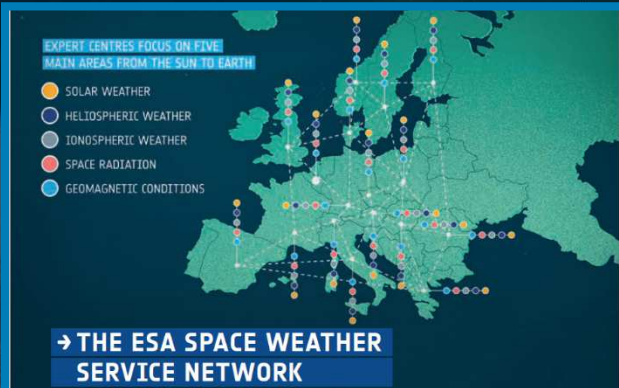


The ESA Space Weather Service Network Products and Services Supporting Atmospheric Drag Calculation: Current Capabilities and Outlook

Alexi Glover, Jussi Luntama
Space Weather Office, ESA Space Safety Programme
ESA/ESOC Darmstadt, Germany

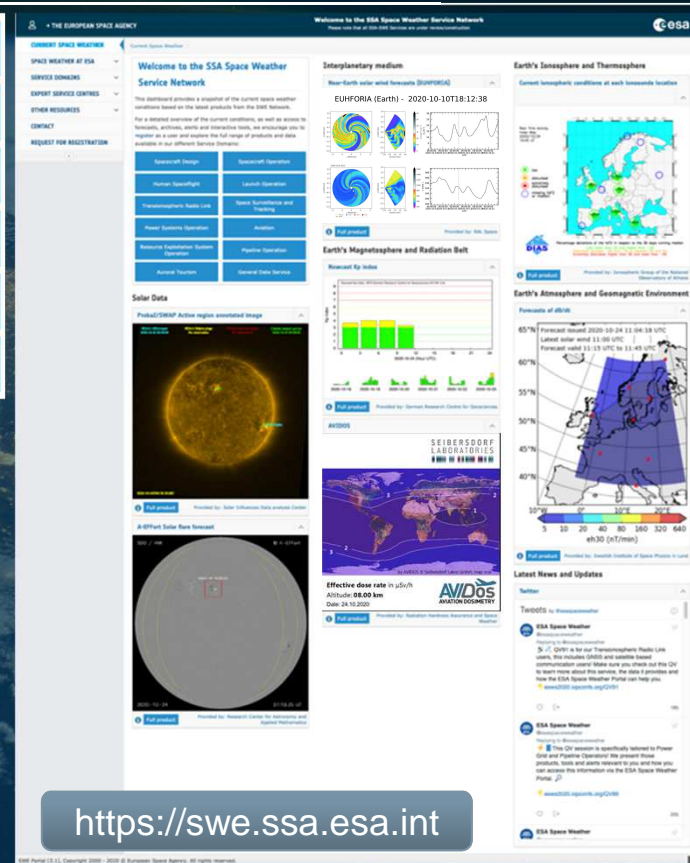


ESA SPACE WEATHER SYSTEM TODAY



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 >250 products
- Service user support and staffed helpdesk
- European Service Network of >50 participating entities
- > 2500 registered users
- > 1.5M hits on service portal monthly
- Space and Ground-based sensor system enhancements
- Coordinated Communication Protocol

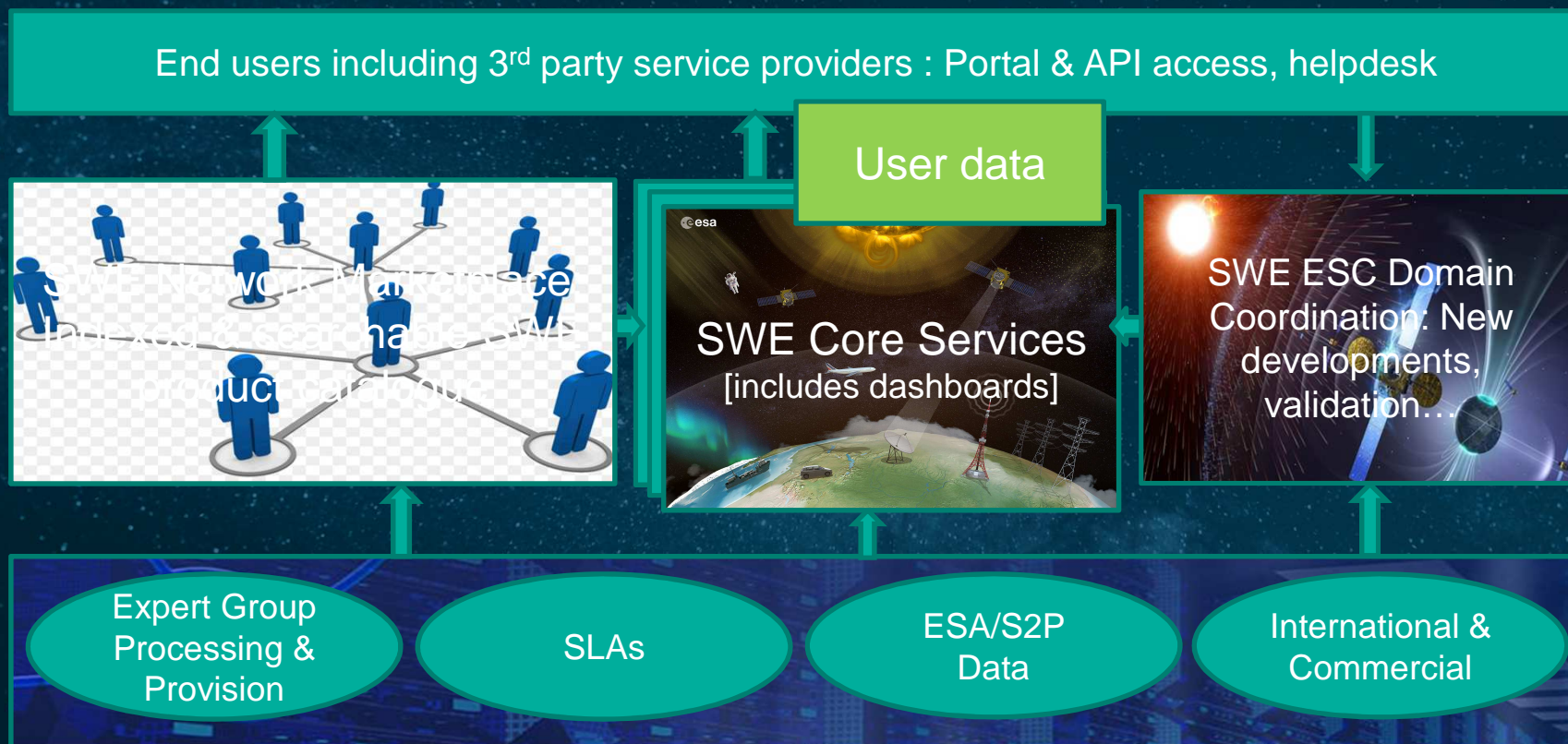


<https://swe.ssa.esa.int>



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SWE Service Ecosystem





Domain Requirements



Atmospheric
estimates for drag
calculations

Forecast of
geomagnetic and
solar indices

Nowcast & forecast
of geomagnetic &
solar indices



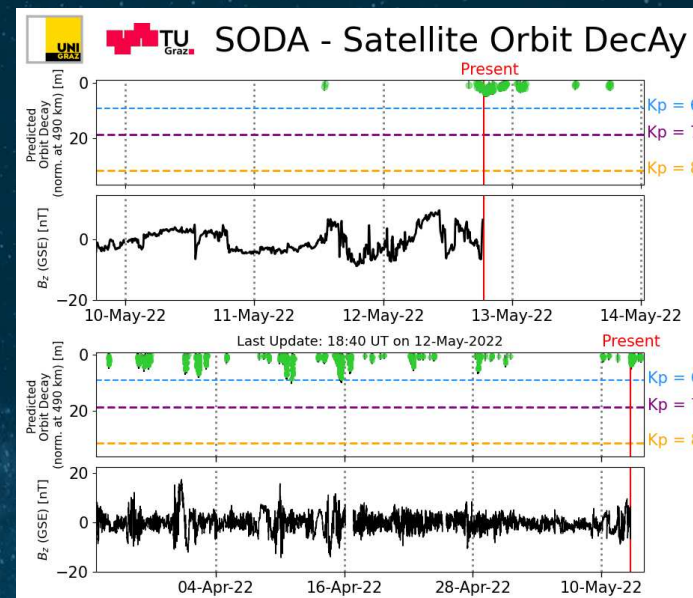
Estimate of
atmospheric density in
the past years and
predicted in near real-
time

Database of past
values of solar and
geomagnetic
indices

Developments in Progress



- SWESNET project:
 - SODA: Satellite Orbit Decay Forecast [Uni Graz]
 - Forecast of events causing >10m orbital decay in specific orbits
 - Nowcast & Forecast Solar Radio Indices [CLS]
 - F30, 30 day forecast
- VSWMC model couplings in testing include: EUHFORIA + Indices + Gorgon-Space + ODI (F10.7) + CTIP + MCM (DTM)
- ROSIE solar telescope as a new source of F10.7 & F30 data, [Univ Wroclaw & ITTI]

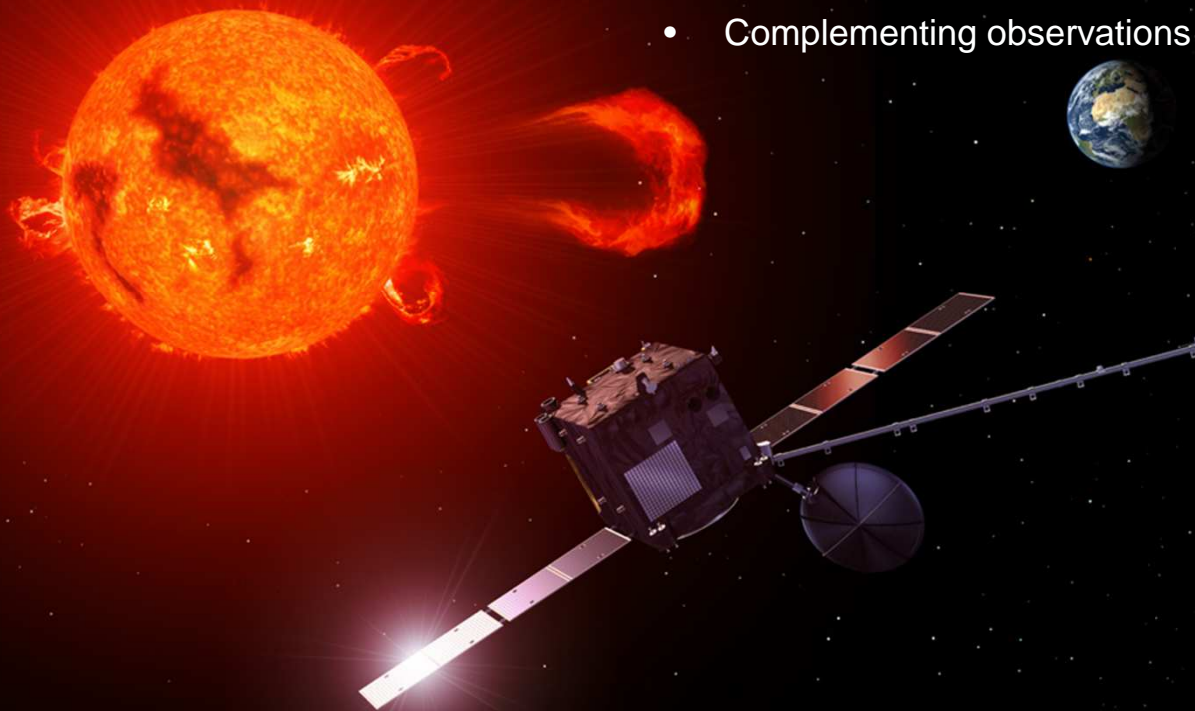


Uni Graz

Vigil mission to L5



- Continuous observations of Sun and heliosphere between Earth and the Sun
- Data availability in near real-time => operational applications
- Complementing observations from Sun-Earth line



Vigil mission status in Q1 2022

- Evaluation in 2021 considered the mission baseline cost high
=> high risk of not achieving sufficient support in MC22
- Mission currently in extended Phase B1 (B1X) with the objectives to
 - Revisit the mission and satellite objectives to meet the budget constraints
 - Optimise the payload suite and define industrialisation requirements/constraints
 - Preparation of the proposal for MC22
- Vigil mission objectives critically analysed in Mission Advisory Group (MAG) meeting on 1st February 2022
=> Payload baseline update consolidated

Vigil mission objectives and observations



	Objective	Observations	
A	<ul style="list-style-type: none"> Improved assessment of CME motion and density, in the corona and heliosphere, in combination with L1 observations Observations necessary to improve solar activity onset detection and identification 	Coronagraphy Heliospheric imaging Magnetography (EUV imaging)	Highest priority
B	<ul style="list-style-type: none"> Measure vector components of the IMF Determine the characteristics of solar wind features rotating towards Earth 	Plasma spectrometry Magnetometry (EUV imaging)	2 nd priority
C	<ul style="list-style-type: none"> Enable assessment of developing solar activity, through the monitoring of active region development up to 4 or 5 days beyond the East limb 	X-ray flux monitoring ¹⁾ EUV imaging ²⁾ Magnetography	Highest priority
D	<ul style="list-style-type: none"> <i>Detection of SPEs, monitoring of low energy ion signatures (secondary objective)</i> 	Radiation monitor	Enhancing

¹⁾ Supports objectives, measurements partially compensated by EUV images

²⁾ Strongly supports objectives in C, contributes to A and B. Not mandatory for 1st priority objectives



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Vigil payload baseline update

- Mission streamlining by removal of supporting instruments from baseline
=> New Proposed Baseline “3+2”:
 - Priority instruments for Objectives A and C: CCOR, PMI, HI
 - Secondary priority instruments for Objectives B: PLA, MAG
- Instrument exchange agreement between ESA and NOAA:
 - CCOR for Vigil provided by NOAA
 - ESA provides XFM for SWFO
- LGR-MAG strong recommendation: Vigil should carry EUV imager to support space weather forecasting (Objectives C)
=> bilateral discussion with NASA in progress

THANK YOU

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