

Global Space-based Inter-Calibration System (GSICS)

Annual Meeting

12<sup>th</sup> March 2023

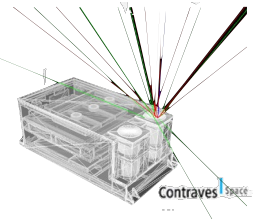

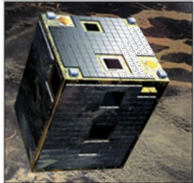



# ESA Assets and Intercalibration Capability





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# Radiation Monitor Assets

## Standard Radiation Environment Monitor (SREM)

ESA, Oerlikon Contraves (RUAG), Paul Scherrer Institute (PSI)

Giove-B 2008    Rosetta 2004    Herschel 2009    Planck 2009

## Environment Monitoring Unit (EMU)



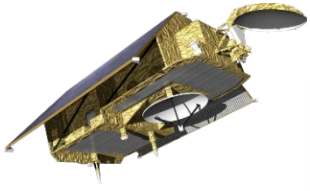



Proton sensor, Heavy ion sensor, Electron charge g SURF sensor, FEU PCB, CEU PCB, PSU PCB, Shielded zone for SURF amplifiers

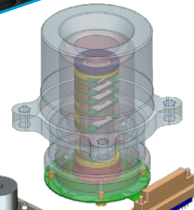
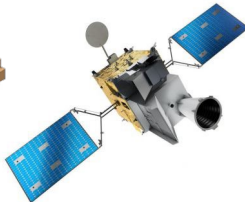

GSAT0207 2016    GSAT0215 2017




## Next Generation Radiation Monitor (NGRM)

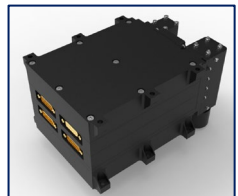
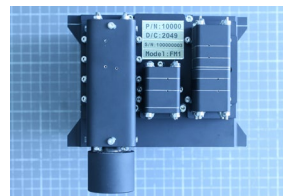




EDRS-C 2019    Sentinel-6 2020






Meteosat 3<sup>rd</sup> Gen. 2022+    MetOP 2<sup>nd</sup> Gen. 2025+

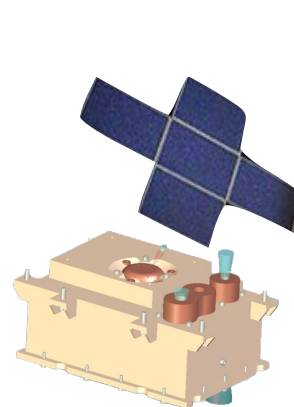
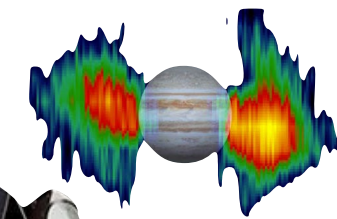
## Influence sur les Composants Avancés des Radiations de l'Espace Next. Gen. (ICARE-NG)

HOTBIRD™ 13 F&G





## Rad-hard electron Monitor (RADEM)

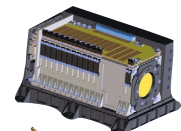
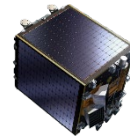



JUICE 2023

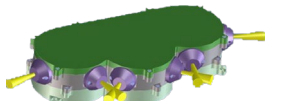

## Selected other monitors


RadMag    RadCube 2021

EPT    PROBA-V 2013

3DEES    PROBA-3 2024



HardPix (and others)  
Lunar Gateway 2025

# Radiation Monitor Orbital Coverage

## GEO

Past: AlphaSat/MFS

Present: **EDRS-C/NGRM, MTG-I/RMU(NGRM)**

Future: additional MTG-I/RMU, HotBird/ICARE-NG

## MEO

Past: Giove-A/Merlin, Giove-B/SREM

Present: Galileo(GSAT 0207 & 0215)/EMU

Future: Galileo 2<sup>nd</sup> Gen. – 6 RMU and 6 Plasma

## LEO

Past: PROBA-1/SREM

Present: RadCube/RadMag

PROBA-V/EPT+SATRAM

Future: MetOp-SG/RMU(NGRM)

## HEO

Past: XMM-Newton/ERMD

Present: INTEGRAL/IREM

Future: **PROBA-3/3DEES (end 2024)**, Lunar Gateway/ERSA

## Inter-

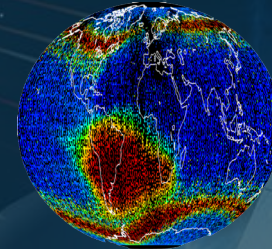
## plane-

## tary

Past: Herschel/SREM, Planck/SREM, Rosetta/SREM

Present: BepiColombo/BERM, JUICE/RADEM

Future: Lunar Gateway/ERSA



### European Radiation Sensor Array (ERSA)

To launch on Lunar Gateway PPE in Q4 2025 hosting: SREM, NGRM, ICARE-NG HardPix and ESA Active Dosimeter (EAD)

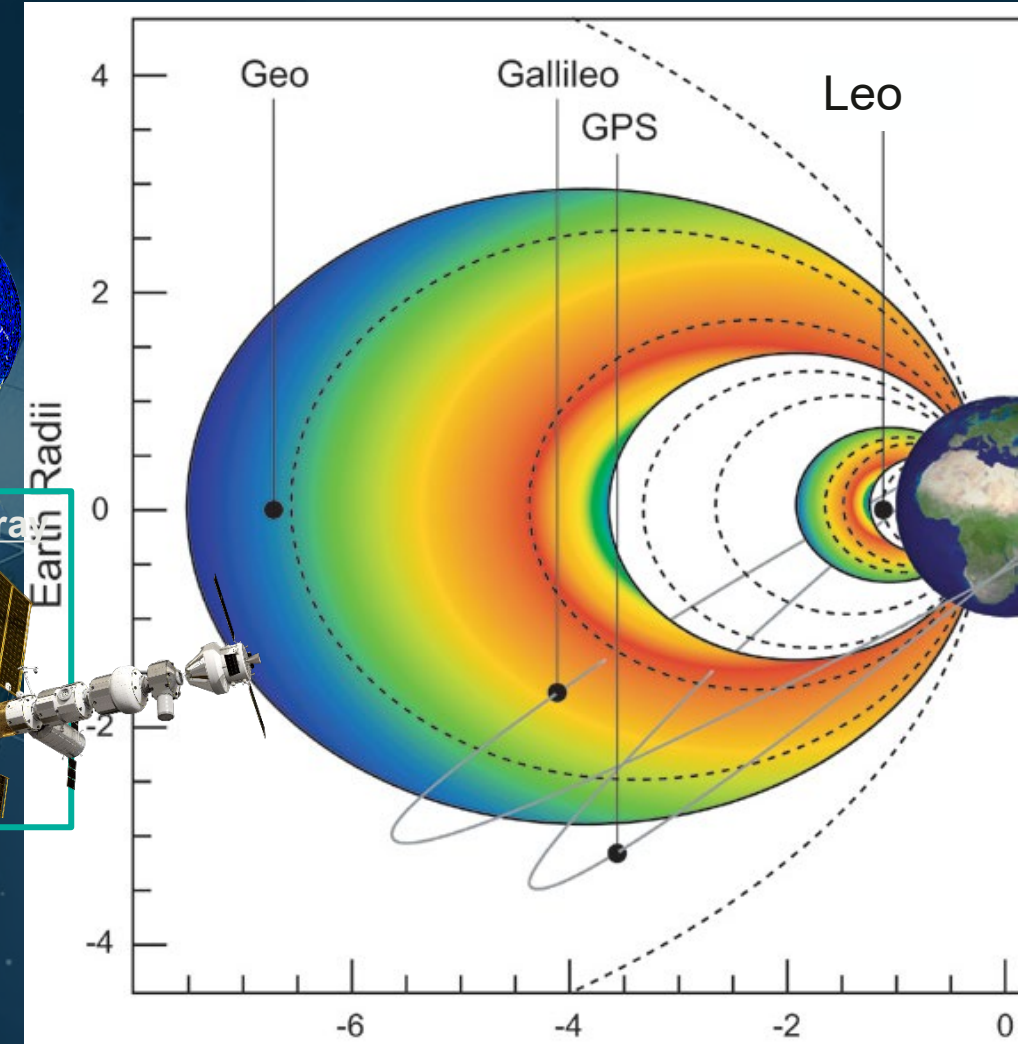
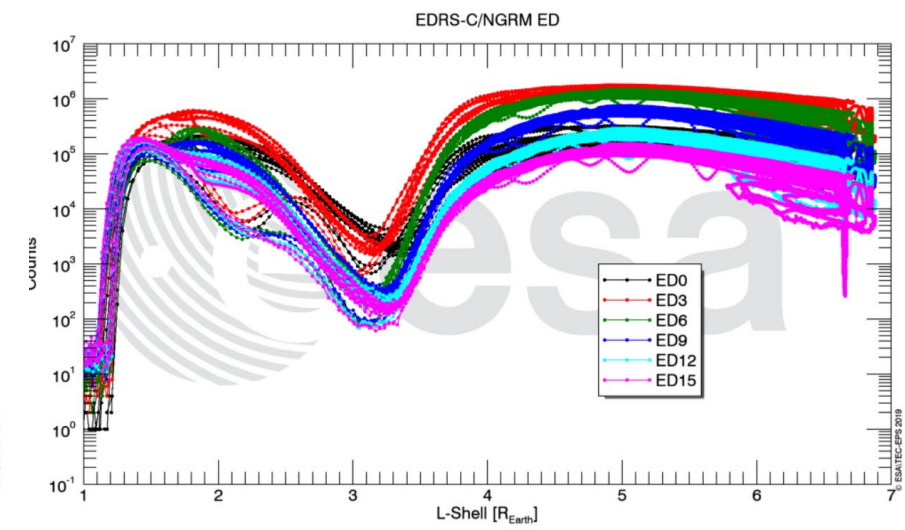
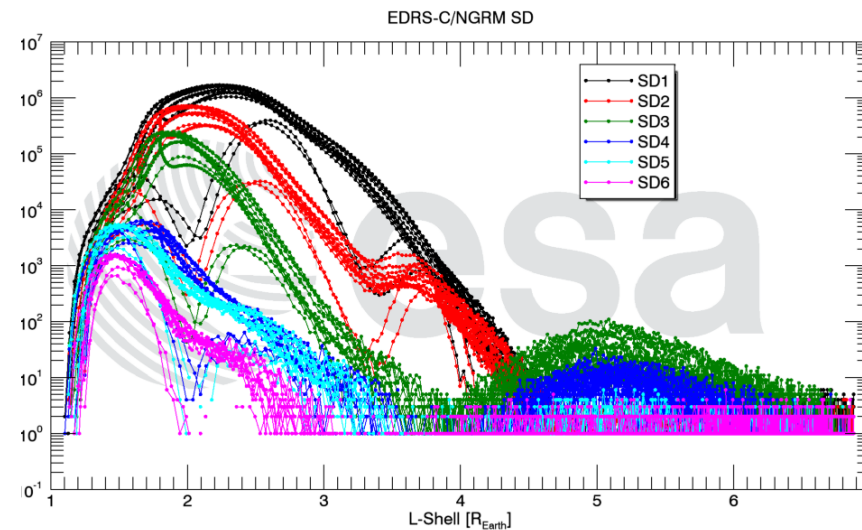
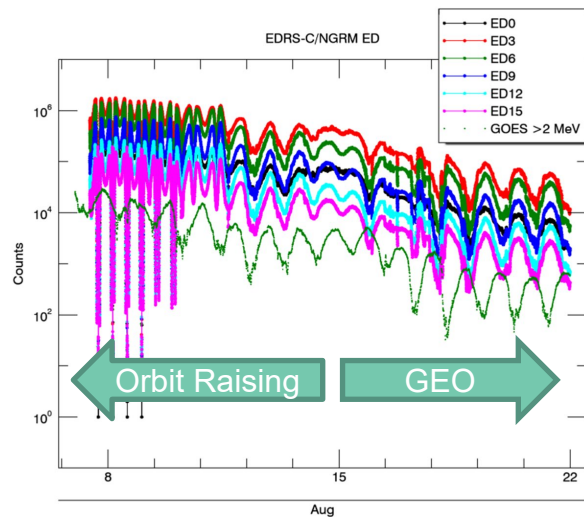
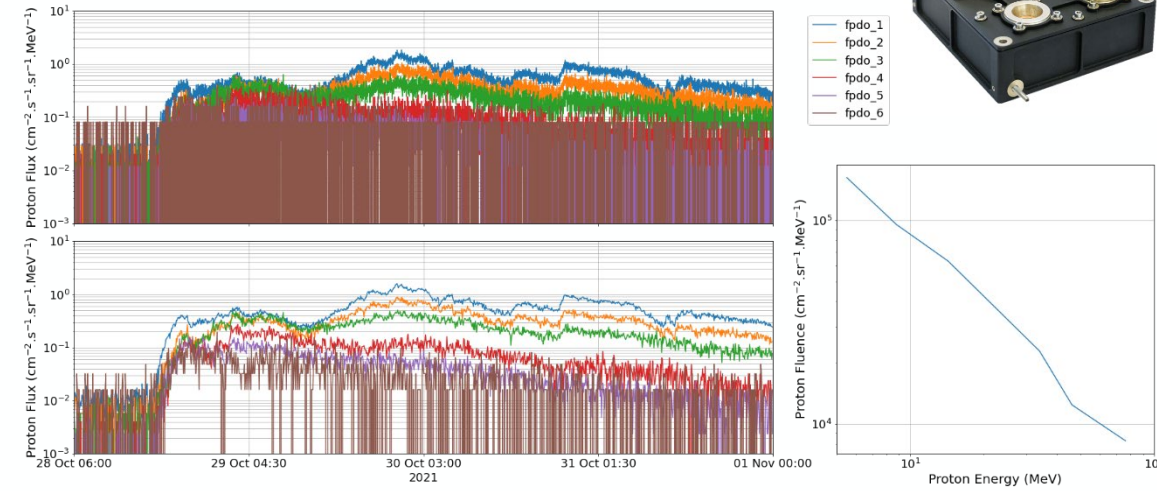
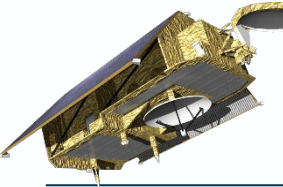


Image Credit: British Antarctic Survey

# EDRS-C/NGRM

- Next Generation Radiation Monitor (NGRM) was designed by PSI and developed by Thales Alenia Space Switzerland
  - Electron data from 0.35 to 2.6 MeV
  - Proton data from 2 to 200 MeV
- Images below show the first data from 1<sup>st</sup> flight of the Next Generation Radiation Monitor (NGRM)
- Right shows observations from a solar particle event (GLE73)
- Publications: [Desorgher et al. 2013](#) & [Sandberg et al. 2022](#)

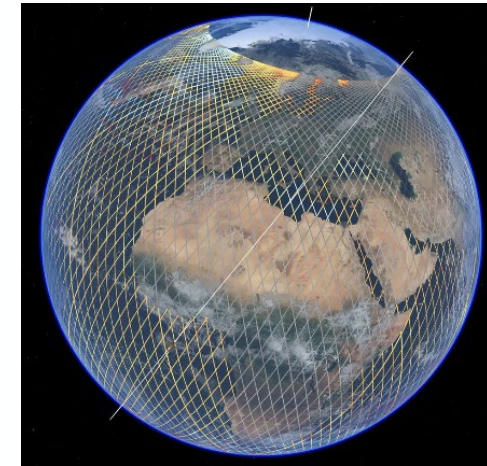




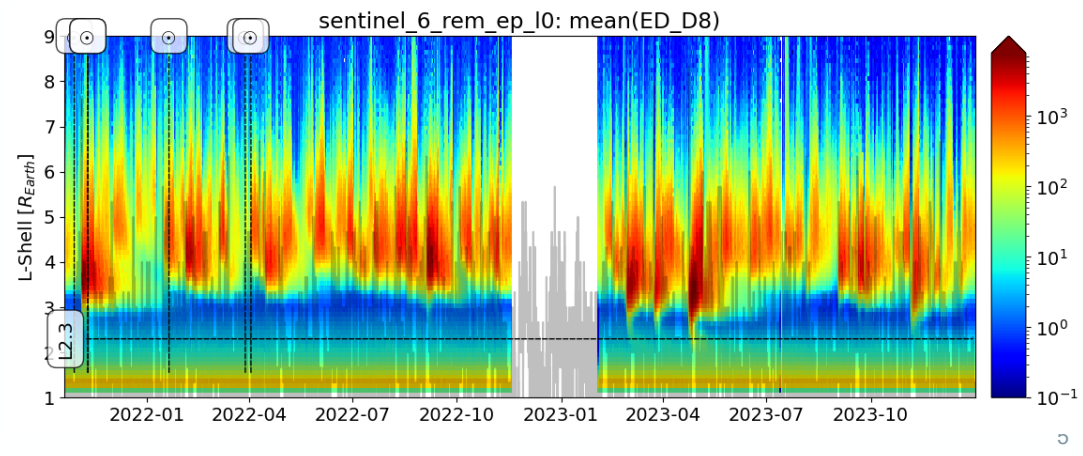
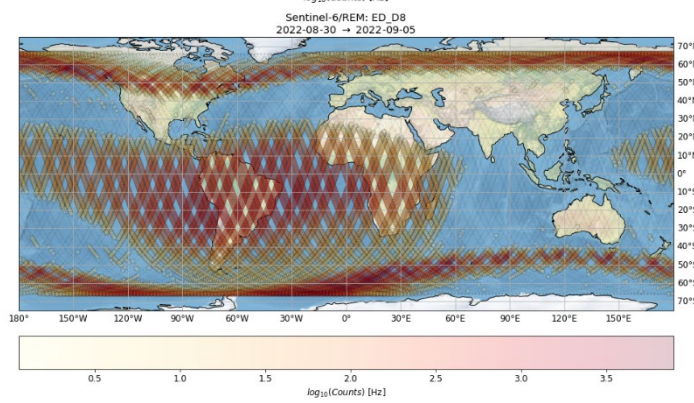
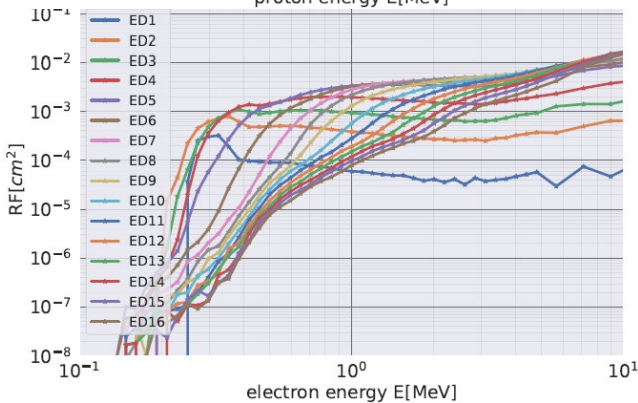
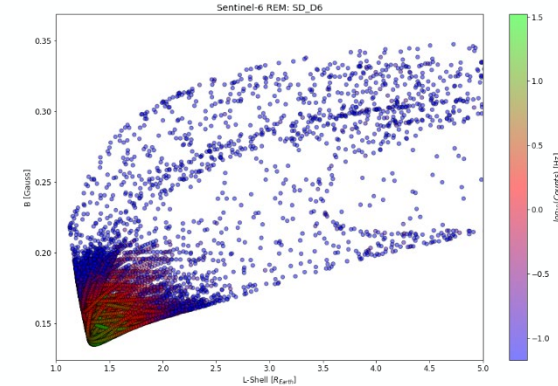
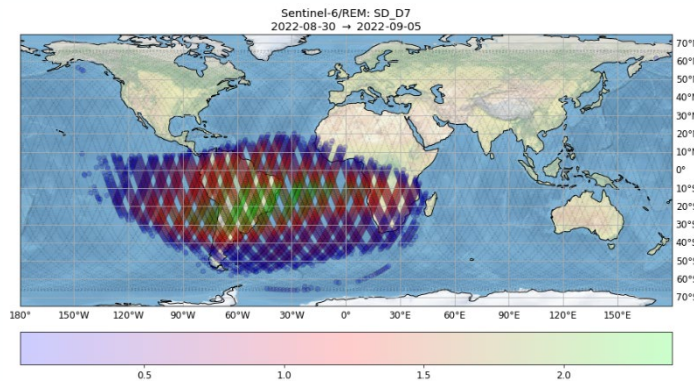
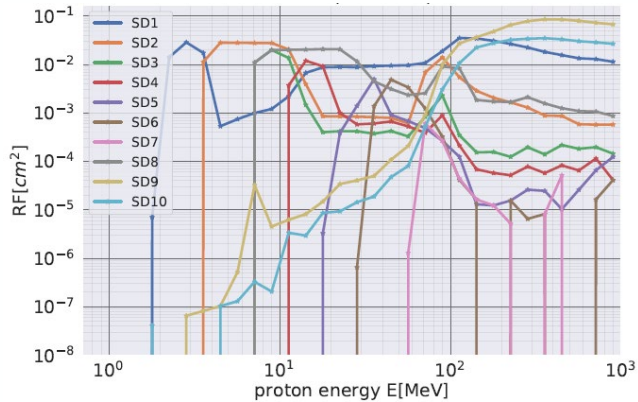
# NGRM Data: Sentinel-6 Focus



- Sentinel-6 (Michael Freilich) data received from launch on 21<sup>st</sup> November 2020: <https://space-env.esa.int/sentinel-6-ngrm-first-data/>
- First NGRM on Meteosat 3<sup>rd</sup> Generation (RMU) in GEO launched in December 2022
- Further units planned for MetOp-SG programme as well as the Lunar Gateway (ERSA).



➤ Sentinel-6 flies in a 1336 km altitude orbit with 66° inclination



# Cross-Comparisons with GEO measurements

