ESSC

ESA Council at Ministerial Level

Recommendations sent to ESA delegations and ESSC stakeholder mailing list (190+)

SCIENCE CONNECT
YOUR PARTNER IN SCIENCE

Recommendations to EC

ESSC

SCIENCE CONNECT
YOUR PARTNER IN SCIENCE
EUROPEAN SCIENCE FOUNDATION

The aim of this new committee is to prepare detailed recommendations for a consolidated and strategic European approach to SWx, within which we can identify the appropriate efforts and investments that need to occur in all parts of the *"SWx progress iteration loop"*, which is defined by communication between

a) new science understanding
b) the improved potential to deliver SWx products
(based on the most recent science findings)
c) evolving requirements of European end-users and infrastructure providers

(b) and c) are then feeding back to new requirements on efforts to improve science understanding

This Working Group should also analyse the challenges and monitor the approaches being taken around the globe, in order to carry out a gap- and requirement-analysis with special consideration of potential European strengths and weaknesses (vulnerabilities) to meet the global SWx challenge in true global partnership for mutual benefits.

Strategic Advice…

EUROPEAN SPACE SCIENCES COMMITTEE
European SWx Assessment and Consolidation Committee, ESWACC

1 **Prof. Hermann Opgenoorth, Chair**, IRF, Uppsala, Sweden (Chair, PSSE - ESSC)

2 **Prof. Bob Wimmer-Schweingruber, Vice Chair** University Kiel, Germany (Member, PSSE - ESSC)

3 Prof. Mike Hapgood, RAL, UK,

4 Prof. Mauro Messerotti, INAF Trieste, Italy,

5 Dr. David Berghmans, ROB Brussels, Belgium,

6 Prof. Jean Lilensten, IPAG Grenoble, France

7 Prof. Mark Lester, Univ. Leicester, UK

8 Prof. Manuela Temmer, Univ. Graz Austria

9 Dr. Kirsti Kauristie, FMI, Helsinki, Finland

10 Dr. Anna Belehaki, NOA, Athens, Greece

11 Prof. Michael Hesse, Birkeland Centre, Bergen, Norway (former director of NASA GSFC Division of Heliophysics and CCMC)

Ex-officio: Dr. Juha-Pekka Luntama, ESA SSA-SWE, Dr. M. Ljungqvist EC-DG Growth, and Dr. G. Peter, EU-JRC (ISPRA)

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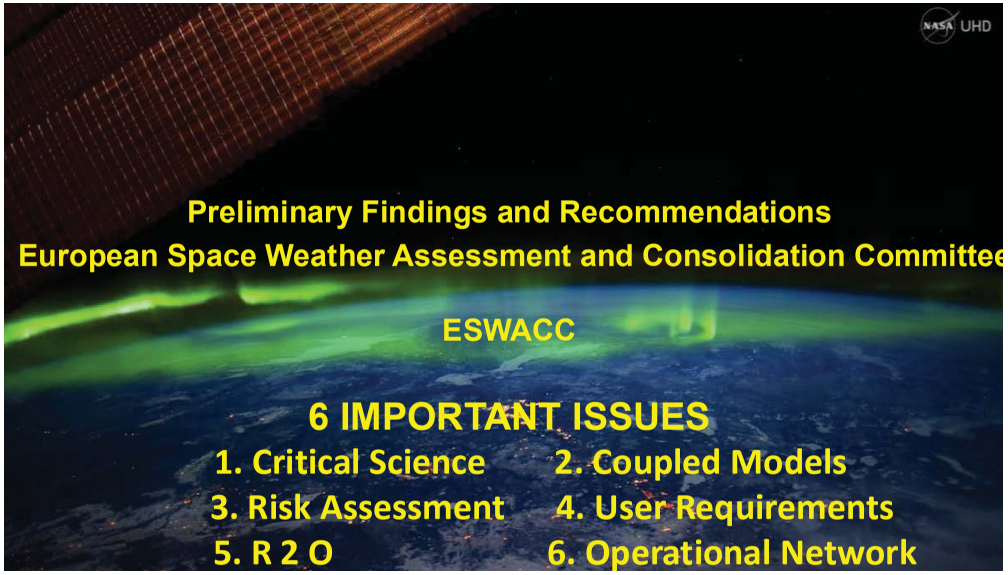
…uirements for the WG work:

- To investigate a possible consolidation of user needs and produce a map of competencies needed for taking the next steps in implementing Space Weather services for Europe.
- To investigate a possible consolidation of research needs concerning data coverage, data quality control, and supporting actions for transitioning research results into actionable products

- The resulting recommendations will need to balance
  - long-term efforts and investments in basic science,
  - short-term efforts and investments in applied science and
  - immediate efforts and investments in infrastructure resilience, survival and recovery.
- Any such recommendation should - if possible – also include efforts already undertaken by national and international organisations in Europe.

The committee will closely collaborate and coordinate its activities with the existing ESA SSA-SWE program and the parallel activities within the European Commission to recommend a path forward towards the establishment of a long-term European space weather effort and closely linked tailored SWx service functions for Europe as a whole - as a part of the the global picture.



(1) Imminent Need for Critical Research with Dedication to Enable Space Weather Understanding and Prediction (General)

ESWACC

- A unique fleet of spacecraft is now observing the sun, the solar wind and the near Earth environment
- Such an opportunity for ground-breaking science including several multi-spacecraft missions, and well developed ground-based networks will not re-occur within the foreseeable future of SWx observations
- We still lack critical scientific understanding of the solar cycle, solar eruptions, CME interaction with and propagation in the solar wind, mechanisms of energy storage, transformation and release in the magnetosphere/ionosphere system, and finally its propagation into the atmosphere, to improve the value of space weather forecasts as to meet the expectations emerging from most user requirements
- We also lack a coordinated science effort to combine the results of such research for SWx purposes

Recommendations:

- *Dedicated financial support to a directed **SWx-enabling research** effort in solar, heliospheric and magnetosph./ionosph./atmosph. physics to build a better knowledge base for future SWx services*
- *Exploitation of existing SWx dataset and "harvesting of low hanging fruits" should be lifted out of future general H2020 data exploitation calls - make a "dedicated drive" for space weather enabling science*
- *Efforts to combine data and results from connected regimes (system science) should be encouraged*
- *Funding should be sustainable (long-term) and make best use of the European assets in collaboration both in Europe and with similar efforts around the world*

(1) Imminent Need for Critical Research with Dedication to Enable Space Weather Understanding and Prediction (Ground-Based)

ESWACC

- To achieve an optimum exploitation of space science data from space assets it will also be necessary both to maintain and to close some glaring gaps in the coverage of present day ground-based space science observing instrument networks in Europe
- Networks of magnetometers, radars, ionosondes, Solar imaging, Neutron monitors, radio-observations etc., are presently operated on decreasing and often uncoordinated national funding.
- Europe also lacks a coordinated science effort to combine the results of such directed SWx research.

Recommendations:

- *Dedicated financial support - both at national and European level – to ground-based network efforts (maintenance and expansion into gaps), which support SWx-enabling research efforts in solar, heliospheric and magnetospheric/ionospheric/atmospheric physics in order to build a better knowledge base for future SWx services*
- *Such networks include magnetometers, ionospheric radars, optical observations, ionosondes, multi-frequency radio-observations of the sun, solar imaging (visible and H-Alpha) Neutron monitors, radio-scintillation and Faraday-rotation observations in the solar wind etc.*
- *Encourage member states to see funding of national instrument assets (often parts of networks) as a subscription for access to all data from wider European and global programs. Efforts should be supported to combine any European asset concerning such instrumentation into regional and global networks, to enable improved collaboration and data-sharing with other space-based SWx assets.*

(2) Support to Coupled Physics-based Modelling: Sun/Solar Wind/Magnetosphere/Ionosphere/Atmosphere

ESWACC

- Todays understanding of the physics of the sun, the solar wind and the magnetosphere/ionosphere/atmosphere system is incomplete and does not allow the reliable prediction which is needed for operational purposes. Even the most advanced models at our disposal have critical shortcomings and gaps, especially in coupling the immense diversity of the associated physical scales.
- This translates into an urgent need for further development of advanced physics-based models and also to couple such models for various regimes in space. Only then will we be able to make sufficient forecasts of timing, location and severity of SWx effects in the coupled solar-terrestrial system - which are essentially required to protect our technological assets.

Recommendations:

- *There should be a dedicated and sustained financial support in Europe for the development of state-of-the-art physics-based models for the sun, the solar wind and the magnetospheric/ionospheric/atmospheric system.*
- *To define and monitor any future progress of such efforts one will need a mechanism - and also well defined scientific and operational metrics - to validate and compare the performance of physics-based models, both throughout Europe and in collaboration with other global efforts.*
- *Using the NASA Community Coordinated Modelling Center, CCMC, as a role model, European efforts should be supported to combine and couple such models into an operational chain of predictive models from the Sun to Earth.*

(3) Consolidation of National, Regional and European Risk Assessments

- At present we lack a complete and true evaluation and description of European SWx risks for most individual countries and even for any regional and over-regional risks, which are emerging from the increasing interdependencies of the potentially affected infrastructure.
- The risks emerging from SWx events - and thus the definition of user-requirements - will obviously not be the same for different parts of Europe and also for different space and ground-based technological assets.
- There is an urgent need for a coordinated European assessment of national and regional risks and socio-economic impacts of a variety of space weather events, both for extreme and average solar activity.
- Only the basis of such a risk assessment a full catalogue of **European User Requirements** can be compiled.

Recommendations:

- *Support and enable a coordinated Europe-wide effort of national risk and socio-economic impact studies of SWx events – in close collaboration between SWx scientists and end-user engineers*
- *Support the combination of national risk assessments into regional and Europe-wide risk and impact analyses, addressing the interdependency and connectivity of many - if not all - technological infrastructures in Europe - build on laudable efforts already conducted by the EU JRC/Infrastructre.*
- *Support and enable awareness about and the dissemination of such risk assessments to national decision makers, but also to the communities of scientists, service providers and end users alike.*
- *Create an active exchange forum for tri-lateral discussions and regular updating processes between SWx Scientists, End Users and Service Providers (role model: European Space Weather Week, ESWW)*

(4) Consolidation of European User Requirements

- At present we lack a complete and true evaluation and description of European SWx User Requirements
- The one originally compiled by the ESA-SSA program was primarily oriented towards the needs of operators of space assets, and is only recently being updated to include more of the needs of state and industry sectors dealing with energy, communication, transport and logistics, health, finance, security etc…
- Only on the basis of a full European-wide risk assessment as described under (3) can a new and complete catalogue of **European User Requirements** be compiled, addressing risks on all assets (space only ≈10%)
- This catalogue should become a "living document", since both the infrastructures and their particular vulnerabilities and resiliencies constantly change and develop - as does the scientific understanding of potential SWx events and risks.

Recommendations:

- *Support and enable a coordinated European wide effort to define European SWx user requirements based on needs as specified by local region (such as arctic, sub-auroral, Mediterranean) and infrastructure domain (communication, energy, health, finance), addressing the risks from SWx impacts on space-based and ground-based infrastructure - build on efforts already conducted by JRC.*
- *There will be a need to prioritise such user requirements based on their value in mitigating particular impacts, e.g. forecasts helping operators to maintain power supplies or communication.*
- *Create an exchange forum for tri-lateral discussions and regular updating processes concerning user requirements between SWx Scientists, End Users and Service Providers. For most requirements the description of context and clear rationale will be crucial to determine the forecast type and quality.*

(5) "R2O" or how can SWx scientists best interface with what there is and will be in Europe and the world in terms of candidate organisations for SWx services

- There is no doubt that SWx services and predictions of events and effects are are urgently needed today by a variety of end users and decision makers to protect their assets in space and on the ground.
- The development of **future improved SWx services** must be driven by specific User Requirements (4), and based - and constantly improved - on the basis of a thorough SWx Risk Assessment.
- To improve the reliability of forecasts such future services should continuously be improved on the basis of the best available scientific knowledge. They must also make use of the best performing, coupled and "state-of-the-art" models available. To this end a constant dialogue between all SWx partners, i.e. SWx scientists and SWx engineers in the service and user communities will be required.

Recommendations:

- *Utilise and coordinate existing national efforts to provide regional space weather services (Examples: Belgium: ROB, UK Met-Office, France OFRAME, Germany, Greece, Italy, Scandinavia, etc.)*
- *Such coordination should initially happen at a European level, and later become closely adjusted to a parallel development on global scale (UN) and with respect to efforts of other nations (US, China,…)*
- *Any future European SWx service organisation should be well aligned with existing global organisations such as WMO, ICAO, etc…*
- *Any European effort should involve both ESA and all member-states, be driven by the European user requirements (4), and maintain a dialogue between service providers and the SWx science community.*

(6) Define and implement an operational network for future SWx observations

- Based on the emerging scientific understanding of space weather events and processes one has to define a baseline and optimum set of observable parameters at the Sun and in the heliospheric/magnetospheric/ionospheric/atmospheric system, which is needed to drive the required forecasts.
- Based on such required sets of observables one will have to define a minimum and optimum network of space and ground-based instrumentation, monitoring such variables with sufficient accuracy and in real-time. **NOTE: Any future observational network should also allow for new science emergence**.
- Any European network for space weather should be imbedded in a global effort of other nations, and that implies both complementarity and comparability in terms of location and type of measurement!
- *Space Weather* **knows no borders - it is a global threat**.

Recommendations:

- *Collaborate with the ESA-SSA optional program and also the space agencies of individual member states on the definition and future operation of a "fleet" of dedicated spacecraft and hosted payload elements for European Space Weather purposes.*
- *In collaboration with individual member states support the maintenance, modernisation and augmentation of ground-based instrument networks for space weather purposes*
- *In parallel each type of mission, payload or G-B instrument network needs to become part of a specific European and/or global network (examples of "types": Solar observations, L1/L5, various Geospace regimes (Magnetosphere, Ionosphere, Atmosphere, Ring current), G-B instrument networks: SuperMAG, SuperDARN, EISCAT 3D, solar radio-observations , GONG, NMDB, etc.)*

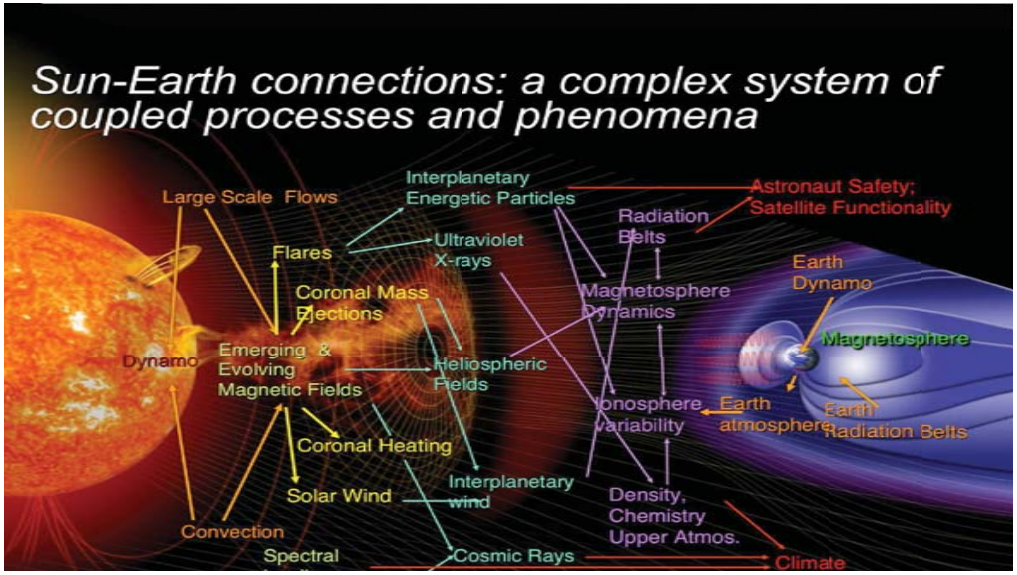
(7) Conclusions and overarching recommendations:

- There is an urgent need for coordination of SWx efforts in Europe - also to enable Europe to make a contribution to parallel global efforts. Space weather is a global threat, demanding a global response.
- a) assessment of risks, b) formulation of requirements, c) enabling of critical science, d) development and coupling of advanced models, e) R2O and f) the definition of an operational observing network for future services and are the 6 essential and indispensable activities, where coordination at European level is required.

E S W A C C

Recommendations:

- ***Any European effort in the field of Space Weather must keep the entire picture in mind. To take care of only some parts of the entity of necessary and indispensable actions cannot succeed.***
- ***We strongly advocate dedicated science efforts in parallel with the development of societal services.***
- ***Another European-wide process, which successfully has taken care of similar requirements and activities as a complete entity, is the COPERNICUS programme dealing with Earth Observations.***
- ***In the long term such a process cannot remain based on efforts by the most developed nations alone. Capacity Building and Outreach efforts towards nations with less sophisticated and less developed infrastructure is a crucial element to achieve a sustainable and resilient modern technological society.***
- ***Outside Europe such efforts should embrace developing ("ODA") nations, particularly in Africa and elsewhere, where societal and economic collaboration, increasing infrastructure investments, and the establishment of European assets are presently on-going.***



Recent & Next steps in European - and Global - SWx consolidation

- 2nd ESWACWG Meeting at ROB in Brussels, Nov 25/26, 2017
- Round Table Discussion and Town Hall Meeting ESWW Nov 30, 2017
- Finalisation UN-OOSA Doc. on Thematic Priority 4 on SW (ICSW) Nov 30, 2017
- UN-COPUOS STSC & EG Meeting, February 2018, Vienna, Austria
- 3rd ESWACWG meeting May 2018 (ESA ESTEC, Noordwijk, NL)
- UNISPACE +50 High Level Conference in Vienna, June 2018
- COSPAR General Assembly Pasadena, PSW session & meeting July 2018
- I-SWAT activity starts to support SWx science consolidation, after COSPAR GA, Pasadena 2018
- ------ NOW: ESWW 2018 Town Hall Meeting and consultation during SWWT ----------
- 4th ESWACWG meeting – Final Position Paper and Recommendations (January 2019?)
- COPUOS STSC adopts plans for new ICSW (incl PSW) February 2019
- Global SWx-Coordination Workshop organised by COSPAR PSW/UN-OOSA in 2019
- UN-OOSA ICSW replaces EG on SWx in 2020
- ICSW (supported by COSPAR PSW) works towards Global SWx Service Target to 2030

SWWT PM-39 20181107-minutes

Annex 7

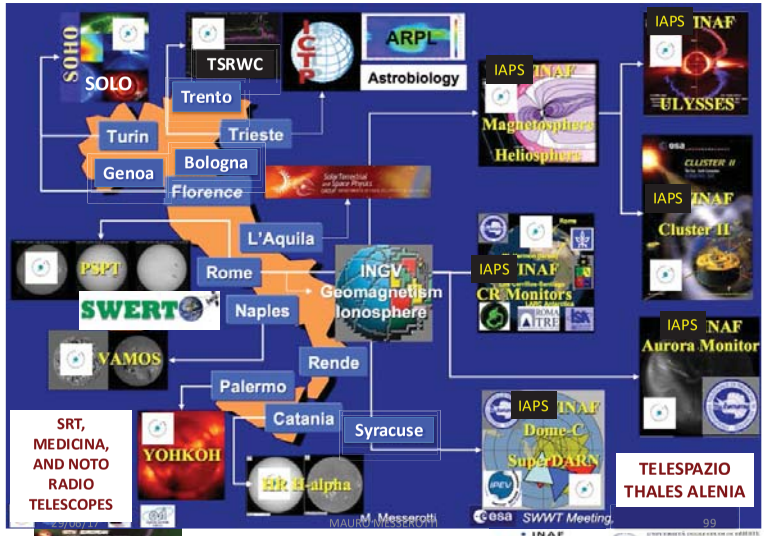
esa SPACE WEATHER WORKING TEAM

ASI ROADMAP TOWARDS SWX SCIENCE AND INAF SWX WORKFLOW

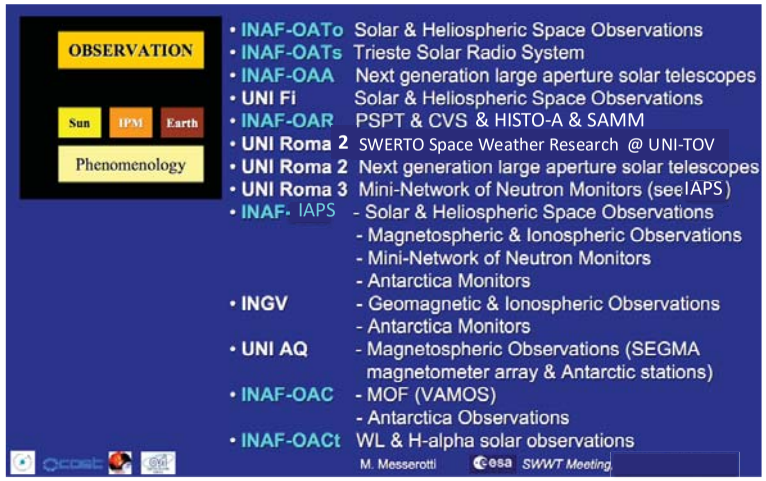
Mauro Messerotti[1,2]

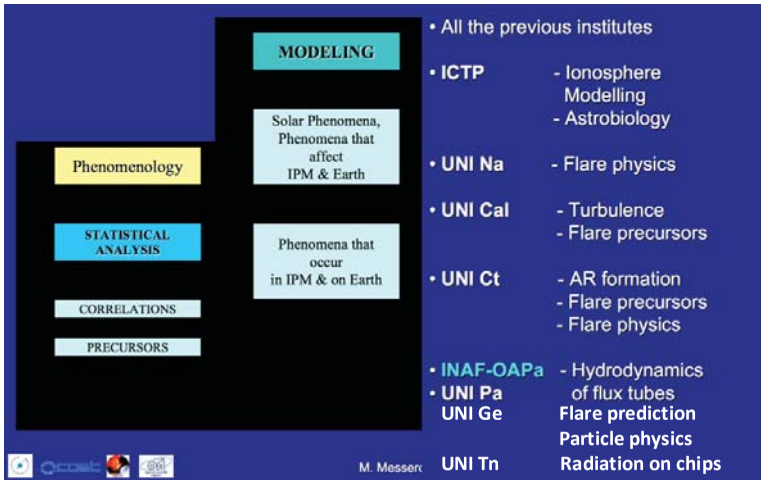
[1]INAF-Trieste, Italy

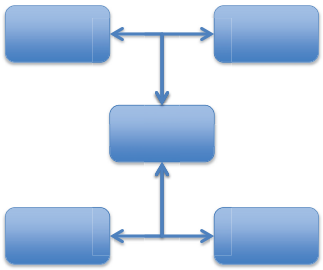
[2]UNI-Trieste, Italy



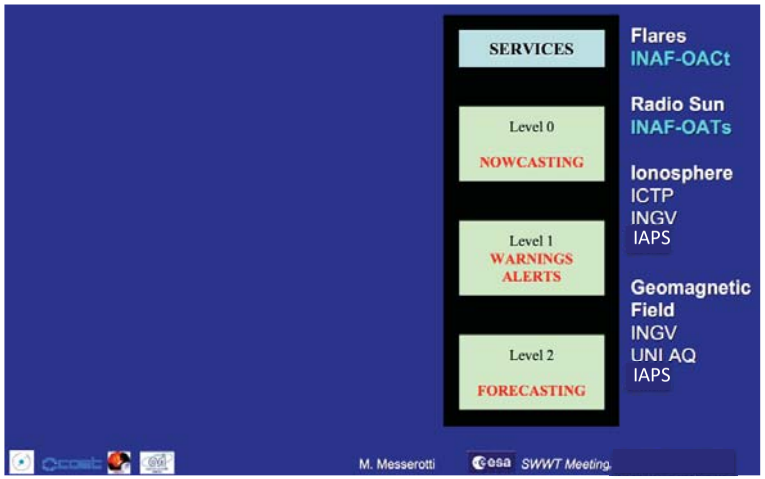
ITALIAN RESOURCES FOR SPACE WEATHER SCIENCE AND OPERATIONS



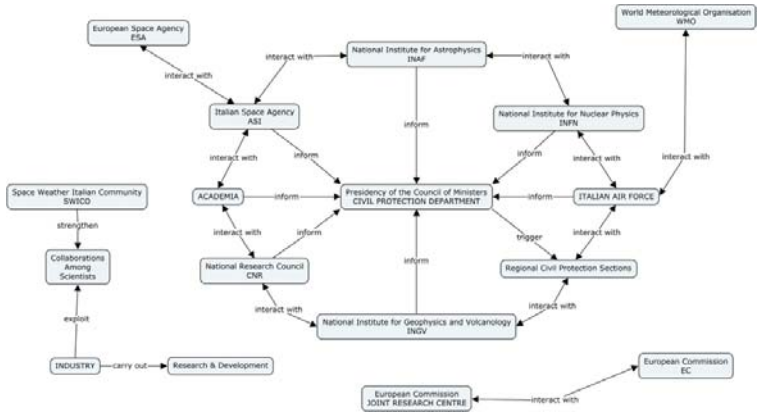




A PROTOTYPE SWX FUNCTIONAL MODEL DIAGRAM FOR ITALY



A Prototype SWx Functional Model Diagram for Italy



MESSEROTTI, 2017

ITALIAN SPACE AGENCY (ASI)

THE ITALIAN SPACE AGENCY SPACE WEATHER ROADMAP

ASI PERSPECTIVE FOR SWX SCIENCE

- **A Working Group has been appointed in April 2018 with the purpose to coordinate and promote activities related to SWx science**

- Led by Christina Plainaki (ASI), the WG has 17 experts from national institutions and organisations (ASI, INAF, INFN, INGV, Aeronautica Militare (Air Force), Università degli Studi di Perugia, Università degli Studi di Tor Vergata, Università degli Studi di Trento)

MAIN GOALS OF THE ASI SWX WG

1. **To create "Italy's Roadmap towards Space Weather" using as a starting point the initial proposal by ASI for a Roadmap envisioning the development of a prototype of a National Scientific Space Weather Data Centre**
2. To develop a "Roadmap Implementation plan" taking into account all required scientific, technological and programmatic activities, as well as human resources and materials needed for the implementation of this centre in ASI/SSDC
3. **To organize in ASI a dedicated Workshop where "Italy's Roadmap towards Space Weather" will be presented to the scientific and industrial communities as well as to Institutions and Organizations involved in Space Weather activities. In this context, it will be possible for the ASI SW WG to obtain additional feedback to integrate within the Roadmap**

STATUS OF THE ASI SWX WG WORK

a. **ROADMAP DOCUMENT DISTRIBUTED TO THE COMMUNITY IN SEPTEMBER 2018**
b. ROADMAP IMPLEMENTATION PLAN UNDER DISCUSSION
c. **DEDICATED WORKSHOP SCHEDULED AT THE ASI PREMISES IN ROME ON 18 DECEMBER 2018**
d. ASPIS DEVELOPMENT START: 2019/Q1 (EXPECTED)

ASI ROADMAP TOWARDS SWX SCIENCE

ASI SW WG Italy's Roadmap towards Space Weather Science 1

Italy's Roadmap towards Space Weather science

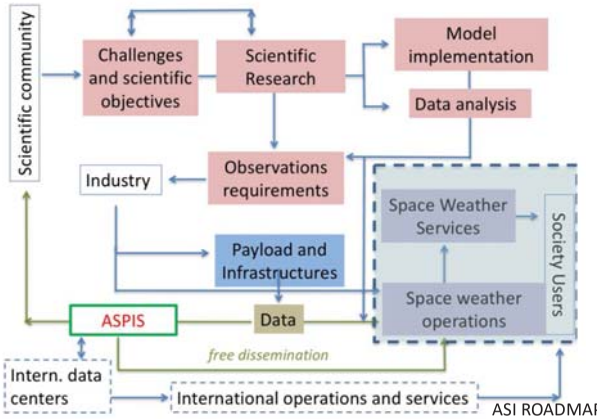
A Technical Note on

Recommendations advancing our scientific knowledge to meet the needs of the space weather community

prepared by the ASI **Space Weather Working Group**

Initial version: July 2017
First revision: July 2018
Second revision: September 2018

ASI NATIONAL SWX SCIENTIFIC DATA CENTER (ASPIS) CONCEPT



ASI ROADMAP, 2018

KEY CONSTITUENTS OF THE NATIONAL SPACE WEATHER SYSTEM

NATIONAL INSTITUTE FOR ASTROPHYSICS (INAF)

THE NATIONAL INSTITUTE FOR ASTROPHYSICS SPACE WEATHER WORKFLOW

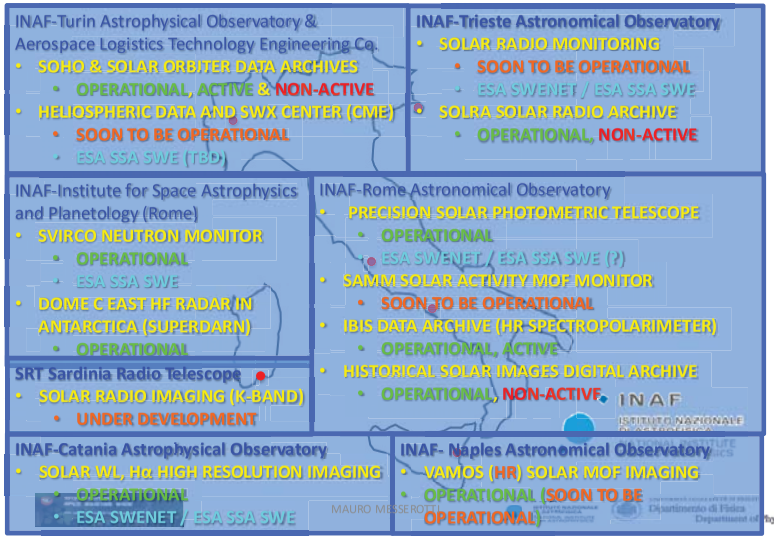
"INAF INFRASTRUCTURES FOR SPACE WEATHER" DOCUMENT

INAF INFRASTRUCTURES FOR SPACE WEATHER

v.2.0
14 May 2018

M. MESSEROTTI
Senior Advisor for Space Weather
INAF Science Directorate

INAF SWx and Space Climate Observing and Archiving Facilities



TSRWC

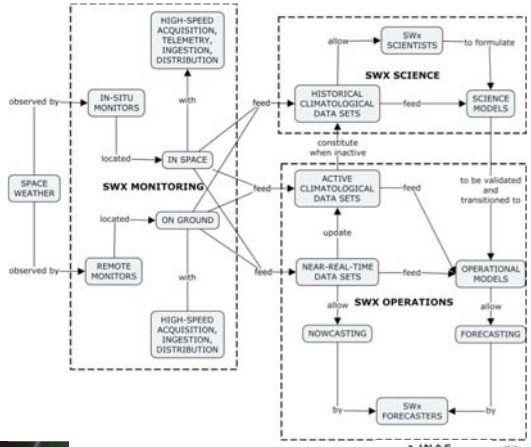
TRIESTE SOLAR RADIO WEATHER CENTRE (2019 Q2)

TSRS 2.0
A Solar Radio Polarimeter for SWx

Funded by INAF-Science Directorate, National Division for Radio Astronomy in the framework of the INAF Space Weather National Programme

- High time resolution
- Circular Polarisation
- Data Calibration
- NRT Operations in:
  - L band (1.35-1.45 GHz)
  - 2800 MHz (10.7 cm)
  - C band (3-4 GHz)
  - Ku band (11.5-12.5 GHz)
  - Ka band (22-23 GHz)
- In support of:
  - INAF SunDish Network
  - ASI Fiducial GPS Network
  - ESA SSA-SWE Network
  - LOFAR SWx applications
  - SKA Heliophysics applications
  - Solar Orbiter/Metis Coronagraph
- Operational in 2019 Q1

INAF WORKFLOW FOR SPACE WEATHER



IN THIS FRAMEWORK

- FORMALISATION OF SPACE WEATHER AS A TOPIC OF GLOBAL INTEREST IN VIEW OF RESILIENCE TO NATURAL DISASTERS
- ***US-Italy Earth Sciences and Cultural Heritage Working Group (with focus on "Resilience to Natural Disasters", 2019-2021)***

  Embassy of Italy, Washington DC

  December 6, 2018

INAF PERSPECTIVES FOR SWx

AN **INAF NATIONAL SPACE WEATHER PROGRAMME** IS UNDER STUDY AND IT IS AIMED AT

a. **EXPLOITING INAF SWX OBSERVING FACILITIES**

   E.G. THE EXISTING ONES PARTICIPATING IN ESA SSA SWE

b. **UPGRADING TO FULL OPERATIVENESS ADDITIONAL SWX FACILITIES**

   E.G. NEUTRON MONITOR, HR MOF OBSERVATIONS

c. **DEVELOPING NEW INAF SWX FACILITIES**

   E.G. USE OF LARGE SINGLE-DISH RADIO TELESCOPES FOR SOLAR OBSERVATIONS (SRT, MEDICINA, NOTO)

d. **EXPLORING THE USE OF LOFAR FOR SWX OBSERVATIONS**

SWWT PM-39 20181107-minutes

Annex 8

OFRAME

French Organisation
for Applied Space Weather

What OFRAME is

- OFRAME was founded in 2017 by several French research bodies
- Objective = *"a single point of entry for space weather"*
  - Structure the French scientific community that is working on space weather (presently too fragmented)
  - Provide an interface between the scientific community and end users
  - Provide scientific expertise on space weather issues
  - Liaise with national/international research programs
- Governance
  - 12 scientists
  - Coordinators: Alexis Rouillard and Thierry Dudok de Wit

Roadmap of OFRAME

- Three science themes
  - Solar monitoring
  - Geospace monitoring
  - Integrated modelling of the Sun-Earth system
- Website : http://www.meteo-espace.fr (soon active)
- Activities include
  - Training and outreach
  - Fora between users and scientists (e.g. *HF communication and ionospheric effects*)
  - Involvement in international bodies (WMO, ISES, …)
  - and more.

SWWT PM-39 20181107-minutes

Annex 9

SWWT Forecaster Forum: new challenges

Larisa Trichtchenko

ESWW November 7, 2018

Forecaster Forum Introduction

Tasks:

- To discuss in details recent SW events and forecasts
- To identify successes and faults of recent forecasts
- To identify the origins of forecast faults
- To propose ways for improvements

Forecaster Forum Introduction

Members:

- Space scientists engaged in the forecast
- Space scientists engaged in space weather observations
- Other space scientists
- Mostly from ISES RWC

Forecaster Forum
Current status: ESWW 2018

Tasks:

- To discuss in details recent SW events and forecasts:

Event of September 2017 is discussed at multiple presentations during ESWW 2018

- To identify successes and faults of recent forecasts
- To identify the origins of forecast faults
- To suggest ways for improvements:

Discussed on Wed, Nov 7, invited talk (Angelos Vourlidas), as well at Topical Discussion Meetings (Nov 5, predicting storms without CMEs;Nov 7, solar storm forecasting and analysis, CME arrival time, and posters.

No suggestions for discussions of other events were received

Forecaster Forum
Questions to resolve

Membership change:

- To invite meteorologists engaged in forecasts of SWx to SWx-related workshops (ESWW)?

or

- To propose SWx Forecast as a topic at Met-related conferences and to invite space scientists engaged in the forecasts?

or

- To organise special workshops (including training and different real scenarios of successful and faulty forecasts) for the both groups of forecasters

or

- To have some kind of combination of these?

Forecaster Forum
Current Status

Members:

- Space scientists engaged in the forecast

Mostly working at ISES RWC

Currently engaged in several time demanding scientific projects as well

<u>New group of forecasters:</u>

Meteorologists trained to forecast SWx

Mostly working at Met-associated RWC

Potentially can be interested in discussions of the forecasts