Observations from NOAA's Newest Solar Proton Sensor

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NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

National Aeronautics and Space Administration
GOES-R Program

Cooperative Institute for Research in Environmental Sciences at the University of Colorado Boulder

Introduction

- **Solar energetic particles are ~10-100 Mega Electron Volt (MeV) ions produced in solar flares and coronal mass ejections (CMEs).**
- **Solar particle events (SPEs), lasting several days to a week, can increase the flux of 10-100 MeV ions ~100,000 times above typical background levels.**
- **SPEs are a radiation hazard to spacecraft systems and humans in space. SPEs can also cause elevated radiation dose at commercial airline altitudes and produce ionization that disrupts HF communication and navigation systems in the polar regions.**
- **The Solar and Galactic Proton Sensor (SGPS), flown on-board NOAA's new GOES-R series spacecraft, supports real-time alerts of solar particle events by the NOAA – Space Weather Prediction Center, Boulder CO.**

GOES Solar and Galactic Proton Sensor (SGPS)

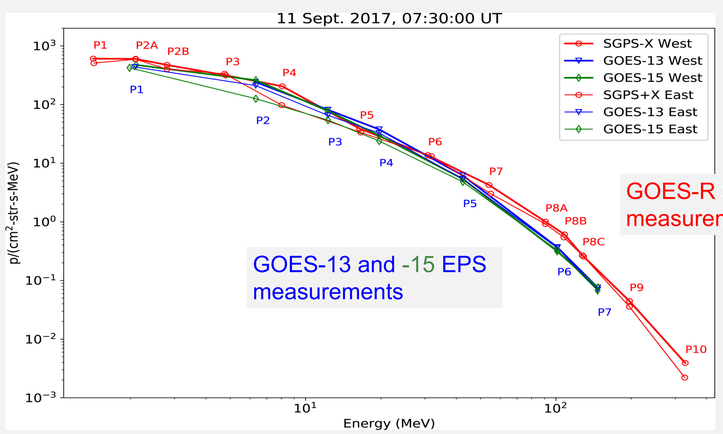
- –2 Units on each GOES-R series spacecraft, one looking East and one West
- –3 solid state telescopes on each unit
- –1 MeV-500 MeV protons in 13 differential channels, plus >500 MeV integral channel
- –4 MeV-500 MeV alphas in 12 energy bands

Energy channels:

P1 (1-1.9 MeV)
P2A (1.9-2.3 MeV)
P2B (2.3-3.4 MeV)
P3 (3.4-6.5 MeV)
P4 (6.5-12 MeV)
P5 (12-25 MeV)
P6 (25-40 MeV)
P7 (40-80 MeV)
P8AF (83-99 MeV)
P8BF (99-118 MeV)
P8CF (118-150 MeV)
P9F (150-275 MeV)
P10 (275-500 MeV)
P11 (> 500 MeV)

September 2017 Solar Particle Events and Comparisons with Leagacy GOES Energetic Particle Sensors (EPS)

The first three of NOAA's Geostationary Operational Environmental Satellite (GOES) –R series spacecraft, GOES -16, -17, and -18, were launched in 2016, 2018 and 2022 respectively. There are two (east and west looking) SGPS units on-board each GOES-R Series spacecraft. The September 2017 solar particle events provided an opportunity for cross calibration of SGPS with the older GOES-13, -14, and -15 Energetic Particle Sensors (EPSs). Comparisons with legacy GOES energetic particle measurements are critical for establishing consistent long-term data sets and understanding changes in trends in solar energetic particle event fluxes.



5-minute averaged GOES-16 SGPS and GOES-13 and -15 EPS Energy Spectra at 7:30 UT on 11 Sept. 2017.

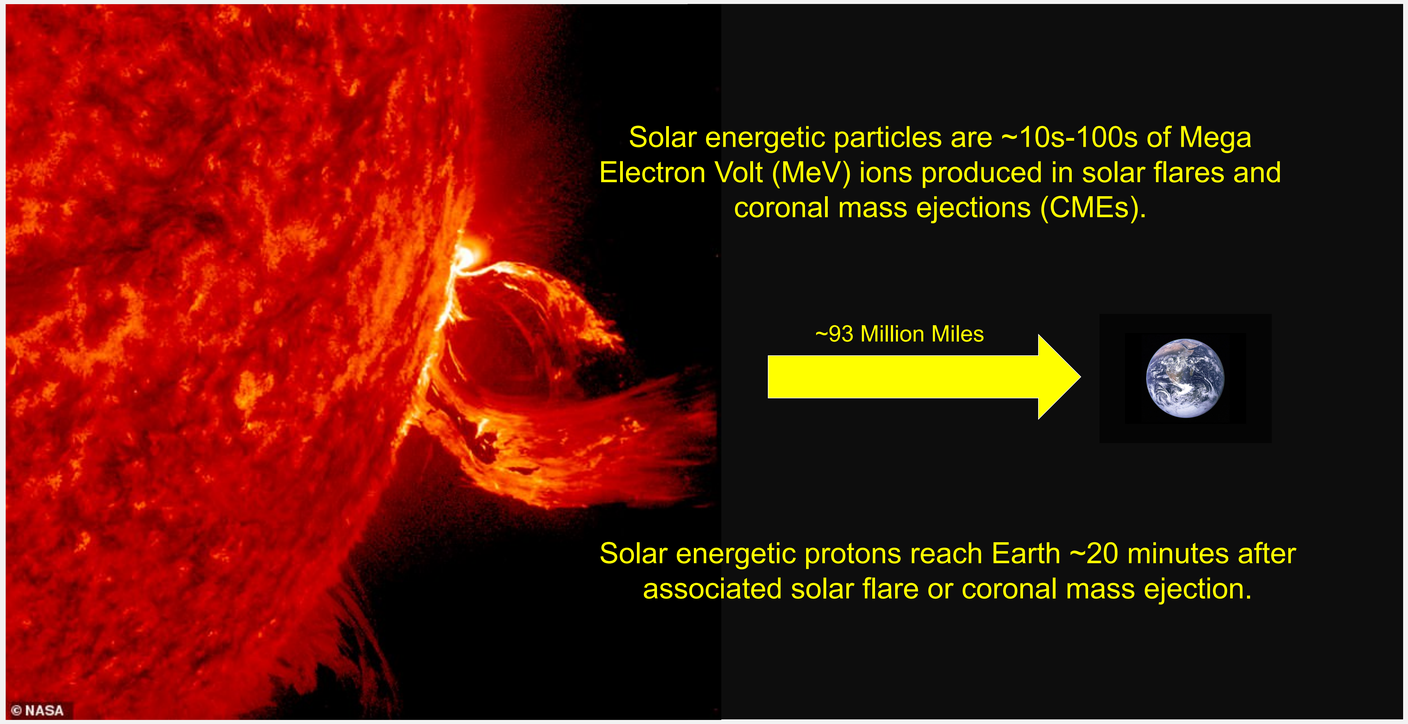
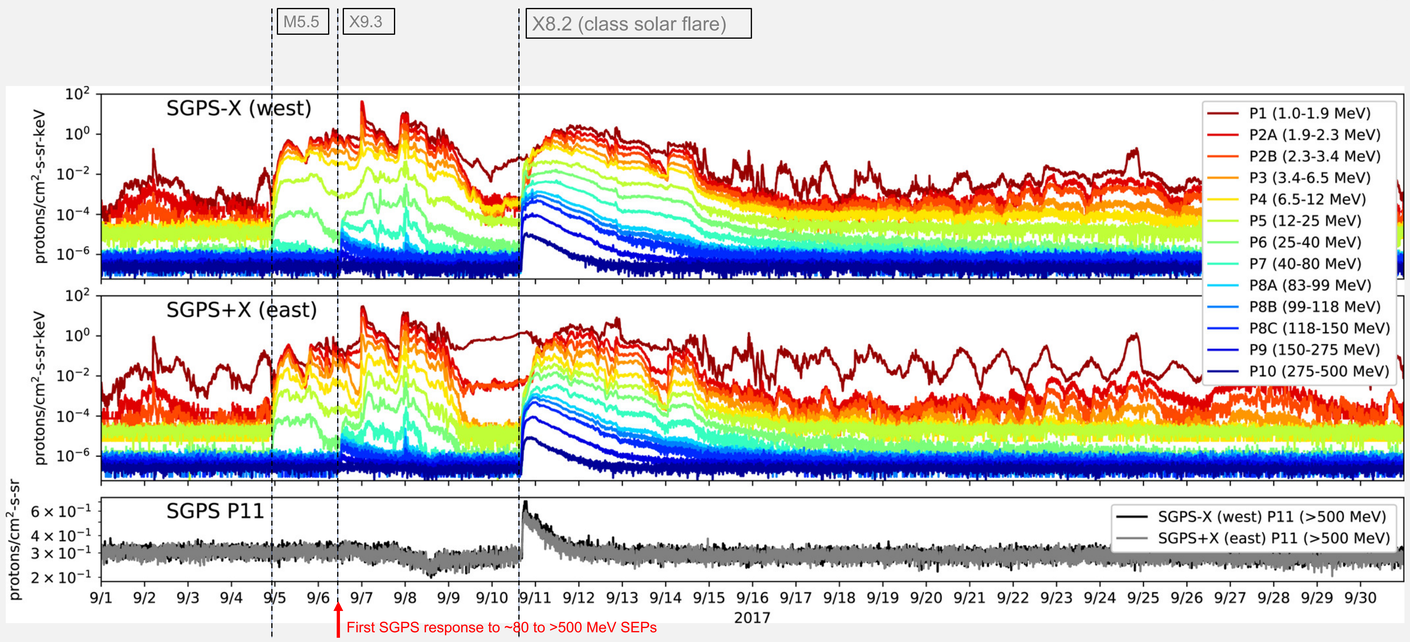


Photo credit: NASA - Solar Dynamics Observatory



5-minute averaged GOES-16 SGPS fluxes from September 2017. This data set available from the NOAA – National Centers for Environmental Information (NCEI) GOES-R website, including P1–P10 (differential) and P11 E (>500 MeV) integral fluxes from east- and west-facing SGPS units [Kress et al., 2021].

Reference: Kress, B. T., Rodriguez, J. V., Boudouridis, A., Onsager, T. G., Dichter, B. K., Galica, G. E., & Tsui, S. (2021). Observations from NOAA's newest solar proton sensor. *Space Weather*, *19*, e2021SW002750. https://doi. org/10.1029/2021SW002750.

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